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Kenya Power

PROTECTIVE RELAYS, CONTROLS DEVICES AND INSTRUMENTS - SPECIFICATION

A Document of the Kenya Power & Lighting Co. Ltd

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0.1 Circulation List

COPY NO.	COPY HOLDER
1	Manager, Standards
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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:
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0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 1 Rev 1	2018-06-28	Replaces Issue 1 rev 0 of 2013-08-29	S. Nguli	Dr. Eng. P. Kimemia

FOREWORD

This specification has been prepared by Network Maintenance (Power System Protection Section) of the Network Management Division in collaboration with Standards Department and lays down specifications for Design, Manufacture and Testing of Protective Relays, Control devices and Accessories, Measuring and Indicating Instruments.

This specification is intended for procurement of materials and does not include provision of contract.

This specification stipulates the minimum requirements for protective relays, control devices and measuring and Indicating Instruments acceptable for use in the company and it shall be the responsibility of the suppliers and manufacturer to ensure that the offered design is of the highest quality and guarantees excellent service to KPLC, good workmanship and good engineering practice in the manufacture of these equipment for KPLC.

There are no other specifications in this series.

Users of these Kenya Power specifications are responsible for their correct interpretation and application.

This specification supersedes all previous specifications for Protective Relay and Control and Measuring and Indicating Instruments.

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

Name	Department
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Eng. Stephen Nguli	Standards
Eng. Raphael Ndolo	Standards
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1. SCOPE

This specification is for Protective Relays, Controls devices and Instruments.

2. NORMATIVE REFERENCES

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

IEC 60255: Measuring relays and protection equipment –. Part 1: Common requirements

IEC 60688: Electrical measuring transducers for converting a.c. and d.c. electrical quantities to analogue or digital signal.

IEC 61000-4-13: Part 4-13: Electromagnetic compatibility (EMC) - Testing and measurement techniques: Harmonics and inter harmonics including mains signalling.

IEC 61850-8-1:2011: Communication networks and systems for power utility automation

IEC 60051-1:2016: Direct acting indicating analogue electrical measuring instruments and their accessories - Part 1: Definitions and general requirements common to all parts

IEC 60870-5:103: Telecontrol equipment and systems - Part 5-103: Transmission protocols - Companion standard for the informative interface of protection equipment

IEC 60055: Paper-insulated metal-sheathed cables for rated voltages up to 18/30 kV (with copper or aluminium conductors and excluding gas-pressure and oil-filled cables) - Part 1: Tests on cables and their accessories

BS 142-2-2.2:1990: Electrical protection relays. Requirements for the principal families of protection relays. Specification for general requirements for measuring relays used for protection.

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

ISO 9001:2008/2015: Quality management systems - Requirements

3. DEFINITIONS AND ABBREVIATIONS

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

3.1. ABBREVIATIONS

KPLC- Kenya Power and Lighting Company Limited

IEC – International Electro technical Commission

ISO – International Organization for Standardization

4. REQUIREMENTS

4.1. SERVICE CONDITIONS

The equipment shall be tropicalized, designed and constructed for continuous indoor operation in areas with the following atmospheric conditions: -

Altitude:	From sea level up to 2200m above mean sea level.
Humidity:	High at the Coast, up to 90% and lower inland, up to 50%.
Temperatures:	Average ambient temperature of +35°C with a minimum of -1°C and a maximum of +40°C.
	Maximum Indoor temperature inside the Relay Panels is +50 ° C.
Pollution:	Heavy saline with severe corrosive effects in coastal lands and generally clean air inland.

4.2. GENERAL REQUIREMENTS

4.2.1. All Relays shall be designed for operations in the severe tropic climate conditions and fully comply with climatic aging tests as per IEC 60932-class 2.

4.2.2. In choosing materials and their finishes, due regard shall be given to the humid tropical conditions under which the Relay will be called upon to work.

4.2.3. Iron and Steel are generally to be painted or galvanized as appropriate. Indoor parts may alternatively have chromium or copper-nickel plated or other approved protective finish.

4.2.4. Small iron and steel parts (other than stainless steel) of all Relays and instruments, the cores of electromagnets and the metal parts of relays and mechanisms shall be treated in an appropriate manner to prevent rusting.

4.2.5. The use of Iron and steels shall be avoided in instruments and electrical relays wherever possible. Steel screws shall be zinc, cadmium or chromium plated or where plating is not possible owing to tolerance limitations; it shall be of corrosion resisting steel.

4.2.6. Instrument screws (except those forming part of a magnetic circuit) shall be of brass or bronze.

4.2.7. Springs shall be of non-rusting material, e.g., phosphor-bronze or nickel silver, as far as possible.

4.2.8. Neoprene and similar synthetic compounds, not subject to deterioration due to the climatic conditions, shall be used for gaskets.

4.2.9. Power supply modules for Relays and Measuring instruments:

a. All equipment and apparatus including protective relays and control and measuring devices shall be capable of satisfactory operation at 80% to 125% of the rated supply voltage.

b. The Rated DC supply voltage shall be inscribed on the device.

4.3. SPECIFIC REQUIREMENTS

4.3.1. Materials

4.3.1.1. All materials supplied under this tender shall be new and of the best quality and of the class most suitable for working under the conditions specified.

4.3.1.2. They shall withstand the variations of temperature and atmospheric conditions arising under working conditions without distortion, deterioration or undue stresses in any parts or heating.

4.3.1.3. All the devices shall be suitable for installation in relay panels inside control rooms without air conditioning.

4.3.1.4. The heat generated by the relays and other measuring devices shall therefore be minimal to ensure that the temperature inside the panels does not rise beyond the rating of the relays and other devices.

4.3.2. Instruments

4.3.2.1. All measuring instruments, including the energy meters, shall be of flush-mounted, back-connected, dust-proof and heavy-duty switchboard type and in accordance with the requirement of IEC 60051.

4.3.2.2. For analogue type instruments, scale plates shall be of a permanent white circular or rectangular finish with black pointer and markings. The scale range shall be provided as given in the detailed specifications.

4.3.2.3. All measuring instruments of analogy type shall be approximately 96 X 96 mm enclosures and shall be provided with clearly readable long scale, approximately 240 degrees. The maximum error shall not be more than one and a half (1.5%) percent of full-scale range.

4.3.3. **Protective Relays**

4.3.3.1. All Measurement relays shall be flush mounted and of Numeric Design, with event recording, disturbance recording, power measurement, and shall be in accordance to IEC 60255.

4.3.3.2. Besides the communication port, the relays shall have a human – machine interface facility (HMI) comprising a keypad and an LCD screen, where one can easily access relay information and manually program the parameter settings.

4.3.3.3. Relay contacts shall be suitable for making and breaking the maximum currents, which they are required to control in normal service.

4.3.3.4. The Relay Trip contacts shall be capable of interrupting without damage the Circuit Breaker Trip Coil Current should the Circuit Breaker Auxiliary Contacts fail to open. Relay trip contacts shall be rated for 130V DC and switching capacity of 1000W/VA make, and 30W/VA break. Permissible current shall be 5A continuous and 15A for 3 seconds.

4.3.3.5. Where contacts of the protective relays are not sufficient for Circuit Breaker Tripping and interrupting the Trip Current, this shall be clearly stated by the manufacturer.

4.3.3.6. Relay contacts shall make firmly without bounce and the relay mechanism shall not be affected by Panel vibration or external magnetic fields.

4.3.3.7. Relays shall be suitable for operation on the rated D.C. Auxiliary supply without use of dropping resistors or diodes.

4.3.3.8. The relay Thermal rating shall be such that the fault clearance times on any combination of current and time multiplier settings shall not exceed the thermal withstand capability of the relay. (Max. fault current = 31.5kA).

4.3.3.9. The relays, control devices and instruments shall be supplied complete with all screws, bolts, brackets and all other accessories necessary for mounting/installation in panels and terminating all external wiring connections.

4.3.3.10. Plug –in auxiliary relays for DIN rail mounting shall be supplied complete with the bases.

4.4. DETAILED SPECIFICATIONS FOR RELAYS, INSTRUMENTS AND CONTROL DEVICES

These specifications indicate the required performance characteristics for each of the Protection Relays.

4.4.1. **Ratings for Protection Relays and Control Devices:**

Unless other stated, all protection relays and control devices shall have the following rated values:

(a) The power system where the relays are to be installed has nominal frequency of 50HZ
(b) The rated CT secondary current is 1A
(c) The rated VT secondary voltage is 110V AC, phase to phase (63.5V AC phase to ground)
(d) DC auxiliary rating is 110V DC.
(e) Relay trip operation shall be indicated by a red LED, for measurement relays. Red mechanical flags are acceptable for transformer mechanical protection – auxiliary

4.4.2. **Distance Protection Relay Type I:**

4.4.2.1. The Distance relay is for use on Transmission Lines, to provide fast and highly dependable selective fault clearance on both overhead and underground feeders.

4.4.2.2. The Relay shall be for application in a substation with 1&1/2 circuit breaker configuration, hence shall be suitable for tripping of two circuit breakers, monitoring the status of two circuit breakers and automatic reclosure of two circuit breakers. The relay shall be used for re-trofit to replace existing old static & electromechanical relays.

4.4.2.3. **This shall have the following functions and features: -**

i. The relay shall have four analogue current input channels and five voltage input channels for connection of CT & VT secondary analogue signals as a minimum.
ii. The relay shall be suitable for Flush mounting on the protection panel
iii. The relay shall be of Numeric/Digital Design and employ complete digital signal processing of measured values.
iv. The Relay offered must have been in Service in Kenya Power System and operated successfully for the last Eight years.
v. Improved designs of previous relays are acceptable. Relay offers from Manufacturers who have not supplied relays before are not acceptable for this tender.
vi. Relays that have failed in service or mal-operated shall not be acceptable
vii. Full Scheme distance protection, with parallel calculation and monitoring of all the fault loops.
viii. The relay shall have selective single phase and/or three phase tripping Logic

ix. Under Impedance Starting criteria. Other starting criteria in addition to the under impedance starting are acceptable.

x. Five zones of phase distance protection (for Phase-phase faults) with selectable Mho and quadrilateral characteristics. Parameters (resistive reach, reactive reach and time delay) for each zone to be independently set.

xi. As a minimum five zones of ground distance protection, (for Phase- Ground/Phase-Earth Faults) with selectable Mho and Quadrilateral characteristics with residual current compensation. Parameters (resistive reach, reactive reach and time delay) for each Zone to be independently set.

xii. The Distance Protection Zones direction shall be independently set as forward or reverse or non-direction.

xiii. Operating time for Distance Zone 1 set at 0 seconds delay shall not exceed 30ms

xiv. Communication channel Aided Scheme logic for phase and ground distance protection with the following schemes

(a) Permissive Under Reach Transfer scheme (PUTT)

(b) Permissive Overreach Transfer scheme(POTT) and

(c) Blocking Schemes.

(d) Direct Transfer Tripping Scheme

Note: The Tele-protection scheme shall be suitable for hardwiring connection between the relay and the telecommunication multiplexer cabinet.

xv. Load encroachment Discrimination Feature, to guarantee reliable discrimination between load operation and short circuits for long highly loaded lines, to prevent inadvertent trips.

xvi. Parallel line compensation to cancel the effect of mutual inductance.

xvii. Measuring voltage monitoring/ Fuse failure supervision Logic.

xviii. The distance relay shall be blocked from operating in the event of failure of the measuring voltage or when the auxiliary switch of the Voltage transformer secondary MCB trips.

xix. Weak in-feed Protection: Echo and/or Trip, to allow effective operation of permissive schemes when there is no in-feed on one end of the line.

xx. Current Reversal Guard Feature – for use on parallel lines

xxi. Power Swing detection feature for blocking Distance operation for moderate power swings and to trip for out of step conditions

xxii. Voltage Memory Feature for use by the distance comparators

xxiii. Automatic Switch on to Fault Feature(SOTF), enabled when the line is de-energised and only active for a set time delay after the line circuit breaker is closed

xxiv. Directional Earth Fault Protection, with communication channel aided scheme with the following schemes: -

(a) Directional Comparison Scheme(POTT)

(b) Blocking Scheme

(c) Selectable final time tripping for use when the communication channel is not in use, or for use on radial feeder. It shall be possible enable/disable the final time trip feature.

xxv. Back up three phase overcurrent & Earth fault protection, with the following protection functions:

a) High set element for Phase and Earth fault overcurrent with selectable definite time delay

b) Low set element for Phase and Earth fault overcurrent with inverse current-time characteristics as per IEC 60255.

xxvi. Stub Bus overcurrent protection enabled via binary input when the bay disconnector is open

xxvii. Under frequency and rate of change of frequency Protection

xxviii. Overvoltage protection

xxix. Circuit Breaker Failure Protection

xxx. Circuit Breaker Contact wear feature

xxxi. Broken Conductor detection for Alarm purposes.

xxxii. Auto-reclose function for One Phase and/or three phases, suitable for use with the following selections made via external switch:

(a) Auto reclose Block: No Auto-reclose: Trip to Lockout

(b) Single Pole Autoreclose: (Single pole Trip and Auto-reclose for Distance Zone 1- phase to ground faults only). Other faults types shall lead to three phase trip and lock out.

(c) Single Pole + Three Phase Auto-reclose (SPAR + DAR): Single pole trip and auto-reclose for Distance Zone 1 phase to ground faults only, followed by three pole trip and

auto-reclose for the next phase to ground fault or phase to phase fault within the reclaim time). If the first fault is phase to phase, then the scheme will perform three phase trip and auto-reclose only and lock out if a second fault of any type occurs during the reclaim time. Three phase faults shall lead to Trip and Lockout.

(d) Three Phase Autoreclose (DAR): three phase Trip and auto-reclose only for phase to ground faults or Phase to Phase faults. Lock out for three phase faults.

(e) It shall be possible to initiate autoreclose in the distance relay from the line current differential relay in the neighbouring panel protecting the same transmission line.

xxxiii. Synchro-check Function for use with three phase auto-reclose

xxxiv. Fault Locator; with automatic display on the Relay LCD Screen of the distance to fault in terms of Line percentage or distance in km. This information is for use by other operational staff to guide the maintenance/repair teams. The last distance to fault will always be displayed on the screen, for ease on access by the Operational Personnel.

Note 1: In the bid submission the bidder shall demonstrate that the requirement of this clause is fully met. Requirement to use the keypad to access this information is **not acceptable**

Note 2: Distance Relays which do not meet this requirement shall **not be accepted**

The accuracy of Distance to fault location shall be ±2% as a minimum.

The following information shall be provided with fault location:

(a) The short-circuit loop which was used to determine the fault reactance

(b) The reactance X per phase in Ohms Primary and secondary

(c) The reactance R per phase in Ohms Primary and secondary

(d) The distance to fault in percentage and km of line length

xxxv. The relay shall be able to display of Fault details on the LCD such as Fault- Loop or Faulty phases, the Zone, and the Relay Operate time.

xxxvi. Disturbance recorder with capacity to record ten analogues and twelve digital signals. The relay shall have capacity to store the latest, twenty (20), disturbance records.

xxxvii. Storage of at least one hundred (100) event records

xxxviii. Storage of at least Twenty (20) Trip records. The following fault data will be available:

a) Magnitude and phase angle of phase currents and voltages before the fault

b) Magnitude and phase angle of phase currents and voltages during the fault

c) The sequence of events of digital signals, start and operate (Trip) signals involved in fault detection and clearance. The events shall me time tagged to 10ms level.

xxxix. Events and fault records shall not be erased even when the auxiliary DC supply is switched off.

xl. Metering and display on the LCD screen of the following Power system instantaneous parameters including;

a) Voltage

b) Load current

c) Active Power

d) Reactive Power

e) Apparent Power

f) Power Factor and

g) Frequency

NB: Simultaneous Maximum demand values of Active Power, Reactive Power and Apparent Power shall be available in the relay.

xli. At least Twenty-Four (24) Binary inputs.

xlii. At least Thirty-two (32) Binary outputs

Note: *Two pairs of the binary output relays shall be rated to directly energise the circuit breaker trip coil. These output relays shall provide phase segregated outputs for each phase. This is to allow single phase tripping and auto-reclose. This trip output relays shall have fast operating times of less than 5 ms*

xliii. Stability against switching inrush currents and reverse faults.

xliv. Clear faulted phase indication.

xlv. Clear fault identification even for boundary conditions.

xlvi. At Least twelve (12) LEDs for indication of the following; - Relay trip, Phase L1, Phase L2, Phase L3, Zone 1, Zone 2, Zone 3, DEF, Channel aided trip, SOTF, etc.

xlvii. Relay healthy LED

xlviii. Relay self-supervision, with LED for healthy status indication(green) and Error indication (red) and watchdog contact

xlix. Protocol applicable: Full IEC 61850-8-1 compliant & IEC 60870-5- 103. Appropriate communication ports to be provided for local and remote communication.

l. Relay Terminals-shall be screw type terminals large enough to accommodate at least 2 x 2.5 mm2 cable and shall be located at the back of the relay

li. Front Serial RS232 or USB or Optical or Ethernet Port shall be provided for relay configuration and parameter setting and download of Data using a Laptop Computer.

lii. Software for Programming the configuration and Relay Settings and also downloading and analysing the Relay Data shall be provided.

liii. Relay to Laptop connection cable shall be provided.

liv. **Relay configuration:** The Manufacturer shall carry out relay configuration at the Factory to suit installation in existing transmission substations in KPLC Network. Existing Protection and control drawings for the substations shall be handed over to the manufacturer/supplier for relay configuration. The FATs shall be carried out once the relays have been configured. Correct functionality of all relay Protection and Control Functions shall checked during the FATS, including correct operation of the single pole auto reclose scheme where applicable.

4.4.3. **Distance Protection Relay Type II**

4.4.3.1. The Distance relay shall be used for protection of Sub transmission and Distribution Lines, both overhead lines and underground cables of different characteristic impedances and lengths. The relay shall be used for fault location on the protected feeders.

4.4.3.2. To achieve this, the relay shall automatically display the distance to fault in km on the LCD screen upon fault interruption. ***This requirement is critical and the offered relays that are not able to meet this requirement will not be considered.***

4.4.3.3. The ability to Access the distance to fault details using the Keypad or a laptop is of secondary value and shall not be considered as a solution for the above requirement.

4.4.3.4. **The relay shall have the following functions and features: -**

i. The relay shall have four analogue current input channels and four voltage input channels for connection of CT & VT secondary analogue signals

ii. Shall be suitable for Flush mounting on the protection panel

iii. The relay shall be of Numeric/Digital Design and employ complete digital processing of measured values

iv. The Relay offered must have been in Service in Kenya Power System and operated successfully for the last Six years. Improved designs of previous relays are acceptable. Relays offers from Manufacturers who have not supplied relays before are not acceptable for this tender.

v. Relays that have failed in service or mal-operated shall not be acceptable

vi. Full distance Protection Scheme, i.e., non-switched

vii. Under Impedance Starting criteria. Other starting criteria in addition to the under impedance starting are acceptable.

viii. The relay shall employ three phase tripping criteria, since it shall be used on sub-transmission and distribution lines

ix. Four zones of Phase distance protection (for Phase-phase faults) with selectable Mho and Quadrilateral characteristics. Parameters (resistive reach, reactive reach and time delay) for each Zone independently set.

x. Four zones of Ground distance protection, (for phase- Ground/Phase-Earth Faults) with selectable Mho and Quadrilateral characteristics with residual current compensation. Parameters (resistive reach, reactive reach and time delay) for each zone shall be independently set.

xi. The distance Zones direction shall be independently set as forward or reverse or non-direction. Minimum operating time shall not exceed 40ms.

xii. Communication channel Aided Scheme logic for the distance protection with the following schemes:

a. Permissive Under-reach Transfer scheme

b. Permissive Overreach Transfer scheme and

c. Direct Transfer Tripping Scheme

Note: The tele-protection shall be achieved by hard wiring between the relay and the telecommunication equipment

xiii. Load encroachment Discrimination Feature, to increase the possibility to detect high resistive faults on heavily loaded lines.

xiv. Fuse failure supervision Logic

xv. Voltage Memory Feature for use by the distance comparators

xvi. Automatic Switch on to Fault Feature(SOTF), enabled when the line is de-energised and only active for a set time delay after the line circuit breaker is closed

xvii. Directional Earth Fault Protection, with communication channel aided scheme as follows

a. Directional Comparison Scheme

b. Blocking Scheme

***Note**: Selectable final time tripping for use when the communication channel is not in use, or for use on radial feeder.*

xviii. Back up three phase overcurrent & Earth fault protection, with the following protection functions:

(a) High set element for Phase and Earth fault overcurrent with selectable definite time delay

(b) Low set element for Phase and Earth fault overcurrent with inverse current-time characteristics as per IEC 60255.

Other Functions, include:

xix. Sensitive Earth Fault Protection

xx. Stub Bus overcurrent protection

xxi. Circuit Breaker Failure Protection

xxii. Under-frequency and rate of change of frequency protection

xxiii. Overvoltage protection

xxiv. Broken conductor detection for Alarm purposes.

xxv. Auto-reclose function for three phases, suitable for high speed and delayed auto-reclose.

xxvi. The Auto-reclose scheme will be selectable as enabled or disabled preferably on the relay LCD screen:

xxvii. Only the selected functions in the distance relay shall initiate auto-reclose

xxviii. The auto-reclose function shall be capable of two auto-reclose shots, with separately set dead times.

***Note**:* It shall be possible to initiate auto-reclose in the distance relay from an external backup overcurrent and earth fault relay on the same Panel.

xxix. Fault Locator; with automatic display on the Relay LCD Screen of the distance to fault in terms of Line percentage or distance in km. This information is for use by other operational staff to guide the maintenance teams. The last distance to fault shall always be displayed on the screen.

