Kenya Power

SPECIFICATION FOR TRANSFORMER OIL REGENERATION PLANT

A Document of the Kenya Power & Lighting Co. Ltd
February 2025

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0.1 CIRCULATION LIST

COPY NO.	COPY HOLDER
1	Senior Engineer, E/Plant Coast Region
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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)
0	2025-02-2	New issue	DOUGLAS M. KANYI	George Welimo

FOREWORD

This specification has been prepared by the E/plant workshop of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for Transformer oil regeneration plant.

The Transformer oil regeneration plant is intended for use by the e/plant workshop for regenerating and degassing used transformer oil

This specification was prepared to establish and promote uniform requirements for Transformer oil regeneration plant to be used at Kenya Power and Lighting Company Ltd.

There are no other specifications in this series.

This specification stipulates the minimum requirements for Transformer oil regeneration plant 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 the Transformer oil regeneration plant. for KPLC.

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

1. SCOPE

1.1. This specification is for Transformer oil regeneration plant for use by company's E/plant workshop.

1.2. The specification covers requirements, inspection and tests, schedule of Guaranteed Technical Particulars, marking and packaging of Transformer oil regeneration plant.

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 61557: Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c - Equipment for testing, measuring or monitoring of protective measures - Part 1: General requirements;

IEC 60815: Selection and dimensioning of high voltage insulators intended for use in polluted conditions –Part 1: Definitions, information and general principles

OIML D 11: General Requirements for Measuring Instruments - Environmental Conditions

IEC 61000: Electromagnetic Compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test; – Part 6-2: Generic standards – Immunity for Industrial environment.

IEC 60529: Degrees of protection provided by enclosures (IP code)

ISO 9001: Quality Management systems – Requirements

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

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 abbreviations.

3.1. ABBREVIATIONS

KPLC- Kenya Power and Lighting Company Limited

ISO – International Organization for Standardization.

LED –Light Emitting Diode

Kg –Kilogram

KV - Kilovolt

IP – Ingress Protection

LV – Low Voltage

EMC – Electromagnetic Compatibility

EU – European Union

4. REQUIREMENTS

4.1. SERVICE CONDITIONS

4.1.1 The Transformer oil regeneration plant. shall be suitable for use outdoors in tropical areas and harsh climatic conditions including areas exposed to:

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

b) Humidity of up to 95%;

c) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +50°C

d) Pollution: Degree 2

4.2. DESIGN, CONSTRUCTION AND OPERATION

4.2.1. Design

4.2.1.1. The Transformer oil regeneration plant. shall be rated for continuous operation.

4.2.1.2. The transformer oil regeneration plant shall be designed for regenerating 1000 liters per day

4.2.1.3. The Transformer oil regeneration plant. shall be capable of doing the following functions:

a) Filter, heat, dehumidify and degas the oil at a vacuum level sufficient to condition the oil for the required parameters to the values

b) Pump the oil from one tank to another by by-passing to purification process, if required

c) completely regenerate transformer insulating oils

4.2.1.4. The plant shall be capable of processing the oil on single pass basis at rated flow to the following specification

a. Moisture content : Less than 5 PPM
b. Gas content: Less than 0.1% by volume
c. Dielectric strength 70 kV across 2.5 mm gap
d. Filtration: Less than 0.2 micron
e. Power factor Tan Delta at 90 °C: 0.002

4.2.1.5. The Plant shall be suitable for treating transformer oil by first heating it and then passing it through specially designed filter vessel. Oil shall then pumped into regeneration unit and back to degasser for moisture and dissolved gasses removal. The set shall be designed for high vacuum and low temperature of oil for achieving the required results

4.2.1.6. Plant's design shall include Fuller's Earth reactivation insitu for continuous reuse of Fuller's Earth. Oil processing or reactivation could be carried out in all columns.

4.2.1.7. Reactivation of the Fuller's Earth, shall be fully automated and enables the plant to process oil again and again, using the same Fuller's Earth. Fuller's earth shall not need to be removed from the for a period of up to two years. When finally removed (as dry, neutral sand) it shall be used for building materials or similar.

4.2.1.8. The plant shall be suitable for operation on 50Hz, 3 phase system with neutral solidly grounded, the 3-phase voltage supply shall be 415 V $\pm$ 10%. The plant shall be of latest design, sturdy in construction and requiring minimum maintenance.

4.2.2. Construction

4.2.2.1. The Plant shall be suitable for outdoor use. All components including control panel shall have outdoor weather protected enclosures of sheet metal. The casing shall be provided with large doors for easy access to the various components

4.2.2.2. Locking of the casing doors be provided with latching from inside wherever possible. Good locking arrangement for main entry door and also on the doors wherever inside latching is not possible shall also be provided.

4.2.2.3. All plant components degassing and regeneration shall be mounted on a common base frame, including all necessary piping for oil and vacuum as well as electrical wiring

4.2.2.4. All bought out components shall be of reputed makes. Manufacturer's test reports for pumps and motors will be supplied

4.2.2.5. The plant shall have vacuuming and regeneration system suitably designed for carrying out degassing and regeneration functions.

4.2.2.6. Sampling valves in the inlet and outlet pipes of filter press shall be provided

4.2.2.7. Flow meter with totalizer in the outlet pipe of filter press shall be provided

4.2.2.8. One moisture sensor in the outlet pipe of filter press shall be provided

4.2.2.9. Arrangement for reflushing of part of filtered oil and degassed oil shall be provided.

4.2.2.10. A valve for draining the oil each from the heater tank, edge filter, filter press shall be provided

4.2.2.11. Oil heater, filter vessel, degasser shall be of mild steel construction. The internal and external surface including oil heater, filter vessel, degassifier, regeneration

columns and structural steel work to be painted and shall be shot or sand blasted to remove all rust and scale of foreign adhering matter or grease. All steel surface in contact with insulating oil shall be painted with two coats of heat resistant oil insoluble, insulating vanish/paint

4.2.2.12. All internal painted steel surface shall be given a primary coat for zinc chromate second coat of oil and weather resistant varnish of a colour distinct from primary and final two coats of glossy oil and weather resisting paint

4.2.2.13. All paints shall be carefully selected to withstand heat and extremes of weather. The paint shall not scale off or crinkle or be remove by abrasion due to normal handling

4.2.2.14. The machine external overall dimensions shall be submitted for this tender.

4.2.2.15. Lifting Hooks for Plant shall be provided to facilitate ease of Plant Loading / Unloading

4.2.2.16. Transformer oil regeneration plant. shall be fitted with suitable dampers to withstand shocks and vibration during operation and transportation on top of a truck/lorry

4.2.2.17. Scheme drawings for Transformer oil regeneration plant. offered and Flow diagram of oil filtration and regeneration, pumps and motors shall be submitted with tender, clearly detailing important dimensions, any special features of the offered design, components, accessories and fittings.

4.2.2.18. Complete list of components, instruments and accessories offered with their make and accompanied with catalogue/brochure/pamphlets/literature/write-ups shall be submitted with the tender.

