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Kenya Power

200 MVA 220/132/11 kV POWER TRANSFORMER - SPECIFICATION

A Document of the Kenya Power & Lighting Co. Plc

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0.1 CIRCULATION LIST

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

REVISION OF KPLC STANDARDS

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

0.2 AMENDMENT RECORD

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 1 Rev 0	2026-01-28	New Issue	Eng. Julius Ndirangu	Eng. Faith Gicugu

FOREWORD

This Specification has been prepared by the Standards Department in collaboration with Electrical Plant Department, all of The Kenya Power and Lighting Company Plc (Kenya Power) and it lays down requirements for a 200 MVA, 220/132/11 kV Power Transformer. It is intended for use in purchasing the equipment.

The specification stipulates the minimum requirements for the 200 MVA, 220/132/11 kV Power Transformer acceptable for installation in the Kenya Power grid. It shall be the responsibility of the supplier and manufacturer to ensure adequacy of the design, good workmanship, good engineering practice and adherence to standards, specifications and applicable regulations, and that the offered design is of the highest quality and guarantees excellent service to Kenya Power.
The specifications in this series are as follows:
1: TSP/10/003-1: Specification for 90MVA 220/132/11 KV Power Transformer
2. TSP/10/003-2: Specification for 75MVA 220/132/12.3 KV Power Transformer

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

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1.0. SCOPE

1.0. This specification covers design, engineering, manufacture and assembly of 3 phase, 200MVA, 220/132/11kV, 50Hz, ONAN/ONAF Power/auto Transformer complete with all fittings and accessories required for efficient and trouble free operations of transformer.

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

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

2.0. REFERENCES

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

ISO 1461:	Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods.
IEC 60076:	Power transformers (all parts).
IEC 61869:	Instrument transformers.
IEC 60296:	Specification for unused mineral insulating oil for transformers and switchgear.
IEC 60076-7:	Loading guide for oil-immersed power transformers
IEC 60214:	Tap-changers - Part 1: Performance requirements and test methods, Part 2: Application guide.
IEC 60512:	Connectors for electronic equipment
BS 381C:	Specification for colours for identification coding and special purposes

3.0. TERMS AND DEFINITIONS

3.1. For the purpose of this specification, the terms and definitions given in the reference standards shall apply.

3.2. The term similar rating where used in this specification shall be for transformer ratings within the range 90MVA – 200MVA and primary voltage rating of 132kV – 400kV, secondary voltage of 132kV – 220kV, Tertiary 11kV-33kV 50Hz with vector group YNad11, YNyn0d11, Dyn1 or Dyn11.

4.0. REQUIREMENTS

4.1. Service Conditions

4.1.1. Operating conditions

4.1.1.1. The transformer shall be suitable for continuous operation outdoors in tropical areas with the following conditions.

(a) Altitude: Up to 2200 meters above sea level.

(b) Temperature: Average of +30°C with a minimum of -1°C and max +40 °C

(c) Humidity: Up to 95%,

(d) Pollution: Design pollution level to be taken as "Very Heavy" (Pollution level IV) according to IEC 60815

(e) Isokeraunic level: Up to 180 thunderstorm days per year

4.1.2. System characteristics

4.1.2.1.1. The primary system is 220,000 volts, 3-phase, 3-wire, 50Hz. The system is mostly overhead and exposed with continuous overhead earth wire.

4.1.2.1.2. The secondary system is 132,000 volts, 3-phase, 3-wire, 50Hz. The system is mostly overhead and exposed with continuous overhead earth wire.

4.1.2.1.3. The tertiary system is 11,000 volts, 3-phase, 3-wire, 50Hz.

4.1.2.1.4. The Transformer shall be operated at a high loading factor.

4.2. General Requirements

4.2.1. The transformer shall be three winding, auto configuration with a loaded tertiary, outdoor, oil-immersed, of ONAN/ONAF cooling classification and core type (lamination stackings).

4.2.2. The transformer shall be a three-phase integral unit.

4.2.3. The transformer shall be of the free breathing type. A dehydrating cobalt free breather of approved design shall be provided.

4.2.4. The transformer and accessories shall be designed to facilitate operation, inspection, maintenance and repairs. All apparatus shall be designed to ensure satisfactory operation under sudden variations of load and voltage as may be met with under working conditions on the system, including those due to short circuits.

4.2.5. The design shall incorporate every reasonable precaution and provision for safety during operation and maintenance in compliance with Kenyan regulatory requirements.

4.2.6. All materials used shall be new and of the highest quality and class to withstand and operate satisfactorily under the conditions specified in clause 4.1. They shall withstand the variations of temperatures and atmospheric conditions arising under working conditions without undue distortion or deterioration or the setting up of undue stresses in any part, and without affecting the strength and suitability of the various parts for the functions, they have to perform.

4.2.7. Corresponding parts liable to be replaced shall be interchangeable.

4.2.8. All outdoor apparatus, including bushings insulators with their mountings, shall be designed to avoid pockets in which water can collect.

4.2.9. All connections and contacts shall be of ample section and surface for carrying continuously the specified currents without undue heating and fixed connections shall be secured by bolts or set screws of ample size, adequately locked. Lock nuts shall be used on stud connections carrying current.

4.2.10. All leads from the winding to the terminals and bushings shall be adequately supported to maintain enough clearance to the tank surface and prevent injury from vibration including a systematical pull under short circuit conditions.

4.2.11. All apparatus shall be designed to minimize the risk or accidental short-circuit caused by animals, birds or vermin.

4.2.12. In tank, on-load-tap changers shall be located such that the space above the diverter switch chamber will be free of inter-connecting pipes etc. for lifting the diverter switch unit for inspection, maintenance and repair purposes. The diverter switch shall be three phase unit.

4.2.13. Galvanizing shall be applied by the hot-dipped process to ISO 1461 and for all parts other than steel wires shall consist of a thickness of zinc coating equivalent to not less than 610g of zinc per square meter of surface. The zinc coating shall be smooth, clean and of uniform thickness and free from defects. The preparation of galvanizing and the galvanizing itself shall not adversely affect the mechanical properties of the coated material. The quality will be established by tests as per ISO 1461.

4.2.14. All bolts, nuts, and washers exposed to atmosphere and in contact with non-ferrous parts, which carry current, shall be of phosphor bronze.

4.2.15. If bolts and nuts are placed so that they are inaccessible by means of ordinary spanners, suitable special spanners shall be provided by the supplier.

4.2.16. Except for protective hardware, which may have to be removed at site, all external surfaces shall receive at least four coats of paint. The total dry film thickness shall be at least 100 microns.

4.2.17. Descriptive labels for mounting indoors or inside cubicles and kiosks shall be of material that will ensure permanence of the lettering. A matt or satin finish shall be provided to avoid dazzle from reflected light. Labels mounted on dark surface shall have white lettering on a black background. Danger notices shall have red lettering on a white background.

4.2.18. All interior surfaces of chambers or kiosks that are in contact with air shall receive at least three coats of paint, of which the topcoat shall be of a light shade.

4.2.19. The design and all materials and processes used in the manufacture of the transformer, shall be such as to reduce to a minimum the risk of the development of acidity in the oil.

4.2.20. Every care shall be taken to ensure that the design and manufacture of the transformers and auxiliary plant shall have minimum noise and vibration levels following good modern manufacturing practices. The maximum noise levels shall be stated in the bid.

4.3. Ratings

4.3.1. The transformer shall be capable of operating under natural cooled condition up to 70% of the specified full load. The forced cooling equipment shall come in to operation by pre-set contacts of the winding temperature indicator and the transformer shall operate as a forced cooling unit up to full rating of 200MVA.Tertiary winding to have a power rating of 15MVA.

4.3.2. Cooling shall be so designed that during total failure of power supply to cooling fans, the transformer shall be able to operate at full load for at least 10 minutes without the calculated winding hot spot temperature exceeding 140°C. Supporting calculations for this to be submitted with the bid.

4.3.3. The windings of the transformer shall be rated at 200MVA **(ONAF).** These ratings shall be for the operating conditions stated in clause 4.1.

The rating specified in this clause shall be the continuous rating at the maximum ambient temperature and altitude given in clause 4.1.

4.3.4. The transformer shall be capable of carrying its full normal rating continuously at any tap under the conditions stated in clause 4.3.1 without undue stress, overheating, or the temperature rise in the hottest region exceeding 55°C and 60°C in oil and windings respectively and with voltage variation of ±10% corresponding to the voltage of that tap.

4.3.5. The transformer shall be capable of being over loaded in accordance with IEC 60076-7.There shall be no limitations imposed by bushings, tap changers or any other associated equipment.

The loading capabilities shall be demonstrated by a temperature – rise test. This test shall be done in the presence of KPLC Representatives during factory visit (altitude correction shall be as per clause 4.3.1 of IEC 60076-2).

4.3.6. The transformer shall be capable of withstanding the maximum fault level at its rated voltage and impedance for 2 seconds. The design should cater for the expected lifetime of the transformer.

4.3.7. The thermal ability of the offered transformer design to withstand short circuit shall be demonstrated by calculation carried out in accordance with the requirements of clause 4.1.1 to 4.1.5 of IEC 60076-5.

The calculation showing details and compliance with the requirements of clause 4.1.1 to 4.1.5 of IEC 60076-5 shall be submitted with tender. The duration of the current to be used for the calculation of the thermal ability to withstand short circuit shall be 2 seconds as per IEC 60076-5.

4.3.8. The ability of the transformer to withstand the dynamic effects of short circuit shall be demonstrated by tests and complete test reports (including oscillograms and records of the condition of the transformer before and after the short-circuit test) which shall be submitted for tender evaluation. The bidder should have successfully carried out dynamic short circuit test on offered transformer or similar transformer as defined in IEC 60076-5.This shall be applicable for 220kV class auto transformers of MVA rating similar or higher than the tendered transformer.
The offered transformer should comply with the requirements of similarity clause specified in IEC 60076-5 with respect to short circuit tested transformer and bidder shall enclose a compliance sheet to establish the same. The transformer accessories bushings, built in CTs shall be designed to withstand without damage, the thermal and mechanical effects of any external short circuit to earth and of short circuits at the terminals of winding for a period of 2 seconds.