Note: In the bid submission the bidder shall demonstrate that the requirement of this clause is fully met. Requirement to use the keypad or laptop to access this information is OK, as a secondary option, but will not be considered on its own to fulfil the requirements above.

Distance Relays Offered which do not meet the above requirement shall not be accepted

xxx. The accuracy of Distance to fault location shall be ±2% as a minimum.

xxxi. The following additional information shall be provided with fault location:

a) The short-circuit loop which was used to determine the fault reactance

b) The reactance X per phase in Ohms Primary and secondary

c) The reactance R per phase in Ohms Primary and secondary

d) The distance to fault in percentage and km of line length:

This detailed information

xxxii. The relay shall be able to display Fault details on the LCD Screen such as Fault- Loop or Faulty phases, the Zone, and the Relay Operate time.

xxxiii. Internal Disturbance recorder with capacity to record eight analogue and twelve digital signals. The relay shall have capacity to store the latest, twenty (20), disturbance records.

xxxiv. Storage of at least Fifty (50) event records

xxxv. Storage of at least twenty (20) trip records. The following fault data will be available:

(a) Magnitude and phase angle of phase currents and voltages before the fault

(b) Magnitude and phase angle of phase currents and voltages during the fault

(c) The sequence of events of digital signals, start and operate (Trip) signals involved in fault detection and clearance. The events shall me time tagged to 10ms level.

xxxvi. Events and fault records shall not be erased even when the auxiliary DC supply is switched off.

xxxvii. Metering and display on the LCD screen of the following Power system instantaneous parameters including;

(a) Voltage

(b) Load current

(c) Active Power

(d) Reactive Power

(e) Apparent Power

(f) Power Factor and

(g) Frequency

Note: Simultaneous Maximum demand values of Active Power, Reactive Power and Apparent Power shall be available in the relay.

xxxviii. As a minimum the relay shall have ten (10) Binary inputs.

xxxix. As a minimum the relay shall have twelve (12) Binary outputs.

Note: Two pairs of the binary output relays shall be rated to directly energise the circuit breaker trip coil. These contacts shall be able to safely interrupt the Circuit Breaker trip Coil current.

xl. Stability against switching inrush currents and reverse faults.

xli. Clear faulted phase indication.

xlii. Clear fault identification even for boundary conditions.

xliii. At least twelve (12) LEDs for indication of the following; - Relay trip, Phase L1, Phase L2, Phase L3, Zone 1, Zone 2, Zone 3, DEF, Channel aided trip, SOTF, etc.

xliv. Relay healthy LED

xlv. Relay self-supervision, with LED for healthy status indication(green) and Error indication (red) and watchdog contact

xlvi. Protocol applicable: IEC 61850-8-1. Appropriate communication ports to be provided on the relay.

xlvii. Relay Terminals-shall be screw type terminals large enough to accommodate at least 2 x2.5mm^2 cable and shall be located at the back of the relay.

xlviii. Front Serial RS232 or USB or Optical or Ethernet Port shall be provided for relay configuration and parameter setting and download of Data using a Laptop Computer.

xlix. Software for Programming the configuration and Relay Settings and also downloading and analysing the Relay Data shall be provided.

l. Relay to Laptop connection cable

li. **Relay configuration:** The Manufacturer shall carry out relay configuration at the Factory to suit installation in existing transmission substations in KPLC Network. Existing Protection and control drawings for the substations shall be handed over to the manufacturer/supplier for relay configuration. The FATs shall be carried out once the relays have been configured. Correct functionality of all relay Protection and Control Functions shall checked during the FATS.

4.4.4. **Line Current Differential Relay Type I:**

The differential relay shall be used to protect an overhead transmission line. The actual line length will be indicated in the technical schedules. The lines to be protected are of varying lengths. The specific requirements in terms of length of line to be protected will be stated in the scope of supply or Price schedule.

4.4.4.1. Each relay is expected to interface directly with a single mode optical fibre (OPGW).

4.4.4.2. Each Relay should come with 20 metre fibre patch cords with ST connectors to connect with optical fibre cable at the ODF.

4.4.4.3. In addition to performing the differential function the relay shall incorporate back up distance protection and three phase overcurrent and earth fault back-up protection functions.

4.4.4.4. The Differential relay is for use on Transmission Lines, to provide fast and highly dependable selective fault clearance on overhead lines.

4.4.4.5. The Relay shall be for application in a substation with 1&1/3 circuit breaker configuration, hence shall be suitable for tripping of two circuit breakers, monitoring the status of two circuit breakers and automatic reclosure of two circuit breakers.

4.4.4.6. The relay shall be used for re-trofit purposes to replace existing old static & electromechanical relays.

4.4.4.7. **The relays should also incorporate the following protection features.**

i. Full numerical design with at least two groups of settings.

ii. The Relay offered must have been in Service in Kenya Power System and operated successfully for the duration of service. Improved designs of previous relays are acceptable.

iii. Relays that have failed in service or mal-operated shall not be acceptable

iv. The relay shall be suitable for Flush mounting on the panel.

v. Single pole and three pole tripping logic

vi. The relays at the two ends shall operate under directly connected fiber optical cable

vii. Simultaneous tripping of relays at both ends even if there is little or no in-feed from one end.

viii. Phase segregated current differential measurement of both magnitude and phase angle.

ix. High speed discriminative Protection for all fault types.

x. High sensitivity for detection of high resistive phase to earth faults

xi. Integrated Distance protection with at least three Zones of selectable Quadrilateral/mho comparator characteristics, with load encroachment discrimination, SOTF, Power Swing Block. Fuse Failure Protection and Directional earth fault Protection.

xii. The distance protection and the Directional Earth Protection shall have unit protection schemes such as those covered in the specifications for Distance Protection Type I.

xiii. In case of Loss of communication for the differential protection, the distance protection will automatically be enabled.

xiv. Back up Overcurrent and earth fault protection with Definite Time and Inverse IEC Time-current Characteristics

xv. Selective Single phase and three phase tripping suitable for single pole trip and auto-reclose for phase to ground faults and three phase trip and lock out for other faults.

xvi. The relay shall be capable of initiation of auto-reclose on an external autoreclose relay. The relay shall achieve the following functionality via an external selector switch:

a. **Autoreclose Block**; No Autoreclose/Trip to Lockout

b. **Single Pole Autoreclose** (Single pole Trip and Autoreclose for phase to ground faults only)

c. **Single pole + Three Phase Autoreclose (SPAR + DAR):** Single pole trip and autoreclose for Phase to ground faults followed by three pole trip and auto-reclose for the next phase to ground or phase to phase fault within the reclaim time). Where the initial fault is a phase to phase fault, then only one shot of three phase trip and auto-reclose will be performed.

d. **Three Phase Autoreclose (DAR):** three phases and autoreclose only for phase to ground faults

e. It shall be possible to initiate autoreclose in a distance relay in the neighbouring protection panel for protection of the same transmission line.

xvii. The relay shall have communication channel supervision facilities.

xviii. The relay shall have high stability under transient conditions.

xix. The relay shall have high stability for heavy through faults and CT saturation effects.

xx. The relay shall be insensitive to DC Components and Harmonics.

xxi. The relay shall be capable of communication between the two ends via directly connected Optical fibre cable.

xxii. Direct Transfer tripping via the optical fibre cable, independent of differential scheme.

xxiii. Line capacitive charging current compensation and withstand.

xxiv. CT ratio (Amplitude) and phase angle correction in built in the relay

xxv. Selectable minimum operating current, 10-150% of in for low set differential element.

xxvi. High set differential operating element

xxvii. Relay Operate time: less than 30ms.

xxviii. Transformer inrush restraint

xxix. The differential Relay shall restrain upon the loss of the communication channel and block the differential scheme and enable emergency overcurrent protection.

xxx. Relay terminals shall be provided at the back and shall be suitable for termination of 2.5 mm2 cable. The terminal screws shall be design of star/flat type.

xxxi. Distance to fault measurement, with automatic display on the Relay LCD Screen, where the distance to fault can be directly read/seen.

xxxii. Display of Fault details on the LCD such as Fault Loop or Faulty phases, the Zone, and the Relay Operate time.

xxxiii. Storage of at least Five (5) disturbance(oscillograph)

xxxiv. Storage of at least Twenty (20) event records

xxxv. Storage of at least Five (5) Trip records including value of phase and earth fault

xxxvi. currents and the relay tripping times

xxxvii. Events and fault records shall not be erased even when the auxiliary DC supply is

xxxviii. switched off.

xxxix. Status indications of all input, output and internal functions.

xl. Programmable binary inputs, which can be configured to perform, customized

xli. functions.

xlii. Programmable relay outputs (trips and alarm contacts) that can be configured to

xliii. perform various tasks.

xliv. Metering, including; U, I, P, Q, S, F & Cos Φ

xlv. At least Sixteen (16) Binary inputs.

xlvi. At least twenty (20) Binary outputs

xlvii. Human – Machine interface with visual display of measurements and internal

xlviii. operations of the relays. Facilities for scrolling should be provided. Default display

xlix. should be programmable. It should be possible and convenient to program Relay

l. settings from the HMI.

li. The bias and operate current on a phase basis in both magnitude and phase for both

lii. local and remote ends should be accessible through the MMI.

liii. 9 pins – RS232 port for connection to laptop PC should be available on the front of the relay or any other suitable serial communication port.

liv. Protocol applicable: Full IEC 61850-8-1 compliant & IEC 60870-5- 103. Appropriate

lv. communication ports to be provided for local and remote communication.

lvi. Self – supervision with fault diagnosis and watchdog contact.

lvii. LED indications for: Relay healthy(Green), relay faulty(Amber) and Protection operated (Red)

lviii. Shall have twelve (12) LEDs for various indications

lix. Password Protection for relay settings.

lx. Independent Latching of Trip commands, to prevent CB reclose.

lxi. Except for the latched commands, all other relay Operations should be resettable with the Relay covers on.

lxii. Upon Operation, the Relay will indicate the Faulted Phase(s), Time taken to Trip and Fault Current on the MMI. Additionally, the faulted phases, Issuance of Trip Command, and Communication failure between the two Relays should be indicated using Red LEDs.

lxiii. Fault Locator with automatic display on the Relay LCD Screen of the differential relay distance to fault in terms of Line percentage or distance in km. This information is for use by other operational staff to guide the maintenance/repair teams. The last distance to fault will always be displayed on the screen.

Note: In the bid submission the bidder shall demonstrate that the requirement of this clause is fully met. Requirement to use the keypad to access this information is not acceptable.

lxiv. **Binary Output Relays**: Two pairs of the binary output relays shall be rated to directly energise the circuit breaker trip coil. This output relays shall provide phase segregated outputs for each phase. This is to allow single phase trip and auto-reclose. This trip output relays shall have fast operating times of less than 5 ms.

lxv. **Relay configuration:** The Manufacturer shall carry out relay configuration at the Factory to suit installation in existing transmission substations in KPLC Network. Existing Protection and control drawings for the substations shall be handed over to the manufacturer/supplier for relay configuration.

lxvi. The FATs shall be carried out once the relays have been configured. Correct functionality of all relay Protection and Control Functions shall checked during the FATS, including correct operation on the single pole auto reclose scheme where applicable.

4.4.5. **Line Current Differential Relay Type II:**

The differential relay shall be used to protect a 66kV underground/Overhead Line.

4.4.5.1. The actual length of overhead Line or Under-ground cable to be protected shall be stated in the Scope of Supply or Price Schedule.

4.4.5.2. An underground all dielectric fibre cable to be laid in the same trench as the 66kV underground single-phase power cables will provide the communication channel for the Line current differential Protection Scheme.

4.4.5.3. Each relay shall interface directly with the underground single mode optical fibre cable.

4.4.5.4. Each Relay should come with 20 metre fibre patch cords with ST connectors to connect with optical fibre cable at the ODF.

4.4.5.5. In addition to performing the differential function the relay should incorporate back up distance protection and three-phase overcurrent and earth fault back-up protection functions.

4.4.5.6. The Relay offered must have been in Service in Kenya Power System and operated successfully for the duration of service. Improved designs of previous relays are acceptable

4.4.5.7. **The relays should incorporate the following Protection Features: -**

i. Fully numerical design with at least two groups of settings.

Note: *Relays offers from Manufacturers who have not as yet supplied relays to Kenya are not acceptable for this tender.*

ii. Relays that have failed in service or mal-operated shall not be acceptable

iii. The relay shall be suitable for Flush mounting on the panel.

iv. Three phase tripping logic

v. Simultaneous tripping of relays at both ends even if there is little or no in-feed from one end.

vi. Phase segregated current differential measurement of both magnitude and phase angle.

vii. High speed discriminative Protection for all fault types.

viii. High sensitivity for detection of high resistive phase to earth faults

ix. Integrated Distance protection with at least three Zones of selectable Quadrilateral/mho comparator characteristics, with load encroachment discrimination.

x. Back up Overcurrent and earth fault protection with Definite Time and Inverse IEC Time-current Characteristics

xi. Three-phase auto reclose Function

xii. Communication channel supervision facilities.

xiii. High stability under transient conditions.

xiv. High stability for heavy through faults and CT saturation effects.

xv. Insensitive to DC Components and Harmonics.

xvi. Be capable of communication between the two ends via directly connected Optical fibre cable.

xvii. Direct Transfer tripping via the optical fibre cable, independent of differential scheme.

xviii. Cable capacitive charging current compensation and withstand.

xix. CT ratio (amplitude) and phase angle correction in built in the relay

xx. Selectable minimum operating current, 10-150% of In.

xxi. Relay Operate time: less than 30ms.

xxii. Transformer inrush restraint

xxiii. The differential Relay shall restrain upon the loss of the communication channel and block the differential scheme and enable Emergency backup overcurrent and Earth fault protection. Relay terminals shall be provided at the Back and shall be suitable for termination of 2.5 mm2 cable. The terminal screws shall be of star or flat type.

xxiv. Distance to fault measurement, with automatic display on the relay LCD screen, where the distance to fault can be directly read/seen.

xxv. Display of Fault details on the LCD such as Fault Loop or Faulty phases, the Zone, and the Relay Operate time.

xxvi. Storage of at least five (5) disturbance(oscillographic)

xxvii. Storage of at least twenty (20) event records

xxviii. Storage of at least five (5) Trip records including value of phase and earth fault currents and the relay tripping times

xxix. Events and fault records shall not be erased even when the auxiliary DC supply is switched off.

xxx. Status indications of all input, output and internal functions.

xxxi. Programmable binary inputs, which can be configured to perform, customized functions.

xxxii. Programmable relay outputs (trips and alarm contacts) that can be configured to perform various tasks.

xxxiii. Metering, including; U, I, P, Q, S, F & CosΦ

xxxiv. At least Twelve (12) Binary inputs.

xxxv. At least Twelve (12) Output Relays/Contacts

xxxvi. Human – Machine interface with visual display of measurements and internal operations of the relays. Facilities for scrolling should be provided. Default display should be programmable. It should be possible and convenient to program Relay settings from the MMI.

xxxvii. The bias and operate current on a phase basis in both magnitude and phase for bothlocal and remote ends should be accessible through the MMI.

xxxviii. Protocol applicable: Full IEC 61850-8-1 compliant. Appropriate communication ports to be provided for local and remote communication.

xxxix. 9 pin – RS232 port for connection to laptop PC should be available on the front of the relay or any other suitable serial port.

xl. Self – supervision with fault diagnosis.

xli. LED indications for; Relay healthy(Green), relay faulty(Amber) and Protection Operated(Red)

xlii. Additional at least twelve (12) LEDs for various indications

xliii. Password Protection for relay settings.

xliv. Independent Latching of Trip commands, to prevent CB reclose.

xlv. Except for the latched commands, all other relay Operations should be resettable with the Relay cover on.

xlvi. Upon Operation, the Relay will indicate the Faulted Phase(s), Time taken to Trip and Fault Current on the MMI. Additionally, the faulted phases, Issuance of Trip Command, and Communication failure between the two Relays should be indicated using Red LEDs.

xlvii. Relay configuration: The Manufacturer shall carry out relay configuration at the factory to suit installation in existing transmission substations in KPLC Network. Existing Protection and control drawings for the substations shall be handed over to the manufacturer/supplier for relay configuration. The FATs shall be carried out once the relays have been configured. Correct functionality of all relay Protection and Control Functions shall checked during the FATS.

4.4.6. **Biased Differential Protection Relay for a Two or Three Winding Power Transformer:**

Note: *The relay offered must have been in service in Kenya Power for at Least 8 years and offered satisfactory service. Improved designs of previous relays are acceptable.*

4.4.6.1. **The Relay shall have the following Functions and Features: -**

i. Suitable for protection of a two or three winding power transformer, with a power rating of up to 90 MVA, with HV winding rated up to 245kV. Specific requirements will be stated in the Scope of supply or Price schedules.

ii. Relay must be of Numerical design

iii. Flush mounting design

iv. Pick up setting range, for IDIFF >; 0.1 to 1.0 x rated current, as a minimum

v. Pickup on switch-on (factor of IDIFF>) 1.0 to 2.0

vi. High-set Element (IDIFF>>) with a setting range of 1.0 to 20.0 x rated current

vii. Independent definite time delay setting for IDIFF> and for IDIFF>> of 0.00 to 30.00 seconds as a minimum

viii. Magnetizing current inrush restraint feature, using 2nd harmonic restraint and /or zero crossing on the sine wave

ix. Setting range of I2fN/IfN of 10 to 50% as a minimum

x. Compensation for zero sequence currents that may appear on only one winding of the power transformer

xi. Measurement and indication on the LCD screen, of phase – HV&LV currents and relay differential and bias currents

xii. Storage of at least Five (5) Fault records and Ten (10) Event records

xiii. Events and fault records shall not be erased even when the auxiliary DC supply is switched off

xiv. The Fault flags shall be visible on the LCD screen, and provide details of the phases that have operated and the fault current values.

xv. Over-fluxing protection function with at least two stages of alarm and trip functions

xvi. 5th harmonic restraint feature on the differential Element to prevent unnecessary tripping due to CT saturation or transformer over-excitation.

xvii. Over-excitation Protection with both alarm and trip elements

xviii. Stabilized against transient and steady-state fault currents caused e.g. by over-excitation of transformers, using fifth harmonic.

xix. Insensitive against DC offset currents and current transformer saturation.

xx. High stability also for different current transformer saturation

xxi. High-speed instantaneous trip on high-current transformer faults.

xxii.

xxiii. Independent of the conditioning of the star point(s) of the power transformer.

xxiv. High earth-fault sensitivity by detection of the star point current of an earthed transformer winding

xxv. Integrated matching of the transformer connection group

xxvi. Integrated matching of the transformation ratio including different rated currents of the transformer windings

xxvii. Dual Bias characteristics with two slopes to ensure relay stability for heavy through faults. The start and end of the two slopes shall be settable, in terms of the rated current.

xxviii. Unbalanced Load Protection

xxix. Thermal Overload Protection

xxx. Back up Overcurrent and Earth Fault protection for HV and/or LV winding

4.4.6.2. The following measurements shall be available in the relay:

i. Magnitudes and phase angles of the phase currents for the three phases on the HV side of Transformer

ii. Magnitudes and phase angles of the phase currents for the three phases on the LV side of Transformer

iii. Magnitude of differential current and restraining current for the three phases

iv. The disturbance recorder function shall have a capacity for eight (8) analogue and twelve (12) digital signals. The last four disturbance records will be available in the relay.

v. Red L.E.D to indicate that the relay has operated/issued trip command

vi. Relay Self diagnostic, with LED to indicate Relay failure and a contact for remote indication of relay failure status

vii. The relay shall have at least eight (8) LEDs for trip and alarms and at least four (4) binary inputs.

viii. The relay shall have at least our (4) outputs relays with normally open contacts for circuit breaker tripping and alarm annunciation. Two pairs of contacts shall be rated to directly energise the circuit breaker tripping coil.

ix. The relay shall have the ability to select output contacts to latched or non-latched status and the LCD screen where the settings and measurands can be read.

x. The relay shall have keypad for manual programming of settings and data access.

xi. The relay shall have front serial RS232 or USB or Ethernet Port for Relay communication with a laptop computer for relay configuration and parameter settings and download of fault records, events records and disturbance record.

xii. Relay terminals-shall be screw type terminals large enough to accommodate at least 2x2mm2 cable and shall be located at the back of the relay.

xiii. Four (4) sets of installation, commissioning, operation and maintenance manuals shall be provided.

xiv. Relay to Laptop connection cable shall be provided.

xv. Software for relay configuration and settings programming using Laptop computer shall be provided.

4.4.7. **Restricted Earth Fault Relay:**

NB: The relay Offered must have been in service in Kenya Power for at Least 8 years and offered satisfactory service. Improved designs of previous relays are acceptable.