4.2.3. Operation

4.2.3.1. Operation sequence and dangers sign plates shall also be provided

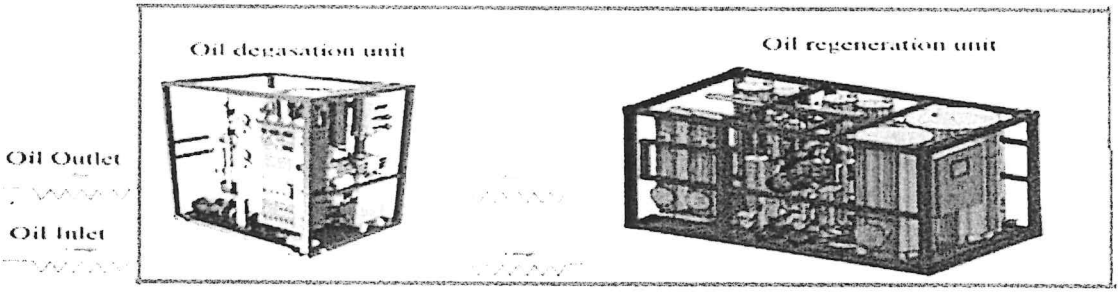
4.2.3.2. The plant shall carry out oil regeneration and degassing under vacuum of 0.3Torr or less.

4.2.3.3. Oil shall be taken in through inlet valve

4.2.3.4. An inlet pump shall circulate the oil through the heater where the oil temperature shall be raised up to 70°C.

4.2.3.5. This oil shall be filtered through a pre filter (10 micron) to remove major portion of coarse dirt and pumped to a vacuum chamber.

4.2.3.6. Oil shall then be pumped into regeneration unit and back to degasser for moisture and dissolved gasses removal as per the figure below



4.2.3.7. Vacuum chamber shall contain permanent dispersion media (PDM), a cylindrical type element. The oil shall flow through the pores of the PDM into shower in order to ensure more exposure of vacuum to the oil particles. This process, shall boil off dissolved water and gases effectively

4.2.3.8. Dehydrated oil shall be collected at the bottom of the vacuum chamber and pumped through the fine filter (0.5 micron) to the outlet valve

4.2.3.9. At the beginning of the process outlet valve shall be closed and the oil shall circulate through a by-pass valve. This shall make the system stable

4.2.3.10. The reactivation phase shall take approximately 10 to 14 hours and upon its completion, the re-circulation of oil shall be re-initiated by pressing a single function key.

4.2.3.11. After sufficient re-circulation, the system shall be ready to automatically engage back into a Regeneration operating condition.

4.3. TECHNICAL PARTICULARS

4.3.1. DEGASSING UNIT MAIN COMPONENTS

4.3.1.1. OIL PUMP (INLET PUMP)

4.3.1.1.1. The pumps shall be single stage positive displacement gear type.

4.3.1.1.2. The pump motor shall have insulation class-F with IP-54 or better protection.

4.3.1.1.3. Suitable mechanical seals shall be provided to ensure vacuum tightness.

4.3.1.1.4. A built in pressure relief valve to re-circulate the oil to suction side in case of accidental pressure rise shall be provided.

4.3.1.1.5. Suction lift of the pump shall be at least 5 meters of transformer oil at atmospheric pressure and temperature.

4.3.1.1.6. A separate bypass valve shall be provided across the gear pump so that the flow rate through the filter can be adjusted as required.

4.3.1.1.7. The pumps shall be provided with an interlock with delay such that if there is no oil flow for 30 sec. through the heater, the pump shall trip automatically and also if the pump is not operating the heater will not be energized

4.3.1.1.8. The following oil inlet pump details shall be provided

a) Pump Make
b) Pump Type
c) Pump Capacity
d) Motor make and type
e) Motor Rating
f) Motor type of starter

4.3.1.2. MAGNETIC STRAINER

4.3.1.2.1. The plant shall be provided with a suitable magnetic strainer with wire mesh to filter all particles of sizes above 0.5 mm and all magnetic particles.

4.3.1.2.2. The strainer shall be installed at the suction of the oil pump described at 4.3.1

4.3.1.3. **HEATERS**

4.3.1.3.1. The oil heater vessel shall be of mild steel welded construction and insulated with glass/mineral wool.

4.3.1.3.2. The heating elements shall be divided into three banks, each individually controlled by a separate thermostat. For the required oil condition temperature of 70°C these thermostat are set at 50°C, 60°C and 70°C

4.3.1.3.3. Selector switch shall be provided for full load operation of heaters depending upon the desirable temperature of oil.

4.3.1.3.4. Heater shall be capable of heating oil up to 80°C. The recommended operating temperature of oil is 60 to 70°C.

4.3.1.3.5. The heater capacity shall be sufficient to heat up the oil from the ambient temperature to the required operating temperature by indirect heating

4.3.1.3.6. Heater control bank shall be controlled by temperature controller housed on a control panel for easy observation and re-adjustment.

4.3.1.3.7. Selector switch shall be provided for full load operation of heaters depending upon the desirable temperature of oil.

4.3.1.3.8. Heaters shall be interlocked with inlet pump and shall not be in "ON position" unless the inlet pump is working.

4.3.1.3.9. One suitable pressure relief valve shall be fixed on the heater chamber to prevent any pressure rise above the acceptable limit.

4.3.1.3.10. A drain point shall be provided for the heater tank.

4.3.1.4. **After FILTER (After degassing stage)**

4.3.1.4.1. Cartridge filter shall be provided to ensure maximum particle size to less than 0.5 micron in the filtered oil.

4.3.1.4.2. The filter body shall be fabricated of mild steel and designed for leak tightness at full vacuum and high pressure.

4.3.1.4.3. The oil will flow from dirty oil chamber to clean oil chamber through filter elements.

4.3.1.4.4. Cartridge type element used shall be suitable for transformer oil in service and submicronic filtration. The media shall be non-hygroscopic and ofhigh dirt holding capacity.

4.3.1.4.5. The filter elements shall be easily removable for replacement when required.

4.3.1.4.6. Compound gauge to indicate pressure across the filter vent and drain with valves and other necessary accessories shall be mounted on the filter for each operation

4.3.1.5. **Pre FILTER PRESS (Before degassing chamber)**

4.3.1.5.1. For treating dirty oil, filter press of adequate rating shall be supplied for supplementing the capacity of filter elements.

4.3.1.5.2. These units shall be designed for quick and easy replacement of media.

4.3.1.5.3. A sludge outlet for receiving the solid impurities and cleaning the filter plate without opening the unit shall be provided.

4.3.1.5.4. Theunit shall also be provided with vent and drain valves, pressure gauge at inlet and outlet and other necessary accessories.

4.3.1.5.5. The pre filter shall be of 10micron to remove major portion of coarse dirt.

4.3.1.6. **DEGASSING CHAMBER**

4.3.1.6.1. The degassing chamber shall be of welded construction and shall be suitable for operation under full vacuum. The fill of ''rasig" Rings and trays for distribution shall be designed for efficient distribution of oil over large areas.

4.3.1.6.2. Incoming transformer oil should be spread over these rings in the form of film and a longer surface area, thus achieving better degassing and dehumidification.

4.3.1.6.3. The degassing chamber shall be suitable for ensuring the desired oil properties.

4.3.1.6.4. Arrangement for condensing back lighter fraction (Aromatics) of the insulating oil into the system shall be provided.

4.3.1.6.5. The degassing channels shall have adequate height to allow long enough free fall for complete degassing.

4.3.1.6.6. Design shall be such as to minimize foam formation

4.3.1.6.7. The degassing chambers shall be provided with suitable level monitor for oil or foam level in the chamber and shall trip the inlet pump when the level rises above the designed maximum level in order to prevent foam to enter the vacuum pumping system.