4.3.7 Short circuit level of the HV, LV and Tertiary system to which the transformer will be Connected is as follows:
220kV system-40kA 3 seconds.
132kV system-31.5kA, 3 seconds.
11kV system-25kA, 3 seconds.

4.4. Winding and Connections

4.4.1 The Vector Group shall be stated on the schedule of requirements in the tender and shall be YNad11, YNyn0d11, Dyn1 or Dyn11.

4.4.2 The transformer shall be capable of operation without danger on any particular tapping at the rated MVA when the voltage may vary by ± 10% of the voltage corresponding to the tapping.

4.4.3 The windings and connections as well as the insulating material shall not soften, ooze, shrink or collapse during service. The materials shall be non-catalytic and chemically inactive in transformer oil during service.

4.4.4 The windings and connections shall be properly braced to withstand shocks during transportation or due to short circuit and other transient conditions during service.

4.4.5 Adequate pre-shrinkage of the coil assembly using pre-compressed press board material having low moisture content for the radial spacer blocks shall be ensured by the manufacturer so that there is no displacement of the radial spacer blocks due to frequent short circuits on the transformers.

4.4.6 All windings after being wound and all fibrous hygroscopic materials used in the construction of the transformer shall be dried under vacuum and impregnated with hot oil.

4.4.7 The coil clamping rings wherever used shall preferably be of flat insulated steel laminations.

4.4.8 The radial spacer blocks must be made of pre-compressed pressboard material, which will not soften while in contact with oil or fray out into fibers or edges. The slots should be so dimensioned that the blocks will not come out of the slots.

4.4.9 All joints shall be brazed/crimped considering the vibrations due to short circuits and load fluctuations.

4.4.10 KPLC will inspect built-up winding for its quality, weight of copper, insulation and overall weight of coil assembly. The size of conductor used for different windings shall also be checked during stage inspection to check the current density.

4.4.11 The transformer shall be designed with particular attention to the suppression of harmonic voltage, especially the third and fifth, so as to eliminate wave-form distortion and from any possibility of high frequency disturbances, inductive effects or of circulating currents between the neutral points at different transforming stations reaching such a magnitude as to cause interference with communication circuits.

4.4.12 The windings shall be designed to reduce to a minimum the out-of-balance forces in the transformer at all voltage ratios.

4.5. Tapping

4.5.1. Tapping Range

The transformer shall be provided with tapping on the 220kV winding for a variation of no load primary voltage for parallel operation, with Tap No. 1 having the highest voltage assignment, as follows:

220,000 volts	+ 8 × 1.67%
	- 8 × 1.67%

4.5.2. Tapping Method

Tapping shall be carried out by means of an on-load tap changer as described in clause 4.12 below.

4.6. Core and Flux Density

4.6.1. Core

4.6.1.1. The core shall be constructed from the laminations of high-grade cold rolled non-aging, grain oriented silicon steel of maximum 0.27mm lamination thickness. The grade of CRGO shall be stated in the bid.

4.6.1.2. The design of the magnetic circuit shall be such as to avoid static discharges, development of short-circuit paths within itself or to the earthed or to the clamping structure and the production of flux components at right angles to the plane of the laminations which may cause local heating.

4.6.1.3. Every care shall be exercised in the selection, treatment and handling of core steel to ensure that as far is practicable, the laminations are flat and the finally assembled core is free from distortion.

4.6.1.4. Adequate oil ducts shall be provided in the core for cooling. Tinned copper strip bridging pieces shall be used for maintaining electrical continuity wherever the magnetic circuit is provided into pockets by such ducts or insulating material thicker than 0.25mm.

4.6.1.5. There shall be no movement of the core assembly relative to the tank during transport, installation as well as in service due to sudden jerks caused by short circuits and fluctuating loads.

4.6.1.6. All steel sections used for supporting the core shall be thoroughly sand blasted or shot blasted after cutting, drilling and welding. Any non-magnetic or high resistance alloy shall be of established quality.

4.6.1.7. Adequate lifting lugs shall be provided to enable core and winding to be lifted.

4.6.1.8. The supporting framework of the Cores shall be so designed as to avoid the presence of pockets, which would prevent complete emptying of the tank through the drain valve, or cause trapping of air during filling.

4.6.1.9. The insulation structure for the core to bolts and core to clamp plate shall be such as to withstand a voltage of at least 2kV AC for one minute.

4.6.2. Flux Density

4.6.2.1. The primary voltage variation, which may affect the flux density at every tap, shall be kept in view while designing the transformer.

4.6.2.2. The transformer shall be so designed that the working flux density shall not exceed 1.6 Tesla at normal voltage, frequency & ratio.

4.6.2.3. Tenderers shall indicate the continuous allowable maximum flux for one minute and five seconds.

4.6.2.4. The limit of flux density at which core material used saturates shall also be stated in the tender. The name and grade of core material shall be stated in the tender.

4.6.2.5. The successful tenderer shall be required to furnish magnetization curve of the core material, design calculations and such other data/documents deemed fit by the purchaser for being satisfied that flux density is as desired.

4.6.2.6. The flux density/design shall meet the over fluxing of the core due to temporary over voltage of the orders of 25% for one minute and 40% for five seconds that may appear in abnormal conditions such as the one obtained following sudden loss of large loads.

4.7. Losses, Regulation and Impendence

4.7.1. Losses of the transformer shall be stated and shall be regarded as the maximum allowed not subject to plus tolerances (due to capitalization). The fixed losses shall be as low as is consistent with good design, reliability and economical use of materials.

4.7.2 Voltage regulation from no-load to continuous rated output at unity power factor, at 0.8 lagging and 0.8 leading power factor with constant voltage across the higher voltage windings shall be stated in the bid.

4.7.3 The impedance voltage at extreme tapings, Minimal tapping and at principal tapping shall be stated and shall be subject to tolerances in accordance with IEC 60076.

4.7.4 As per IEC 60076-5, the short-circuit apparent power of 220kV, 132kV & 11kV systems shall be taken as 20,000MVA, 10,000MVA & 500MVA respectively in order to obtain the value of the symmetrical short circuit current to be used for the design and tests.

4.8. Terminals: Arrangement & Bushings

4.8.1. The 220kV, 132kV and 11kV windings shall be brought out separately through open bushings of outdoor, weatherproof design and to IEC 60137.

4.8.2. 220kV and 132kV bushings shall be of oil-filled condenser type construction, draw-out type and shall each have a capacitance test point.

4.8.3. Bushings for 11kV terminals shall be of the solid porcelain type.

4.8.4. The neutral bushing of the transformer shall be identical to the corresponding phase terminal bushings (132kV Bushing).

4.8.5. Spacing and air clearances shall be so coordinated as to render the probability of a flashover from the terminal of one winding to the terminal of another winding negligible.

4.8.6 Creepage distance of bushings shall not be less than 31mm/kV, based on operating phase-to-phase voltage.

4.8.7 Bushing terminals shall be clamp type suitable for both copper and aluminum bus bars of sizes up to 76mm diameter.

4.8.8 Each bushing of the 220kV and 132kV windings shall be mounted on a turret. Each turret shall be suitable for accommodating at least three sets of current transformers.

4.8.9 Each bushing of the 11kV windings shall be mounted on a turret. Each turret shall be suitable for accommodating at least three sets of current transformers.

4.8.10 Terminal arrangement on the HV (220kV), LV (132kV and Tertiary (11kV) sides shall be, **A, B, C, n, a1, b1, c1** and a2, b2, c2 respectively. The phase markings shall be visible from ground level.

4.9. Current transformers to be fitted by the Manufacturer

4.9.1. Current transformers shall be installed in the bushing turrets and shall be of the following quantities, ratios, ratings and class:

PHASE	CORE	BURDEN	RATIO	CLASS
HV-side (220kV)				
A	1	20VA	600/1A	cl. 5P20

PHASE	CORE	BURDEN	RATIO	CLASS
	2	Vk min 450V,Iex max 150mA	600/1A	cl. PX
	3	20VA	600/1A	Cl 0.5
	4	20VA	600/1A	Cl PX
B	1	20VA	600/1A	cl. 5P20
	2	20VA	600/1A	cl. PX
	3	10VA	600/?	cl. 1
	4	Vk min 450V,Iex max 150mA	600/1A	Cl PX
	5	20VA	600/1A	Cl 0.5
C	1	20VA	600/1A	cl. 5P20
	2	Vk min 450V,Iex max 150mA	600/1A	cl. PX
	3	20VA	600/1A	Cl 0.5
	4	20VA	600/1A	Cl PX
LV-side (132kV)				
a	1	20VA	900/1A	cl. 0.5
	2	20VA	900/1A	cl. 5P20
	3	Vk min 450V,Iex max 100mA	900/1A	cl. PX
	4	Vk min 450V,Iex max 100mA	900/1A	cl. PX
b	1	20VA	900/1A	cl. 0.5
	2	20VA	900/1A	cl. 5P20
	3	20VA	900/1A	cl. 1
	4	Vk min 450V,Iex max 100mA	900/1A	cl PX
	5	Vk min 450V,Iex max 100mA	900/1A	Cl PX
c	1	20VA	900/1A	cl. 0.5
	2	20VA	900/1A	cl. 5P20
	3	Vk min 450V,Iex max 100mA	900/1A	cl. PX
	4	Vk min 450V,Iex max 100mA	900/?	cl PX
n	1	Vk min 450V,Iex max 100mA	900/1A	cl. PX
	2	Vk min 450V,Iex max 100mA	900/1A	Cl PX
	3	20VA	900/1A	cl. 5P20
Tertiary side 11kV Side	Core	VA	Ratio	Class
a	1	20VA	800/1	Cl 5P20
	2	Vk min 450V,Iex max 50mA	800/1	Cl PX
b	1	20VA	800/1	Cl 5P20
	2	Vk min 450V,Iex max 50mA	800/1	Cl PX
c	1	20VA	800/1	Cl 5P20
	2	Vk min 450V,Iex max 50mA	800/1	Cl PX

Nominal system voltage (kV, rms)	Highest system voltage (kV, rms)	Lightning Impulse withstand voltage, 1.2/50µs, dry, +ve (kV, peak)	Power frequency withstand voltage, 50Hz, 60s, wet, (kV, rms)
132	145	750	325
220	245	1050	460
11	12	95	38

4.12. On Load Tap Changer and Mechanism Box

4.12.1. The transformer shall be complete with vacuum type on-load, electrically driven tap changing mechanism of the high-speed resistor transition type, and shall comply with the requirements of IEC 60214, 60512 and this specification. The equipment shall be suitable for remote operation from a remote control panel supplied with the transformer as well as for local operation from the Motor Drive Unit (MDU) mounted on the transformer body.