4.4.7.1. This relay shall be used for protection of one winding of a power transformer.

4.4.7.2. This relay shall have the following functions and features: -

i. Relay shall be of Numerical, static type or Electro-Mechanical type.

ii. The Relay shall operate on high impedance principle.

iii. The relay shall be of numeric design.

iv. The relay shall be suitable for flush mounting on panel front.

v. The relay shall be of an independent relay and not a function in the differential relay.

vi. Relay shall reject harmonics produced by the system particularly third harmonics.

vii. Stabilising resistor and voltage dependent resistor (metrosil) of suitable rating shall be offered with the Relay based on maximum through Fault of 31kA.

viii. The relay current setting range shall be 0.05- 0.8 x rated current (In) as a minimum and an operating time < 25ms at 5 times the setting.

ix. The relay shall have four (4) LEDs for relay status indication and for trip and alarms annunciation as a minimum and two (2) binary inputs as a minimum

x. The relay shall have four (4) Binary Outputs as a minimum with LCD screen where the settings and measurands can be read

xi. The relay's REF operate current shall be displayed on the LCD screen and keypad for manual programming of settings and data access

xii. The relay shall have serial RS232, USB or Ethernet Port for relay configuration and programming of parameter settings and data download using a laptop computer.

xiii. The relay shall have an event recorder with capacity to store the last fifty (50) events

xiv. The relay shall have fault recorder with capacity to store the last ten (10) fault records

xv. The relay shall have a disturbance record with capacity to store the last four (4) disturbance records

xvi. The relay terminals shall be screw type terminals large enough to accommodate at least 4 mm^2 cable and shall be located at the back of the relay

4.4.8. **Stabilizing Resistor**

Each REF relay shall be supplied with an adjustable stabilizing resistor. For dimensioning of the stabilizing resistor consider maximum through fault phase –earth current of 31.5kA.

4.4.9. **Voltage Dependent Resistor (Metrosil)**

4.4.9.1. Each REF relay shall be supplied with a voltage dependent resistor (VDR) or metrosil to limit voltage across the REF high impedance circuit. The basis for the rated voltage of the VDR is the maximum phase-earth through fault of 31.5kA.

Note: *The Stabilising resistor and the Voltage dependent resistor shall preferably be housed in a box with terminals that allow connection of the REF relay to the resistor and VDR in the box. Several terminals will be provided to allow selection of required stabilizing resistor. The single box will be suitable for panel mounting.*

4.4.10. **Feeder Protection and Bay Control Relay**

NB: The relay Offered must have been in service in Kenya Power for at Least 8 years and offered satisfactory service. Improved designs of previous relays are acceptable.

4.4.10.1. This relay shall have the following functions and features: -

i. The Feeder Protection and bay control relay shall be of Numeric Design

ii. The relay shall be suitable for flush mounting

iii. The relay will have a large LCD screen measuring at least 7cm X 7cm where a mimic of the switchgear arrangement and status of the switchgear for the bay shall be displayed.

iv. The position of the Circuit Breaker, i.e. racked-in or withdrawn shall be indicated.

v. Circuit Breaker close and open push key buttons with symbols and colour codes as per the IEC standards shall be provided on the relay as well as switchgear selection key.

vi. A Local/Remote key selector switch shall be provided on the relay and the selected status of the selector switch indicated by means of an LED.

vii. The Relay offered shall have at least the following protection functions; -

(a) Three Phase Overcurrent and Earth Fault

(b) Sensitive earth fault

(c) Broken Conductor detection

(d) Autoreclose

(e) Circuit breaker contact wear

(f) Circuit breaker Failure protection

(g) Under and over frequency protection as well as rate of change protection

(h) Over voltage protection

Note1: *All the protection functions shall meet the requirements of each function as included in this specification.*

Note 2*: Earth Fault and Sensitive Earth Fault Protection elements shall be separate to allow independent settings to be applied.*

Note 3*: Earth Fault and Sensitive earth fault shall have separate CT inputs.*

Note 4*: Detailed specifications for three phase overcurrent, earth fault and sensitive earth fault functions are included elsewhere in these specifications.*

viii. The relay shall have a circuit breaker contact wear counter/monitor.

ix. The Relay shall measure and display (Metering) on the LCD screen the following power system parameters; Current (I), Voltage (V), Active Power (P), Reactive Power (Q), Frequency (HZ) and power factor (P.F).

x. The relay shall store at least twenty (20) fault records, Fifty (50) events and ten (10) disturbance records. The disturbance record shall have capacity to monitor Eight (8) analogue and ten (10) digital channels.

xi. It shall be possible to display instantaneous measurands on the screen alongside the bay mimic.

xii. The unit shall have an L.E.D to indicate relay healthy status (green colour) and relay faulty status (red colour). A separate Red L.E.D to indicate operation (Trip) of the protection functions.

xiii. The relay shall have at least Eight (8) programmable LEDs for displaying Protection function operations and other alarms.

xiv. The template for writing the alarm labels shall be provided with the relay

xv. The relay shall have at least twelve (12) binary inputs

xvi. The Relay shall have at least six (6) output relays

xvii. The relay shall be provided with IEC 61850-8-1 Communication protocol, and the corresponding communication port.

xviii. The Relay terminals shall be of screw type terminals large enough to accommodate at least 2x2.5mm2 cable and shall be located at the back of the relay.

xix. Front Serial RS232 or USB or Ethernet Port for relay communication with a laptop computer for relay configuration and parameter settings and download of fault records, events records and disturbance record for analysis.

4.4.11. **Auto reclose relay Function in the Feeder Protection Relay.**

This autoreclose function shall be housed within the feeder protection relay and shall have the following features: -

i. Selectable 1 – 3 auto-reclose shots

ii. Independently set dead time for each shot

iii. Autoreclose inhibit after manual close both from external CB close switch and from control key on the Relay front face.

iv. Each autoreclose shot shall be initiated by the selected protection function(s). Operation of protection function not selected to initiate a particular shot of autoreclose shall lead to lock-out of the relay, hence circuit breaker.

v. Autoreclose inhibition for over current high set element.

Note: The Protection Functions Offered shall satisfy the detailed specifications as included elsewhere in this specification for each of the protection and control functions.

4.4.12. **Feeder Protection Relay:**

4.4.12.1. The Relay shall have the following protection functions and features in a single casing as a minimum: -

i. Three phase overcurrent

ii. Earth fault

iii. Sensitive Earth Fault

iv. Broken Conductor detection

v. Autoreclose function for three phase autoreclose.

vi. Under- and Over-Frequency Protection, including rate of change frequency protection

Note 1: *Earth Fault and Sensitive Earth Fault Protection elements shall be separate to allow independent settings to be applied. These functions will have separate CT inputs*

Note 2: *Earth Fault and Sensitive earth fault elements shall have separate CT Inputs.*

Note 3: *Detailed specifications for three phase overcurrent, earth fault and sensitive earth fault functions are included elsewhere in this specification. All requirements must be met.*

4.4.12.2. There shall be independent CT input for Earth Fault and for Sensitive Earth Fault Protection to allow independent connection of the Sensitive Earth Fault Protection Function to a separate Core type CT

4.4.12.3. Relay must be of Numerical design.

4.4.12.4. Relays that have failed in service or mal-operated shall not be acceptable

4.4.12.5. The relays shall be suitable for flush mounting on the front of the panel

4.4.12.6. Current setting range for overcurrent function shall be 0.5In-2.0In as a minimum

4.4.12.7. Current setting range for earth fault function shall be 0.05In-0.8In as a minimum

4.4.12.8. Two stages of High Set Element for both overcurrent and earth fault protection function, with a setting range of 1-20In as a minimum and a definite time delay setting of 0 – 60 seconds as a minimum.

4.4.12.9. I.D.M.T characteristics for overcurrent and Earth fault protection function according to BS142 or IEC60255 i.e. Standard Inverse (SI), Very Inverse (VI), Extremely Inverse (EI), Long Time Inverse (LTI), including definite time for the high-set Elements.

4.4.12.10. Time setting multiplier 0.05 – 1.0 as a minimum

4.4.12.11. Current setting range for sensitive earth fault function 0.01In - 0.8In as a minimum

4.4.12.12. Definite time delay characteristic for Sensitive earth fault function; setting range, 0- 30 seconds as a minimum.

4.4.12.13. Requirements for the auto reclose function:

i. Three phases auto reclose

ii. Selectable 1 – 3 autoreclose shots

iii. Independently set dead time for each shot

iv. Autoreclose inhibit after manual close

v. Each autoreclose shot shall be initiated by the selected Protection Function(s). Operation of Protection Function not selected to initiate a particular shot of Autoreclose shall lead to Lock-out.

vi. Autoreclose inhibition for over current high set element

4.4.12.14. Data Storage:

i. Storage of at least five (5) fault/trip records

ii. Ten (10) event records

iii. Five (5) disturbance records

Note: *Events and fault records shall not be erased even when the auxiliary DC supply is switched off*

4.4.12.15. Configurable output relays for protection element pick up (start) and Trip outputs which can be used to back-trip upstream circuit breakers and for implementing blocking schemes for busbar protection.

4.4.12.16. Red L.E.D to indicate that the protection functions have operated and issued a trip output to Trip the circuit breaker.

4.4.12.17. Relay self-diagnostic, with LED to indicate relay healthy status (green colour) and relay failed status (red colour) and a watch dog contact for remote alarm

4.4.12.18. LEDs: The relay shall have a minimum eight (8) LEDs for alarms annunciation.

4.4.12.19. Binary Outputs: The relay shall have as a minimum twelve (12) Binary inputs.

4.4.12.20. Binary Outputs: The relay shall have a minimum four (4) outputs Relays. One (1) of the output relays shall be adequately rated to directly operate the circuit breaker trip coil.

4.4.12.21. LCD screen where the settings and measurands can be read

4.4.12.22. Keypad for manual programming of settings and data access

4.4.12.23. Relay Terminals-shall be screw type terminals large enough to accommodate at least 4mm2 cable and shall be located at the back of the relay

4.4.12.24. The relay applicable protocol shall be IEC 61850-8-1

4.4.12.25. Front Serial RS232 or USB or Ethernet Port for relay communication with a laptop computer for relay configuration and parameter settings and download of fault records, events records and disturbance records for analysis.

4.4.12.26. Software for configuration and relay parameter settings and also downloading and analysing the relay fault data shall be provided.

4.4.12.27. Relay to Laptop connection cable shall be provided

4.4.12.28. Auto reclose relay Function in the feeder protection relay. This auto reclose function shall be housed within the feeder protection relay: -

i. Selectable 1 – 3 auto reclose shots

ii. Independently set dead time for each shot

iii. Auto-reclose inhibit after manual close

iv. Each auto-reclose shot shall be initiated by the selected protection function(s). Operation of protection function not selected to initiate a particular shot of auto-reclose shall lead to lock-out of the relay.

v. Auto-reclose inhibition for over current high set element.

4.4.13. **Three- Phase Directional Overcurrent and Earth Fault Relay:**

NB: The relay Offered must have been in service in Kenya Power for at Least 8 years and offered satisfactory service. Improved designs of previous relays are acceptable.

The relay shall have the following functions and features: -

i. Relay must be of Numerical design.

ii. Shall be suitable for flush mounting on the front of the panel

iii. The Relay Offered must have been in Service in Kenya Power System and operated successfully for the eight (8) years. Improved designs of previous relays are acceptable. Relays that have failed in service or mal-operated shall not be acceptable

iv. The relay shall have a red L.E.D to indicate that the relay has operated to trip

v. Relay Self diagnostic, with LED to indicate relay healthy status (green colour) and relay

vi. failed status (red colour) and a watch dog contact for remote alarm shall be provided.

vii. Current setting range for overcurrent relay 0.5In-2.4x rated current (In), as a minimum

viii. Current setting range for earth fault relay 0.05In-0.8xrated current (In), as a minimum

ix. Quadrature connection for polarizing voltage

x. Applicable on the LV side of a Dyn1 transformer

xi. Overcurrent high set Element, with a setting range of 1-20 x rated current (In) as a minimum.

xii. Earth fault high set element, with a current setting range of 1-20 x rated current as a minimum.

xiii. All stages of the Phase and Earth Fault elements shall be freely assigned the directional feature, as forward, reverse or non-directional.

xiv. Inverse Current-Time characteristics according to BS 142 or IEC 60255 and Definite time characteristics. The characteristic for each protection function shall be selectable.

xv. The normal operating boundary shall be +/-90 degrees from relay characteristic angle.

xvi. Relay sensitivity shall be 1% of rated value of current and polarizing voltage at an angle equal to the relay characteristic angle.

xvii. Time setting multiplier 0.05 – 1.0, as a minimum

xviii. Broken conductor detection feature

xix. Circuit breaker contact wear monitor

xx. Storage of at least five (5) fault records and ten (10) event records

Note: *Events and fault records shall not be erased even when the auxiliary DC supply is switched off.*

xxi. Storage of the last two disturbance records as a minimum.

xxii. Configurable output relays with ability to output starting elements to control tripping of other upstream protection relays.

xxiii. The relay shall have as a minimum eight (8) LEDs for alarms annunciation

xxiv. The relay shall have as a minimum four (4) binary inputs.

xxv. The Relay shall have as a minimum four (4) output relays and an LCD screen where the settings and measurands can be read.

xxvi. Keypad for manual programming of settings and data access

xxvii. Relay Terminals-shall be screw type terminals large enough to accommodate at least 4mm2 cable and shall be located at the back of the relay

xxviii. Front Serial RS232 or USB or Ethernet port for relay communication with a laptop computer for relay configuration and parameter settings and download of fault records, events records and disturbance records for analysis.

4.4.14. **Three Phase Overcurrent and Earth Fault Relay:**

NB: The relay offered must have been in service in Kenya Power for at least 8 years and offered satisfactory service. Improved designs of previous relays are acceptable.

The relay shall have the following Functions and Features: -

i. Relay must be of Numerical Design

ii. Relays shall be suitable for Flush mounting on the panel front and current setting range for overcurrent relay shall be 0.5In-2.0In as a minimum

iii. Current setting range for earth fault relay shall be 0.05In-0.8In as a minimum

iv. I.D.M.T characteristics for overcurrent and earth fault protection function according to BS142 or IEC60255 i.e. Standard Inverse (SI), Very Inverse (VI), Extremely Inverse (EI), Long Time Inverse (LTI), including definite time for the high-set Elements.

v. The relays 'time setting multiplier 0.05 – 1.0, as a minimum and under frequency protection feature shall be provided.

vi. Relays Broken conductor detection protection feature shall be provided.

vii. High set element for both overcurrent and earth fault protection, with a setting range of 1-20 x rated current (In) and a definite time delay setting of– 60 seconds shall be provided.

viii. Circuit breaker contact wear monitor: Ability to store at least five (5) fault records and ten (10) event records

ix. Events and fault records shall not be erased even when the auxiliary DC supply is switched off.

x. Means of identifying fault type and stage of protection that has operated either by

xi. use of LEDs or by automatic display of the fault records details on the relay LCD.

xii. Trip and start contacts shall be freely configurable to the output relays with drop off /pickup ratio >90% and low transient overreach < 10%.

xiii. Red L.E.D to indicate that the relay protection functions have operated/tripped and relay self-diagnostic, with LED to indicate relay healthy status (Green colour) and relay failed status (Red colour) and a watch dog contact for remote alarm shall be provided.

xiv. The relay shall have as a minimum eight (8) LEDs for alarms annunciation

xv. The relay shall have as a minimum four (4) binary inputs.

xvi. The Relay shall have as a minimum four (4) output relays

xvii. LCD screen where the settings and measurands can be read.

xviii. Relay Terminals-shall be screw type terminals large enough to accommodate at

xix. least 4mm2 cable and shall be located at the back of the relay.

xx. LCD screen Keypad for manual programming of settings and data access.

xxi. The relay shall have front serial RS232 or USB or Ethernet Port for relay communication with a laptop computer for relay configuration and parameter settings and download of fault records, events records and disturbance records for analysis.

xxii. Relay to Laptop connection cable shall be provided

4.4.15. **Earth Fault Relay:**

The Relay shall have the following functions and Features: -

i. Relay must be of Numerical Type

ii. Current setting range 0.05In-0.8In

iii. The Relay must have been in operation in Kenya Power System and operated successfully for the last eight (8) years. Improved designs of previous relays are acceptable.

iv. Shall be suitable for flush mounting on the front of the panel

v. Inverse Current – Time characteristics for Earth fault protection function according to BS142 or IEC60255 i.e. Standard Inverse (SI), Very Inverse (VI), Extremely Inverse (EI), Long Time Inverse (LTI), including definite time for the high-set Elements.

vi. Time setting multiplier 0.05 – 1.0 x rated current (In)

vii. High set Element with a setting range of 1-20 x rated current (In).

viii. Circuit breaker contact wear monitoring

ix. Ability to store at least five (5) Fault records, and ten (10) event records

x. Events and fault records shall not be erased even when the auxiliary DC supply is switched off.

xi. Trip and Start Contacts shall be freely configurable to the output Relays.

xii. Drop off /pickup ratio >90% and low transient overreach < 10%

xiii. Red L.E.D to indicate that the Relay has operated to trip

xiv. Relay Self diagnostic, with LED to indicate Relay failure and a contact for remote indication

xv. The relay shall have as a minimum four (4) LEDs for alarms annunciation

xvi. The relay shall have as a minimum four (4) binary inputs.

xvii. The Relay shall have as a minimum four (4) output relays

xviii. LCD screen where the Settings and measurands can be read

xix. Keypad for manual programming of settings and data access

xx. Relay Terminals-shall be screw type terminals large enough to accommodate at least 4mm2 cable and shall be located at the back of the relay

xxi. Front Serial RS232 or USB or Ethernet Port for relay communication with a

xxii. Laptop computer for Relay configuration and parameter settings and download

xxiii. of fault records, events records and disturbance records for analysis.

xxiv. Relay to Laptop connection cable

4.4.16. **Sensitive Earth Fault Relay:**

The Relay shall have the following functions and features: -

i. Relay must be of Numerical Type

ii. Should be suitable for flush mounting on the front of the panel

iii. The Relay must have been in operation in the Kenya Power System and operated successfully for the last eight (8) years. Improved designs of previous relays are acceptable.

iv. Relays that have failed in service or mal-operated shall not be acceptable

v. Current setting range for earth fault relay 0.0125In- 0.8In

vi. Definite time delay characteristic shall have setting range 0- 30seconds.

vii. Fault records, Event Records Events and fault records shall not be erased even when the auxiliary DC supply is switched off, drop off /pickup ratio >90% and low transient overreach < 10%.

viii. Red L.E.D to indicate that the Relay has operated to trip, relay self-diagnostic, with LED to indicate Relay failure and a contact for remote indication

ix. The relay shall have as a minimum four (4) LEDs for alarms annunciation

x. The relay shall have as a minimum four (4) binary inputs.

xi. The Relay shall have as a minimum four (4) output relays

xii. LCD screen where the settings and measurands can be read

xiii. Keypad for manual programming of settings and data access

xiv. Relay Terminals-shall be screw type terminals large enough to accommodate at least

xv. 2 x 2.5 mm2 cable and shall be located at the back of the relay

xvi. Front Serial RS232 or USB or Ethernet Port for relay communication with a laptop

computer for relay configuration and parameter settings and download of fault records, events records and disturbance records for analysis.

4.4.17. **Electrical Reset – Trip Relay**

The manufacturer shall have experience of a minimum of 15 years in the manufacture of trip relays

The relay shall be used to trip circuit breakers and shall have the following features: -

i. High burden tripping relay, immune to capacitance discharge currents and leakage currents

ii. At least Four (4) pairs of normally open (NO) and two (2) pairs of normally closed (NC) or 4NO/NC output contacts.

iii. Instantaneous operation; time <15ms

iv. The Relay shall be suitable for flush mounting

v. Flag or target shall be a red; L.E.D, or durable bulb or Red Mechanical flag

vi. The Relay shall be electrically reset, and the reset button shall be inbuilt on the relay and accessible without opening the relay cover or shall be supplied separately for panel flush mounting, in which case the reset button shall be illuminated with red colour.

vii. Contact rating – capable of carrying 30Amps for 3 seconds and 10A, continuously

viii. Relay terminals-shall be screw type large enough to accommodate at least 4mm2 cable and shall be located at the back of the relay

ix. Relay terminals shall be clearly marked

x. Relay contacts configuration shall preferably be drawn on the relay casing.

xi. Alternatively, a connection drawing shall be supplied with the relay.

xii. Size not greater than 24x19x6 cm

4.4.18. **Self-Reset Trip Relay**

The manufacturer shall have experience of a minimum of 15 years in the manufacture of trip relays

The relay shall be used to trip Circuit Breakers. The relay shall have the following features: -

i. High burden tripping relay, immune to capacitance discharge currents and leakage currents

ii. At least Four (4) pairs of normally open (NO) and two (2) pairs of normally closed (NC) or 4NO/NC output contacts.

iii. Instantaneous operation; time <15ms

iv. The Relay shall be suitable for flush mounting or for mounting on 35mm DIN rail, in which case the relay shall be supplied complete with the base

v. Flag or target shall be a red; L.E.D, or durable bulb or Red Mechanical flag

vi. The Relay shall be self-reset, once the relay initiating the trip resets.

vii. Contact rating – capable of carrying 30Amps for 3 seconds and 10A, continuously and the Relay terminals shall be clearly marked

viii. Relay Terminals-shall be screw type terminals large enough to accommodate at least

ix. 2 x 2.5 mm^2 cable and shall be located at the back of the relay

x. Drawing for relay connection shall be provided with the relay

xi. Relay contacts configuration shall preferably be drawn on the relay casing.

xii. Alternatively, a connection drawing shall be supplied with the relay.

xiii. Size not greater than 24x19x6 cm

4.4.19. **Trip circuit supervision Relay Type I:**

The manufacturer shall have experience of a minimum of 15 years in the manufacture of Trip Circuit Supervision relays

The relay shall have the following features: -

i. Continuous supervision of trip circuit for circuit breaker in both OPEN & CLOSED positions

ii. Trip Circuit Healthy – Red/Green L.E.D ON

iii. Trip circuit fail –Green/Red L.E.D OFF

iv. Two (2) normally closed (NC) and two (2) normally open(NO) or 2 C/O (change-over) output contacts

v. The relay shall have a time delay of at least 150mS to avoid transient operations

vi. Contact ratings – 30 Amps for 3 seconds and 5 Amps continuously.

vii. Suitable for flush mounting on the relay panel

viii. Relay Terminals-shall be screw type terminals large enough to accommodate at least 4mm2 cables and shall be located at the back of the relay and relay terminals shall be clearly marked.

ix. Relay shall be supplied complete with the base.

x. Relay contacts configuration shall preferably be drawn on the relay casing.

xi. Alternatively, a connection drawing shall be supplied with the relay.

xii. Size not greater than 16x9x9 cm

4.4.20. **Trip circuit supervision Relay Type II:**

The manufacturer shall have experience of a minimum of 15 years in the manufacture of Trip Circuit Supervision relays

The relay shall have the following Features: -

i. Continuous supervision of trip circuit for circuit breaker in both OPEN & CLOSED positions

ii. Trip Circuit Healthy – Red/Green L.E.D ON

iii. Trip circuit fail - Green/Red L.E.D OFF

iv. Two (2) normally closed (NC) and two (2) normally open (NO) or 2C/O (change-over) output contacts.

v. The relay shall have a time delay of at least 150mS to avoid operation due to transient DC supply interruptions.

vi. Contact ratings – 30 Amps for 3 seconds and 5 Amps continuously.

vii. Suitable for DIN Rail (35 mm) Mounting

viii. Relay Terminals-shall be screw type terminals large enough to accommodate at least 2 x 2.5 mm^2 cable and shall be located at the back of the relay

ix. Relay terminals shall be clearly marked

x. Relay shall be supplied complete with the base

xi. Relay contacts configuration shall preferably be drawn on the relay casing.

xii. Alternatively, a connection drawing shall be supplied with the relay.