4.3.1.6.8. The oil inlet pump starts again automatically once the oil level in the degassing chamber falls below the present oil level

4.3.1.6.9. Necessary illuminated sight glass shall be provided through which oil flow through the degasser can be viewed clearly

4.3.1.6.10. The degasser shall be provided with vacuum gauges, vacuum breaking valves, main and auxiliary vacuum connections and other necessary accessories

4.3.1.7. **VACUUM PUMPING SYSTEM FOR OIL FILTRATION**

4.3.1.7.1. The pump shall be provided with a suitable vacuum pumping system for creating adequate high vacuum in the degassing chamber.

4.3.1.7.2. The pumping system shall consist of suitable combination of Roots Blower and Rotary vane vacuum pumps with inter stage condensing units.

4.3.1.7.3. The pump motor shall be insulation class-F with IP-54 or better protection

4.3.1.7.4. The Roots blower shall be reputed make. Suitable built in labyrinth packing system, slinger rings, oil return chamber shall be provided between bearings and working chamber to prevent penetration of lubricating oil to the working chamber.

4.3.1.7.5. The pumps motor shall be dynamically balanced. The pumps shall be suitable for starting evacuation form atmospheric pressure and shall be applied with necessary over flow valve.

4.3.1.7.6. The rotary vane vacuum pumps shall be installed after the roots blower.

4.3.1.7.7. An automatic by pass valve across the roots blowers shall permit operation of rotary vane pump alone to operate when so required.

4.3.1.7.8. The rotary vane pumps are provided with gas ballast valve to prevent contamination of vacuum pump oil with moisture.

4.3.1.7.9. The vacuum pump shall also be provided with suitable non-return valve device such that in the event of power failure, the vacuum in the degassing chamber shall be maintained and the vacuum pump oil is not sucked back into the degassing chamber.

4.3.1.7.10. A high vacuum safety valve (piston type) to prevent back streaming of oil and air intrusion shall be provided. The pump motors shall be have return stop device.

4.3.1.7.11. Rotary vane vacuum pump shall have ultimate capability of 0.5 mbar

4.3.1.7.12. Roots blower shall have ultimate capability of 0.01 mbar

4.3.1.8. **OIL EXTRACTION PUMP**

4.3.1.8.1. Suitable pumping system shall be provided for extracting oil from degasser under vacuum and supplying to transformer oil tank.

4.3.1.8.2. The pump shall be either glandless centrifugal type with canned motors or a combination of gear pump and centrifugal pump with mechanical seals suitable for extracting oil from high vacuum degassing chamber.

4.3.1.8.3. The discharge pump shall be able to deliver the oil at its rated capacity of the machine under full vacuum condition of the degassing chamber with adequate head of 15 meters of water column

4.3.1.8.4. The oil extraction pump shall be located at a suitable level below the degasser chamber to ensure adequate suction head for the pump.

4.3.1.8.5. The pump shall be supplied with double check valve assembly and solenoid operated non-return valve.

4.3.1.8.6. In order to stop reverse flow of oil in case of power failure. the pumping system shall preferably be self-priming type alternatively priming device with safety interlock to protect pump against dry running shall be provided.

4.3.1.8.7. An interlock logic arrangement shall be provided between low level float switch (located in degassing column) and discharge pump to prevent dry running.

4.3.1.8.8. Sampling valves shall be provided at the discharge of extraction pump for testing of oil properties

4.3.1.8.9. Re-circulation line with valves shall be provided to re-circulate a part of the purified oil to the inlet point if necessary during operation

4.3.1.8.10. The pump motor shall have insulation class-F with IP-54 or better protection

4.3.2. **REGENERATION UNIT MAIN COMPONENTS**

4.3.2.1. **FULLER'S EARTH COLUMN**

4.3.2.1.1. A set of mild steel columns shall be filled with a special blend of structured Activated Fuller's Earth Clay packing.

4.3.2.1.2. Shall have a filtering layer preventing column screen from clogging, and reactivation controlling temperature sensors.

4.3.2.1.3. The number of columns shall be dependent on the flow rate of the system and on the length of oil processing time (ie. before reactivation of clay is required) desired by the operator.

4.3.2.2. **OIL STORAGE TANKS: 2NOS**

4.3.2.2.1. Rectangular steel tanks of adequate capacity shall be employed for intermediate storage of oil during system operation and media reactivation.

4.3.2.3. **SCRUBBER:**

4.3.2.3.1. The system shall include a gas purification system to ensure that no environmental air contamination or noxious odors are generated during the regeneration process.

4.3.2.3.2. Purification system shall employ air coolers and an activated carbon scrubber, which is considered a consumable element.

4.3.2.4. **REACTIVATION BLOWER:**

4.3.2.4.1. A Roots blower shall be equipped for the reactivation process, coupled to a TEFC (Totally Enclosed Fan-Cooled) motor.

4.3.2.5. **MONO-BLOCK PUMP**

4.3.2.5.1. Shall be provided for cooling the exhaust gas

4.3.2.5.2. **NOICE SILENCER**

4.3.2.5.2.1. Steel vessel with sound insulation shall be installed to reduce noise produced by vacuum system

4.3.2.5.3. **FINE FILTER**

4.3.2.5.3.1. Fine filter shall be installed in a steel vessel with nominal filtration fineness of 0.2 micron.

4.3.2.5.4. **VACUUM PUMP**

4.3.2.5.4.1. Rotary vane vacuum pump shall be used for reactivation of sorbent

4.3.3. **INSTRUMENTATION AND CONTROL**

4.3.3.1. Following minimum instruments shall be provided on the purification plant

a) Compound gauge at oil pump discharge.
b) Compound gauge at filter inlet.
c) Compound gauge at filter outlet.
d) Pressure gauge at discharge pump outlet.
e) Pressure gauge at degassifier
f) Vacuum gauge in between roots vacuum Mcleod Vacuum Gauge at degasser and Sight glass as degassifier.
g) Temperature indicator (Dial type) at heater
h) Temperature indicator (Dial type) at heat
i) Voltmeter.
j) Oil flow meter (positive displacement typ
k) Ammeter.

4.3.3.2. A centralized electrical panel with auxiliary step down transformer, contactors, back up protection fuses, indicating lamps etc. to be provided with following minimum audio and visual alarms:

a) High temperature at heater outlet
b) High differential pressure across filters
c) Oil pump trip
d) Vacuum pump trip

e) Loss of vacuum in degassing chamber

f) Loss of vacuum in transformer evacuation line

g) No oil flow through heater

h) High oil level in degasser.

4.3.3.3. All controls and annunciation equipment shall be suitable for 240 V AC

4.3.3.4. Suitable interlock as described against each equipment shall be provided for safe and trouble free operation.

4.3.3.5. All instrument control hardware and alarms shall be mounted on a suitable control panel.

4.3.3.6. Amimic diagram with indication lamps showing on off status of various equipment shall be provided on the control panel.

4.3.3.7. The control panel shall feature a PLC Based system for automation provided with suitable switchgears

4.3.3.8. In conjunction with the PLC, a 15" color HMI touch screen panel (brand and models are subject to change) (Noted as Option HMI/1) shall be mounted on the main control panel.