4.12.2. The mechanism shall be so designed as to ensure that when a tap change operation is in progress, it shall be able to complete the task independently irrespective of operation of any relays or switches.

4.12.3. Adequate means shall be provided to safeguard the transformer and its auxiliary circuits from damage should a failure of the auxiliary supply or any other mal-operation occur during the progress of tap changing that may prevent it from completing its task.

4.12.4. Means shall be provided in the marshalling kiosk for mechanical isolation of the supply to the Motor Drive Unit, and a suitable thermal overload device (details to be submitted with tender) shall be provided in the MDU for the protection of the motor. The possibility of over-running the mechanism at each end of the voltage range shall be prevented by means of limit switches and mechanical stops. Other techniques used to prevent tap changer runaway shall be indicated.

4.12.5. A mechanically operated device shall be provided to indicate the tap position locally, and a suitable tap position transmitter shall be provided for the remote tap position indication.

4.12.6. A counter shall be provided on the tap changing mechanism box to indicate the total number of operations completed by the equipment.

4.12.7. Contactors and associated equipment for the control circuit for local/remote and manual operations of the tap changer mechanism shall be housed in the mechanism box.

4.12.8. The tap changer shall be In Tank housed in a separate compartment and shall be Vacuum Type switching Oil insulated. Sufficient documentation for the vacuum switch in form of manuals,

instructions, drawings, technical characteristics, copies of type test certificates and type test reports, manufacturing and export experience of the supplier shall be submitted with the tender for technical evaluation. The tap changer shall be of a design & make approved by KPLC.(preferably MR Germany).

4.12.9. The Motor Drive Unit shall have the following in addition to what has been stated above:

4.12.9.1. Isolating switch in the transformer marshalling box for the supply to the tap changer Motor Drive Unit,

4.12.9.2. Raise/lower contactors for tap changer motor operation, and associated single-phase protection/overload relay,

4.12.9.3. Switch for selection of local/remote tap changer control,

4.12.9.4. Switch or switches for local tap changer operation,

4.12.9.5. Provisions shall be made available for hand operation in the mechanism box,

4.12.9.6. Provide glanding plate.

4.12.8 The tap changer shall be complete with remote tap changer control panel, automatic voltage regulating relay and parallel operation scheme detailed in clauses 4.12.11, 4.12.12 and 4.12.13 and shall be of design and type approved by KPLC.

4.13. Remote Tap Changer Control Panel

4.13.1. The remote tap changer control panel shall as a minimum, contain the following devices:

4.13.1.1. Automatic Voltage Regulating Relay.
4.13.1.2. Off/Manual/Automatic switch for the Relay.
4.13.1.3. Raise /Lower control switch.
4.13.1.4. Raise , Lower, 'out of step' and tap change in progress indication lamps
4.13.1.5. Dial type Tap position indicator (technical details to be submitted with the tender).
4.13.1.6. Master/Follower/Independent Scheme and selector switch. The Tap Changer shall employ, negative reactance or circulating current principle scheme for parallel operation with other three similar transformers but of different rating.
4.13.1.7. Local /Remote switch
4.13.1.8. KV meter (technical details to be submitted with the tender)
4.13.1.9. Door operated lamp and anti-condensation heater.
4.13.1.10. Heater switch ON/OFF to control anti-condensation heater
4.13.1.11. Various control circuits controlled by Miniature Circuit Breakers

4.14. Automatic Voltage Regulating Relay

4.14.1. The automatic voltage regulating relay shall, as a minimum, incorporate the following features:

4.14.1.1. Rated voltage transformer input shall be 110V AC.
4.14.1.2. Rated Current 1 Amp.
4.14.1.3. Initial time delay range 5-100 seconds, and ability to select Integrated delay or Definite time delay.
4.14.1.4. Inter-tap delay 1-80 seconds
4.14.1.5. Relay voltage setting, adjustable in steps of 1V from 85 - 130V
4.14.1.6. Line drop compensation 0-20 V at rated current for both reactive and resistive setting
4.14.1.7. Under voltage inhibit range 70%-90% & over current inhibit range 150%-250%
4.14.1.8. Bandwidth range 0.5-5 % of voltage level
4.14.1.9. Over voltage inhibit
4.14.1.10. The AVR should have a selector switch with OFF/Manual/Auto
4.14.1.11. Should be of Numeric Design.
4.14.1.12. The Relay shall be designed to employ both Circulating Current Compensation and Negative (Reverse) Reactance compounding to minimize circulating current for Parallel Transformer Operation.
4.14.1.13. Tap changer Maintenance, by maintaining Tap Operation count.
4.14.1.14. Tap Changer Mechanism Failure.
4.14.1.15. The Voltage Regulating Relay shall be powered from universal 110V DC or 230V AC supply.

4.15. Parallel Operation

4.15.1. A scheme for operating this transformer in parallel with other similar units of different rating shall be provided and wired in the marshalling kiosk (box) by the manufacturer ready for inter-phasing.

4.15.2. The scheme shall maintain the transformers in stable parallel operation and limit circulating current to a minimum.

4.15.3. In the event of this transformer being disconnected from the system, its reconnection shall not result in its tap changer failing to operate automatically because of tapping discrepancy.

4.15.4. 4.13.4 Suitable selector switch shall be provided, so that any one transformer of the group can at a time be selected as “Master”, “Follower” or “Independent”.

4.15.5. Necessary interlock blocking independent control when the units are in parallel shall be provided.

4.15.6. The scheme shall be such that only one transformer of a group can be selected as "Master".

4.15.7. An out –of- step device shall be provided for each transformer which shall be arranged to prevent further tap-changing when transformers in a group operating in "Parallel control" are one tap out-of-step.

4.16. Marshalling Kiosk (Box)

4.16.1. The transformer shall be complete with a marshaling kiosk (box).

6.16.1.1. The marshalling kiosk shall be of outdoor, IP 55, weatherproof, vermin-proof type with a hinged, lockable door fitted with a glass panel to facilitate reading of oil and winding temperature gauges without opening the door.

6.16.1.2. The kiosk shall be mounted so that its window is approximately 1600mm above ground level; and shall accommodate at least the following items:-

a) Winding temperature indicators for both 220kV and 132kV with a maximum pointer drag hand type with a resetting knob and three separately adjustable mercury contacts for alarm, trip and operation of cooler control circuits as required.

b) Oil temperature indicator with a maximum pointer drag hand type with a resetting knob and two separately adjustable mercury contacts for alarm and trip.

c) Mechanical isolating switch for the incoming 3 phase, 4 wire, 400V±6% 50Hz supply to the marshalling kiosk. 400 volts and 230 volts socket outlets (British Standard design) shall also be provided in the kiosk.

d) A mechanical isolating switch for the outgoing 3-phase 4-wire 400V±6% 50Hz supply to the OLTC Motor drive unit.

e) An internal standard screw type illumination lamp and heater for the kiosk with respective switches. The lamp shall be door-switch operated.

f) Wiring, fuses, links, terminal boards and cable glands for bottom entry of multicore cables.

g) Anti-condensation heater with a switch.

h) Thermostat for anti-condensation heater control.

i) Hygrostat for anti-condensation heater control.

k) Phase sequence relay for detection of wrong phase rotation for the supply to the fans and the OLTC Motor Drive Unit.

4.16.2. Detailed technical details, drawings, and schematics shall be submitted with the tender documents for evaluation.

4.17. Auxiliary Supplies, Alarms & Indications

4.17.1. Equipment shall be rated for the following auxiliary power supplies:

(a) Cooler control circuits: 230V±6%, single phase, 50Hz
(b) Tap changer control: 230V±6%, single phase, 50Hz
(c) Cooling fan motors: 400V±6%, three phase, 50Hz
(d) Tap changer motor: 400V±6%, three phase, 50Hz

4.17.2. Alarms and Indications

4.17.2.1. The transformer shall be complete with standard alarms, signals and indications. These will include the following and the detailed list shall be submitted to KPLC for approval before manufacture:

a) Tap changer not operating, alarm
b) Tap changers out of step, alarm
c) Voltage transformer failure
d) Fan failure, alarm
e) Oil/gas flow transformer, alarm
f) Oil/gas flow transformer, trip
g) On load tap changer protective relay operated, trip
h) Oil gauge low level, alarm
i) Oil gauge low level, trip
j) Tap changer oil gauge level low, alarm
k) Tap changer oil gauge level critical, trip
l) Top oil temperature high, alarm
m) Top oil temperature critical, trip
n) Winding temperature high, alarm
o) Winding temperature critical, trip
p) Cooling fans automatically operated from the winding temperature indicators

4.18. Transformer Tank and Tank Cover

4.18.1. The tank shall be of top cover design and shall be constructed of mild steel plates of sufficient thickness and strength and shall be complete with all required accessories. It shall be designed so as to allow the complete transformer when filled with oil to be lifted by crane or jacks, transported by road, rail or on water without overstraining any joints and without causing subsequent leakage of oil. The minimum thickness for sides, bottom and top cover shall be 8mm, 20mm and 20mm respectively.

4.18.2. The base of the tank shall be so designed that it shall be possible to move the complete transformer unit in any direction without injury when using rollers, and/or plates.

4.18.3. The tank and its accessories shall be so designed as to prevent collecting or trapping of gases. Where this cannot be avoided, pipes shall be provided to vent the gas into the main expansion pipe.