Note: The manufacturer for the auxiliary relays below shall have a least 15 years' experience in the manufacture of auxiliary relays for transformer mechanical protection Trip function

4.4.21. **Auxiliary relays For Transformer Mechanical Protection Trip Function Type I:**

The relays shall be used as repeat relays for power transformer mechanical protection functions.

The Relay shall have the following features: -

i. High speed operation; < 20 ms for tripping
ii. One (1) element in one casing/relay
iii. Hand reset contacts
iv. Manually reset Operation indication/mechanical flag (Red in colour)
v. Shall be suitable for 35mm DIN rail mounting inside the panel
vi. At Least Three (3) pairs of normally open (NO) output contacts
vii. Relay Terminals-shall be screw type terminals large enough to accommodate at least 2.5 mm2 cables and located at the back of the relay.
viii. Contact ratings – 30 Amps for 3 seconds and 10 Amps continuously.
ix. Relay terminals shall be clearly marked, with indelible numbers
x. Relay shall be supplied complete with base.
xi. Relay contacts configuration shall preferably be drawn on the relay casing.
xii. Alternatively, a connection drawing shall be supplied with the relay.
xiii. Size not greater than 24x18x10 cm

4.4.22. **Auxiliary relays For Transformer Mechanical Protection Trip Function Type II:**

The Relay shall have the following features: -

i. High speed operation < 20 ms for Tripping
ii. One element (1) in one casing
iii. Self-reset contacts
iv. Manually reset Operation Indication flag – Red in colour
v. Provision of hand operation to close relay contacts for testing
vi. Shall be suitable for DIN Rail (35mm) mounting at the back of the panel
vii. At Least Three (3) pairs of normally open(NO) output contacts
viii. Complete relay including the relay base (socket).
ix. Contact ratings – 30 Amps for 3 seconds and 5 Amps continuously.
x. Relay Terminals-shall be screw type terminals large enough to accommodate at least 2.5 mm2 cable
xi. The Relay terminals shall be clearly marked.
xii. Relay contacts configuration shall preferably be drawn on the relay casing.

xiii. Alternatively, a connection drawing shall be supplied with the relay.

xiv. Relay shall be supplied complete with base

xv. Size not greater than 10x5x5 cm

4.4.23. **Auxiliary relays For Transformer Protection Alarm Function Type III:**

The relay shall have the following features: -

i. Moderate speed of operation < 35ms for Alarm

ii. One (1) element in one casing/relay

iii. Self-reset contacts

iv. Provision of hand operation to close relay contacts for testing

v. Manually reset operation indication flag – Red in colour

vi. Shall be suitable for DIN Rail mounting at the back of the panel

vii. At least Three (3) NO (Normally open) output contacts per element

viii. Contact ratings - 30 Amps for 3 seconds and 10 Amps continuously.

ix. Complete relay including the relay base (socket)

x. Relay Terminals-shall be screw type terminals large enough to accommodate at least 2.5 mm^2 cable

xi. Relay terminals shall be clearly marked

xii. Relay contacts configuration shall preferably be drawn on the relay casing

xiii. Relay supplied complete with base

xiv. Size not greater than 10x5x5 cm

4.4.24. **Bistable Auxiliary relays:**

The Relay shall have the following features: -

i. The manufacturer shall have at least 10 years' experience in the manufacture of Bistable auxiliary relays for use in Protection and Control Panels.

ii. Application of alternate control pulses cause the contacts to change from one state to the other.

iii. If the supply is interrupted, the contacts remain in their previous position even when the voltage is restored.

iv. Equipped with two DC coils, one for each contact position

v. Two identical stable latched positions with position indicators

vi. Rated DC supply110V DC; +10% & -20%

vii. Contacts at least 5NO + 5NC Contacts

viii. Contact ratings – 30 Amps for 3 seconds and 10 Amps continuously.

ix. Operating time ≤ 25 ms

x. Suitable for mounting on 35 mm DIN rail

xi. Coils not continuously energized- connected through contacts for cut-off after operation

xii. The terminals shall be screw type and large enough to accommodate 2x2.5 mm2 cable

xiii. Relay shall be supplied complete with the base

4.4.25. **DC Supply under Voltage Relay.**

The Relay shall have the following features: -

i. Shall have a settable range for under voltage pick up, of 30-80% of the rated DC Voltage

ii. Relay nominal voltage 110V DC

iii. Shall have an accuracy of < ± 4%

iv. Shall be self-reset when the voltage returns to normal level

v. Shall have a built-in indication LED (green) and a Built in Operation LED (red)

vi. Shall have at least 2 NC auxiliary contacts (contacts close for under voltage conditions)

vii. The Relay shall be rated for continuous operation at the rated DC voltage.

viii. Shall be suitable for mounting Flush mounting

ix. The terminals shall be screw type and large enough to accommodate 2.5 mm^2 cable

4.4.26. **Annunciator Relay Type I**

The manufacturer shall have a minimum experience of 15 years in the manufacture of the annunciator relay. The Annunciator relays shall have compact design. The Relay shall have the following features:

i. The Annunciator shall be designed to receive station equipment status information through hardwired contacts, hence provide a common point through which alarms can be monitored.

ii. The relay shall be compact and integrated into one common device. Relays with individual alarm covers are not acceptable.

iii. The relay shall be suitable to read and acknowledge alarms locally or remotely

iv. The relay shall be fully programmable via keypad and/or Laptop.

v. The status of the alarms shall be retained even with loss of auxiliary dc power supply. On power, up the last alarm status will be displayed.

vi. Shall have Silence, Accept, Reset and Test push buttons, to control the Alarms

vii. The single relay shall be equipped with at least thirty-six (36) separate alarm elements in a single casing. Each alarm to be independently programmable

viii. The relay shall be of digital design

ix. The relay shall be suitable for flush panel mounting

x. Each of the elements shall be freely assigned to one of two common output alarms; Urgent, and Non-urgent alarm.

xi. Each Alarm Element shall have a red L.E.D. to indicate alarm ON status. It shall also have provision for fixing of Identification Label changeable at site. A flashing alarm element shall be clearly visible.

xii. The Urgent and Non-Urgent common alarms shall be freely configurable to the output relays.

xiii. It shall have high immunity against electrical interference.

xiv. Relay Terminals-shall be of screw type, large enough to accommodate at least 2x2.5 mm2 cable and shall be located at the back of the relay.

xv. Relay terminals shall be clearly marked with indelible writing.

xvi. Relay contacts configuration shall preferably be drawn on the relay casing

xvii. At least two output relays one for urgent and the other for non-urgent alarm

xviii. The relay shall be supplied with field configurable labels.

xix. At least two (2) pairs of Normally Open (NO) out-put contacts for each out-put relay

4.4.27. **Annunciator Relay Type II:**

The manufacturer shall have a minimum experience of 15 years in the manufacture of the annunciator relay. The relay shall have the following functions and features: -

i. The Annunciator shall be designed to receive station equipment status information through hardwired contacts, hence provide a common point through which alarms can be monitored.

ii. The relay shall be compact and integrated into one common device. Relays with individual alarm covers are not acceptable.

iii. The relay shall be suitable to read and acknowledge alarms locally or remotely

iv. The relay shall be fully programmable via keypad and/or Laptop.

v. The status of the alarms shall be retained even with loss of auxiliary dc power supply, on power up the last alarm status will be displayed.

vi. The relay shall be of digital design

vii. The relay shall be suitable for flush panel mounting. The Relay shall have the following features: -

viii. Shall have Silence, Accept, Reset and Test push buttons, to control the Alarms

ix. The single relay shall be equipped with sixteen (16) separate alarm Elements in a single casing.

x. The Relay Offered must have been in Service in Kenya Power System and operated successfully for the last 4 years. Improved designs of previous relays are acceptable.

xi. Relays offers from Manufacturers who have not supplied relays before are not acceptable for this tender.

xii. Relays that have failed in service or mal-operated shall not be acceptable

xiii. Each of the elements shall be freely assigned to one of two common output Alarms; Urgent and NON-urgent Alarm.

xiv. Each Alarm Element shall have a Red L.E.D. to indicate ON status. It shall also have provision for fixing of Identification Label changeable on site. A flashing Alarm element shall be clearly visible.

xv. The Urgent and Non-Urgent common alarms shall be freely configurable to the output Relays.

xvi. It shall have high immunity against electrical interference

xvii. Relay Terminals-shall be of screw type, large enough to accommodate at least 2x2.5 mm^2 cable and shall be located at the back of the relay

xviii. Relay terminals shall be clearly marked, with indelible writing

xix. Relay contacts configuration shall preferably be drawn on the relay casing

xx. At least two out-put relays one for urgent and the other for non-urgent alarm

xxi. Drawings for wiring of the relay shall be supplied with the relay.

4.4.28. **Annunciator Relay Type III:**

The manufacturer shall have a minimum experience of 15 years in the manufacture of the annunciator relay. The Relay shall have the following features: -

i. The Annunciator shall be designed to receive station equipment status information through hardwired contacts, hence provide a common point through which alarms can be monitored.

ii. The relay shall be compact and integrated into one common device. Relays with individual alarm covers are not acceptable.

iii. The relay shall be suitable to read and acknowledge alarms locally or remotely

iv. The relay shall be fully programmable via keypad and/or Laptop.

v. The status of the alarms shall be retained even with loss of auxiliary dc power supply. On power, up the last alarm status will be displayed.

vi. The relay shall be of digital design

vii. The relay shall be suitable for flush panel mounting

viii. Shall have Silence, Accept, Reset and Test push buttons, to control the alarms

ix. The single relay shall be equipped with at least eight (8) but not more than sixteen (16) separate alarm elements in a single casing.

x. Relays that have failed in service or mal-operated shall not be acceptable

xi. Each of the elements shall be freely assigned to one of two common output alarms; Urgent and NON-urgent Alarm.

xii. Each alarm element shall have a red L.E.D. to indicate ON status. It shall also have provision for fixing of Identification Label changeable at site. A flashing alarm element shall be clearly visible when standing in front of the annunciator relay

xiii. The Urgent and Non-Urgent common alarms shall be freely configurable to the output relays.

xiv. It shall have high immunity against electrical interference.

xv. Relay terminals-shall be screw type, large enough to accommodate at least

xvi. 2x2.5 mm^2 cable and shall be located at the back of the relay

xvii. Relay terminals shall be clearly marked, with indelible writing

xviii. Relay contacts configuration shall preferably be drawn on the relay casing

xix. At least two output relays one for urgent and the other for non-urgent alarm

xx. A Drawing for wiring of the relay shall be supplied with the relay.

4.4.29. **Electronic Hooter:**

The manufacturer shall have a minimum experience of 10 years in the manufacture of the switch.

The Hooter shall have the following features: -

i. The hooter is for use in substations to announce abnormal conditions. It is to be mounted on the control panel inside the substation control building.

ii. It shall suitable for Flush mounting on the panel

iii. Maximum output 80-110 dB(A), preferably with flashing LED

iv. Bezel size from 96x96 mm up to 110x110 mm

v. Rated frequency 50 HZ

vi. Siren Tone; selectable tones including siren tone acceptable.

vii. Rated voltage shall be 230V AC; +/-10 % or rated DC supply voltage of 110V DC and 30V DC

viii. Protection degree shall be IP 20

ix. Operating mode shall be continuous

x. Operating temperature of up to 50^0C

xi. Terminals shall be screw type and suitable for connection of 2.5 mm ^{2} cable

xii. Terminals shall be indelibly marked

4.4.30. **Anti-condensation Heater:**

The manufacturer shall have a minimum of 10 years' experience in the manufacture of the heater.

The heater shall be used in protection and control panels and marshalling boxes in the substation to prevent condensation. The heater shall have the following features: -

i. The heater should be suitable for mounting inside Protection or Control panels with Protection Relays and other measuring and control devices.

ii. The Heater shall be rated at 75W and 230V AC and should be suitable for preventing condensation within the panels which have dimensions of 2200x800x800 mm for the climatic conditions specified in section

iii. The heater body shall be of extruded aluminium profile or stainless steel

iv. The heater shall have natural convection and be of durable construction.

v. The heater shall be suitable for horizontal or vertical mounting on a DIN rail (35 mm) or flat surface inside the panel

vi. The terminals shall be screw type and large enough to accommodate 2.5 mm^2 cable

4.4.31. **Hygrostat:**

The manufacturer shall have a minimum of 10 years' experience in the manufacture of the hydrostat. This device shall be used for switching ON and OFF anti-condensation heaters in protection and control panels and inside switchyard mechanism boxes, in Air Insulated Substations. The hygrostats shall have the following features:

i. Temperature control with a variable setting of 0-60^{0}C, as a minimum

ii. Humidity setting with a variable setting of 50 – 90%, as a minimum

iii. Suitable for mounting on 35 mm DIN rail

iv. Two normally open (2NO) Contacts, suitable for switching on the heater. The contact rating shall be declared in the bid.

v. Rated power supply for the hygrostat shall be 230 V AC ±10%

Note: *The manufacturer of the control switches shall have minimum experience of 10 years in the manufacture of the control switches.*

4.4.32. **Discrepancy Switch for Circuit Breaker Control:**

The manufacturer shall have minimum experience of 15 years in the manufacture of the switch. The control switch shall have the following features: -

i. Suitable flush mounting

ii. Press and Turn operation for Circuit Breaker close and open operation.

iii. As a minimum three (3) pairs of Normally Open(NO) contacts for circuit breaker close operation and two (2) pairs of Normally Open(NO) contacts for circuit breaker open operation.

iv. White colour continuous illumination for discrepancy in circuit breaker status. The illumination shall be by white LED bulb.

v. The discrepancy switch shall be sturdy and durable.

vi. The position for circuit breaker close and the position for circuit breaker open Operations shall be clearly marked on the escutcheon plate supplied with the switch.

vii. The top of the switch having the escutcheon plate shall have a rectangular outer shape.

viii. The switch shall have screw type terminals large enough to accommodate 2x2.5mm2 cable

ix. Switch terminals shall be indelibly marked, white numbers on black background

x. The switch contacts configuration shall preferably be drawn on the switch

xi. Switch to be supplied with white illumination LED bulb

xii. The lamp shall be rated at below 4 W power consumption

xiii. The switch shall be supplied with a drawing showing how the switch operates and contact configuration.

xiv. Switch Offered shall be type DK10 or equivalent in terms of size, quality and durability.

4.4.33. **Circuit Breaker Close/Open Control Switch:**

NB: The manufacturer shall have experience of a minimum of 10 years in the manufacture of Circuit breaker control switches

The control switch shall have the following features: -

i. The switch shall have a mechanical interlock to prevent accidental operation of the switch. Pistol Grip make is preferred.

ii. It shall have a Close, Neutral and Open positions engraved on an escutcheon plate fixed on the switch, in black letters on white background. After an operation, the switch shall return to the neutral Position by spring Action.

iii. The switch shall have screw type terminals suitable for connection of 2.5 mm2 cable.

iv. Contacts configuration for open and for close operation shall as a minimum be; two (2) Normally Open (NO) contacts.

v. As a minimum, the Contact ratings shall be 30 Amps for 3 seconds and 10 Amps continuously.

4.4.34. **Push Button Switches for Circuit Breaker Close/Open Operation – Type I**

NB: The manufacturer shall have experience of a minimum of 10 years in the manufacture of Circuit breaker close/open push button control switches

The control switch shall have the following features: -

i. Shall be shrouded or well recessed in their housing to minimize the risk of in-advertent operation

ii. Shall be non-retaining type, made of non-hygroscopic materials and fitted to avoid any possibility of sticking

iii. The contacts shall be shrouded to minimize ingress of dust and accidental contact.

iv. Shall have two pairs of Normally Open Contacts (2NO)

v. Shall be Suitable for flush mounting

vi. Screw type terminals suitable for connection of 2.5 mm^2 cable

vii. The push button for close operation should be Red in colour and integrally labelled "CB ON"

viii. The push button for open operation should be Green in colour and integrally labelled "CB OFF"

ix. Contacts rated to carry 16 Amps, 220V DC

4.4.35. **Push Button Switch for Alarm /Trip Relay Reset – Type II**

NB: The manufacturer shall have experience of a minimum of 10 years in the manufacture of Circuit breaker control switches

The push button switch shall have the following features: -

i. Shall be shrouded or well recessed in their housing to minimize the risk of inadvertent operation

ii. Shall be non-retaining type, made of non-hygroscopic materials and fitted to avoid any possibility of sticking

iii. The contacts shall be shrouded to minimize ingress and should have two pairs of Normally Closed Contacts (2NC)

iv. Shall be suitable for flush mounting

v. Screw type terminals suitable for connection of 2.5 mm^2 cable

vi. The push button shall be blue in colour

vii. The contacts shall be rated to carry 5 Amps, 220V DC

Note: The manufacturer of selector switches shall have experience of a minimum of 10 years in the manufacture of the control selector switches

4.4.36. **Local/Remote Selector Switch:**

For use on Protection and control panels and on switchgear installed in the switchyard

i. Shall be suitable for flush mounting on the Panel

ii. Shall have two position selection, Local and Remote

iii. Shall have Two pairs of change-over contacts(NOC)

iv. Shall have contact Rating 6A, 440V AC/220V DC

v. Locate and Remote positions indelibly labelled on an escutcheon plate fixed on the switch.

vi. It shall have screw type terminals suitable for connection of 4 mm^2 cable

4.4.37. **OFF/Local/Remote Selector Switch:**

For use on outdoor Circuit Breakers and Transformer Tap Changers

i. Shall be suitable for flush mounting on the Plate

ii. It shall have three position selection, OFF, Local and Remote

iii. It shall have Four pairs of change-over contacts

iv. Contact Rating 16A, 440V AC/220V DC

v. OFF, Locate and Remote positions indelibly labelled on an escutcheon plate fixed on the switch.

vi. Screw type terminals suitable for connection of 4 mm^2 cable

4.4.38. **ON/OFF Selector Switch:**

For use on outdoor Protection and Control Panels

i. Suitable for flush mounting on the Panel

ii. Two position selection, ON and OFF

iii. Two pairs of change-over contacts

iv. Contact Rating 4Amps, 220V DC

v. ON and OFF positions indelibly labelled on an escutcheon plate fixed on the switch.

vi. Screw type terminals suitable for connection of 2.5 mm^2 cable

4.4.39. **Semaphores for Isolator and Earth Switch Position Indication**

The manufacturer shall have at least 10 years' experience in the manufacture of the semaphores. This device shall be used to remotely mimic on the control panel, the position (open or closed) of disconnectors/Isolators, which are in the switchyard. The Status Indicator shall have the following features: -

i. Shall be suitable for flush mounting

ii. With Red L.E.D for closed (ON) status indication and Green L.E.D for open (OFF) status Indication.

iii. Shall be of circular or rectangular front appearance

iv. The Unit shall have screw type terminals large enough to accommodate 2x2.5mm2 cable

v. The Terminals shall be indelibly marked

4.4.40. **LED Indicating Lamps:**

The manufacturer shall have at least five years' experience in the manufacture of LED indicating lamps. The lamps are primarily for indicating the status of switchgear in the substation. They shall have the following features: -

i. The LED indicating lamps shall be complete with lamp and mounting base

ii. These shall be suitable for mounting on the front of the control panel (Flush mounting).

iii. The Indicators Lamps shall be of LED type

iv. The Lamp Indicators should be rated for 4W power consumption or less.

v. The lamp indicators should be designed for continuous operation and to give a long operating life of at least 10 years.

vi. Red LED indicators shall be of the high brightness type

Note1: The colour and quantities of the LED Indicating lamps will be specified in the Bill of materials and price schedules

Note 2: The manufacturer of Miniature Circuit Breakers (MCBs) shall experience of at least 15 years in the manufacture of the MCBs

4.4.41. **Miniature Circuit Breaker Type I:**

These shall be for use on the secondary side of Voltage transformer and shall have the following features: -

i. Shall be three pole unit

ii. Shall be rated operating voltage, 400V AC

iii. Rated Insulation voltage shall be 600V AC

iv. Rated frequency shall be 50 HZ

v. Degree of Protection shall be: IP20

vi. Setting value of thermally delayed Overload release, 3 A

vii. Overcurrent release set at 20A

viii. Rated continuous current for contacts of 6 Amps

ix. MCB should have an Auxiliary 1 NC & 1 NO contact.