4.3.3.9. The HMI shall be linked to laptop to have control and monitoring of the system operations .

4.3.3.10. The HMI shall provide a very detailed flow diagram to be shown and allows for maximum feedback and interface for the operator.

4.3.3.11. All operating controls shall be located on the flow diagram with appropriate identification and major function are controlled and adjusted by the touch of the screen/mouse.

4.3.3.12. Data logging shall be provided on the HMI and also via CSV files for downloading to a laptop.

4.3.4. HOSES FOR TRANSFORMER OIL AND VACUUMING

4.3.4.1. Reinforced rubber hoses shall be provided for each operation of oil suction and Oil discharge

4.3.4.2. Four pieces of oil hose of nitrile rubber reinforced with amour 1.5 inch internal diameter.Each piece shall be 15 meters long and shall be with leakage-proof, quick connect couplers for connection to installations under operation.

4.3.4.3. Hose pipes for oil service shall be suitable for transformer oil applicable up to temperature of 100°C. full vacuum and pressure up to 2.5 kg/cm^2 or 245.2kPa.

4.3.4.4. All oil hoses shall be built up around an earthed core or have built in earthed conductor to avoid static electricity accumulation.

4.3.4.5. Suitable mobile hose racks shall be provided to accommodate the hoses. All pipes fittings and hoses shall be properly labelled and distinctively marked

4.3.5. **ELECTRICAL SYSTEM**

4.3.5.1. The plant shall receive 415v, 3-phase, 50Hz, 4 wire power supply through flexible cable in the cable in the distribution panel location on the plant. The incoming of the distribution panel shall be switch fuse unit.

4.3.5.2. One length of 20 meters of oil resistant cable with crimped lugs at one end shall be provided for connection of the unit to mains.

4.3.5.3. The length of the cable will be covered in a suitable drum.

4.3.5.4. Provision for earthing the plant at the operating locations with earthing terminals for safety shall be provided.

4.3.5.5. The plant shall be suitably illuminated and ventilated for comfort of operator

4.4. DRAWINGS, DOCUMENTATION AND SUPPORT

4.4.1. Warranty and training

4.4.1.1. The Transformer oil regeneration plant. shall be backed by a minimum of 12-months factory warranty.

4.4.1.2. The Bidder shall submit a clause by clause statement of compliance with the specifications together with copies of the manufacturer's catalogues, brochures and technical clearly marked to support each clause, all in English for evaluation. The manufacturer's type reference/designation of the item offered shall be indicated

4.4.1.3. In the case of tender award, technical details for the Transformer oil regeneration plant. shall be submitted to the Kenya Power for approval before manufacture commences. The tenderer shall submit all the drawings as following

a) Schematic drawings of the plant with all piping systems, control systems and instrumentation with reference of the relevant international standards followed for the design and construction of the plant and its components/material

b) General arrangement plan, section of main and sub-assembles, with detailed dimensions of the pants and the size of each and every part of the equipment to be supplied under this specification

c) Complete list of accessories and auxiliaries with their make and accompanied with catalogue/pamphlets/literature/write-ups

5. MARKING, LABELLING AND PACKING

5.1. MARKING

5.1.1. The following information shall be marked legibly and in a permanent manner on the Transformer oil regeneration plant. :

a) The manufacturer's name or trade mark;

b) Type, model and serial number;

c) Nominal input voltage and Frequency

d) Individual loads ratings e.g Pumps, motors and heaters

e) Total Power (kW) Consumption

f) Vacuum pump sunction capacity and ultimate vacuum level

g) Flow diagram from inlet to outlet connection

h) Letters "PROPERTY OF KENYA POWER"

i) The instructions for handling and use (in the English Language).

5.2. PACKING

5.2.1. The Transformer oil regeneration plant. shall be packed in a carrying case so as to protect it from damage during transportation, handling and storage.

APPENDICIES

A: TESTS AND INSPECTION (Normative)

A.1 Transformer oil regeneration plant. shall be inspected and tested in accordance with the requirements of 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.

A.2 Transformer oil regeneration plant. shall be subject to acceptance tests at the manufacturer's works before dispatch. Acceptance tests shall be witnessed by Three Engineers appointed by KPLC and shall include the following

a) General construction inspection i.e. visual, dimensional and material
b) Operational test of the plant
c) Test for Breakdown voltage, moisture and gas content of oil (before & after purification).
d) Plant capacity test for flow rate
e) Test for electrical check i.e. Insulation Resistance and High Voltage test of Control panel
f) Heater consumption on full load
g) Tests certificates for suction & discharge heads of pumps shall be supplied
h) Tests for checking correctness of all circuits, interlocks and sequence of operation.
i) Leak rate test of Transformer evacuation system and of complete plant
j) Control Panel check
k) Any other test which is required to ensure satisfactory operation of the plant shall be performed by the supplier free of cost.

A.3 On receipt of the Transformer oil regeneration plant. , Kenya Power 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 without charge to Kenya Power, any Transformer oil

regeneration plant. which upon examination, test or use fail to meet any or all of the requirements in the specification.

B: QUALITY MANAGEMENT SYSTEM (Normative)

B.1 The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the Transformer oil regeneration plant. physical properties, tests and documentation, will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001: 2015.

B.2 The Manufacturer's Declaration of Conformity to applicable 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.

B.3 The bidder shall indicate the delivery time of the equipment, manufacturer's monthly & annual production capacity and experience in the production of the Transformer oil regeneration plant. being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar type of the Transformer oil regeneration plant. 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.

C: DOCUMENTATION AND DEMONSTRATION (Normative)

C.1 The bidder shall submit its tender complete with technical documents 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 (GTP) signed by the manufacturer;
b) Copies of the Manufacturer's catalogues, brochures, drawings giving all relevant dimensions, Flow/Schematic Diagram and technical data;
c) Sales records for the last five years and at least four customer reference letters;
d) Details of manufacturing capacity and the manufacturer's experience;

e) Manufacturers letter of authorization, ISO 9001 certificate, and other technical documents required in the tender.
f) Manufacturer's warranty and guarantee; subject to 12 months from date of delivery to KPLC stores
g) Operational manual.
h) Service manual.

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

a) Fully filled clause by clause guaranteed technical particulars (GTP) stamped and signed by the manufacturer.
b) Drawings of the Transformer oil regeneration plant. to be manufactured for KPLC.
c) Schematic drawings of the plant with all piping systems,control systems and instrumentation with reference of the relevant international standards followed for the design and construction of the plant and its components/material
d) General arrangement plan, section of main and sub-assemblies, with detailed dimensions of the pants and the size of each and every part of the equipment to be supplied under this specification
e) Complete list of accessories and auxiliaries with their make and accompanied with catalogue/pamphlets/literature/write-ups
f) Product manuals, operation manuals and brochures,
g) Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001.
h) All documentation necessary for safety of the plant.
i) Packaging details (including packaging materials).

C.3. The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the the Transformer oil regeneration plant. to KPLC.

C.4. The successful bidder shall demonstrate to KPLC Staff (in Mombasa -Mbaraki) the operation of the Transformer oil regeneration plant.