4.18.4. All joints, other than those that may have to be broken shall be welded. Caulking of unsatisfactorily welded joints is forbidden.

4.18.5. The main tank body shall be pressure tested and a certificate issued by the national standards and testing laboratory ascertaining the soundness of all welded joints. A certified copy of previous certificate shall be submitted with the tender for evaluation.

4.18.6. Tank shall be provided with lifting lugs suitable for lifting the complete transformer with oil. Furthermore, a minimum of four accessible jacking positions shall be provided to enable the complete transformer to be raised or lowered using jacks.

4.18.7. The transformer tank and all attachments normally under oil shall be capable of withstanding full vacuum. The oil conservator shall withstand at least 35% full Vacuum.

4.18.8. Tank cover shall be of such a design and construction as to prevent accumulation of water and shall be bolted to the flange on the tank top to form a weatherproof joint.

4.18.9. Inspection openings shall be provided to give easy access to bushings, tapping switch and for testing or general inspection.

4.18.10. Tank cover and inspection covers shall be provided with suitable lifting arrangements. Inspection covers shall not weigh more than 25 kg apiece.

4.18.11. The tank cover shall be fitted with isolated pockets for oil and winding temperature instrument bulbs. Protection shall be provided for each capillary tube. The pocket shall be

fitted with a captive screwed cap to prevent the ingress of water. Detailed drawings shall be provided.

4.18.12. The pocket shall be located in a position of maximum oil temperature at continuous maximum rating and it shall be possible to insert and remove the instrument bulbs without lowering the oil in the tank.

4.18.13. Gaskets for weather and oil-tight joint faces shall be of synthetic rubber-and-cork composition and shall have a minimum thickness of 5mm; except that where jointing faces are, precision-machined, thinner gaskets may be used.

4.18.14. A tinned copper jumper of at least 40mmx1.2mm in dimensions shall be fixed between tank and top cover using bolt, washers and nut all in stainless steel.

4.19. Paint Work

4.19.1. Cleaning and painting shall be in accordance with the following requirements. Any deviations in methodology shall be stated and may only be those that will produce demonstrably superior results.

4.19.2. Quality of paint shall be such that its colour does not fade during drying process and shall be able to withstand temperatures up to 120°C

4.19.3. A test report for the paintwork issued by the national standards and testing laboratory shall be produced at the time of acceptance testing of the transformer.

4.20. Tanks and Accessories

4.20.1. External and internal surfaces of all transformer tanks and chambers and other fabricated steel items shall be cleaned of scale, rust and surface dirt by blast cleaning or other suitable approved method. After cleaning, these surfaces should be immediately covered with paint.

4.20.2. The exterior shall be thoroughly cleaned by shot blasting or other approved method and given priming coat followed by two coats of contrasting colours of durable weather-resisting paint. The final coat shall be high gloss of shade No. 632 (Admiralty Grey) according to BS 381C. The total paint thickness shall not be less than 100µm at any point.

4.20.3. The interior of all transformer tanks and other oil-filled chambers shall be cleaned of all scale and rust by shot blasting or other approved method. Hot oil resistant varnish on white synthetic enamel paint is to be used for painting the inside of all oil-filled chambers, including transformer tanks and CT chambers & covers. The final coat shall be of a light-colored anti-condensation finish.

4.20.4. Cooling System

4.20.4.1. Radiators shall be thoroughly degreased and treated externally by phosphating and/or other rust-inhibiting process.

4.20.4.2. Radiators shall be flood-painted with a primer and two coats of durable weather and oil resisting paint. The final external coat shall be high gloss of shade No. 632 (Admiralty Grey) according to BS 381C. The total paint thickness shall not be less than 85µm at any point.

4.20.4.3. Radiators shall be supplied in banks as suitable. Each bank shall be fitted with gate valves with legible labelling for OPEN/CLOSED positions and used for full isolation from the main tank. Each radiator shall have a top and bottom isolating butterfly valve. The radiator design shall exclude accumulation of rainwater.

4.20.4.4. Radiator banks shall be mounted directly to the transformer main tank for best use of space. Adequate oil seals shall be provided for each radiator.

4.20.4.5. Each radiator shall have a bleeding facility (to allow escape of air) on top.

4.20.4.6. Separately mounted ac motor driven fans fitted with wire mesh guards shall be provided for the radiators. The fan motors shall be totally enclosed, weatherproof, outdoor type suitable for continuous operation and shall be fitted with terminal boxes and glands to accommodate multicore electric supply cables. Technical details of the fan motor shall be submitted with the tender.

4.20.4.7. Suitable starters, protection/warning devices, contactors and switches for the motors shall be provided as stipulated in clause 4.14 above.

4.20.4.8. Suitable lifting lugs shall be provided for removal and assembly of radiators.

4.20.4.9. The complete cooling system and the fittings shall be fully coordinated. Where necessary, the cooling fan motors and shall be fired in designed groups and in such sequence as to achieve the desired control at maximum efficiency safety.

4.21. Fittings And Accessories

All fittings & accessories including Gas & Oil Actuated Relays shall be of a design & make approved by KPLC

4.21.1. Conservator

4.21.1.1. The transformer shall be complete with a conservator having a filling orifice, an isolating valve, a drain valve and a cobalt free dehydrating breather (with oil seal) which shall be accessible from ground level. The drain pipe shall be located at the lowest point in the conservator in its final installed position and welded such that it can drain all the sludge in the conservator.

4.21.1.2. The conservator shall be partitioned proportionately to separate the main tank oil and the tap changer oil. Each compartment to be fitted with a breather and an oil level indicator with electrical contacts for alarms. The main tank conservator shall be fitted with air cell. The conservator complete with drain valve shall be in such a position as not to obstruct the electrical connections to the transformer. An oil gauge shall be provided at one end of the conservator marked with oil levels that can be read by a person standing on the ground. Expansion joints may be provided in the inlet and outlet pipes to the transformer as necessary.

4.21.1.3. The conservator of main tank shall have air cell type constant oil pressure system to prevent oxidation and contamination of oil due to contact with moisture .Conservator shall be fitted with magnetic oil level gauge with potential free high and low oil level alarm contacts and prismatic oil level gauge.

4.21.1.4. The conservator tank shall have adequate capacity with highest and lowest visible levels to meet the requirements of expansion of total cold oil volume in the transformer and cooling equipment from minimum ambient temperature to top oil temperature of 105 deg C. The capacity of the conservator shall be such that the transformer shall be able to carry the specified overload without overflowing of oil.

4.21.1.5. The conservator shall be fitted with lifting lugs in such a position so that it can be removed for cleaning purposes.

4.21.1.6. Conservator shall be positioned so as not to obstruct any electrical connection to transformer.

4.21.1.7. Contact of oil with atmosphere shall be prohibited by using a flexible air cell of nitrile rubber reinforced with suitable material. The temperature of oil in the conservator is likely to raise up to 105 deg C during operation .As such air cell used shall be suitable for operating continuously at this temperature.

4.21.1.8. The transformer manual shall give clear instructions on the operation, maintenance, testing and replacement of air cell. It shall also indicate shelf life, life expectancy in operation and recommended replacement intervals.

4.21.2. Gas and Oil Actuated Relay (Transformer main tank)

4.21.2.1. The transformer shall be complete with a gas and oil actuated relay (Buchholz relay) of double float type with tripping contacts to detect accumulation of gas and sudden changes of oil pressure. Shut off valves and flange couplings shall be provided to facilitate easy removal of the relay without lowering oil level in the main tank.

4.21.2.2. A bleed valve for gas venting, a test valve and a terminal box suitably wired to the marshalling kiosk shall also be provided. The gas-venting pipe shall be brought down to a height reachable from ground level and shall be fitted with a gas-sampling device at the end.

4.21.2.3. Provision should be made on the relay for simulation of gas and oil surge for testing purposes.

4.21.3. Gas and Oil Actuated Relay (Tap changer compartment)

4.21.3.1. Tap changer compartment shall be complete with an oil surge relay with tripping contacts to detect sudden changes of oil pressure.

4.21.3.2. Shut off valves and flange couplings shall be provided to facilitate easy removal of the relay without lowering oil level in the tap changer compartment.

4.21.3.3. A bleed valve for gas venting, a test valve and a terminal box suitably wired to the marshalling kiosk shall also be provided. The gas-venting pipe shall be brought down to a height reachable from ground level and shall be fitted with a oil-sampling device at the end.

4.21.3.4. Provision should be made on the relay for simulation of gas and oil surge for testing purposes.

4.21.4. Pressure Relief Device

4.21.4.1. A pressure relief device shall be provided for the main tank, complete with trip contacts suitably wired to the marshalling kiosk.

4.21.4.2. The device shall be resettable after an operation. Details of the device shall be submitted with the offer.

4.21.4.3. The PRD shall be provided with special shroud to direct the hot oil in case of fault condition. It shall be provided with outlet pipe which shall be taken right up to the soak pit of the transformer. The size of the shroud shall be such that it should not restrict rapid release of any pressure that may be generated in the tank, which may result in damage of equipment.

4.21.4.4. The device shall maintain its oil tightness under static pressure equal to static operating head of oil plus 20kpa.

4.21.4.5. It shall be capable of withstanding full internal vacuum at mean sea level. It shall be mounted directly on the tank. Suitable canopy shall be provided to prevent ingress of rain water.

4.21.5. Winding Temperature Indicator & Oil Temperature Indicator

4.21.5.1. The transformer shall be provided with winding temperature indicator and oil temperature indicator with maximum temperature needle and associated current transformers.

4.21.5.2. The temperature indicators shall have a scale ranging from 20°C to 150°C, preferably uniformly divided.

4.21.5.3. The instrument should be provided with maximum reading pointer and resetting device, switch testing knob and anti-vibration mounting grommets. The instrument shall meet IP55 degree of protection as per IEC 60529.