x. Contact Position Indication: ON / OFF

xi. Suitable for fixing on a DIN rail

xii. Screw type terminals suitable for connection of at least 2x4.0 mm^2 stranded cables

4.4.42. **Miniature Circuit Breaker Type II:**

For protection of LV AC circuits rated at 400VAC & 230 VAC

i. Shall have two tripping mechanisms, delayed thermal tripping mechanism for overload and the electromechanical tripping mechanism for short circuit protection

ii. Tripping characteristic shall be type C

iii. The MCB shall be three pole configurations

iv. Rated short-circuit capacity is 6kA, at 400V AC

v. Contact Position Indication: ON / OFF

vi. One normally closed (1 NC) auxiliary contact

vii. Degree of Protection: IP20

viii. Indelibly labelled screw terminals, suitable for connection of up to 6 mm^2, stranded cable.

ix. Electrical endurance of at least 10,000 cycles

x. Mechanical endurance of at least 20,000 cycles

xi. Rated current of 16 Amps

xii. Rated operational voltage of 400 V AC and maximum operating voltage of 600VAC

xiii. Suitable for fixing on a DIN rail

4.4.43. **Miniature Circuit Breaker Type III:**

For protection of LV AC circuits rated at 400VAC & 230 VAC and shall have the following operating functions: -

i. Should have two tripping mechanisms, delayed thermal tripping mechanism for overload and the electromechanical tripping mechanism for short circuit protection

ii. Tripping characteristic type C

iii. One pole configuration

iv. Rated short-circuit capacity is 6kA, at 400V AC

v. Contact Position Indication: ON / OFF

vi. One normally closed (1 NC) auxiliary contact

vii. Degree of Protection: IP20

viii. Indelibly labelled screw terminals, suitable for connection of up to 6 mm2, stranded cable.

ix. Electrical endurance of at least 10,000 cycles

x. Mechanical endurance of at least 20,000 cycles

xi. Rated current of 16 Amps

xii. Rated operational voltage of 400 V AC and maximum operating voltage of 600V AC

xiii. Suitable for fixing on a DIN rail

4.4.44. **Miniature Circuit Breaker Type IV**

For protection of LV DC circuits rated at 30V DC, 110V DC & 220V DC and shall have the following operating functions: -

i. Shall have two tripping mechanisms, delayed thermal tripping mechanism for overload and the electromechanical tripping mechanism for short circuit protection

ii. Tripping characteristic type C

iii. Two pole configurations

iv. Rated short-circuit capacity is 6kA, at 400V AC/ 220V DC

v. Contact Position Indication: ON / OFF

vi. One normally closed (1 NC) auxiliary contact and degree of protection: IP20

vii. Indelibly labelled screw terminals, suitable for connection of up to 4 mm2, stranded cable.

viii. Electrical endurance of at least 10,000 cycles

ix. Mechanical endurance of at least 20,000 cycles

x. Rated current of 6Amps

4.4.45. **Miniature Circuit Breaker Type V:**

For protection of LV DC circuits rated at 30V DC, 110V DC & 220V DC and shall have the following operating functions: -

i. Shall have two tripping mechanisms, delayed thermal tripping mechanism for

ii. Overload and the electromechanical tripping mechanism for short circuit protection

iii. Tripping characteristic type C

iv. Two pole configurations

v. Rated short-circuit capacity is 6kA, at 400V AC/ 220V DC

vi. Contact Position Indication: ON / OFF

vii. One normally closed (1 NC) auxiliary contact

viii. Degree of Protection: IP20

ix. Indelibly labelled screw terminals, suitable for connection of up to 4 mm2, stranded cable.

x. Electrical endurance of at least 10,000 cycles

xi. Mechanical endurance of at least 20,000 cycles

xii. Rated current of 4Amps

4.4.46. **Miniature Circuit Breaker Type VI**

For protection of LV DC circuits rated at 30V DC, 110V DC & 220V DC and shall have the following operating functions: -

i. Shall have two tripping mechanisms, delayed thermal tripping mechanism for

ii. Overload and the electromechanical tripping mechanism for short circuit protection

iii. Tripping characteristic type C

iv. Two pole configurations

v. Rated short-circuit capacity is 6kA, at 400V AC/ 220V DC

vi. Contact Position Indication: ON / OFF

vii. One normally closed (1 NC) auxiliary contact

viii. Degree of Protection: IP20

ix. Indelibly labelled screw terminals, suitable for connection of up to 6 mm2, stranded cable.

x. Electrical endurance of at least 10,000 cycles

xi. Mechanical endurance of at least 20,000 cycles

xii. Rated current of 10Amps

4.4.47. **Multi-Functional Power Meter**

The manufacturer shall have at least 10 years' experience in the manufacture of the instrument.

i. This is a power measurement meter for panel mounting

ii. The unit shall be of numerical design

iii. The unit shall have a large LCD display for displaying four (4) or more lines of measurands simultaneously.

iv. The keypad shall be simple to allow scrolling between the various measurands

v. The unit shall measure instantaneous values of; rms voltage, both phase – phase and phase to ground, phase currents, active power, reactive power, apparent power, energy, frequency, power factor and phase angle per phase

vi. The Unit shall measure time stamped maximum and minimum demand for current and power (MW & MVA)

vii. The unit shall also measure unbalance voltage and current

viii. The unit shall measure Total harmonic distortion(THD) and Total Demand Distortion(TDD) for current and voltage

ix. The unit shall have the following input ratings, 1Amps and 110V AC phase to phase.

x. The unit should be able to continuously withstand 2Amps and 260 V AC

xi. The unit shall be for flush mounting on the front of the panel

xii. The unit shall be for 3 phases, 4 –wire connection on the secondary of current and voltage transformers

xiii. The unit shall be equipped with an RS232 port for programming the unit to ensure correct measurement and display of the parameters. The CT and VT ratios shall be programmable. Alternatively, programming can be achieved through the keypad.

Note: *Programming will be conducted at site during installation.*

xiv. RS 485 port shall be provided for remote communication.

xv. Communication protocol shall be IEC 61850 and IEC 60870-5-104

xvi. The accuracy of measurement shall be at least class 1.0

xvii. Shall have inbuilt real-time clock and calendar

xviii. It shall be possible to display all the measured parameters on the screen through the pre-programmed display screen. The screen to be displayed shall be selectable using the keys on the front of the unit

xix. The software and the PC to power meter unit connection cable shall be supplied with the units. At least eight communication cables devices shall be required

xx. All the terminals shall be clearly marked

xxi. The measurement range for power shall at least be up to 90 MVA.

xxii. The meter shall be powered with 110V DC; or 110V DC /110V AC

4.4.48. **Tap Position Indication Transducer:**

4.4.48.1. This shall be used in Power transformers with On Load Tap Changer (OLTC) to provide mA output to drive the tap position Indicator on the Remote Tap Changer Control Panel (RTCCP) in the substation control room and also for connection to the SCADA for supervisory indication of the OLTC Tap Position.

4.4.48.2. The Transducer shall be connected to a bridge of resistors and the input signal processed to produce mA, the magnitude of which corresponds to the Tap Position.

4.4.48.3. The transducer shall be configurable for the value of tap step resistor and the output mA.

4.4.48.4. The following specifications shall apply: -

i. Supply voltage; 230V AC and/or 110V DC

ii. Programmable output; 0-10mA, 0-20 mA or 4-20 mA

iii. Measuring range; 17 Tap positions (16 tap steps)

iv. For DIN rail mounting

v. Resistor per step configurable from 10 Ω to 250

vi. Accuracy class 0.25%

vii. Response time shall be < 1 sec.

viii. Rugged and vibration resistant construction

ix. Temperature range; 0 - +50^{0}C

x. Complies with IEC 60688 standard

4.4.49. **Tap Position Indicator**

Shall be used for remote Indication of the Transformer on Load Tap Changer Tap Position and the following specification shall apply: -

i. It shall have a bar graph meter configured to indicate both a numerical value and a bar indication of relative position of the OLTC.

ii. The TPI should have provision for settings Tap Limits above and below which the bar changes colour to call attention to this violation. An output contact for audible alarm shall also be provided.

iii. Input should be 0 – 20 mA for Tap Positions 1 to 17 (16 tap steps). Configurable mA input, and number of tap steps is preferred.

iv. Shall be suitable for flush mounting

4.4.50. **Transducers:**

The manufacturer for the Transducers shall have a minimum experience of 10 years in the manufacture of the instruments.

4.4.51. **MW Transducer**

The Transducer shall have the following features: -

i. DIN rail mounting

ii. Connection shall be 3-Phase, 4-Wire

iii. Inputs 110V AC and 1Amp

iv. Programmable output characteristic

v. Output shall be 0 - ±20 mA

vi. Auxiliary power supply shall be 110 V AC/DC

vii. Relay Terminals-shall be screw type terminals large enough to

viii. Shall accommodate at least 4mm2 cable

ix. Screw type terminals

x. Terminals indelibly marked

4.4.52. **MVAr Transducer**

The Transducer shall have the following features: -

i. DIN rail mounting

ii. Connection shall be 3-Phase, 4-Wire

iii. Inputs 110V AC and 1Amp

iv. Programmable output characteristic

v. Output shall be 0 - ±20 mA

vi. Auxiliary power supply shall be 110 V AC/DC

vii. Relay Terminals-shall be screw type terminals large enough to accommodate at least 4mm2 cable

viii. Screw type terminals

ix. Terminals indelibly marked

4.4.53. **Current Transducer**

The Transducer shall have the following features: -

i. Input 0- 1Amp

ii. Output 0 – 20 mA

iii. Auxiliary power supply shall be 110 V AC/DC

iv. Relay Terminals-shall be screw type terminals large enough to accommodate at least 4 mm^2 cable

4.4.54. **Voltage Transducer**

The Transducer shall have the following Features:

i. DIN rail mounting

ii. Input 0- 110 V AC

iii. Output 0 – 20 mA

iv. Auxiliary power supply shall be 110 V AC, separately connected.

v. Relay Terminals-shall be screw type terminals large enough to accommodate at least $4mm^2$ cable

vi. Screw type terminals

vii. Terminals indelibly marked

4.4.55. **Indicating Instruments Driven by Transducer output:**

The manufacturer for the instrument shall have a minimum experience of 10 years in the manufacture of the instruments.

4.4.56. **MW Instrument**

The Instrument shall have the following features: -

i. Indicating Range, 0 – 23 MW for Transducer input of 0-20 mA

ii. Full Scale Deflection, 30 MW, Import and Export

iii. Black Scale on white background

iv. Red Line at 23 MW

v. Dimensions, 96 X 96 mm

vi. Suitable for Flush Mounting on the panel

vii. The Instrument shall have screw type terminals

4.4.57. **MVAr Instrument**

The Instrument shall have the following features: -

i. Indicating Range, 0 – 23 MVAr for Transducer output of 0-20 mA

ii. Full Scale Deflection, 30 MVAr, Import and Export

iii. Black Scale on white background

iv. Dimensions, 96 X 96 mm

v. Suitable for Flush Mounting on the panel

vi. The Instrument shall have screw type terminals

4.4.58. **Indicating Instruments Directly connected:**

NB: The manufacturer for the instrument shall have a minimum experience of 10 years in the manufacture of the instruments.

4.4.58.1. All the instruments shall be of Moving Iron type with an IP Protection Class shall be IP54.

4.4.58.2. Accuracy class shall be 1.5, with maximum tolerated error of ±1.5% of final scale value and an overload withstand shall be at least 20% continuous

4.4.58.3. All instruments shall be suitable for continuous operation under Tropical Climatic conditions

4.4.58.4. The Insulation withstand shall be in accordance with IEC 51.

4.4.58.5. The manufacturer for the Instrument shall have as a minimum 10 years' experience in the manufacture of the instruments.

4.4.59. **Ammeter with MDI – 200A**

The Instrument shall have the following features: -

i. Flush mounting

ii. Indicating Range, 0 – 200A for current input of 0 – 1A

iii. Full Scale Deflection, 300 A

iv. Red Line at 200 A

v. Shall have a resettable maximum demand current indicator having a different colour from the normal pointer as well as the normal instantaneous current pointer

vi. Black Scale on white background

vii. Dimensions, 96 X 96 mm

viii. Suitable for Flush Mounting on the panel

ix. The instrument shall have screw type terminals large enough to accommodate $4mm^2$ cable

4.4.60. **Ammeter with MDI– 400A**

The Instrument shall have the following features: -

i. Flush mounting

ii. Indicating Range, 0 – 400A for current input of 0 – 1A

iii. Full Scale Deflection, 600 A

iv. Red Line at 400 A

v. Black Scale on white background

vi. Dimensions, 96 X 96 mm

vii. Shall have a resettable maximum demand current indicator having a different color from the normal pointer as well as the normal instantaneous current pointer

viii. Suitable for Flush Mounting on the panel

ix. The instrument shall have screw type terminals large enough to accommodate 4mm2 cable

4.4.61. **Ammeter with MDI– 800A**

The Instrument shall have the following features: -

i. Flush mounting

ii. Indicating Range, 0 – 800A for current input of 0 – 1A

iii. Full Scale Deflection, 1000 A

iv. Red Line at 800 A

v. Black Scale on white background

vi. Dimensions, 96 X 96 mm

vii. Shall have a resettable maximum demand current indicator having a different colour from the normal pointer as well as the normal instantaneous current pointer

viii. Suitable for Flush Mounting on the panel

ix. The instrument shall have screw type terminals large enough to accommodate 4mm2 cable

4.4.62. **Ammeter Selector Switch**

For use on Protection and Control Panels, for measurement of all three phase currents, using one ammeter.

i. Suitable for flush mounting on the Panel

ii. Four position selections, R, Y, and B & OFF, indelibly labelled on an escutcheon plate fixed on the switch.

iii. The phase current measured on the ammeter, corresponds to the selected phase on the switch, while the other two phases will be shorted at the switch.

iv. Contact Rating 10Amps

v. Screw type terminals suitable for connection of 2 x 2.5 mm^2 cable

4.4.63. **Voltmeter – 220kV**

The Instrument shall have the following features: -

i. Indicating Range, 0 – 220kV for voltage input of 0 – 110V AC

ii. Full Scale Deflection, 270kV

iii. Red Line at 220kV

iv. Black Scale on white background

v. Dimensions, 96 X 96 mm

vi. Suitable for Flush Mounting on the panel

vii. The instrument shall have screw type terminals large enough to accommodate 4mm2 cable

4.4.64. **Voltmeter – 132kV**

The Instrument shall have the following features: -

i. Indicating Range, 0 – 132kV for voltage input of 0 – 110V AC

ii. Full Scale Deflection, 150kV

iii. Red Line at 132kV

iv. Black Scale on white background

v. Dimensions, 96 X 96 mm

vi. Suitable for Flush Mounting on the panel

vii. The instrument shall have screw type terminals large enough to accommodate 4mm2 cable

4.4.65. **Voltmeter – 66kV**

The Instrument shall have the following features: -

i. Indicating Range, 0 – 66kV for voltage input of 0 – 110V AC

ii. Full Scale Deflection, 72kV

iii. Red Line at 66kV

iv. Black Scale on white background

v. Dimensions, 96X96 mm

vi. Suitable for Flush Mounting on the panel

vii. The instrument shall have screw type terminals large enough to accommodate 4mm2 cable

4.4.66. **Voltmeter – 33kV**

The Instrument shall have the following features: -

i. Indicating Range, 0 – 33kV for voltage input of 0 – 110V AC

ii. Full Scale Deflection, 36kV

iii. Red line at 33 kV

iv. Black Scale on white background

v. Dimensions, 96 X 96 mm

vi. Suitable for Flush Mounting on the panel

vii. The instrument shall have screw type terminals large enough to accommodate 4mm2 cable

4.4.67. **Voltmeter – 11kV**

The Instrument shall have the following features: -

i. Indicating Range, 0 – 11kV for voltage input of 0 – 110V AC

ii. Full Scale Deflection, 12kV

iii. Red Line at 11kV

iv. Black Scale on white background

v. Dimensions, 96 X 96 mm

vi. Suitable for Flush Mounting on the panel

vii. The instrument shall have screw type terminals large enough to accommodate 4mm2 cable

4.4.68. **Voltmeter Selector Switch**

For use on Protection and Control Panels, for measurement of all phase-earth and phase-phase voltages, using one voltmeter.

i. Suitable for flush mounting on the Panel

ii. Seven position selections, R, Y, B, R-Y, Y-B, B-R & OFF, indelibly labelled on an escutcheon plate fixed on the switch.

iii. The voltage measured on the voltmeter, corresponds to the selected position of the switch, while other phases will be open circuit.

iv. Contact Rating 10Amps

v. Screw type terminals suitable for connection of 2 x 2.5 mm^2 cable

4.4.69. **Check Synchronising Relays**

i. The relay shall be of numerical design

ii. The relay shall be suitable for panel flush mounting

iii. The relay shall measure voltage and shall be used to connect two separate networks together.

iv. The relay shall be used for both synchro-check functions and voltage-check functions.

v. The synchro-check function is used when two separate networks or two electrically interconnected network sections are to be connected together. The relay to issue circuit breaker command when conditions across the breaker are matching as per settings.

vi. Synchronism check- The circuit breaker close command will be issued only when all the conditions listed below are met:

a) Live line and live bus.
b) Voltage level difference.
c) Frequency difference (slip). The bus and line frequency must also be within a range of ±5 Hz from rated frequency.
d) Phase angle difference.
e) A time delay is available to ensure that the conditions are fulfilled for a minimum period of time. Adjustable settings shall be provided for all these functions

vii. The voltage-check function is used when a disconnected bus/line is to be connected to an energized section of a network. The Live and dead voltage thresholds shall be settable. The following functions shall be individually and collectively selectable

(a) Live Bus and Dead Line (LBDL)
(b) Dead Bus and Live Line (LBDL)
(c) Dead Bus and Dead Line (DBDL)

viii. The relay shall indicate whether synchronism status is met either via text on the LCD screen or via LED

ix. The relay shall indicate on the LCD screen the following parameters:

(a) Voltage on each side of the circuit breaker in primary or secondary values
(b) Voltage magnitude difference
(c) Voltage phase difference
(d) Frequency difference

x. The relay shall have self-supervision and incorporate watchdog function and green LED for healthy status and red LED for relay faulty status.

xi. Relay Terminals-shall be screw type terminals large enough to accommodate at least 2 x2.5mm^2 cable and shall be located at the back of the relay

xii. Front Serial RS232 or USB or Optical or Ethernet Port shall be provided for relay configuration and parameter setting and download of Data using a Laptop Computer.

xiii. Software for Programming the configuration and Relay Settings and downloading and analysing the Relay Data

xiv. A provision shall be made via a software key to select the Check Synchronising function on or off.

xv. Relay to Laptop connection cable

4.4.70. **Voltage and Frequency Protection Relay**

i. The relay shall be of numerical design

ii. The relay shall be suitable for panel flush mounting

iii. The relay terminals will be at the rear

iv. The relay rated AC input shall be 110V AC and rated frequency of 50HZ

v. The relay shall have at least three stages of Voltage protection and each stage will be independently set. Each stage shall be set as either overvoltage or undervoltage protection function. The voltage protection will have a settable definite time delay of at least 0-60 seconds in steps of not more than 0.1 seconds.

vi. The frequency function shall have at least three stages, each of which will be independently set. It shall be possible to set each stage as over frequency or under frequency. The frequency setting range shall cover the range 40-60 HZ. The frequency function will have a settable definite time delay, of at least 0-60 seconds in steps of not more than 0.03 seconds. It shall be possible to enable/block the frequency function using the voltage function

vii. The relay shall have a rate of change of frequency function. At least three stages of rate of change of frequency functions shall be provided. Each stage shall be separately set. The frequency function will have a settable definite time delay, of at least 0-60 seconds in steps of not more than 0.03 seconds. It shall be possible to enable/block the rate of change of frequency function with either the under frequency or over frequency function.

viii. The relay shall have self-supervision and incorporate watchdog output contact and green LED for healthy status and red LED for relay faulty status. Relay operation shall be indicated by a red LED.

ix. The relay shall have at least two binary input relays, four binary output relays and four programmable LEDs.

x. Relay terminals shall be screw type terminals large enough to accommodate at least 2 x2.5mm^2 cable and shall be located at the back of the relay

xi. Front Serial RS232 or USB or Optical or Ethernet Port shall be provided for relay configuration and parameter setting and download of Data using a Laptop Computer.

xii. Software for Programming the configuration and Relay Settings and downloading and analysing the Relay Data.

xiii. Relay to Laptop connection cable shall be provided.

4.4.71. **Additional Specifications for Relays**

All measurement relays must be of Numeric design.
Relays of Electromechanical design are acceptable only for use as auxiliary relays and contactors, not for measuring relays.

4.4.72. **Relay Programming Software and Connection Cables**

i. Software must be provided for programming and downloading data for all numerical relays supplied and for any numerical instruments such as transducers provided.

ii. It shall be possible to install the Software to twenty different computers without any additional License Cost. Two (2) CDs shall be supplied for each different type of Software.

iii. Four (4) copies the software Users Guide shall also be supplied. The numerical relays will be equipped with an RS232 communication port or other suitable port to facilitate connection to a Laptop.

iv. The relevant communication cable, between the relay and the laptop shall also be provided. Four (4) cables shall be provided for each set of Relays using the same cable. Four (4) communication cables shall be provided for each set of transducers and also for the power measurement unit.

v. Communication facilities shall be provided on each numerical relay for remote interrogation and programming of the numerical relays.

vi. The relays will also have an MMI consisting of a keypad and an LCD screen to facilitate manual relay programming and data access.

vii. Relay operation due to system fault, shall be indicated by a red L.E.D. and the fault details (flags) shall be displayed on the LCD screen. Both the relay fault flags and red L.E.D shall be reset without opening the relay cover, except where the relay contacts are latched.