D: ACCESSORIES (MANDATORY)

The following spares and accessories shall be part of the bid

1) Pre-filter Cartridges/elements,10 sets
2) After-Filter Cartridges/elements,10 sets
3) Fine filter element for regeneration system, 10 sets
4) Heater elements,2 sets
5) Heater contactor 2 sets
6) Inlet Pump Motor contactor, two sets
7) discharge Pump Motor contactor, two sets
8) Blower Motor contactor, two sets
9) Set of pressure, compound and Vacuum gauges
10) Vacuum pump oil 200 litres

Bidder to indicate any other accessories and spares to be supplied and quote the price of each separately

E: GUARANTEED TECHNICAL PARTICULARS (Normative)

To be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, four customer reference letters, details of suppliers' capacity and experience; and copies of complete type test certificates and test reports for tender evaluation, all in English Language)

Tender No. .....

Bidder's name and Address.....

Clause number	Requirement	Bidder's offer
Manufacturer's Name and address		State
Country of Manufacture		State
Name and model Number		State
1	Scope	State
2	Normative References	State
3	Definitions and Abbreviations	
3.1.	Abbreviations	State
4.1.	SERVICE CONDITIONS	
4.1.1	suitable for use outdoors in tropical areas and harsh climatic conditions	
a)	Altitudes	State
b)	Humidity	State
c)	Average ambient temperature	State
4.2.	**DESIGN, CONSTRUCTION AND OPERATION**	
4.2.1.	**Design**	
4.2.1.1.	The Transformer oil regeneration plant rated for continuous operation.	State
4.2.1.2.	The transformer oil regeneration plant designed for regenerating 1000 liters per day	State design capacity per day

Clause number	Requirement	Bidder's offer
4.2.1.3.	The Transformer oil regeneration plant capable of doing the following functions:	
a)	Filter, heat, dehumidify and degas the oil at a vacuum level sufficient to condition the oil for the required parameters to the values	State
b)	Pump the oil from one tank to another by by-passing to purification process, if required	State
c)	completely regenerate transformer insulating oils	State
4.2.1.4.	The plant capable of processing the oil on single pass basis at rated flow to the following specification	
a.	Moisture content : Less than 5 PPM	State
b.	Gas content: Less than 0.1% by volume	State
c.	Dielectric strength 70 kV across 2.5 mmgap	State
d.	Filtration: Less than 0.2 micron	State
e.	Power factor Tan Delta at 90 °C: 0.002	State
4.2.1.5.	The Plant suitable for treating transformer oil by first heating it and then passing it through specially designed filter vessel. Oil is then pumped into regeneration unit and back to degasser for moisture and dissolved gasses removal. The set is designed for high vacuum and low temperature of oil for achieving the required results	State
4.2.1.6.	Plant's design include Fuller's Earth reactivation insitu for continuous reuse of Fuller's Earth. Oil processing or reactivation is carried out in all columns.	State
4.2.1.7.	Reactivation of the Fuller's Earth, is fully automated and enables the plant to process oil again and again, using the same Fuller's Earth. Fuller's earth shall not need to be removed from the for a period of up to two years. When finally removed (as dry, neutral sand) it shall be used for building materials or similar.	State
4.2.1.8.	The plant is suitable for operation on 50Hz, 3 phase system with neutral solidly grounded, the 3-phase voltage supply shall be 415 V + 10%. The plant shall be of latest design, sturdy in construction and requiring minimum maintenance.	State
4.2.2.	**Construction**	

Clause number	Requirement	Bidder's offer
4.2.2.1.	The Plant is suitable for outdoor use. All components including control panel have outdoor weather protected enclosures of sheet metal. The casing is provided with large doors for easy access to the various components	State
4.2.2.2.	Locking of the casing doors is provided with latching from inside wherever possible. Good locking arrangement for main entry door and also on the doors wherever inside latching is not possible shall also be provided.	State
4.2.2.3.	All plant components degassing and regeneration are mounted on a common base frame, including a11 necessary piping for oil and vacuum as well as electrical wiring	State
4.2.2.4.	All bought out components be of reputed makes. Manufacturer's test reports for pumps and motors will be supplied	Provide list of components and their manufacturer's. Provide test reports
4.2.2.5.	The plant shall have vacuuming and regeneration system suitably designed for carrying out degassing and regeneration functions.	State
4.2.2.6.	Sampling valves in the inlet and outlet pipes of filter press provided	Provide
4.2.2.7.	Flow meter with totalizer in the outlet pipe of filter press provided	Provide
4.2.2.8.	One moisture sensor in the outlet pipe of filter press provided	Provide
4.2.2.9.	Arrangement for reflushing of part of filtered oil and degassed oil provided.	State
4.2.2.10.	A valve for draining the oil each from the heater tank, edge filter, filter press provided	State
4.2.2.11.	Oil heater, filter vessel, degasser is of mild steel construction. The internal and external surface including oil heater, filter vessel, degassifier, regeneration columns and structural steel work painted and shot or sand blasted to remove all rust and scale of foreign adhering matter or grease. All steel surface in contact with insulating oil painted with two coats of heat resistant oil insoluble, insulating vanish/paint	State

Clause number	Requirement	Bidder's offer
4.2.2.12.	All internal painted steel surface given a primary coat for zinc chromate second coat of oil and weather resistant varnish of a colour distinct from primary and final two coats of glossy oil and weather resisting paint	State
4.2.2.13.	All paints selected to withstand heat and extremes of weather. The paint does not scale off or crinkle or be remove by abrasion due to normal handling	State
4.2.2.14.	The machine external overall dimensions shall be submitted for this tender.	Provide and attach drawing
4.2.2.15.	Lifting Hooks for Plant shall be provided to facilitate ease of Plant Loading / Unloading	Provide and attach drawing
4.2.2.16.	Transformer oil regeneration plant fitted with suitable dampers to withstand shocks and vibration during operation and transportation on top of a truck/lorry	State
4.2.2.17.	Scheme drawings for Transformer oil regeneration plant. offered and Flow diagram of oil filtration and regeneration, pumps and motors shall be submitted with tender, clearly detailing important dimensions, any special features of the offered design, components, accessories and fittings.	Submit
4.2.2.18.	Complete list of components, instruments and accessories offered with their make and accompanied with catalogue/brochure/pamphlets/literature/write-ups shall be submitted with the tender.	Submit
4.2.3.	**Operation**	
4.2.3.1.	Operation sequence and dangers sign plates	Provide
4.2.3.2.	The plant oil regeneration and degassing vacuum pressure	State
4.2.3.3.	Oil taken in through inlet valve	State
4.2.3.4.	An inlet pump circulate the oil through the heater where the oil temperature shall be raised up to 70°C.	State
4.2.3.5.	A pre filter size to remove major portion of coarse dirt	State
4.2.3.6.	Oil pumped into regeneration unit and back to degasser for moisture and dissolved gasses removal as per the figure below	State