4.21.5.4. Temperature sensing bulbs located in thermometer pocket on tank cover shall be provided to sense top oil. This shall be connected to the winding temperature indicator instrument by means of flexible stainless steel armour to protect capillary tubing

4.21.5.5. The indicators shall have three sets of independently adjustable contacts as follows:

(i) **Alarm** Adjustable setting: 70°C to 150°C
Fixed differential: Not more than 10°C

(ii) **Trip** Adjustable setting: 70° to 150°C
Fixed differential: Not more than 10°C

(iii) **Cooling control** Adjustable setting: 70° to 150°C
Fixed differential: Not more than 10°C

4.21.5.6. All contacts shall be adjustable to a scale and shall be accessible on removal of the cover for dial type devices. For purposes of (i), ii and (iii) above, the contacts shall be suitable for making or breaking 150VA between the limits of 30 and 250 V a.c. or d.c., and making 500 VA between the limits of the 110 and 250 V d.c.

4.21.5.7. Isolating and test links shall be provided in a control cubicle to allow for measuring the oil temperature and testing the heater coil.

4.21.5.8. The current transformer providing HV and LV winding temperature indication shall be located at the discretion of the manufacturer, in the best position for the duty.

4.21.5.9. Calibration of indicator shall be related to the winding having the maximum temperature rise.

4.21.5.10. If the value on the winding temperature indicator varies by more than 3°C from the values derived from the tests specified in clause 5, then adjustments shall be made to the equipment to achieve these limits.

4.21.6. Accessories

The following accessories shall be provided:

4.21.6.1. Valves with blank flanges fitted at the top and bottom for oil filtration purposes, having the following features:

(a) The valve located at the bottom of the tank shall also be suitable for draining oil from the transformer tank.

(b) All valves shall close with a clockwise rotation. The main inlet and outlet valves shall be provided with "open" and "closed" position indicators, visible from ground level.

(c) All valves shall have provision for padlocking in the open and closed position for operation purposes. The hole for the padlock shall have a clearance of not less than 8mm and not more than 10mm. Locking pin shall be of anti-rattle design to limit noise emissions. The locking padlocks shall be provided.

(d) Closed/Open positions of all valves must be clearly marked.

4.21.6.2. Oil sampling device appropriately located to obtain samples of transformer oil from the top and bottom of the tank.

4.21.6.3. Two earthing terminals located at diagonally opposite corners of the tank.

4.21.6.4. Air release valves or plugs for the main tank, suitably located.

4.21.6.5. Non-deteriorating detailed diagram and rating plates.

4.21.6.6. Other Fittings/accessories

a) Diagram plate
b) Plate of valves and oil piping.
c) Motor drive electrical and protection diagram.
d) Cooling control electrical and protection diagram.
e) Electrical scheme for operating this transformer in parallel with other similar units.
f) Detailed list of the transformer equipment & fittings including their drawings, brochures & instruction manuals.
g) Shipping data
h) Detailed erection, installation, operation and maintenance manuals in English language.
i) Testing Plan.
j) Impact recorder for the whole duration of transit and a report provided afterwards.

k) 2 Sets of keys for padlocking devices (all control boxes as well as valves to be padlocked).

4.22. Transformer Oil

4.22.1. The transformer and all associated oil immersed equipment shall be supplied oil filled. The oil shall be new, unused and shall comply with all the requirements of IEC 60296 (class 1: un-inhibited oil) and as per KPLC specification KP1/3CB/TSP/08/001(shall be attached during tender.

4.22.2. The Tenderer shall provide the chemical composition and properties of the oil and the replacement cycle over the expected life of the transformer.

4.22.3. Cooling of the transformer shall be by natural circulation of oil ONAN and forced circulation of air (ONAF).

4.22.4. Transformer oil used for first filling, testing and impregnation of active parts at the manufacturers works shall be the same type of oil which shall be supplied at site and shall meet parameters as per specification.

4.23. Capitalization

4.23.1. Transformer losses shall be capitalized at the following rates to facilitate evaluation and comparison of tenders.

Total load losses, ONAF rating (copper loss + stray loss) at rated current at 75^0 C in kW, including auxiliary losses	US$ 2577 per kW for 35 years
Total no load losses in kW (core loss + dielectric loss)	US$ 4339 per kW for 35 years

Losses will be capitalized at the above rates and added to the bid price according to the formula below:

Gep = Gbp + G($), where Gep = Bid evaluation price, Gbp = Bid price and

G($) = Adjustment for the cost of the operation and maintenance for 35 years (all in US Dollars)

G($) is obtained by using the following formula:

G($) = US$ 2577 X {Total load losses, ONAF rating (copper loss + stray loss) at rated current at 75^0 C in KW, including auxiliary losses} + US$ 4339 X {Total no load losses in KW (core loss + dielectric loss)}.

4.23.2. The guaranteed transformer losses used in the above capitalization formula shall be the maximum allowed and no plus tolerance shall be allowed during acceptance testing.

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APPENDICES

A. QUALITY MANAGEMENT SYSTEM (Normative)

A.1. The bidder shall submit a quality assurance plan (QAP) that will be used to ensure that the transformer design, material, workmanship, tests, service capability, maintenance and documentation, will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2015.

A.2. The Manufacturer's Declaration of Conformity to reference standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2015 certificate shall be submitted with the tender for evaluation.

A.3. The bidder shall indicate the delivery time of each type of transformer, manufacturer's monthly & annual production capacity and experience in the production of the type and size of transformer being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers outside the country of manufacture for exact or similar rating of transformers sold in the last five years shall be submitted with the tender for evaluation.

B. TESTS AND INSPECTION (Normative)

B.1. The transformer shall be inspected and tested in accordance with the requirements of IEC 60076 and this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified. Tenderers shall confirm the manufacturer's capabilities in this regard when submitting tenders. Any limitations shall be clearly specified.

B.2. Copies of Type Test Certificates & Type Test Reports issued by a third party testing laboratory that is accredited to ISO/IEC 17025 shall be submitted with the tender for the purpose of technical evaluation. A copy of the accreditation certificate to ISO/IEC 17025 for the testing laboratory shall also be submitted. Any translations of certificates and test reports into English language shall be signed and stamped by the Testing Laboratory that carried out the tests.

B.2.1. Type test conducted for the transformer shall include the following tests:

a) Dielectric tests to IEC 60076
b) Short circuit withstand test to IEC 60076.
   - thermal ability of the transformer to withstand short circuit,
   - ability of the transformer to withstand the dynamic effects of short circuit
c) Temperature rise test to IEC 60076.

Note:
Temperature rise test to IEC 60076 if conducted at the manufacturer's premises (factory) shall be in the presence of representatives of a third party testing laboratory accredited to ISO/IEC 17025; who shall sign the certificates and test reports.

B.2.2. Type tests conducted for the on load tap changer to be submitted for tender evaluation shall include:

a) Dielectric tests (Lightning Impulse and Power Frequency Withstand Tests).
b) Short circuit withstand test.
c) Temperature rise test.
d) Switching tests.
e) Transition impedance test.
f) Mechanical tests.

B.3. The transformer shall be subject to acceptance tests at the manufactures' works before dispatch. Acceptance tests shall be witnessed by Engineers appointed by The Kenya Power and Lighting Company Limited and shall include the following:

B.3.1. **Routine tests to IEC 60076 (to be done during acceptance testing at factory)**

- Measurement of winding resistance,
- Ratio test,
- Vector group,
- Separate source voltage withstand test,
- Induced over-voltage,
- Insulation resistance,
- Oil leakage test on fully assembled transformer for 12 hours,
- Measurement of impedance voltage,
- Magnetic balance,
- Measurement of no-load loss and current,
- Measurement of load loss (at normal & extreme taps),
- Tests on on-load tap-changer,
- Tests on on-load tap-changer remote control panel,
- Efficiency at 50%, 75%, 100% loading at unity p.f and rated terminal voltage (Corrected to 75°C),

B.3.2. **Type Tests to IEC 60076 (to be performed on one unit during acceptance testing at factory)**

- Temperature rise test.
- Lightning impulse withstand test.

B.3.3 **Additional tests (to be done during acceptance testing at factory)**

- Visual Inspection (verification of auxiliaries, fittings & accessories, markings & nameplates, paintwork, workmanship and finish),
- Measurement of power taken by the fans,
- Insulation dissipation factor,
- Condenser bushing capacitance and tan delta,
- DGA (dissolved gas analysis) of the insulating oil.- To be performed before and after temperature rise test,
- Acoustic and sound level,
- Insulation tests on the auxiliary wiring in the marshalling box and remote tap changer control panel,
- Measurement of zero sequence impedance,
- Measurement of harmonics no-load current,
- CT ratio and polarity,
- Measurement of zero phase sequence impedance,
- Paint thickness,
- Tank pressure test,
- Sweep frequency response analysis.

B.4. **Testing Facility**

B.4.1. The bidder shall provide current e-mail address, fax and telephone numbers and contact person at the Testing Authority where Type Tests and Special Tests to IEC 60076 were carried out.

B.4.2. All test and measuring equipment to be used during acceptance testing shall have been calibrated and copies of valid calibration certificates shall be provided to Kenya Power Engineers. A detailed list of workshop tools, test/measuring equipment and list of tests to IEC 60076 that can be carried out by the manufacturer shall be submitted with the tender for evaluation.

B.4.3. Test reports for each transformer (including its individual components) shall be submitted to The Kenya Power and Lighting Company for approval before shipment.

B.4.4. During delivery of the transformers, KPLC will inspect them and may perform or have performed any of the relevant tests in order to verify compliance with the specification. The

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

C. MARKING, LABELLING AND PACKING(Normative)

C.1. The transformer and associated components shall be packed in a manner as to protect it from any damage in transportation and handling. It shall be dispatched oil-filled and fully wired. All piping shall follow the contour of the transformer as closely as possible to avoid damage during transportation and handling. Auxiliary equipment and accessories/fittings shall be protected against mechanical damage and oil vandalism.

C.2. Each assembly and package of items associated with the transformer shall be suitably marked for ease of identification. Parts detached for shipping including oil chambers shall be protected against moisture and dust ingress. Sufficient number and sizes of oil seals, gaskets and other necessary parts shall be provided.