5. Laptop Specifications

5.1. 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
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' Authorization	a) Manufacturers Authorization Certificate/ Letter and for the models quoted, the principal (Manufacturer) MUST have an established regional office in Kenya.

APPENDIX A: TESTING

A.1. The manufacturers shall carry out all the routine tests of the protective relays, control devices and accessories and measuring instruments at the factory.

A.2 Copies of test reports shall be packaged together with the respective relays and measuring instruments before delivery to KPLC.

A.3. The tests shall be in accordance with the requirements of IEC 60255 & IEC 60051.

APPENDIX B: WARRANTY

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

B.2. A warranty of 48 months from the date of delivery of the measuring protection relays to Kenya Power store shall be offered by the manufacturer for the protection measurement relays, including annunciator relays.

B.4. The Warranty for other auxiliary relays and control devices shall be 36 months from the date of delivery of the devices to Kenya Power store. Any protection relays and control and measurement devices found to have failed at commissioning or while the device is in service or store during the stated warranty periods shall be replaced free of charge by the manufacturer/Supplier.

APPENDIX C: QUALITY MANAGEMENT SYSTEMS (NORMATIVE)

C.1. The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the PQA properties, tests 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 ISO 9001:2015.

C.2. The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications, including copy of valid and relevant ISO 9001: 2008 or 2015 certificate, shall be submitted with the tender for evaluation.

C.3. The manufacturer shall indicate the delivery time of the equipment; manufacturer's monthly & annual production capacity and experience in the production of the type and size of items being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar type of PQA sold in the last five years as well as reference letters from at least four of the customers shall be submitted with the tender for evaluation.

APPENDIX D: TECHNICAL DOCUMENTATION (NORMATIVE)

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

a) Fully-filled clause by clause Guaranteed Technical Particulars (GTPs)- Appendix D - stamped and signed by the manufacturer.

b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data for the equipment;

c) Details of the manufacturer's experience; Sales records for the last five years and at least four customer reference letters.

d) Copies of previous test certificates and test reports (As given in Clause A.2) by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation. A copy of accreditation certificate for the laboratory shall also be submitted (all in English Language);

e) Marking & Packaging details (including packaging materials).

D.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 (GTPs) stamped and signed by the manufacturer **(these are not the ones submitted with the tender)**;

b) Technical details and drawings with details of portable single phase secondary injection set to be manufactured for KPLC.

c) Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations.

D.3. Routine and sample test reports for the equipment to be supplied shall be submitted to Kenya Power for approval before shipment/delivery of the goods.

D.4. Each equipment package shall be supplied with detailed user's manual printed in English language that includes the following among other information written in English language to Kenya Power stores. All information shall be unambiguous. All documentation necessary for safety of the equipment as specified in IEC 61010-1 clause 5.4 shall be provided with the equipment.

APPENDIX E: TECHNICAL MANUALS/GUIDE AND OPERATION AND MAINTENANCE MANUALS

Technical manuals and operation and maintenance manuals shall be supplied with the goods as follows: -

E.1. Eleven (11) copies of hard copy technical manual/guides shall be furnished to KPLC for each type of relay, transducer, and instrument and control device. Soft copy of the manuals shall also be supplied with the goods.

The technical manual shall describe in detail the handling, installation, application, technical data and operating curves, test and commissioning, servicing/maintenance and calibration of the protection relays, measuring devices, transducers and control accessories,

E.2 These shall also include user/operator guide for protection relays, transducers, instruments and measuring devices for programming of the settings and configuration and accessing the settings and data. Application drawings for the relay/device shall be included

APPENDIX F: FACTORY ACCEPTANCE TESTS, INSPECTION AND TRAINING

F.1. The protective relays shall be subjected to factory acceptance testing and inspection by two KPLC engineers at place of manufacture where all routine tests as per IEC 60255 shall be carried out on two relays of each type for each specific (unique) configuration.

F.2. All the Relays, Instruments and Control devices shall be inspected to ensure they fully comply with the specifications.

F.3. In addition, training shall be conducted in the factory for the two KPLC engineers attending FATs, for the durations indicated below. Approval for shipment of goods by KPLC shall dependent on a satisfactory FAT report by the Engineers.

F.4. The full cost of the visit, including air tickets and accommodation shall be borne by KPLC. The manufacturer/bidder shall however take care of the local transport.

F.5. Factory Training shall be carried out for the following relays: -

(i) Distance Protection Relay - 3 days

(ii) Line Current Differential Protection Relay – 3 days

(iii) Biased Differential Protection Relay - 2 days

(iv) Three Phase Over current and Earth fault Relay - 2 days

(v) Three Phase Directional Over current and Earth Fault Relay - 2 days

(vi) Feeder Protection & Control Relay – 2 days

(vii) Transducer – 1 days

(viii) Power Measurement Unit – 1 day

F.6. The purpose of the training is to ensure that the KPLC engineers have adequate knowledge so that the relays are correctly installed, configured and parameters correctly set and finally the relays are successfully tested and put into service on the Kenyan Power system. The manufacturer/supplier shall conduct an assessment to ensure that the KPLC Engineers have acquired the necessary knowledge and skills to be able to successfully apply the relays on the power system.

F.7. Where the number of days required for training on any of the above relays is more than what is indicated above, the manufacturer/bidder shall indicate the required number of days in their bid. The number of days indicated above is however the minimum requirement.

F.8. Each supplier/manufacturer shall conduct training for the protection relays they shall be offered to supply after tender evaluation.

APPENDIX G: LOCAL TRAINING IN NAIROBI

G.1. Local Training shall be conducted for KPLC Engineers and Technicians in Nairobi. This training shall cover the following relays: -

(a) Distance Protection Relay - 2 days

(b) Line Current Differential Protection Relay – 3 Days

(c) Transformer Differential Protection Relay - 3 days

(d) Three Phase Directional overcurrent and Earth Fault Relay - 2 days

(e) Three Phase Over Current and Earth Fault Relay – 2 days

(f) Feeder Protection & Control Relay – 2 days

(g) Transducer – 1 day

(h) Power Measurement Unit – 1 day

G.2. The Training shall be for a maximum of 15 working days and will involve training of up to15 Engineers/ Technicians.

G.3. The manufacturer shall meet the total cost of the factory as well as Local Training in Nairobi Kenya.

G.4. The supplier shall also meet all the other costs for conducting the local training, including local accommodation and transport for the training staff. The supplier shall provide all the training materials including notes.

G.5. The purpose of the training is to ensure that the KPLC Engineers/Technicians have adequate knowledge so that the relays are correctly installed, configured and parameters correctly set and finally the relays are successfully tested and put into service on the Kenyan power system. The manufacturer/supplier shall conduct an assessment to ensure that the KPLC Engineers have acquired the necessary knowledge and skills to be able to successfully apply the relays on the power system.

APPENDIX H: REQUIREMENT FOR TENDER EVALUATION

H.1. Two copies each of product catalogue and technical publications for the specific protection relays, transducers, instruments and control devices offered shall accompany the bid.

H.2. The product catalogue and technical publications provided shall provide all the technical details of the offered relays/devices, including all the technical data and protection and control functions included in the device.

H.3. Application drawings for the relay/device shall also be submitted with the bid. the product catalogue and technical publication shall be used to verify information entered in the technical schedules completed by the bidder.

H.4 .Failure to submit the product catalogue and the technical publication for each relay/device included in the bid may lead to rejection of the bid.

APPENDIX I: SOFTWARE

I.1. The software for each relay, transducer and measurement device shall be supplied for: -

(i) Configuration of the protection, measurement and transducer device.

(ii) Setting and programming of all parameters for the relay, measurement and transducer device/

(iii) Download and analysis of relay disturbance and fault record data.

I.2. Four CDs for each type of software shall be supplied.

I.3. It shall be possible to install each software in twenty (20) desktop/laptop computers without requirement for additional licenses. Where additional licenses are required, the cost shall be considered to have been included in the bid.

I.4 The latest version of each software at the time of shipment of the goods shall be supplied.

APPENDIX J: PC TO DEVICE CONNECTION CABLE

Twelve (12) sets of each different type of PC to relay/measurement/transducer device connection cable and all other integral accessories/tools to ensure successful communication between the Laptop and the relay/device shall be supplied.

APPENDIX K: PACKING AND DELIVERY

K.1. PACKING

(i) Each item shall be packed properly or protected for shipment from the place of manufacture to the KPLC store.

(ii) Each crate of package shall contain a packing list in a waterproof envelope and a copy in triplicate shall be forwarded to KPLC prior to dispatch. All items of material shall be clearly marked for easy identification against the packing list.

(iii) All cases, packages, etc, shall be clearly marked on the outside to indicate the total weight, to show where the weight is bearing and the correct position of the slings and shall bear an identification mark relating them to the appropriate shipping documents.

(iv) All Accessories necessary for mounting the Relays, Instruments and Control Devices on to the panels, for terminations of cables or for labelling of LED indications shall be provided with the Relays, Instruments and Control Devices.

K.2. MARKING

The packaging shall be marked as detailed below.

(a) Consignee: THE KENYA POWER & LIGHTING CO. LTD.

(b) Name of Project: PROTECTIVE RELAYS AND CONTROL DEVICES AND INSTRUMENTS FOR PROJECTS

(c) Contract No.: .....

(d) Port of destination: .....

e) Item Number, Package number and quantity per package: ----------

f) Description of Contents: .....

Net and gross weight, cubic measure: .....

APPENDIX L: DELIVERY

L.1. The Supplier shall deliver all the Protection and Control items to KPLC bulk Stores at Isiolo Road, Nairobi.

L.2. Before acceptance of the devices, all the relays, Instruments and Control accessories shall be checked for any physical damage, for completeness and correctness.

L.3. The Supplier shall notify KPLC at least one week in advance on his/her date of delivery of the goods to the store.

L.4. Together with KPLC's representative the supplier will remove the seals on the packages and together inspect the goods for adherence to specifications, for completeness and to ensure that the goods have no physical damage.

L.5. Incorrect, damaged or incomplete Relays, Instruments and Control Accessories as per the Technical Specifications and the accepted offer and the delivery shall not be accepted and the supplier will take away such goods.

L.6 All goods must be supplied within the stipulated time as per the contract.

APPENDIX M: TENDER AWARD

The tender shall be awarded based on the lowest successfully evaluated bidder for each item; i.e., the Relays, Control devices, Transducers and Measurement Instruments and Measurement Unit.

Protection relays and control devices offered, and which has shown poor performance service in the system shall be rejected.

For purposes of reliability of the Power System Protection Systems, Distance Relays Type I and Line Current Differential Relay Type I may be awarded to two different manufacturers each. The same case applies to Distance Protection type II and Line Current Differential Type II. This is however subject to the relays meeting all the requirements of the specifications.

Warranty for all protection relay devices shall be 3 years from the date of delivery to the stores.

Note 1: The cost for hard cover Technical Manuals, Guide and Operation and Maintenance manuals shall be deemed to be included in the unit cost of the respective Protection relay, Transducer, Measurement device and control device. Twelve (12) hard copy original manuals for each relay/device type shall be supplied together with the relay/device.

Note 2: Each supplier/manufacturer shall supply Twelve (12) Laptop to Protection relay/Transducer/Measurement device, serial communication cables for the relays/devices that the

supplier/manufacturer is offered to supply. The cost of the serial communication cables shall be deemed to be included in the bid price.

Note 3: Software for the Protection relays, Transducers and Power measurement units shall be supplied as indicated elsewhere in these specifications. This software shall be supplied by the supplier/manufacturer for the items they are offered to supply. The cost of the software shall be deemed to be included in the bid price.