Clause number	Requirement	Bidder's offer
4.2.3.7.	Vacuum chamber contain permanent dispersion media (PDM), a cylindrical type element. The oil flow through the pores of the PDM into shower in order to ensure more exposure of vacuum to the oil particles. This process, boil off dissolved water and gases effectively	State
4.2.3.8.	Dehydrated oil collected at the bottom of the vacuum chamber and pumped through the fine filter (0.5 micron) to the outlet valve	specify
4.2.3.9.	At the beginning of the process outlet valve closed and the oil circulate through a by-pass valve. This make the system stable	State
4.2.3.10.	The reactivation phase take approximately 10 to 14 hours and upon its completion, the re-circulation of oil re-initiated by pressing a single function key.	specify
4.2.3.11.	After sufficient re-circulation, the system ready to automatically engage back into a Regeneration operating condition.	State
4.3.	**TECHNICAL PARTICULARS**	
4.3.1.	**DEGASSING UNIT MAIN COMPONENTS**	
4.3.1.1.	**OIL PUMP (INLET PUMP)**	
4.3.1.1.1.	The pump be single stage positive displacement gear type.	State
4.3.1.1.2.	The pump motor have insulation class-F with IP-54 or better protection.	state
4.3.1.1.3.	Suitable mechanical seals provided to ensure vacuum tightness.	state
4.3.1.1.4.	A built in pressure relief valve to re-circulate the oil to suction side in case of accidental pressure rise provided.	state
4.3.1.1.5.	Suction lift of the pump at least 5 meters at atmospheric pressure and temperature.	state
4.3.1.1.6.	A separate bypass valve provided across the gear pump so that the flow rate through the filter can be adjusted as required.	state

Clause number	Requirement	Bidder's offer
4.3.1.1.7.	The pumps provided with an interlock with delay such that if there is no oil flow for 30 sec. through the heater, the pump trip automatically and also if the pump is not operating the heater will not be energized	state
4.3.1.1.8.	The following oil inlet pump details shall be provided	
a)	Pump Make	state
b)	Pump Type	state
c)	Pump Capacity	state
d)	Motor make and type	state
e)	Motor Rating	state
f)	Motor type of starter	state
4.3.1.2.	**MAGNETIC STRAINER**	
4.3.1.2.1.	The plant provided with a suitable magnetic strainer with wire mesh to filter all particles of sizes above 0.5 mm and all magnetic particles.	state
4.3.1.2.2.	The strainer shall be at the suction of the oil pump described at 4.3.1	state
4.3.1.3.	**HEATERS**	
4.3.1.3.1.	The oil heater vessel be of mild steel welded construction and insulated with glass/mineral wool.	State
4.3.1.3.2.	The heating elements divided into three banks, each individually controlled by a separate thermostat. For the required oil condition temperature of 70°C these thermostat are set at 50°C, 60°C and 70°C	State
4.3.1.3.3.	Selector switch provided for full load operation of heaters depending upon the desirable temperature of oil.	State
4.3.1.3.4.	Heaters capable of heating oil up to 80°C. The recommended operating temperature of oil is 60 to 70°C.	State
4.3.1.3.5.	The heater capacity sufficient to heat up the oil from the ambient temperature to the required operating temperature by indirect heating	State
4.3.1.3.6.	Heater control bank controlled by temperature controller housed on a control panel for easy observation and re-adjustment.	State

Clause number	Requirement	Bidder's offer
4.3.1.3.7.	Selector switch provided for full load operation of heaters depending upon the desirable temperature of oil.	State
4.3.1.3.8.	Heaters interlocked with inlet pump and not be in "ON position" unless the inlet pump is working.	State
4.3.1.3.9.	One suitable pressure relief valve shall be fixed on the heater chamber to prevent any pressure rise above the acceptable limit.	State
4.3.1.3.10.	A drain point shall be provided for the heater tank.	State
4.3.1.4.	**After FILTER (After degassing stage)**	
4.3.1.4.1.	Cartridge filter provided to ensure maximum particle size to less than 0.5 micron in the filtered oil.	State
4.3.1.4.2.	The filter body fabricated of mild steel and designed for leak tightness at full vacuum and high pressure.	State
4.3.1.4.3.	The oil will flow from dirty oil chamber to clean oil chamber through filter elements.	State
4.3.1.4.4.	Cartridge type element used ,suitable for transformer oil in service and submicronic filtration. The media non-hygroscopic and of high dirt holding capacity.	State
4.3.1.4.5.	The filter elements easily removable for replacement when required.	State
4.3.1.4.6.	Compound gauge to indicate pressure across the filter vent and drain with valves and other necessary accessories mounted on the filter for each operation	State
4.3.1.5.	**Pre FILTER PRESS (Before degassing chamber)**	
4.3.1.5.1.	For treating dirty oil, filter press of adequate rating supplied for supplementing the capacity of filter elements.	State
4.3.1.5.2.	These units designed for quick and easy replacement of media.	State
4.3.1.5.3.	A sludge outlet for receiving the solid impurities and cleaning the filter plate without opening the unit provided.	State
4.3.1.5.4.	The unit provided with vent and drain valves, pressure gauge at inlet and outlet and other necessary accessories.	State
4.3.1.5.5.	The pre filter of 10 micron to remove major portion of coarse dirt.	State

Clause number	Requirement	Bidder's offer
4.3.1.6.	**DEGASSING CHAMBER**	
4.3.1.6.1.	The degassing chamber of welded construction and suitable for operation under full vacuum. The fill of "rasig" Rings and trays for distribution shall be designed for efficient distribution of oil over large areas.	State
4.3.1.6.2.	Incoming transformer oil should be spread over these rings in the form of film and a longer surface area, thus achieving better degassing and dehumidification.	State
4.3.1.6.3.	The degassing chamber suitable for ensuring the desired oil properties.	State
4.3.1.6.4.	Arrangement for condensing back lighter fraction (Aromatics) of the insulating oil into the system shall be provided.	State
4.3.1.6.5.	The degassing channels have adequate height to allow long enough free fall for complete degassing.	State
4.3.1.6.6.	Design minimize foam formation	State
4.3.1.6.7.	The degassing chambers provided with suitable level monitor for oil or foam level in the chamber and trip the inlet pump when the level rises above the designed maximum level in order to prevent foam to enter the vacuum pumping system.	State
4.3.1.6.8.	The oil inlet pump starts again automatically once the oil level in the degassing chamber falls below the present oil level	State
4.3.1.6.9.	Necessary illuminated sight glass provided through which oil flow through the degasser can be viewed clearly	State
4.3.1.6.10.	The degasser provided with vacuum gauges, vacuum breaking valves, main and auxiliary vacuum connections and other necessary accessories	State
4.3.1.7.	**VACUUM PUMPING SYSTEM FOR OIL FILTRATION**	
4.3.1.7.1.	The pump with a suitable vacuum pumping system for creating adequate high vacuum in the degassing chamber.	State
4.3.1.7.2.	The pumping system consist of suitable combination of Roots Blower and Rotary vane vacuum pumps with inter stage condensing units.	State
4.3.1.7.3.	The pump motor insulation class-F with IP-54 or better protection	State