C.3. In addition to markings and labels required elsewhere in the tender & specification, each equipment and component shall be marked in accordance with the relevant IEC standard. Each transformer shall be provided with a rating plate of weatherproof material, fitted in a visible position, showing the appropriate details listed in IEC 60076. The entries on the plate shall be indelibly marked (either by etching, engraving or stamping) and shall be legible and durable.

C.4. In addition, the name plate shall include load and no load losses for the highest, lowest and principle tap positions, temperature class of insulation, connection diagram and the inscription 'PROPERTY OF THE KENYA POWER AND LIGHTING CO.' all marked indelibly and legibly as in 6.3.

D. DOCUMENTATION(Normative)

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

a) Guaranteed Technical Particulars;
b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
c) Sales records and at least four customer reference letters;
d) Details of manufacturing capacity and the manufacturer's experience;
e) Copies of required type test certificates and type test reports by a third party testing laboratory accredited to ISO/IEC 17025;
f) Copy of accreditation certificate to ISO/IEC 17025 for the testing laboratory.

D.2. The successful bidder (supplier) shall submit the following documents/details (from the manufacturer as per tender) to The Kenya Power & Lighting Company for approval before manufacture:

a) Guaranteed Technical Particulars;
b) Design drawings & construction details of the transformer including 3-D views;
c) Quality assurance plan (QAP) that will be used to ensure that the design, material, workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2008;
d) Test Program to be used after manufacture;
e) Marking details and method to be used in marking the transformer;
f) Manufacturer's undertaking to ensure adequacy of the design, adherence to applicable standards/specification, good workmanship and good engineering practice in the manufacture of the transformers for The Kenya Power and Lighting Company Limited;
g) Packaging details (including packaging materials and marking and identification of component packages).

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

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E. SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR OFFERED TRANSFORMER

(to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data & calculations, sales records, four customer reference letters, details of manufacturing capacity, the manufacturer's experience, copies of complete type test reports and accreditation certificate to ISO/IEC 17025 for the testing laboratory for tender evaluation, all in English Language)

TENDER NO. .....BIDDER'S NAME & ADDRESS .....

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	Name and address of the Manufacturer	State	
	Country of manufacture	State	
	Manufacturer's Letter of Authorization	Provide	
	Model/Type Reference No. of the offered transformer	State	
	Manufacturer's warranty and guarantee for the offered transformer	Provide	
1	**Scope**		
1.0	This specification is for newly manufactured outdoor oil type power transformer, 200MVA, 220,000/132,000/11,000 volts, 50 Hz, ONAF three-phase power transformer.	State	
1.1	The specification also covers inspection and test of the transformer as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation	State	
2	Applicable standards	State	
3	Terms and definitions	State	
4.1	**Service conditions**		
4.1.1.1	Operating conditions	State	
4.1.2	System Characteristics		
4.1.2.1	Primary system	State	
4.1.2.2	Secondary system	State	
4.1.2.3	Tertiary system	State	
4.1.2.4	Loading factor	State	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
4.2	**General requirements**		
4.2.1	Three winding, auto configuration, outdoor, oil-immersed, of **ONAN/ONAF** classification	State	
	core type	State	
4.2.2	The transformer shall be a three-phase integral unit	State	
4.2.3	The transformer shall be of the free breathing type, with a dehydrating cobalt free breather of approved design	Provide	
4.2.4	Designed to facilitate operation, inspection, maintenance and repairs.	Specify	
	Apparatus designed to ensure satisfactory operation under sudden variations of load and voltage	Specify	
4.2.5	Design to incorporate precaution and safety during operation and maintenance	Provide	
4.2.6	Nature of materials used for construction.	State	
4.2.7	Corresponding parts liable to be replaced shall be interchangeable		
4.2.8	All outdoor apparatus, including bushings insulators with their mountings, shall be designed to avoid pockets in which water can collect	Specify	
4.2.9	All connections and contacts shall be of ample section and surface for carrying continuously the specified currents without undue heating	Specify	
	Fixed connections shall be secured by bolts or set screws of ample size, adequately locked. Lock nuts shall be used on stud connections carrying current	Specify	
4.2.10	All leads from the winding to the terminals and bushings shall be adequately supported to prevent injury from vibration including a systematical pull under short circuit conditions	Specify	
4.2.11	Apparatus designed to minimize the risk or accidental short-circuit caused by animals, birds or vermin	Specify	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
4.2.12	Location of on-load tap-changer in tank and type of diverter switch.	Specify	
4.2.13	hot-dipped process to ISO 1461 Galvanizing	State	
	thickness of zinc coating	State	
4.2.14	Material of bolts, nuts, and washers	Specify	
4.2.15	Suitable special spanners for bolts and nuts inaccessible via ordinary spanners	Provide	
4.2.16	external surfaces paint coating and film thickness	Specify	
4.2.17	Material for descriptive labels mounted indoors or inside cubicles and kiosks	Specify	
4.2.18	Paint coating for interior surfaces of chambers or kiosks that are in contact with air	Specify	
4.2.19	Design and all materials and processes used in the manufacture of the transformer, shall be such as to reduce to a minimum the risk of the development of acidity in the oil	Specify	
4.2.20	design and manufacture of the transformers and auxiliary plant shall have minimum noise and vibration levels	Specify	
	maximum noise levels	State	
4.3	**Ratings**		
4.3.1	With ONAN cooling, MVA	State	
	With ONAF cooling, MVA	State	
	b) Rated no load voltage		
	HV-kV	State	
	LV-kV	State	
	T-kV	State	
4.3.2	Temperature rise		
	Temperature rise of top oil (deg. C), 2200 m.a.s.l with cooling fans off and in full load	State	
	Temperature rise of winding measured by resistance.	State	
	With ONAN cooling (deg. C), 2200m asl	State	
	With ONAF cooling (deg. C), 2200m asl	State	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	Period of operation of transformer at full load without calculated winding hot spot temperature exceeding 140°C and with:		
	- 50% coolers off	State	
	- 100% coolers off	State	
	Rated frequency (Hz)	State	
	Noise level when energized at normal voltage and normal frequency at no load	State	
4.3.3	ONAF Rating of the winding	State	
4.3.4	Continuous Full load capability of the transformer at any tap		
4.3.5	Overload capability of the transformer.		
4.3.6	The transformer shall be capable of withstanding the maximum fault level at its rated voltage and impedance for 2 seconds	State	
	Value of symmetrical short-circuit current I as per clause 4.1.2 of IEC 60076-5	State	
	Duration of the symmetrical short-circuit current as per clause 4.1.3 of IEC 60076-5	State	
4.3.7	Demonstration of thermal ability of offered transformer design to withstand short circuit (submit detailed calculation in accordance with clause 4.1.2 and 4.1.5 of IEC 60076-5)	Provide	
	Maximum permissible values of the average temperature of each winding after short circuit as per clause 4.1.4 of IEC 60076-5	State	
	Short circuit current density (A/mm^2)		
	220kV winding	State	
	132kV winding	State	
	11kV winding	State	
4.3.8	Tests to demonstrate the ability of the transformer to withstand dynamic effects of short circuit	Submit test reports	
	Average temperature θ_1 attained by each winding after short circuit (calculation of	Provide	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	temperature as per clause 4.1.5 of IEC 60076-5)		
	Overload capacity for 2 hours after continuous full load run (indicate clause of standard)	State	
	Thermal time constant in hours	State	
4.3.9	Short circuit rating of HV, LV and Tertiary winding.	State	
4.4	**Winding and Connections**		
4.4.1	Vector group	State	
4.4.2	Voltage variations corresponding to the tapping	State	
4.4.3	Windings and connections material properties in service	Specify	
4.4.4	windings and connections shall be properly braced to withstand shocks during transportation or due to short circuit and other transient conditions during service	Specify	
4.4.5	Coil assembly technic	Specify	
4.4.6	Vacuum drying of winding after assembly	Specify	
4.4.7	coil clamping rings material	Specify	
4.4.8	spacer blocks material	Specify	
4.4.9	Brazing/crimping of joints	Specify	
4.4.10	Stage inspection of winding	State compliance	
	Size of conductor used for different windings shall also be checked during stage inspection	State compliance	
	a) Conductor area in mm^2		
	i) HV	Specify	
	ii) LV	Specify	
	iii) T	Specify	
	b) Current density in A/mm^2, ONAF		
	i) HV	Specify	
	ii) LV	Specify	
	iii) T	Specify	
	c) Type of windings		
	i) HV	Specify	
	ii) LV	Specify	
	iii) T	Specify	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	d) Winding insulation type and class, graded or ungraded		
	i) HV	Specify	
	ii) LV	Specify	
	iii) T	Specify	
	e) Insulating material		
	i) Turn insulation; HV side	Specify	
	ii) Turn insulation; LV side	Specify	
	iii) Turn insulation; Tertiary	Specify	
	iv) Between HV and LV	Specify	
	v) Between LV and T	Specify	
	vi) For core bolts, washers and end plates	Specify	
	f) Tapping connection	Specify	
	g) Type of axial support		
	i) HV winding	Specify	
	ii) LV winding	Specify	
	iii) Tertiary winding	Specify	
	h) Type of Radial Coil support		
	i) HV winding	Specify	
	ii) LV winding	Specify	
	iii) Tertiary winding	Specify	
4.4.11	Design of the transformer for the suppression of harmonic voltage	Specify	
4.4.12	windings shall be designed to reduce to a minimum the out-of-balance forces in the transformer at all voltage ratios	Specify	
4.5	**Tapping**		
4.5.1	Tapping range		
	i) Tap step (percent)	State	
	ii) Total tap ranges - (+) % to (-) %	State	
	iii) Tapping provided at HV	State	
4.5.2	Tapping method	State	
4.6	**Core and flux density**		
4.6.1	Core		
4.6.1.1	a) Type of transformer (stacked core type required)	Specify	
	b) Material of Laminations		
	i) Grade of CRGO & manufacturer	Specify	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	ii) Thickness of single lamination	Specify	
	iii) Stack-factor	Specify	
	iv) Specific weight/m3	Specify	
	v) Specific loss watts/kg.	Specify	
	vi) Net core area in sq. meters	Specify	
4.6.1.2	Design of the magnetic circuit	Specify	
4.6.1.3	Treatment and handling of core steel	State	
4.6.1.4	Adequate oil ducts in the core for cooling with necessary interventions	Provide	
4.6.1.5	no movement of the core assembly relative to the tank during transport	State	
4.6.1.6	sand blasted or shot blasted of all steel sections supporting the core	Specify	
4.6.1.7	Lifting lugs	Provide	
4.6.1.8	supporting framework designed to avoid the presence of pockets	Specify	
4.6.1.9	The insulation structure for the core to bolts and core to clamp plate to withstand 2kV (minimum) for one minute	Specify	
4.6.2	Flux Density		
4.6.2.1	Primary voltage variation check	State	
4.6.2.2	Maximum working flux density (normal Voltage, frequency & ratio)	State	
4.6.2.3	continuous allowable maximum flux for:		
	one minute	State	
	five seconds	State	
4.6.2.4	Flux density limit at which core material Saturates	State	
4.6.2.5	Magnetization curve and design calculations	Provide	
4.6.2.6	over fluxing of the core due to temporary over voltage orders:		
	One minute	State	
	Five seconds	State	
4.7	**Losses, regulation and impedance: Clause 4.7.1 to 4.7.4**		
	a) Magnetization data at no load, at 90% rating, at 100% rating and at 110% rating at rated voltage and frequency	State	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	i) No-load current in Amps	State	
	ii) Power factor	State	
	iii) Total no load losses in KW (core loss + dielectric loss)	State	
	b) Total load losses (copper loss + stray loss) at rated current at 750 C in KW	State	
	i) For ONAN Rating	State	
	ii) For ONAF Rating (including auxiliary losses)	State	
	iii) Auxiliary Losses	State	
	Symmetrical short circuit current		
	h) Efficiency at 750 C taking into account input of cooling plant loss: At Unity Power Factor and at 0.8 Power Factor Lagging:		
	i) At 125% full load	State	
	ii) At 100% full load	State	
	iii) At 75% full load	State	
	iv) At 50% full load	State	
	Voltage regulation		
	I)Regulation at full load & at 75^0 C		
	i) At unity p.f. in %	State	
	ii) At 0.8 p.f. (lag) in %	State	
	Impedance voltage at rated current and frequency at 75^0 C (%)		
	i) Positive sequence at normal tap in %	State	
	ii) Positive sequence at Max. Voltage tap in %	State	
	iii) Positive sequence at Min. voltage tap in %	State	
	Resistance at 75^0 C of:		
	i) HV Winding in ohms (at principle & extreme taps)	State	
	ii) LV Winding in ohms	State	
	iii) Tertiary winding (where applicable)	State	
	Reactance per phase at rated frequency at normal tap on rated MVA base: - HV to LV - %	State	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT				BIDDER'S OFFER
	Minimum short-circuit apparent power for HV & LV and T system	State				
4.8	**Terminals arrangement & bushings: clauses 4.8.1 to 4.8.9**					
4.81	Details of Bushings (indicate details for HV, LV & N,T	HV LV N				
	i)Type	State				
	ii)One minute power frequency withstand voltage kV (rms), dry	State				
	iii)One minute power frequency withstand voltage kV (rms), wet	State				
	iv)1.2/50μs lightning impulse voltage, dry (kVp)	State				
	v) Total creepage distance in Air (mm)	State				
	vi) Weight of bushings (kg)	State				
	vii) Maximum current rating of each bushing	State				
	viii) Quantity of oil in the bushings in liters	State				
4.8.4	Type of neutral bushing	State				
4.8.5	Spacing and air clearance cordination	State				
4.8.6	Bushing creepage distances	State				
4.8.7	Bushing terminals	State				
4.8.8	220kV and 132kV bushing and CT mounting	State				
4.8.9	11kV bushing and CT mounting	State				
4.8.10	Terminal arrangements and phase marking of HV, LV and Tertiary	State				
4.9	**Current transformers: clauses 4.9.1 to 4.9.4**					
	a) HV side (Phase A, B & C)	State				
	i) Phase A	Core1	Core2	Core3	Core4	
	Burden					
	Ratio					