APPENDIX N: GUARANTEED TECHNICAL PARTICULARS FOR RELAYS, TRANSDUCERS

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
1	Manufacturers Name and address	
2	**Scope**	
3	Applicable standard(s)	
4.1	Service conditions(state)	
4.2	**General requirements**	
4.2.1	Compliance to climatic aging conditions as per IEC 60932 class 2	
4.2.2-4.2.4	Galvanizing /plating of all indoor parts to prevent rusting	
4.2.5-4.2.7	Material used for instrument and relay screws and springs	
4.2.8	Material used for gaskets	
4.2.9	Rated supply voltage of relays and measuring devices	
4.3.1	**Materials**	
4.3.1.1-4.3.1.4	Specify all compliance requirements in these clauses	
4.3.2	**Instruments**	
4.3.2.1	Instruments to be flush mounted, back connected and dust roof as per IEC 60051	
4.3.2.2	Size of analogue meters, scales and maximum errors.	
4.3.3.	**Protective Relays**	
4.3.3.1	Relays to be flush mounted and Numeric design as per IEC 60255	
4.3.3.2	Communication port type, HMI, and key pad	
4.3.3.3	Relay making and breaking contacts rating	
4.3.3.4	Relay DC voltage rating and switching capacity	
4.3.3.6-4.3.3.7	No use of dropping resistors/diodes	
4.4.3.8	Relay thermal ratings and multiplier Settings	
4.4.3.10	DIN rail mounting for plug in auxiliary relays	
4.4.1	**Ratings for Protection Relays and Control Devices:**	
(i)	Secondary rating of relay CTs	
(ii)	Secondary Voltage Rating of VT	
(iii)	DC auxiliary rating	
(iv)	Relay trip indication	
4.4.2	**Distance Protection Relay Type I**	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
i.	Manufacturer's Name	
	Type or Designation name of Relay	
	Complete order number for offered Relay	
	Numerical Design	
	Flush mounting design.	
	Relay suitable for use on a feeder in a 1&1/2 Breaker substation arrangement.	
ii.	High speed output relays for circuit breaker opening.	
	Full Scheme Distance relay	
	Number of similar Relay sold to date to the export market: Requirement; 1000	
	Experience in the manufacture of distance relay	
	Minimum operating voltage and current for impedance measurement/directional sensitivity	
	Operating time for fast operating output relays	
	Operating time for other output trip relays	
iii.	Tripping logic	
iv.	Number of Zones of protection	
v.	Zone Impedance Comparator Characteristics	
vi.	Impedance setting range for each Zone	
vii.	Communication Aided Schemes for Distance Protection	
viii.	Communication Aided schemes for Directional Earth Fault(DEF) Protection	
	Pick up setting range for the DEF element	
	Load Encroachment Discrimination Feature	
ix.	Fuse Failure Supervision	
x.	Weak end in feed & Echo feature	
xi.	Current reversal guard Feature	
xii.	Power Swing Tripping & Blocking function	
xiii.	Voltage Memory Function	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xiv.	SOTF Function	
	Settings range for the SOTF Function	
xv.	Back-up Overcurrent and Earth fault protection function	
xvi.	Under-Frequency and rate of frequency change Protection function	
	Settings range for the Under-frequency and rate of change Protection	
xvii.	Settings range for the Backup Overcurrent and Earth Fault Protection	
xviii.	Circuit Breaker contact wear feature	
xix.	Broken Conductor detection	
xx.	Auto-reclose Function that is able to operate as per the specifications	
xxi.	Accuracy for Distance to Fault Location	
	Automatic display of fault details on the Relay. List the fault data displayed	
xxii.	Storage capacity for disturbance records, trip/fault records and events records	
xxiii.	Fault Locator with automatic Distance to Fault indication on the LCD screen in km. The Distance to fault Location will	
xxiv.	Relay configuration & parameter settings, Event & Fault records and LED status are retained upon loss of relay DC power supply	
xxv.	Metering provided	
xxvi.	Number of Binary Inputs	
xxvii.	Number of Binary outputs	
xxviii.	Ratings for output relay contacts	
xxix.	Number of LEDs	
xxx.	Communication protocols	
xxxi.	Communication ports provided	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xxxii.	Type and size of connection terminals for cable termination	
xxxiii.	Relay to Laptop connection cables offered	
xxxiv.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
4.4.3	**Distance Protection Relay Type II**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Relay	
iii.	Complete order number for offered Relay	
iv.	Number of similar Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of distance relay	
vi.	Minimum operating voltage and current for impedance measurement/directional sensitivity	
vii.	No of analogue inputs	
viii.	Flush mounting design	
ix.	Numerical Design	
x.	Relay Starting Criteria	
xi.	Minimum operating time	
	Tripping logic	
xii.	Number of Zones of Protection	
xiii.	Zone Impedance Comparator Characteristics	
	Impedance setting range for each Zone	
xiv.	Communication Aided Schemes for Distance	
xv.	Communication Aided schemes for Directional Earth Fault (DEF)	
	Pick up settings range for the DEF element	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
	Load Encroachment Discrimination	
xvi.	Fuse Failure Supervision	
	Weak end In feed & Echo	
	Current reversal guard	
xvii.	Voltage Memory function	
xviii.	SOTF	
	Settings range for the SOTF element	
xix.	Back-up protection	
	Settings range for the Backup Overcurrent and Earth Fault Protection Element	
	Voltage protection; settings range	
	Under frequency and Rate of Change of Frequency Protection	
	Settings range for the under-frequency and rate of change of frequency Protection	
	Autoreclose Function	
xx.	Broken Conductor detection	
	Circuit Breaker contact wear feature	
xxi.	Fault Locator with automatic Distance to Fault indication on the LCD screen in km	
xxii.	Accuracy for Distance to Fault Location	
xxiii.	Automatic display of fault details on the screen. List the Fault data displayed.	
	Ability to display selected load measurements on the LCD screen all the time.	
	Availability of maximum demand values	
	Storage capacity for disturbance records, trip records and events record	
xxiv.	Metering provided	
xxv.	Number of Binary Inputs	
xxvi.	Number of Binary outputs	
	Ratings of output relay contacts	
xxvii.	Number of LEDs	
xxviii.	Communication protocols	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xxix.	Communication ports provided	
xxx.	Type and size of connection terminals for cable termination	
xxxi.	Relay to Laptop connection cables offered	
xxxii.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
4.4.4	**Line Current Differential Relay Type I**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Relay	
iii.	Complete order number for offered Relay	
iv.	Flush mounting design	
v.	Numerical Design	
vi.	Number of similar Relay sold to date to the export market: Requirement; 1000	
vii.	Experience in manufacture of Line Current Differential relay	
viii.	Minimum operating voltage and current for impedance measurement/directional sensitivity	
ix.	Minimum operating current /relay sensitivity	
x.	Minimum operating time	
xi.	Tripping logic	
xii.	Simultaneous Tripping at both ends of the line even with no in feed at one end.	
xiii.	Phase segregated measurement of current magnitude and phase angle	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xiv.	High Speed relay operation suitable for protection of Transmission line	
xv.	Transformer Inrush restraint and ratio and phase angle compensation	
xvi.	Direct Transfer of Trip Function between the relays via fiber optical cable	
xvii.	Operates with directly connected fibre cables	
xviii.	Differential Protection blocks upon loss of communication to prevent mal-operation	
xix.	Auto-reclose Function: Available modes of Auto-reclose	
xx.	Integrated Distance Protection	
xxi.	Number of Zones for integrated distance Protection	
xxii.	Zone Impedance Comparator Characteristics	
xxiii.	Impedance Settings range for each Zone	
xxiv.	Automatic Display on the LCD screen of Distance to Fault in km	
xxv.	Back up Overcurrent and Earth Fault Protection	
xxvi.	Settings range for Back up Overcurrent and Earth fault Protection Elements	
xxvii.	Storage capacity for disturbance records, trip records and events record	
xxviii.	Metering capability	
xxix.	Number of Binary Inputs	
xxx.	Number of Binary outputs	
xxxi.	Ratings for relay output contacts	
xxxii.	Ratings for relay output contacts	
xxxiii.	Number of LEDs	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xxxiv.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
xxxv.	Communication protocols	
xxxvi.	Communication ports provided	
xxxvii.	Type and size of connection terminals for cable termination	
xxxviii.	Relay to Laptop connection cables offered	
xxxix.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
4.4.5	**Line Current Differential Relay Type II**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Relay	
iii.	Complete order number for offered Relay	
iv.	Flush mounting design	
v.	Number of similar Relay sold to date to the export market: Requirement; 500	
vi.	Experience in manufacture of Line Current Differential relay	
vii.	Minimum operating current /relay sensitivity	
viii.	Minimum operating time	
ix.	Tripping logic	
x.	Simultaneous Tripping at both ends of the line even with no in feed at one end.	
xi.	Phase segregated measurement of current magnitude and phase angle	
xii.	Transformer Inrush restraint and ratio and phase angle compensation	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xiii.	Direct Transfer of Trip Function between the relays via fiber optical cable	
xiv.	The differential relays will block upon loss of communication between them, to prevent mal-operation.	
xv.	Status indications of all input, output and internal functions.	
xvi.	Display of Remote end currents on the local relay.	
xvii.	Display on the LCD screen of Bias and Differential currents	
xviii.	Ability of the Differential relays to send Direct inter-trips via the fiber optic cable.	
xix.	Transformer inrush restraint feature	
xx.	CT ratio mismatch and phase angle compensation	
xxi.	Auto-reclose Function: Available modes of Auto-reclose	
xxii.	Integrated Distance Protection	
xxiii.	Number of Zones for integrated distance Protection	
xxiv.	Zone Impedance Comparator Characteristics	
xxv.	Impedance Settings range for each Zone	
xxvi.	Automatic Display on the LCD screen of Distance to Fault in km.	
xxvii.	Back up Overcurrent and Earth Fault Protection	
xxviii.	Settings range for Back up Overcurrent and Earth Fault Protection Elements	
xxix.	Storage capacity for disturbance records, trip records and events record	
xxx.	Metering capability	
xxxi.	Number of Binary Inputs	
xxxii.	Number of Binary outputs	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xxxiii.	Ratings for Relay output Contacts	
xxxiv.	Ability to latch output relays	
xxxv.	Number of LEDs	
xxxvi.	Communication protocols	
xxxvii.	Communication ports provided	
xxxviii.	Type and size of connection terminals for cable termination	
xxxix.	Relay to Laptop connection cables offered	
xl.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
xli.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
4.4.6	**Biased Differential Protection for a Two Winding Transformer**	
i.	Relay Manufacturer's name	
ii.	Type or designation name of the relay offered	
iii.	Complete order number of offered relay	
iv.	Numerical Design	
v.	Flush Mounting design	
vi.	Number of similar Relay sold to date to the export market: Requirement; 1000	
vii.	Experience in manufacture of Biased Differential Protection relay	
viii.	Minimum operating current for biased differential /relay sensitivity and setting range	
ix.	Minimum operating time at 2 x setting	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
x.	Provision of unrestrained High-set differential element and setting range	
xi.	Magnetizing Inrush detection method(s) and settings range	
xii.	Provision of Integral CT correction ratio feature and setting range	
xiii.	Integral Vector Group compensation feature	
xiv.	Display of HV & LV differential and bias currents on the LCD screen	
xv.	Storage capacity for Disturbance, Event and Trip/Fault records	
xvi.	Display of Fault currents on the LCD	
xvii.	Provision of over-fluxing Alarm and Trip functions	
xviii.	5th Harmonic restraint feature and settings range	
xix.	Dual- Bias characteristics	
xx.	Relay trip Indication by Red LED	
xxi.	No of Binary Inputs	
xxii.	No. of Binary Outputs	
xxiii.	Ratings of relay output contacts	
xxiv.	Number of LEDs	
xxv.	Ability to latch output contacts	
xxvi.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
xxvii.	LCD screen and Keypad for programming relay parameter settings and data access	
xxviii.	Communication protocols	
xxix.	Communication ports provided	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xxx.	Type and size of terminals for cable connection	
xxxi.	Software offered for relay configuration and programming	
xxxii.	Laptop to relay connection cable	
xxxiii.	Metering capability	
4.4.7	**Restricted Earth Fault**	
i.	Relay Manufacturer's name	
ii.	Number of similar Relay sold to date to the export market: Requirement; 1000	
iii.	Experience in manufacture of Restricted Earth Fault Relay	
iv.	Type or Designation name of Relay	
v.	Complete order number for offered Relay	
vi.	Suitable for High Impedance operating principle application	
vii.	Minimum pick up & setting range	
viii.	Relay Operating time at 5 x setting current	
ix.	Number of LEDs	
x.	Number of Binary inputs	
xi.	Number of Binary outputs	
xii.	Ratings of output relay contacts	
xiii.	Keypad for relay parameter settings and data access	
xiv.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
xv.	Software for relay configuration and parameter setting. Software to be offered in CD form	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xvi.	Connection cable from Laptop to Relay offered	
4.4.8	**Stabilizing Resistor**	
i.	Type and reference number of Stabilizing Resistor Offered.	
ii.	Setting Range of Offered resistor in Ohms.	
iii.	Maximum through fault for the REF scheme	
4.4.9	**Voltage Dependent Resistor (Metrosil)**	
i.	Type and reference number of Voltage Dependent Resistor (VDR) Metrosil offered. Rated voltage of VDR based on maximum fault current of 25kA.	
ii.	Both Stabilising Resistor and Voltage dependent resistor are housed in a single box with external connection terminals suitable panel mounting.	
iii.	Type and size of Relay terminals for cable connection	
iv.	Software for relay configuration and parameter setting. Software to be offered in CD form	
v.	Connection cable from Laptop to Relay offered	
4.4.10	**Feeder Protection and Bay Control Relay**	
i.	Relay Manufacturer's name	
ii.	Type or Designation name of Relay offered	
iii.	Complete order number for offered Relay	
iv.	Number of similar Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of Feeder Protection & Control Relay	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
vi.	Numerical design	
vii.	Flush Mounting design	
viii.	Number of CT inputs	
ix.	Number of VT inputs	
x.	Protection and control Functions included in the relay available in relay and parameter setting range for each function: O/C, E/F, SEF, etc, including highest elements	
xi.	Settings range for protection and control elements included in the relay, including time-current characteristics that are available for assignment to each protection element	
4.4.11.	**Auto Reclose Relay Function in the Feeder Protection Relay.**	
i.	Auto reclose function and number of autoreclose shots possible	
ii.	Independent settings for each autoreclose shot, including selectable protection functions to initiate autoreclose for each shot	
iii.	Start and trip signals of Protection functions are freely assignable to the various output relays	
iv.	Broken Conductor Function and settings range	
v.	Circuit Breaker contact wear feature	
vi.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
vii.	Relay has circuit breaker close and open push buttons	
viii.	Relay LCD screen size	
ix.	Free selection of measurements to be displayed on the relay screen.	
x.	Bay MIMIC to be included on the LCD display	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xi.	Ability to control circuit breaker, disconnectors and earth switch on the mimic on relay LCD using the open and close push buttons on the relay front face	
xii.	Metering/Measurement capability	
xiii.	Number of LEDS	
xiv.	Number of Binary inputs	
xv.	Number of Binary outputs	
xvi.	Ratings of relay output contacts	
xvii.	Communication ports	
xviii.	Communication protocols	
xix.	Type and size of relay terminals for cable connection	
xx.	Software for relay configuration and parameter setting. Software to be offered in CD form	
xxi.	Keypad for relay parameter settings and data access	
xxii.	Connection cable from Laptop to Relay offered	
4.4.12	**Feeder Protection Relay**	
i.	Relay Manufacturer's name	
ii.	Type or Designation name of Relay offered	
iii.	Complete order number for offered Relay	
iv.	Number of similar Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of Feeder Protection Relay: Requirement	
vi.	Relay is of Numerical design	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
vii.	Flush mounting design	
viii.	Number of CT inputs Provided	
ix.	Number of VT inputs provided	
x.	Protection Functions included in the relay	
xi.	Setting range for the various protection elements.	
xii.	Auto-reclose function and number of autoreclose shots possible	
xiii.	Independent settings for each auto-reclose shot and free selection of protection functions to initiate autoreclose for each shot	
xiv.	Broken Conductor Function and settings range	
xv.	Relay has circuit breaker close and open push buttons	
xvi.	Relay LCD screen size	
xvii.	Free selection of measurements to be displayed on the relay screen	
xviii.	Metering/Measurement capability	
xix.	Number of LEDS	
xx.	Number of Binary inputs	
xxi.	Number of Binary outputs	
xxii.	Ratings of output relays contacts	
xxiii.	Start and Trip Contacts of the protection elements shall be freely configurable.	
xxiv.	Communication ports	
xxv.	Communication protocols	
xxvi.	Circuit Breaker contact wear feature	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xxvii.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
xxviii.	Storage capacity for disturbance, event and fault records	
xxix.	Metering/Measurement capability	
xxx.	Software for relay configuration and parameter setting. Software to be offered in CD form	
xxxi.	Connection cable from Laptop to Relay offered	
xxxii.	Type and size of relay terminals for cable connection	
4.4.13	**Three Phase Directional Overcurrent and Earth Fault Relay**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Relay	
iii.	Complete order number for offered Relay	
iv.	Number of similar Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of Three Phase Directional Overcurrent & Earth Fault Relay	
vi.	Numerical/digital design	
vii.	Flush mounting	
viii.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
ix.	Protection Functions offered and the parameters setting range : DO/C, DE/F, for both low set and high set elements	
x.	Time-Current characteristics available for all protection elements or stages	
xi.	Quadrature connection of polarizing voltage	
xii.	Free assignment of the directional feature to all phase and earth fault protection elements	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xiii.	Operating range: maximum relay torque angle	
xiv.	Other protection Functions included in the relay	
xv.	Setting range for Relay Characteristic Angle	
xvi.	Circuit Breaker contact wear feature	
xvii.	Sensitivity of the directional element: minimum operating values for voltage and current	
xviii.	Connection cable from Laptop to Relay offered	
xix.	Number of similar Relay sold to date to the export market: minimum - 1000	
xx.	Experience in manufacture of Directional Overcurrent and Earth Fault Relay in years	
xxi.	Number of LEDs	
xxii.	Number of Binary Inputs	
xxiii.	Number of Binary outputs	
xxiv.	Ratings for output relays contacts	
xxv.	Free assignment to output relays of start and trip signal of Protection functions	
xxvi.	Communication ports	
xxvii.	Communication protocols	
xxviii.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
xxix.	LCD screen size	
xxx.	Storage capacity for disturbance, event and trip/fault records	
xxxi.	Metering/Measurement capability	
xxxii.	Software for relay configuration and parameter setting. Software to be offered in CD form	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xxxiii.	Connection cable from Laptop to Relay offered	
xxxiv.	Type and size of relay terminals for cable connection	
4.4.14	**Three Phase Overcurrent and Earth Fault Relay**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Relay	
iii.	Complete order number for offered Relay	
iv.	Number of similar Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of Three Phase Overcurrent and Earth Fault Relay	
vi.	Numerical/Digital design	
vii.	Flush mounting	
viii.	Protection Functions offered and the parameters setting range for all protection elements	
ix.	Time-current characteristics available for various Overcurrent, Earth fault elements and other protection elements	
x.	Broken Conductor Function	
xi.	Under frequency Protection	
xii.	Circuit Breaker contact wear feature	
xiii.	Number of LEDs	
xiv.	Number of Binary Inputs	
xv.	Number of Binary outputs	
xvi.	Ratings of output relays contacts	
xvii.	Communication ports	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xviii.	Communication protocols	
xix.	Circuit Breaker maintenance	
xx.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
xxi.	Configuration of Start and trip contacts	
xxii.	Storage capacity for disturbance, event and trip/fault records	
xxiii.	Metering/Measurement capability	
xxiv.	Size of LCD screen	
xxv.	Relay Keypad for relay parameter setting and data access	
xxvi.	Software for relay configuration and parameter setting. Software to be offered in CD form	
xxvii.	Connection cable from Laptop to Relay offered	
xxviii.	Type and size of relay terminals for cable connection	
xxix.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
4.4.15	**Earth Fault Relay**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Relay	
iii.	Complete order number for offered Relay	
iv.	Number of similar Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of Earth Fault Relay	
vi.	Numeric/Digital design	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
vii.	Panel mounting design	
viii.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
ix.	Parameter settings range for low set and high set elements	
x.	Time-Current Characteristics available in the relay	
xi.	Circuit Breaker Contact wear feature	
xii.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
xiii.	Relay Drop off/Pick up Ratio	
xiv.	Size of LCD screen	
xv.	Relay Keypad for programming of relay settings and data access	
xvi.	Number of LEDs	
xvii.	Number of Binary Inputs	
xviii.	Number of Binary outputs	
xix.	Ratings of output relays contacts	
xx.	Communication ports	
xxi.	Communication protocols	
xxii.	Circuit Breaker maintenance	
xxiii.	Storage capacity for disturbance, event and trip/fault records	
xxiv.	Metering/Measurement capability	
xxv.	Software for relay configuration and parameter setting. Software to be offered in CD form	
xxvi.	Connection cable from Laptop to Relay offered	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xxvii.	Communication ports	
xxviii.	Communication protocols	
xxix.	Type and size of relay terminals for cable connection	
4.4.16	**Sensitive Earth Fault Relay.**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Relay	
iii.	Complete order number for offered Relay	
iv.	Number of similar Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of Sensitive Earth Fault Relay	
vi.	Numerical/digital design	
vii.	Flush mounting	
viii.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
ix.	Pick up Current setting range	
x.	Definite Time delay setting range	
xi.	Drop off/Pick up ratio	
xii.	Relay self-diagnostic with watchdog contact, relay healthy LED(green) and red LED for relay failure	
xiii.	Number of LEDs	
xiv.	Number of Binary Inputs	
xv.	Number of Binary outputs	
xvi.	Ratings of output relays contacts	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xvii.	Communication ports	
xviii.	Communication protocols	
xix.	Keypad for manual programming of relay settings	
xx.	Circuit Breaker contact wear feature	
xxi.	Storage capacity for disturbance, event and trip/fault records	
xxii.	Metering/Measurement capability	
xxiii.	Connection cable from Laptop to Relay offered	
xxiv.	Type and size of relay terminals for cable connection	
xxv.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
4.4.17	**Electrical Reset-Trip Relay**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Trip Relay	
iii.	Complete order number for offered Trip Relay	
iv.	Number of similar Trip Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of Trip Relay:	
vi.	Flush Design	
vii.	High Burden trip relay; immune to capacitance discharge and leakage currents	
viii.	Shall be electrically resettable	
ix.	Number and configuration of output contacts	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
x.	Output contact rating	
xi.	Relay flag on operation	
xii.	Type and size of relay terminals for cable connection	
xiii.	Size : lxhxb	
xiv.	Relay terminals are indelibly marked	
4.4.18.	**Self-Reset Trip Relay**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Trip Relay	
iii.	Complete order number for offered Trip Relay	
iv.	Number of similar Trip Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of Trip Relay:	
vi.	Flush Design	
vii.	High Burden trip relay; immune to capacitance discharge and leakage currents	
viii.	Shall be electrically resettable	
ix.	Number and configuration of output contacts	
x.	Output contact rating	
xi.	Relay flag on operation	
xii.	Type and size of relay terminals for cable connection	
xiii.	Size: lxhxb	
xiv.	Relay terminals are indelibly marked	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
4.4.19	**Trip Circuit Supervision Relay Type I**	
i.	Manufacturer's Name	
ii.	Type or Designation name of TCS Relay	
iii.	Complete order number for offered TCS Relay	
iv.	Number of similar TCS Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of Trip Circuit Supervision Relay	
vi.	Trip Coil supervision for both Circuit Breaker in closed and open positions	
vii.	TCS healthy indication	
viii.	TCS faulty indication	
ix.	Inherent operation time delay	
x.	Number, rating and configuration of contacts	
xi.	Flush mounting	
xii.	Type and size of relay terminals for cable connection	
xiii.	Relay terminals are indelibly marked	
xiv.	Size : lxhxb	
4.4.20	**Trip Circuit Supervision Relay Type II**	
i.	Manufacturer's Name	
ii.	Type or Designation name of TCS Relay	
iii.	Complete order number for offered TCS Relay	
iv.	Number of similar TCS Relay sold to date to the export market: Requirement; 1000	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
v.	Experience in manufacture of Trip Circuit Supervision Relay	
vi.	Trip Coil supervision for both CB in closed and open positions	
vii.	TCS healthy flag indication	
viii.	Inherent operation time delay	
ix.	TCS faulty flag/indication	
x.	Number, rating and configuration of contacts	
xi.	Relay Terminals are inherently marked	
xii.	35mm DIN rail mounting	
xiii.	Type and size of relay terminals for cable connection	
4.4.21	**Auxiliary Relays for Transformer Mechanical Protection Trip Function Type I**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Auxiliary Relay	
iii.	Complete order number for offered Auxiliary Relay	
iv.	Number of similar Auxiliary Relay sold to date to the export market: Requirement; 2000	
v.	Manufacturer's Experience in manufacture of Auxiliary Relay type I	
vi.	Relay operating time	
vii.	Number of relay elements per casing	
viii.	Draw out design	
ix.	Hand reset contacts and red flag	
x.	Suitable for DIN Rail mounting	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xi.	Number of NO contacts and rating	
xii.	Type and size of relay terminals for cable termination	
xiii.	Relay terminals indelibly marked	
xiv.	Size : lxhxb	
4.4.22	**Auxiliary Relays for Transformer Mechanical Protection Trip Functions Type II**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Auxiliary Relay	
iii.	Complete order number for offered Auxiliary Relay	
iv.	Number of similar Auxiliary Relay sold to date to the export market: Requirement; 2000	
v.	Manufacturer's Experience in manufacture of Auxiliary Relay type II:	
vi.	Relay operating time	
vii.	Self-reset contacts with red operation flag	
viii.	Relay supplied complete with mounting base	
ix.	35 mm DIN Rail mounting	
x.	Number of NO contacts and rating	
xi.	Type and size of relay terminals for cable termination	
xii.	Relay terminals indelibly marked	
xiii.	Size : lxhxb	
4.4.23	**Auxiliary Relays for Transformer Mechanical Protection Alarm Functions Type III**	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
i.	Manufacturer's Name	
ii.	Type or Designation name of Auxiliary Relay	
iii.	Complete order number for offered Auxiliary Relay	
iv.	Number of similar Auxiliary Relay sold to date to the export market: Requirement; 2000	
v.	Manufacturer's Experience in manufacture of Auxiliary Relay type III	
vi.	Relay operating time	
vii.	Self-reset contacts and red operational indicator	
viii.	Relay operating speed	
ix.	One element per casing	
x.	Relay supplied completed with mounting base	
xi.	35 mm DIN Rail mounting	
xii.	Number of NO contacts and rating	
xiii.	Type and size of relay terminals for cable termination	
xiv.	Relay terminals indelibly marked	
xv.	Size : lxhxb	
4.4.24	**Bistable Auxiliary relays**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Bistable auxiliary Relay	
iii.	Complete order number for offered Bistable auxiliary Relay	
iv.	Number of similar Bistable auxiliary Relay sold to date to the export market: Requirement; 2000	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
v.	Experience in manufacture of Bistable auxiliary relay	
vi.	The relay has two operating coils	
vii.	Relay operating time	
viii.	35 mm DIN Rail mounting	
ix.	Number of NO contacts and rating	
x.	Type and size of relay terminals for cable termination	
xi.	Number of similar Relay sold to date to the export market: Requirement; 1000	
4.4.25	**DC Supply Under Voltage Relay**	
i.	Manufacturer's Name	
ii.	Type or Designation name of DC supply under voltage Relay	
iii.	Complete order number for offered DC supply under voltage Relay	
iv.	Number of similar DC supply under voltage Relay sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of DC Supply Under-voltage relays	
vi.	Relays pick up and drop off value. NB: nominal rating is 110 V DC	
vii.	Accuracy	
viii.	Number and rating of relay contacts	
ix.	Panel mounting design	
x.	Relay flag for under-voltage indication	
xi.	Self-reset flag	
xii.	Type and size of relay terminals for cable connection	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
4.4.26	**Annunciator Relay Type I**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Annunciator Relay	
iii.	Complete order number for offered Annunciator Relay	
iv.	Number of similar Annunciator Relay sold to date to the export market: Requirement; 1000	
v.	Years of Experience in the manufacture of Annunciator relays	
vi.	Numeric/Digital design	
vii.	Panel flush mounting design	
viii.	Alarm management buttons	
ix.	Number of alarm elements/windows	
x.	Method of programming the Alarms	
xi.	Behaviour of alarms upon loss of auxiliary DC supply	
xii.	LED colour for each alarm ON Indication	
xiii.	Years of Service in Kenya Power	
xiv.	Field configurable labels	
xv.	Alarm elements freely assigned to URGENT or NON-URGENT alarm bus and to output relays	
xvi.	URGENT & NON-URGENT alarms shall be assigned to separate output relays	
xvii.	Number of contacts for output relays	
xviii.	Type and size of relay terminals for cable connection	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
4.4.27	**Annunciator Relay Type II**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Annunciator Relay	
iii.	Complete order number for offered Annunciator Relay	
iv.	Number of similar Annunciator Relay sold to date to the export market: Requirement; 1000	
v.	Years of Experience in the manufacture of Annunciator relays	
vi.	Numerical/Digital design	
vii.	Panel flush mounting design	
viii.	Alarm management buttons	
ix.	Number of alarm elements/windows	
x.	Method of programming the alarms	
xi.	Behaviour of alarms upon loss of auxiliary DC supply	
xii.	LED colour for alarm ON Indication	
xiii.	Years of service in Kenya Power	
xiv.	Field configurable labels	
xv.	Alarm elements freely configurable to URGENT or NON-URGENT alarm bus and to output relays	
xvi.	Number of contacts for output relays	
xvii.	Type and size of relay terminals for cable connection	
4.4.28	**Annunciator Relay Type III**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Annunciator Relay	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
iii.	Service experience in KPLC	
iv.	Complete order number for offered Annunciator Relay	
v.	Number of similar Annunciator Relays sold to date to the export market: Requirement; 1000	
vi.	Years of Experience in the manufacture of Annunciator relays	
vii.	Numeric/Digital design	
viii.	Panel flush mounting design	
ix.	Alarm management buttons	
x.	Number of alarm elements/windows	
xi.	Method of programming the Alarms	
xii.	Behaviour of alarms upon loss of auxiliary DC supply	
xiii.	Years of Service in Kenya Power	
xiv.	Field configurable labels	
xv.	LED colour for alarm ON Indication	
xvi.	Alarm elements freely configurable to URGENT or NON-URGENT alarm bus and to output relays	
xvii.	Number of contacts for output relays	
xviii.	Type and size of relay terminals for cable connection	
4.4.29	**Electronic Hooter**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Electronic Hooter	
iii.	Complete order number for offered Electronic Hooter	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
iv.	Number of similar Electronic Hooters sold to date to the export market: Requirement; 500	
v.	Years of Experience in the manufacture of Electronic Hooters	
vi.	Panel mounting design	
vii.	Maximum output in dB(A)	
viii.	Physical size of hooter	
ix.	Type of Tone	
x.	Continuous operating mode	
xi.	Type and size of relay terminals for cable connection	
4.4.30	**Anti-condensation Heater**	
i.	Manufacturer's Name	
ii.	Manufacturer's Experience	
iii.	Type or Designation name of Heater	
iv.	Complete order number for offered Heater	
v.	Number of similar Heaters sold to date to the export market: Requirement; 1000	
vi.	Rated voltage and power	
vii.	Make/finish of heater body	
viii.	Suitable for mounting on DIN rail	
ix.	Type and size of heater terminals for cable connection	
4.4.31	**Hygrostat**	
i.	Manufacturer's Name	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
ii.	Manufacturer's experience	
iii.	Type or Designation name of Hygrostat	
iv.	Complete order number for offered Hygrostat	
v.	Number of similar Hygrostat sold to date to the export market: Requirement; 1000	
vi.	Temperature and Humidity setting range	
vii.	Suitable for mounting on DIN rail	
viii.	Rated power supply	
ix.	Contacts configuration	
4.4.32	**Discrepancy Switch for Circuit Breaker Control**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Discrepancy switch	
iii.	Complete order number for offered Discrepancy switch	
iv.	Number of similar Discrepancy switches sold to date to the export market: Requirement; 1000	
v.	Experience in manufacture of Discrepancy Switch	
vi.	Panel mounting design	
vii.	Number and configuration of contacts for close and open operations	
viii.	Indelibly marked rectangular escutcheon plate with closing and opening positions clearly marked	
ix.	Rating of discrepancy white illumination bulb	
x.	Type and size of switch contacts for cable termination	
xi.	Contacts indelibly marked	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
4.4.33	**Circuit Breaker Close/Open Control Switch**	
i.	Manufacturer's Name	
ii.	Manufacturer's experience	
iii.	Type or Designation name of Circuit Breaker close/open control switch	
iv.	Complete order number for offered Circuit breaker close/open control switch	
v.	Years of experience in the manufacture of the Circuit Breaker close/open control switch	
vi.	Mechanical interlock	
vii.	Contacts rating and configuration	
viii.	Type and size of switch terminals for cable connection	
4.4.34	**Push Button Switches for Circuit Breaker Close/Open Operation Type I**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Circuit Breaker close/open push button switch	
iii.	Complete order number for offered Circuit Breaker close/open push button switch	
iv.	Years of experience in the manufacture of push button switches	
v.	Shrouded and well recessed	
vi.	Panel mounting design	
vii.	Contacts rating	
viii.	Switch colour for open and label	
ix.	Switch Colour for Close and label	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
x.	Type and Size of switch terminals for cable connection	
4.4.35	**Push Button Switch for Alarm/Trip Relay Reset - Type II**	
i.	Manufacturer's Name	
ii.	Manufacturer's experience	
iii.	Type or Designation name of Push button switch	
iv.	Complete order number for offered push button switch	
v.	Complete order number for offered Push Button switch	
vi.	Years of Experience in the manufacture of push button switches	
vii.	Shrouded and well recessed	
viii.	Flush mounting design	
ix.	Contacts rating	
x.	Switch colour	
xi.	Type and Size of switch terminals for cable connection	
4.4.36	**Local/Remote Selector Switch**	
i.	Manufacturer's Name	
ii.	Type or Designation name of the Local/Remote switch	
iii.	Complete order number for offered Local/Remote switch	
iv.	Years of experience in the manufacture of the switch	
v.	Flush mounting	
vi.	Contacts Rating and configuration	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
vii.	Indelible labelling on escutcheon plate	
viii.	Type and size of switch terminals for cable connection	
4.4.37	**OFF/Local/Remote Selector Switch**	
i.	Manufacturer's Name	
ii.	Manufacturer's experience	
iii.	Type or Designation name of Discrepancy switch	
iv.	Complete order number for offered Discrepancy switch	
v.	Panel mounting design	
vi.	Contacts Rating and configuration	
vii.	Indelible labeling on escutcheon plate	
viii.	Type and size of switch terminals for cable connection	
4.4.38	**ON/OFF Selector Switch**	
i.	Manufacturer's Name	
ii.	Manufacturer's experience	
iii.	Type or Designation name of Discrepancy switch	
iv.	Complete order number for offered On/off switch	
v.	Panel mounting design	
vi.	Contacts Rating and configuration	
vii.	Indelible labelling on escutcheon plate	
viii.	Type and size of switch terminals for cable connection	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
4.4.39	**Semaphore for Isolator and Earth Switch Position Indication**	
i.	Manufacturer's Name	
ii.	Manufacturer's experience	
iii.	Type or Designation name of semaphore	
iv.	Complete order number for offered Semaphore	
v.	Panel mounting design	
vi.	Red LED Indications for Closed and Green LED Indication Open status	
vii.	Shall be of circular or rectangular front appearance	
viii.	Type and size on semaphore terminals for cable connection	
ix.	Number of similar Semaphore sold to date to the export market: Requirement; 500	
4.4.40	**LED Indicating Lamps**	
i.	Manufacturer's Name	
ii.	Manufacturer's experience	
iii.	Type or Designation name of LED Indicating Lamps	
iv.	Complete order number for offered LED Indicating Lamps	
v.	Panel mounting design	
vi.	LED lamp rating in watts	
	Duration for continuous operation	
4.4.41	**Miniature Circuit Breaker Type I**	
i.	Manufacturer's Name	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
ii.	Manufacturer's Experience	
iii.	Type or Designation name of Miniature Circuit Breaker	
iv.	Complete order number for offered Miniature Circuit breaker	
v.	Number of poles	
vi.	One(1) Normally Closed(NC) auxiliary contact	
vii.	Rated operating & insulating voltage	
viii.	Overload setting in Amps	
ix.	Overcurrent release rating in Amps	
x.	Electrical & mechanical endurance	
xi.	Number of Contacts	
xii.	ON/OFF status indication	
xiii.	DIN rail mounting	
xiv.	Type and size of terminals	
4.4.42	**Miniature Circuit Breaker Type II**	
i.	Manufacturer's Name	
ii.	Manufacturer's Experience	
iii.	Type or Designation name of Miniature Circuit Breaker	
iv.	Complete order number for offered Miniature Circuit breaker	
v.	Three pole configuration	
vi.	Rated operating & insulating voltage	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
vii.	Rated short-circuit current	
viii.	Rated current	
ix.	Electrical & mechanical endurance	
x.	Tripping characteristic	
xi.	One(1) Normally Closed(NC) auxiliary contact	
xii.	ON/OFF status indication	
xiii.	DIN rail mounting	
xiv.	Type and size of terminals	
4.4.43	**Miniature Circuit Breaker Type III**	
i.	Manufacturer's Name	
ii.	Manufacturer's experience	
iii.	Type or Designation name of Miniature Circuit Breaker	
iv.	Complete order number for offered Miniature Circuit breaker	
v.	One Pole Configuration	
vi.	Rated operating & insulating voltage	
vii.	Rated short-circuit current	
viii.	Rated current	
ix.	Electrical & mechanical endurance	
x.	Tripping Characteristic	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xi.	One(1) Normally Closed(NC) auxiliary contact	
xii.	ON/OFF status indication	
xiii.	DIN rail mounting	
xiv.	Type and size of terminals	
4.4.44	**Miniature Circuit Breaker Type IV**	
i.	Manufacturer's Name	
ii.	Manufacturer's Experience	
iii.	Type or Designation name of Miniature Circuit Breaker	
iv.	Complete order number for offered Miniature Circuit breaker	
v.	Two Pole Configuration	
vi.	Rated operating & insulating voltage	
vii.	Rated short-circuit current	
viii.	Rated current	
ix.	Electrical & mechanical endurance	
x.	Tripping Characteristic	
xi.	One(1) Normally Closed(NC) auxiliary contact	
xii.	ON/OFF status indication	
xiii.	DIN rail mounting	
xiv.	Type and size of terminals	
4.4.45	**Miniature Circuit Breaker Type V**	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
i.	Manufacturer's Name	
ii.	Manufacturer's Experience	
iii.	Type or Designation name of Miniature Circuit Breaker	
iv.	Complete order number for offered Miniature Circuit breaker	
v.	Two Pole Configuration	
vi.	Rated operating & insulating voltage	
vii.	Rated short-circuit current	
viii.	Rated current	
ix.	Electrical & mechanical endurance	
x.	Tripping Characteristic	
xi.	One(1) Normally Closed(NC) auxiliary contact	
xii.	ON/OFF status indication	
xiii.	DIN rail mounting	
xiv.	Type and size of terminals	
4.4.46	**Miniature Circuit Breaker Type VI**	
i.	Manufacturer's Name	
ii.	Manufacturer's experience	
iii.	Type or Designation name of Miniature Circuit Breaker	
iv.	Complete order number for offered Miniature Circuit breaker	
v.	Two Pole Configuration	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
vi.	Rated operating & insulating voltage	
vii.	Rated short-circuit current	
viii.	Rated current	
ix.	Electrical & mechanical endurance	
x.	Tripping Characteristic	
xi.	One(1) Normally Closed(NC) auxiliary contact	
xii.	ON/OFF status indication	
xiii.	DIN rail mounting	
xiv.	Type and size of terminals	
xv.	Connection type 3 phase, 4 wire	
xvi.	Measurands	
4.4.47	**Multi-Functional Power Meter**	
i.	Manufacturer's Name	
ii.	Type or Designation name	
iii.	Flush mounting	
iv.	Numerical design	
v.	Manufacturer's experience	
vi.	Size of LCD display	
vii.	Measured parameters	
viii.	Measurement of THD & TDD	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
ix.	Rated current and Voltage	
x.	CT and VT ratio programmable	
xi.	3 phase, 4-wire connection	
xii.	Accuracy class	
xiii.	Measurement range for MVA	
xiv.	Communication ports	
xv.	Communication protocols	
xvi.	Software provided	
xvii.	PC to Measurement Unit connection cable provided	
xviii.	Type & size of terminals	
4.4.48	**Tap Position Indication Transducer**	
i.	Supply voltage	
ii.	Outputs in mA	
iii.	Tap position measuring range	
iv.	Mounting	
v.	Resistor per step – configurable range	
vi.	Accuracy	
vii.	Response time	
viii.	Temperature class	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
ix.	Applicable standard	
x.	Construction type	
4.4.49	**Tap Position Indicator**	
i.	Indication of Tap Position	
ii.	Input mA	
iii.	Number of tap steps (1-17)/configurable	
iv.	Mounting style	
4.4.51	**MW Transducer**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Transducer offered	
iii.	Complete order number for offered Transducer	
iv.	Years of Experience in the manufacture of Transducers	
v.	Connection configuration of Transducer	
vi.	Rated voltage & current	
vii.	Rated output in mA	
viii.	Programmable output characteristic and CT & VT ratio	
ix.	Auxiliary supply shall be 110V DC/110V AC	
x.	Type & size of terminals	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xi.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
xii.	Connection cable from Laptop to Transducer offered	
xiii.	Number of similar Transducers sold to date to the export market: Requirement; 500	
4.4.52	**MVAr Transducer**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Transducer offered	
iii.	Complete order number for offered Transducer	
iv.	Years of Experience in the manufacture of Transducer	
v.	Connection configuration for the Transducer	
vi.	Rated voltage & current	
vii.	Rated output in mA	
viii.	Programmable output characteristics and CT & VT ratio	
ix.	DIN rail mounting	
x.	Auxiliary Power supply 110V DC/110V AC	
xi.	Type & size of terminals	
xii.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
xiii.	Connection cable from Laptop to Transducer offered	
xiv.	Number of similar Transducers sold to date to the export market: Requirement; 500	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
4.4.53	**Current Transducer**	
i.	Manufacturer's Name	
ii.	Type or Designation name of offered Transducer	
iii.	Complete order number for offered Transducer	
iv.	Years of Experience in the manufacture of Transducer	
v.	Rated input, in Amps	
vi.	Rated output, in mA	
vii.	Auxiliary power supply 110V DC/110V AC	
viii.	DIN Rail mounting	
ix.	Type and size of terminals	
x.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
xi.	Connection cable from Laptop to Transducer offered	
xii.	Number of similar Transducer sold to date to the export market: Requirement; 500	
4.4.54	**Voltage Transducer**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Transducer	
iii.	Complete order number for offered Transducer	
iv.	Years of Experience in the manufacture of Transducer	
v.	Rated input, in Volts	
vi.	Rated output in kV	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
vii.	DIN rail mounting	
viii.	Auxiliary power supply 110V DC/110V AC	
ix.	Type & size of terminals	
x.	Software for relay configuration and parameter setting and fault data Analysis offered for use with the relay. Software to be offered in CD form	
xi.	Connection cable from Laptop to Transducer offered	
xii.	Number of similar Transducer sold to date to the export market: Requirement; 500	
4.4.55	**INDICATING INSTRUMENTS DRIVEN BY TRANSDUCER OUTPUT**	
4.4.56	**MW Instrument**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Instrument	
iii.	Complete order number for offered Instrument	
iv.	Years of Experience in the manufacture of Instrument	
v.	Rated input in mA	
vi.	Rated output in MW	
vii.	FSD of instrument	
viii.	Black scale on white background	
ix.	Panel mounting design	
x.	Dimensions of Instrument	
xi.	Type & size of terminals	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xii.	Number of similar Instruments sold to the export market: Requirement 400	
4.4.57	**MVAR Instrument**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Instrument	
iii.	Complete order number for offered Instrument	
iv.	Years of Experience in the manufacture of Instrument	
v.	Rated input in mA	
vi.	Rated output in MVAr	
vii.	FSD of instrument	
viii.	Black scale on white background	
ix.	Panel mounting design	
x.	Dimensions of Instrument	
xi.	Type & size of terminals	
xii.	Number of similar Instruments sold to the export market: Requirement 500	
4.4.58	**INDICATING INSTRUMENTS DIRECTLY CONNECTED**	
4.4.59	**Ammeter with MDI– 200 A**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Ammeter	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
iii.	Complete order number for offered Ammeter	
iv.	Years of Experience in the manufacture of Ammeter	
v.	Flush mounting	
vi.	Rated input in Amps	
vii.	Rated output in Amps	
viii.	FSD of Instrument	
ix.	Black scale on white background	
x.	Dimensions of Ammeter	
xi.	Maximum demand Indicator	
	Type & size of terminals	
	Number of similar Ammeter sold to date to the export market: Requirement; 500	
4.4.60	**Ammeter with MDI – 400 A**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Ammeter	
iii.	Complete order number for offered Ammeter	
iv.	Years of Experience in the manufacture of the Ammeter	
v.	Flush mounting	
vi.	Rated input in Amps	
vii.	Rated output in Amps	
viii.	FSD of Instrument	
ix.	Black scale on white background	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
x.	Dimensions of Ammeter	
xi.	Maximum demand Indicator	
xii.	Type & size of terminals	
xiii.	Number of similar Ammeter sold to date to the export market: Requirement; 500	
4.4.61	**Ammeter with MDI – 800 A**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Ammeter	
iii.	Complete order number for offered Ammeter	
iv.	Years of Experience in the Manufacture of Ammeter	
v.	Flush mounting	
vi.	Rated input in Amps	
vii.	Rated output in Amps	
viii.	FSD of Instrument	
ix.	Black scale on white background	
x.	Dimensions of Ammeter	
xi.	Maximum demand Indicator	
xii.	Type & size of terminals	
xiii.	Number of similar Ammeter sold to date to the export market: Requirement; 500	
4.4.62	**Ammeter Selector Switch**	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
i.	Manufacturer's Name	
ii.	Type or Designation name of Ammeter Selector Switch	
iii.	Complete order number for offered Ammeter Selector Switch	
iv.	Years of Experience in the Manufacture of Ammeter Selector Switch	
v.	Flush mounting	
vi.	Independent measurement of all three phase current when used with one Ammeter	
vii.	Contact Rating in Amps	
viii.	Type & size of Terminals	
ix.	Manufacturer's experience on similar equipment	
4.4.63	**Voltmeter - 220KV**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Voltmeter	
iii.	Complete order number for offered Voltmeter	
iv.	Years of Experience in the manufacture of Voltmeter	
v.	Flush mounting	
vi.	Rated input in volts	
vii.	Rated output in Kilovolts (kV)	
viii.	FSD of Instrument	
ix.	Black scale on white background	
x.	Dimensions of Voltmeter	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xi.	Type & size of terminals	
xii.	Number of similar Voltmeter sold to date to the export market: Requirement; 500	
4.4.64	**Voltmeter - 132KV**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Voltmeter	
iii.	Complete order number for offered Voltmeter	
iv.	Years of Experience in the manufacture of Voltmeter	
v.	Flush mounting	
vi.	Rated input in volts	
vii.	Rated output in Kilovolts (kV)	
viii.	FSD of Instrument	
ix.	Black scale on white background	
x.	Dimensions of Voltmeter	
xi.	Type & size of terminals	
xii.	Number of similar Voltmeter sold to date to the export market: Requirement; 500	
4.4.65	**Voltmeter - 66KV**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Voltmeter	
iii.	Complete order number for offered Voltmeter	
iv.	Years of Experience in the manufacture of Voltmeter	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
v.	Flush mounting	
vi.	Rated input in volts	
vii.	Rated output in Kilovolts (kV)	
viii.	FSD of instrument	
ix.	Black scale on white background	
x.	Dimensions of Voltmeter	
xi.	Type & size of terminals	
xii.	Number of similar Voltmeter sold to date to the export market: Requirement; 500	
4.4.66	**Voltmeter – 33 KV**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Voltmeter	
iii.	Complete order number for offered Voltmeter	
iv.	Years of Experience in the manufacture of Voltmeter	
v.	Flush mounting	
vi.	Rated input in volts	
vii.	Rated output in Kilovolts (kV)	
viii.	FSD of instrument	
ix.	Black scale on white background	
x.	Dimensions of Voltmeter	
xi.	Type & size of terminals	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
xii.	Number of similar Voltmeter sold to date to the export market: Requirement; 500	
4.4.67	**Voltmeter – 11 KV**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Voltmeter	
iii.	Complete order number for offered Voltmeter	
iv.	Years of Experience in the manufacture of Voltmeter	
v.	Flush mounting	
vi.	Rated input in volts	
vii.	Rated output in Kilovolts (kV)	
viii.	FSD of instrument	
ix.	Black scale on white background	
x.	Dimensions of Voltmeter	
xi.	Type & size of terminals	
xii.	Number of similar Voltmeter sold to date to the export market: Requirement; 1000	
4.4.68	**Voltmeter Selector Switch**	
i.	Manufacturer's Name	
ii.	Type or Designation name of Voltmeter Selector Switch	
iii.	Complete order number for offered Voltmeter Selector Switch	
iv.	Years of Experience in the Manufacture of Voltmeter Selector Switch	
v.	Flush mounting	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
vi.	Independent measurement of all phase – earth and phase – phase voltages when used with one Voltmeter	
vii.	Contact Rating in Amps	
viii.	Type & size of Terminals	
4.4.69	**Check Synchronising Relays**	
ix.	Manufacturer's Name	
x.	Type or Designation name of check synchronising relays	
xi.	Complete order number for offered check synchronising relays	
xii.	Years of Experience in the manufacture of check synchronising relays	
xiii.	Flush mounting	
xiv.	Application on synchro-check functions and voltage-check functions.	
xv.	Conditions for closing the circuit breaker	
xvi.	Indications status/parameters to be displayed	
xvii.	Self -Supervision facility of the synchro check relay	
xviii.	Terminals type and size of the relay	
xix.	Communication protocol	
xx.	Connection to the lap top	
4.4.70.	**Voltage and Frequency Protection Relay**	
i.	Manufacturer's Name	
ii.	Type or Designation name of voltage and frequency protection relay	