Clause number	Requirement	Bidder's offer
4.3.1.7.4.	The Roots blower reputed make. Suitable built in labyrinth packing system, slinger rings, oil return chamber shall be provided between bearings and working chamber to prevent penetration of lubricating oil to the working chamber.	State
4.3.1.7.5.	The pumps motor dynamically balanced. The pumps suitable for starting evacuation form atmospheric pressure and applied with necessary over flow valve.	State
4.3.1.7.6.	The rotary vane vacuum pumps installed after the roots blower.	State
4.3.1.7.7.	An automatic by pass valve across the roots blowers permit operation of rotary vane pump alone to operate when so required.	State
4.3.1.7.8.	The rotary vane pump provided with gas ballast valve to prevent contamination of vacuum pump oil with moisture.	State
4.3.1.7.9.	The vacuum pump provided with suitable non-return valve device such that in the event of power failure, the vacuum in the degassing chamber shall be maintained and the vacuum pump oil is not sucked back into the degassing chamber.	State
4.3.1.7.10.	A high vacuum safety valve (piston type) to prevent back streaming of oil and air intrusion provided. The pump motors have return stop device.	State
4.3.1.7.11.	Rotary vane vacuum pump have ultimate capability of 0.5 mbar	Specify
4.3.1.7.12.	Roots blower have ultimate capability of 0.01 mbar	State
4.3.1.8.	**OIL EXTRACTION PUMP**	
4.3.1.8.1.	Suitable pumping system provided for extracting oil from degasser under vacuum and supplying to transformer oil tank.	State
4.3.1.8.2.	The pump either glandless centrifugal type with canned motors or a combination of gear pump and centrifugal pump with mechanical seals suitable for extracting oil from high vacuum degassing chamber.	State
4.3.1.8.3.	The discharge pump able to deliver the oil at its rated capacity of the machine under full vacuum condition of the degassing chamber with adequate head of 15 meters of water column	State
4.3.1.8.4.	The oil extraction pump located at a suitable level below the degasser chamber to ensure adequate suction head for the pump.	State

Clause number	Requirement	Bidder's offer
4.3.1.8.5.	The pump supplied with double check valve assembly and solenoid operated non-return valve.	State
4.3.1.8.6.	In order to stop reverse flow of oil in case of power failure, the pumping system preferably be self-priming type alternatively priming device with safety interlock to protect pump against dry running be provided.	State
4.3.1.8.7.	An interlock logic arrangement provided between low level float switch (located in degassing column) and discharge pump to prevent dry running.	State
4.3.1.8.8.	Sampling valves provided at the discharge of extraction pump for testing of oil properties	State
4.3.1.8.9.	Re-circulation line with valves provided to re-circulate a part of the purified oil to the inlet point if necessary during operation	State
4.3.1.8.10.	The pump motor shall have insulation class-F with IP-54 or better protection	State
4.3.2.	**REGENERATION UNIT MAIN COMPONENTS**	
4.3.2.1.	**FULLER'S EARTH COLUMN**	
4.3.2.1.1.	A set of mild steel columns e filled with a special blend of structured Activated Fuller's Earth Clay packing.	State
4.3.2.1.2.	Have a filtering layer preventing column screen from clogging, and reactivation controlling temperature sensors.	State
4.3.2.1.3.	The number of columns dependent on the flow rate of the system and on the length of oil processing time (ie. before reactivation of clay is required) desired by the operator.	State no of columns
4.3.2.2.	**OIL STORAGE TANKS: 2NOS**	
4.3.2.2.1.	Rectangular steel tanks of adequate capacity e employed for intermediate storage of oil during system operation and media reactivation.	State
4.3.2.3.	**SCRUBBER:**	
4.3.2.3.1.	The system include a gas purification system to ensure that no environmental air contamination or noxious odors are generated during the regeneration process.	State
4.3.2.3.2.	Purification system employ air coolers and an activated carbon scrubber, which is considered a consumable element.	State

Clause number	Requirement	Bidder's offer
4.3.2.4.	**REACTIVATION BLOWER:**	
4.3.2.4.1.	A Roots blower equipped for the reactivation process, coupled to a TEFC (Totally Enclosed Fan-Cooled) motor.	State
4.3.2.5.	**MONO-BLOCK PUMP**	
4.3.2.5.1.	Provided for cooling the exhaust gas	State
4.3.2.5.2.	**NOICE SILENCER**	
4.3.2.5.2.1.	Steel vessel with sound insulation installed to reduce noise produced by vacuum system	State
4.3.2.5.3.	**FINE FILTER**	
4.3.2.5.3.1.	Fine filter installed in a steel vessel with nominal filtration fineness of 0.2 micron.	State
4.3.2.5.4.	**VACUUM PUMP**	
4.3.2.5.4.1.	Rotary vane vacuum pump shall be used for reactivation of sorbent	State
4.3.3.	**INSTRUMENTATION AND CONTROL**	
4.3.3.1.	Following minimum instruments shall be provided on the purification plant	
a)	Compound gauge at oil pump discharge.	State
b)	Compound gauge at filter inlet.	State
c)	Compound gauge at filter outlet.	State
d)	Pressure gauge at discharge pump outlet.	State
e)	Pressure gauge at degassifier	State
f)	Vacuum gauge in between roots vacuum Mcleod Vacuum Gauge at degasser and Sight glass as degassifier.	State
g)	Temperature indicator (Dial type) at heater	State
h)	Temperature indicator (Dial type) at heat	State
i)	Voltmeter.	State
j)	Oil flow meter (positive displacement typ	State
k)	Ammeter.	State
4.3.3.2.	A centralized electrical panel with auxiliary step down transformer, contactors, back up protection fuses, indicating lamps etc. to be provided with following minimum audio and visual alarms:	

Clause number	Requirement	Bidder's offer
a)	High temperature at heater outlet	State
b)	High differential pressure across filters	State
c)	Oil pump trip	State
d)	Vacuum pump trip	State
e)	Loss of vacuum in degassing chamber	State
f)	Loss of vacuum in transformer evacuation line	State
g)	No oil flow through heater	State
h)	High oil level in degasser.	State
4.3.3.3.	All controls and annunciation equipment shall be suitable for 240 V AC	State
4.3.3.4.	Suitable interlock as described against each equipment shall be provided for safe and trouble free operation.	State
4.3.3.5.	All instrument control hardware and alarms shall be mounted on a suitable control panel.	State
4.3.3.6.	Amimic diagram with indication lamps showing on off status of various equipment shall be provided on the control panel.	State
4.3.3.7.	The control panel shall feature a PLC Based system for automation provided with suitable switchgears	State
4.3.3.8.	In conjunction with the PLC, a 15" color HMI touch screen panel (brand and models are subject to change) (Noted as Option HMI/1) shall be mounted on the main control panel.	State
4.3.3.9.	The HMI shall be linked to laptop to have control and monitoring of the system operations .	State
4.3.3.10.	The HMI shall provide a very detailed flow diagram to be shown and allows for maximum feedback and interface for the operator.	State
4.3.3.11.	All operating controls shall be located on the flow diagram with appropriate identification and major function are controlled and adjusted by the touch of the screen/mouse.	State
4.3.3.12.	Data logging shall be provided on the HMI and also via CSV files for downloading to a laptop.	State
4.3.4.	**HOSES FOR TRANSFORMER OIL AND VACUUMING**	
4.3.4.1.	Reinforced rubber hoses provided for each operation of oil suction and Oil discharge	State