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT				BIDDER'S OFFER
	Class					
	ii) Phase B	Core1	Core2	Core3	Core4	
	Burden					
	Ratio					
	Class					
	iii) Phase C	Core1	Core2	Core3	Core4	
	Burden					
	Ratio					
	Class					
	b) LV side	State				
	i) Phase a	Core1	Core2	Core3	Core4	
	Burden					
	Ratio					
	Class					
	ii) Phase b	Core1	Core2	Core3	Core4	
	Burden					
	Ratio					
	Class					
	iii) Phase c	Core1	Core2	Core3	Core4	
	Burden					
	Ratio					
	Class					
	iv) Neutral n	Core1	Core2	Core3	Core4	
	Burden					
	Ratio					
	Class					
	c) Tertiary	Core1	Core2	Core3	Core4	
	Burden					
	Ratio					
	Class					
4.9.2						
4.9.3	Current Transformer standard	State				
4.9.4	Submission of current transformer technical particulars.	Provide				
4.9.5	Connection of current transformer secondary leads	State				
4.10	**Air clearance: clauses 4.10.1 to 4.10.3**					
	i) HV – HV	State				
	ii) HV – LV	State				

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	iii) HV – Earth	State	
	iv) LV – LV	State	
	v) LV – Earth	State	
	vi) HV – Tertiary, LV – Tertiary, Tertiary – Tertiary phase to phase & phase to earth	State	
4.11	**Insulation levels at 22000m above sea level: indicate for HV, LV, N & Tertiary where applicable**	HV LV N Tertiary	
	a) Nominal system voltage, kV	State	
	b) Highest system voltage, kV	State	
	c) Lightning Impulse withstand voltage, 1.2/50µs, dry, +ve (kV, peak)	State	
	d) Power frequency withstand voltage, 50Hz, 60s, wet, (kV, rms)	State	
	e) Test voltages to be used at factory during acceptance testing	State	
	f) Altitude of factory	State	
4.12	**On load tap changer: clauses 4.12.1 to 4.12.12**		
	i) Manufacturer and Type & Model No. of OLTC (must be of a Type & make approved by KPLC)	State	
	ii) Rating	State	
	iii) Rated voltage kV	State	
	iv) Rated current Amps	State	
	v) Step voltage kV	State	
	vi) No. of steps No.	State	
	vii) Approximate over all dimensions (Width x Breadth x Depth) in mm	State	
	viii) Approximate overall weight in kg.	State	
	ix) Time to complete one tap change step in seconds	State	
	x) Technical documents required for the OLTC offered: -type test certificates and type test reports, -manufacturing experience, -sales records,	State	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	-installation instructions and manuals and -manufacturer's authorization.		
	xi) Automatic Voltage Regulating Relay (to be of KPLC approved design & make and technical details shall be submitted with the tender)	State	
4.12.2	Design to ensure independent completion of tap change operation.	state	
4.12.3	Prevention of damage of transformer with incomplete tap changer operation	state	
4.12.4	Mechanical isolation of supply to MDU and tap changer motor overload protection	state	
4.12.5	Local and remote tap changer position indication	State	
4.12.6	Provision of tap changer operation counter	State	
4.12.7	Housing of contactors and equipment for local/remote operation of tap changer	State	
4.12.8	Tap changer location and type.	State	
4.12.9.1-4.12.9.6	Motor drive unit additional components	State	
4.12.10	Components of tap changer and the type of tap changer offered	State	
4.13	**Remote Tap Changer Control Panel: clauses 4.13.1 to 4.13.7**		
	i) Automatic Voltage Regulating relay	Provide	
	ii) Control switches	Provide	
	iii) Indication lamps	Provide	
	iv) Tap position indicator	Provide	
	v) Local / Remote switch	Provide	
	vi) kV meter	Provide	
	vii) Door operated lamp and anti-condensation heater	Provide	
4.14	**Automatic Voltage Regulating relay**		
	i) Rating (voltage & current)	Specify	
	ii) Initial time delay (5-100 seconds)	Specify	
	iii) Inter-tap delay (1-80 seconds)	Specify	
	iv) Line drop compensation	Specify	
	v) Under voltage inhibit range 70%-90%	Specify	
	vi) over current inhibit range 150%-250%	Specify	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	vii) Bandwidth range 0.5-5 % of voltage level	Specify	
	selector switch with OFF/Manual/Auto	Specify	
	viii) Numerical design	Specify	
	employ both Circulating Current Compensation and Negative (Reverse) Reactance compounding	Specify	
	Maintain Tap Operation count	Specify	
	Tap Changer Mechanism Failure	Specify	
4.15	**Parallel Operation: clause 4.15.1 to 4.15.7**		
	Provided and wired in the marshalling kiosk (box) by the manufacturer ready for inter-phasing.	Specify	
4.16	**Marshalling box: clauses 4.14.1 & 4.14.2**		
4.16.1	outdoor, IP 55, weatherproof, vermin-proof type with a hinged, lockable door fitted with a glass panel	Specify	
	Installed items		
	a) Winding & Oil temperature indicators	Specify	
	b) Power supply with mechanical isolating switch (400 V, 50 Hz)	Specify	
	c) Socket outlets (British standard design)	Specify	
	d) Outgoing supply to OLTC MDU with mechanical isolating switch (400 V, 50 Hz)	Specify	
	d) Door-switched illuminating lamp (standard screw type)	Specify	
	e) Anti-condensation heater with hygrostat control and switch	Specify	
	f) MCB control for all circuits	Specify	
	g) Phase sequence relay for fan circuits		
4.16.2	Detailed technical documentation, drawings and schematics	Submit	
4.17	Auxiliary supplies, alarms & indications: clauses 4.17.1 to 4.17.2	Specify	
4.18	**Transformer tank and tank cover: clauses 4.18.1 to 4.18.14**		
	a) Bolted top cover design	Specify	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	b) Approximate weights	Specify	
	i) Core (kg)	Specify	
	ii) Windings (kg) (Copper & Insulation separately)	Specify	
	iii) Tank & Fittings (kg)	Specify	
	iv) Oil (kg)	Specify	
	v) Total weight of complete transformer (kg)	Specify	
	c) Details of Tank	Specify	
	i) Material for tank	Specify	
	ii) Type of the tank	Specify	
	iii) Thickness of sides in mm	Specify	
	iv) Thickness of Bottom in mm	Specify	
	v) Thickness of Cover in mm	Specify	
	vi) Thickness of Radiators in mm	Specify	
4.19	**Paint work: clauses 4.19.1 to 4.19.2**		
	Test report for the paint work issued by accredited testing lab	Provide	
4.20	**Tank and Accessories: Clause 4.20.1 to 4.20.5**		
4.20.1	External and internal surfaces cleaning method	Specify	
4.20.2	Exterior priming/finishing	Specify	
4.20.3	Interior cleaning & finishing	Specify	
4.20.4	Cooling system: clauses 4.20.4.1 to 4.20.4.9		
	a) Radiators		
	i) Type and make of material used for radiators	Specify	
	ii) Total radiating surface in m^2	Specify	
	iii) Total weight of Radiators in kg	Specify	
	b) Fan motor		
	i) Make and Type (Details)	Specify	
	ii) Number connected	Specify	
	iii) Number in standby	Specify	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	iv) Rated power & efficiency of each motor --- (kW, %)	Specify	
	v) Rated Voltage	Specify	
	vi) Temperature at which control is adjustable	Specify	
	vii) Capacity in Litres/Minute	Specify	
4.21	**Fittings and accessories: clauses 4.21.1 to 4.21.6**		
	a)Capacity of conservator vessel (Litres)	Specify	
	b)Type of oil preservative installed	Specify	
	c)Valve sizes and Numbers to be fitted	Specify	
	i) drain valves -mm- No.	Specify	
	ii) filter valves -mm- No.	Specify	
	iii) sampling valves -mm- No.	Specify	
	Oil sampling device	Provide	
	Earthing terminals location	Specify	
	Air release valves or plugs for the main tank	Provide	
	Non-deteriorating detailed diagram and rating plates	Provide	
4.21.1.1	Components of transformer conservator	state	
4.21.1.2	Conservator partitions, location and devices connected to the conservator	state	
4.21.1.3	Main tank Conservator to have aircell and magnetic oil gauge with oil level alarm contacts	state	
4.21.1.4	Conservator capacity and provision of side glass of oil level high and low indication	state	
4.21.1.5	Conservator to be provided with lifting lugs	state	
4.21.1.6	Conservator to be positioned so as not to obstruct transformer electrical connections.	state	
4.21.1.7	Material of air cell and its operation at high temperatures	state	
4.21.1.8	Provision of manual for operation, maintenance, testing and replacement of air cell.	state	
4.21.2	Gas and oil actuated relay main tank		