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
iii.	Complete order number for offered Voltage and Frequency Protection Relay	
iv.	Number of similar voltage and frequency protection relay sold to date to the export market: Requirement; 2000	
v.	Manufacturer's Experience in manufacture of voltage and frequency protection relay	
vi.	Relay design	
vii.	Flush Mounting	
viii.	Stages of voltage protection and time settings	
ix.	Stages of frequency protection and time settings	
x.	Rate of change of frequency for the relay and time settings	
xi.	Type and size of relay terminals for cable termination	
xii.	Self -supervision and time stamping	
xiii.	No of outputs and indications	
xiv.	Type and size of terminals	
xv.	Communication protocol	
xvi.	Connection to the laptop	
5.0	Laptop specification	
	State detailed specifications of the laptop offered	
A		
A.1	Responsibility of carrying out tests	
A.2	Copies of Type Test Reports submitted with tender	
A.3	Acceptance tests to be witnessed by KPLC at factory before shipment	
A.4	Inspection at the stores and replacement of rejected items	
B		
C		

CLAUSE	KPLC REQUIREMENTS	MANUFACTURER/ SUPPLIERS OFFER
C.1	Quality Assurance Plan	
C.2	Copy of ISO 9001:2008 Certificate	
C.3	Manufacturer's experience	
	Manufacturing Capacity (units per month)	
	List of previous customers	
	Customer reference letters	
D		
D.1	Documents submitted with tender	
D.2	Documents to be submitted by supplier to KPLC for approval before manufacture	
E.	**Technical Manuals**	
E1& E2	No of copies of technical manuals to be provided.	
F& G	Factory Acceptance Tests, Inspection and Training	
FI-G5	Factory Testing and training to be conducted as per specification	
I	**Software**	
	Specify software and means to use to deliver and Test the software.	
K	Packaging	
	Specify mode of packaging and markings to be used	
	Delivery and Inspection at KPLC stores	
	Specify sealing methods and acceptance of the products	
	Replacement of any noncompliance unit(s) without extra charge to KPLC	
	Statement of compliance to specification	

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

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Manufacturer's Name, Signature, Stamp and Date