Clause number	Requirement	Bidder's offer
4.3.4.2.	Four pieces of oil hose of nitrile rubber reinforced with amour 1.5 inch internal diameter.Each piece shall be 15 meters long andwith leakage-proof, quick connect couplers for connection to installations under operation.	State
4.3.4.3.	Hose pipes for oil service shall be suitable for transformer oil applicable up to temperature of 100°C. full vacuum and pressure up to 2.5 kg/cm2 or 245.2kPa.	State
4.3.4.4.	All oil hoses shall be built up around an earthed core or have built in earthed conductor to avoid static electricity accumulation.	State
4.3.4.5.	Suitable mobile hose racks provided to accommodate the hoses. All pipes fittings and ho.ses shall be properly labelled and distinctively marked	State
4.3.5.	**ELECTRICAL SYSTEM**	
4.3.5.1.	The plant shall receive 415v, 3-phase, 50Hz, 4 wire power supply through flexible cable in the cable in the distribution panel location on the plant. The incoming of the distribution panel shall be switch fuse unit.	State
4.3.5.2.	One length of 20 meters of oil resistant cable with crimped lugs at one end shall be provided for connection of the unit to mains.	State
4.3.5.3.	The length of the cable will be covered in a suitable drum.	State
4.3.5.4.	Provision for earthing the plant at the operating locations with earthing terminals for safety shall be provided.	State
4.3.5.5.	The plant shall be suitably illuminated and ventilated for comfort of operator	State
4.4.	**DRAWINGS, DOCUMENTATION AND SUPPORT**	
4.4.1.	**Warranty and training**	
4.4.1.1.	The Transformer oil regeneration plant backed by a minimum of 12-months factory warranty.	State

Clause number	Requirement	Bidder's offer
4.4.1.2.	The Bidder submit a clause by clause statement of compliance with the specifications together with copies of the manufacturer's catalogues, brochures and technical clearly marked to support each clause, all in English for evaluation. The manufacturer's type reference/designation of the item offered shall be indicated	State
4.4.1.3.	In the case of tender award, technical details for the Transformer oil regeneration plant. shall be submitted to the Kenya Power for approval before manufacture commences. The tenderer shall submit all the drawings as following	
a)	Schematic drawings of the plant with all piping systems, control systems and instrumentation with reference of the relevant international standards followed for the design and construction of the plant and its components/material	State
b)	General arrangement plan, section of main and sub-assembles, with detailed dimensions of the pants and the size of each and every part of the equipment to be supplied under this specification	State
c)	Complete list of accessories and auxiliaries with their make and accompanied with catalogue/pamphlets/literature/write-ups	State
5	**MARKING, LABELLING AND PACKING**	
5.1.	**MARKING**	
5.1.1.	The following information shall be marked legibly and in a permanent manner on the Transformer oil regeneration plant. :	
a)	The manufacturer's name or trade mark;	State
b)	Type, model and serial number;	State
c)	Nominal input voltage and Frequency	State
d)	Individual loads ratings e.g Pumps, motors and heaters	State
e)	Total Power (kW) Consumption	State
f)	Vacuum pump sunction capacity and ultimate vacuum level	State

Clause number	Requirement	Bidder's offer
g)	Flow diagram from inlet to outlet connection	State
h)	Letters "PROPERTY OF KENYA POWER"	State
i)	The instructions for handling and use (in the English Language).	State
5.2.	**PACKING**	
5.2.1.	The Transformer oil regeneration plant. shall be packed in a carrying case so as to protect it from damage during transportation, handling and storage.	State
APPENDICIES		
A:	**TESTS AND INSPECTION (Normative)**	
A.1	Transformer oil regeneration plant shall be inspected and tested in accordance with the requirements of 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.	State
A.2	Transformer oil regeneration plant subject to acceptance tests at the manufacturer's works before dispatch. Acceptance tests shall be witnessed by Three Engineers appointed by KPLC and shall include the following	
a)	General construction inspection i.e. visual, dimensional and material	State
b)	Operational test of the plant	State
c)	Test for Breakdown voltage, moisture and gas content of oil (before & after purification).	State
d)	Plant capacity test for flow rate	State
e)	Test for electrical check i.e. Insulation Resistance and High Voltage test of Control panel	State
f)	Heater consumption on full load	State
g)	Tests certificates for suction & discharge heads of pumps shall be supplied	State

Clause number	Requirement	Bidder's offer
h)	Tests for checking correctness of all circuits, interlocks and sequence of operation.	State
i)	Leak rate test of Transformer evacuation system and of complete plant	State
j)	Control Panel check	State
k)	Any other test which is required to ensure satisfactory operation of the plant shall be performed by the supplier free of cost.	State
A.3	On receipt of the Transformer oil regeneration plant. , Kenya Power 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 without charge to Kenya Power, any Transformer oil regeneration plant. which upon examination, test or use fail to meet any or all of the requirements in the specification.	State
B:	**QUALITY MANAGEMENT SYSTEM (Normative)**	
B.1	The supplier submit a quality assurance plan (QAP) that will be used to ensure that the Transformer oil regeneration plant. physical properties, tests and documentation, will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001: 2015.	Submit
B.2	The Manufacturer's Declaration of Conformity to applicable 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.	Submit
B.3	The bidder shall indicate the delivery time of the equipment, manufacturer's monthly & annual production capacity and experience in the production of the Transformer oil regeneration plant. being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar type of the Transformer oil regeneration plant. 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.	State
C:	DOCUMENTATION AND DEMONSTRATION (Normative)	

Clause number	Requirement	Bidder's offer
C.1	The bidder shall submit its tender complete with technical documents 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 (GTP) signed by the manufacturer;	Submit
b)	Copies of the Manufacturer's catalogues, brochures, drawings giving all relevant dimensions, Flow/Schematic Diagram and technical data;	Submit
c)	Sales records for the last five years and at least four customer reference letters;	Submit
d)	Details of manufacturing capacity and the manufacturer's experience;	Submit
e)	Manufacturers letter of authorization, ISO 9001 certificate, and other technical documents required in the tender.	Submit
f)	Manufacturer's warranty and guarantee; subject to 12 months from date of delivery to KPLC stores	Submit
g)	Operational manual.	Submit
h)	Service manual.	Submit
C.2	The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:	
a)	Fully filled clause by clause guaranteed technical particulars (GTP) stamped and signed by the manufacturer;	State
b)	Drawings of the Transformer oil regeneration plant. to be manufactured for KPLC.	State
c)	Schematic drawings of the plant with all piping systems,control systems and instrumentation with reference of the relevant international standards followed for the design and construction of the plant and its components/material	State
d)	General arrangement plan, section of main and sub-assembles, with detailed dimensions of the pants and the size of each and every part of the equipment to be supplied under this specification	State

Clause number	Requirement	Bidder's offer
e)	Complete list of accessories and auxiliaries with their make and accompanied with catalogue/pamphlets/literature/write-ups	State
f)	Product manuals, operation manuals and brochures,	State
g)	Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001.	State
h)	All documentation necessary for safety of the plant.	State
i)	Packaging details (including packaging materials).	State
C.3.	The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the the Transformer oil regeneration plant. to KPLC.	State
C.4.	The successful bidder shall demonstrate to KPLC Staff (in Mombasa) the operation of the Transformer oil regeneration plant.	State
D:	**ACCESSORIES (MANDATORY)**	
The following spares and accessories shall be part of the bid		
1)	Pre-filter Cartridges/elements,10 sets	State
2)	After-Filter Cartridges/elements,10 sets	State
3)	Fine filter element for regeneration system, 10 sets	State
4)	Heater elements,2 sets	State
5)	Heater contactor 2 sets	State

Clause number	Requirement	Bidder's offer
6)	Inlet Pump Motor contactor, two sets	State
7)	discharge Pump Motor contactor, two sets	State
8)	Blower Motor contactor, two sets	State
9)	Set of pressure, compound and Vacuum gauges	State
10)	Vacuum pump oil,200 litres	State
	Bidder to indicate any other accessories and spares to be supplied and quote the price of each separately	State

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Manufacturer's Name, Signature, Stamp and Date