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
4.21.2.1	Transformer to have bucholz relay of double float type with alarm and tripping contacts. Bucholz to have shut-off valves and flange coupling.	state	
4.21.2.2	A bleed valve for gas venting, test valve and terminal box suitably wired to the MK to be provided	state	
4.21.2.3	Provision for simulation of gas and oil surge for testing	state	
4.21.3	Gas and oil actuated relay tap changer		
4.21.3.1	Tap changer compartment to have oil surge relay	state	
4.21.3.2	Shutoff valves and flange couplings for oil surge relay top facilitate easy removal	state	
4.21.3.3	A bleed valve for gas venting, test valve and terminal box suitably wired to the MK to be provided	state	
4.21.3.4	Provision for simulation of gas and oil surge for testing	state	
4.21.4	Pressure relieve device		
4.21.4.1	Pressure relieve device complete with trip contact suitably wired to the MK	state	
4.21.4.2	Reset of pressure relieve device after operation	state	
4.21.4.3	PRD to be provided with shroud and pipe to direct oil to the soak pit in case of fault.	state	
4.21.4.4	The device to maintain oil tightness under static pressure	state	
4.21.4.5	The PRD shall be mounted on top of the tank with canopy to prevent rain water ingress into the tank	state	
4.21.5	Winding and oil temperature indicators		
4.21.5.1	Transformer shall be provided with winding and oil temperature indicators with maximum temperature needle and associated CTs	state	
4.21.5.2	Temperature indicator scales to be from 20°C to 150°C.	state	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
4.21.5.3	Provision of maximum reading pointer and resetting device, switch testing knob and anti-vibration mounting grommets.	state	
4.21.5.4	Temperature sensing bulbs to sense top oil temperature.	state	
4.21.5.5	Provision of alarm, trip and cooling control contacts.	state	
4.21.5.6	All contacts shall be adjustable to a scale and shall be accessible on removal of the cover for dial type devices. Contacts to be suitable for making and breaking 500VA between the limits of 110 and 250V DC.	state	
4.21.5.7	Isolating and test links shall be provided in control cubicle to allow for oil temperature measurement	state	
4.21.5.8	Location of HV and LV winding temperature indication CTs	state	
4.21.5.9	Calibration of indicator shall be related to the winding having the maximum temperature rise.	state	
4.21.5.10	If the value of winding temperature indicator varies by more than 3°C from the values derived from the tests specified in clause 5, adjustments shall be made to the equipment to achieve the limits.	state	
4.21.6	Accessories		
4.21.6.1	Oil filtration valves	state	
4.21.6.2	Top and bottom oil sampling devices	state	
4.21.6.3	Number and location of earthing terminals	state	
4.21.6.4	Air release valves and plugs for radiators, tank and turrets	state	
4.21.6.5	Rating/name plate	state	
4.21.6.6	Other fittings/accessories	state	
4.22	**Transformer oil: 4.22.1 to 4.22.2**		
	a) Transformer to be supplied oil filled	Specify	
	b) Chemical composition and properties of oil	Specify	
	c) Replacement cycle	Specify	
	d) Applicable standard and class of oil	Specify	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	e) Quantity of oil in liters	Specify	
4.22.3	Transformer cooling method		
4.22.4	Transformer oil used for first filling, testing, and impregnation of active parts at manufacturers works hall be the same type supplied at site.	State	
4.23	**Capitalization: clauses 4.24.1 to 4.24.2**		
	Total load losses (ONAF Rating) – kW	Specify	
	Total no load losses in kW (core loss + dielectric loss)	Specify	
	Appendices (Normative)		
A.	**Quality management system**		
A.1.	quality assurance plan (QAP)	Submit	
	Copy of ISO 9001: 2015 certificate submitted	Submit	
A.2.	Manufacturer's Declaration of Conformity to reference standards	Submit	
A.3.	Production capacity (monthly & annual)	Submit	
	List & contact addresses (including e-mail) of the manufacturer's previous customers	Submit	
B.	**Test and Inspection**		
B.1.	Responsibility of testing transformer & manufacturer's capability	State	
	Manufacturer's capability to conduct the tests	State	
B.2.	Copies of type test certificates and reports to IEC 60076 issued by a third party testing laboratory accredited to ISO/IEC 17025	Submit	
	Copy of the accreditation certificate to ISO/IEC 17025 for the testing laboratory	Submit	
B.2.1.	List of type tests conducted on transformer	Submit	
	a) Dielectric tests to IEC 60076	Confirm	
	b) Short circuit withstand test to IEC 60076	Confirm	
	c) Temperature rise test to IEC 60076	Confirm	
B.2.2.	List of type tests conducted on tap-changer	Submit	
	a) Dielectric tests to IEC 60076	Confirm	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	b) Short circuit withstand test to IEC 60076	Confirm	
	c) Temperature rise test to IEC 60076	Confirm	
	d) Switching tests	Confirm	
	e) Transition impedance test	Confirm	
	f) Mechanical tests	Confirm	
B.3	Acceptance tests at manufacturers premises		
B.3.1	Routine tests to IEC 60076 – to be done during factory acceptance testing	List	
B.3.2	Type tests to IEC 60076 – to be performed on one unit during factory acceptance testing	List	
	Temperature rise test	Confirm	
	Lightning impulse withstand test	Confirm	
B.3.3	Additional tests to IEC 60076 – to be done during factory acceptance testing.	List	
B.4	Testing facility		
B.4.1.	Contact details for testing authority	Submit	
B.4.2.	Calibration of test and measuring equipment	Submit	
	A detailed list of workshop tools, test/measuring equipment	Submit	
	and list of tests to IEC 60076 that can be carried out by the manufacturer	Submit	
B.4.3.	Complete test reports for approval before shipment	Submit	
B.4.4.	Inspection or test by KPLC during delivery before acceptance to stores	State compliance	
C.	**Marking, Labelling & Packing**		
C.1.	Packing of the Transformer and associated components	Specify	
C.2.	Marking for ease of identification	Specify	
	Protection of parts against moisture and dust ingress	Specify	
	Sufficient number and sizes of oil seals, gaskets and other necessary parts shall be provided	State & Provide	
C.3. - C.4	a) Contents of name plate	State	

CLAUSE NO.	DESCRIPTION	KPLC REQIREMENT	BIDDER'S OFFER
	b) Method of marking to ensure it is permanent, legible and durable	Specify	
D.	**Documentation**		
D.1.	Documents submitted with tender for evaluation	List	
D.2.	Documents submitted for approval before manufacture	List	
Other details	Overall dimensions of offered transformer including cooling gear, tap changing gear etc.	Specify	
	-Length mm	Specify	
	-Breadth mm	Specify	
	-Height mm	Specify	
	-General arrangement drawing	Submit	
	Detailed list of all the required fittings and accessories indicating type/model number, manufacturer and quantities	Submit	
	List catalogues, brochures and technical data submitted to support offer	Submit	
	Manufacturer's Declaration of Conformity to IEC 60076 (all parts)	Submit	
	Shipping details – List parts normally detached for transport and indicate protection against mechanical damage and oil vandals for entire transformer and components	Submit	
	Deviations from tender specifications (indicate supporting documents submitted)	State	

***Note*
*All guaranteed values **MUST** be clearly stated. Words like 'agreed', Yes; 'confirmed', 'As per KPLC specifications', etc. shall not be accepted and shall be considered non-responsive.*

.....

Manufacturer's Name, Signature, Stamp and Date