

higher than the height of the transformer bushings above the top cover (for 33kV transformer).

- b) Oil level gauge; clearly readable by an operator standing at ground level at a distance of 5 meters away from the transformer mounting. The oil level gauge shall have maximum and minimum oil level markings which shall fall within range of the gauge. The nominal oil level shall be at the centre of the range. The oil level gauge shall be mounted on the side of the transformer for sealed type transformer and on the side of the conservator for the free breathing type transformer.
- c) Two earthing terminals (with cable lug) on the body of the transformer at the bottom diagonally opposite each other. Each terminal shall have two flat washers, one spring washer and lock nut, all in stainless steel. The earthing terminal lugs shall be in tinned copper and shall be suitable for 50mm<sup>2</sup> conductor.
- d) Separate lifting lugs for core, top cover and complete transformer (as per requirements given in this specification).
- e) Off-circuit tap changer; mounted as per this specification. The tap changer shall be rotary type, shall not allow water ingress or oil leakage and have mechanical interlock at each tap corresponding to each tap position. It shall have provision for padlock as per this specification.
- f) Tinned copper jumper of 25x1.2mm fixed between tank and top cover with stainless steel bolt.
- g) Rating and diagram plate (as per IEC 60076 and this specification)
- h) Clamp connectors (as per requirements given in this specification).
- i) Thermometer pocket to be used during temperature rise test.
- j) Jacking lugs
- k) Combined drain plug and sampling device.

All fittings and accessories shall be designed and secured in such a manner that makes it impossible for vandals to siphon oil from the transformer even after forceful breakage of the fitting/accessory. There shall be no oil leaks from the fittings and accessories.

Detailed drawings for the transformer (including internal details), fittings and accessories and showing features that make it impossible for vandals to siphon oil from the transformer even after forceful breakage of the fitting/accessory shall be submitted to KPLC for approval before manufacture.

#### 4.14. Transformer Oil

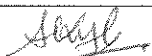
4.14.1 Cooling of the transformer shall be by natural circulation of oil and natural circulation of air (ONAN).

4.14.2 The transformer shall be supplied filled with new oil.

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TRANSFORMER Part 3:  
Ground Mounted Three Phase  
Oil Type Distribution  
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4.14.3 The oil shall be new, unused and shall comply with all the requirements of IEC 60296 (class 1: un-inhibited oil) and as per current KPLC Specification No. KP1/3CB/08/001.

#### 4.15. Quality Management System

4.15.1 The supplier 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 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 9001:2008.

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

4.15.3 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 together with four customer reference letters shall be submitted with the tender for evaluation.

### 5. TESTS AND INSPECTION

5.1 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.

5.2 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.

Copies of type test certificates and type test reports for the transformer offered to be submitted for tender evaluation shall include:

- Dielectric tests to IEC 60076 (Lightning Impulse Withstand Voltage Test).
- Short circuit withstand test to IEC 60076.

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- Temperature rise test to IEC 60076.

Type Test Reports for a transformer of identical or higher voltage and identical or higher KVA rating and within the range of 11/0.420kV – 36/0.420kV AND 500KVA- 2500KVA shall be accepted as representative for any of the pole mounted three phase distribution transformer on tender. The type test reports shall be for a transformer of the same core design and construction as the transformer being offered.

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

5.3 The transformer shall be subject to acceptance tests at the manufacturer's works before dispatch. Acceptance tests shall be witnessed by two Engineers appointed by KPLC and shall include the following:

**5.3.1 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
- Measurement of no-load loss and current
- Measurement of load loss (at normal & extreme taps)
- Tests on off-load tap-changer
- Any other test not listed above but specified by the latest edition of IEC 60076.

**5.3.2 Type Tests to IEC 60076 (to be done on one unit during acceptance testing at factory)**

- Temperature rise test – To be performed on one unit during acceptance testing.
- Lightning impulse withstand test – To be performed on one unit during acceptance testing.

**5.3.3 Additional tests (to be done on samples during acceptance testing at factory)**

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- Visual Inspection (verification of dimensions, fittings & accessories, markings & nameplates, paintwork, workmanship and finish)
- Acoustic and sound level
- Paint thickness
- Tank pressure test

5.3.4 Sampling for routine tests and additional tests shall be as per IEC 60410.

5.4 The manufacturer shall provide current e-mail address, fax and telephone numbers and contact person at the Testing Laboratory where the type tests were obtained.

5.5 Complete Test Reports for each transformer (including its individual components) shall be submitted to KPLC for approval before shipment.

5.6 On receipt of the transformers KPLC will inspect them before acceptance to stores and may perform or have performed any of the relevant tests (including verification of losses) in order to verify compliance with the specification. The supplier shall replace/rectify without charge to KPLC, transformers and components/fittings which upon examination, test or use fail to meet any of the requirements in the specification.

## 6. MARKING, LABELLING AND PACKING

6.1 The transformer and associated components shall be packed in a manner as to protect them from any damage in transportation and handling. The transformer shall first be mounted and bolted to wooden base blocks and then covered with a polythene cover. The transformer with the wooden base blocks shall then be secured tightly in the container to avoid transit movements.

6.2 The transformer shall be dispatched fully assembled and oil filled.

6.3 Each assembly & package of items associated with the transformer shall be suitably marked.

6.4 In addition to markings and labels required elsewhere in the specification, each transformer shall be provided with a rating and diagram 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 permanent.

6.5 In addition, the rating and diagram 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 6.4.

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## 7. DOCUMENTATION

7.1 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 fully filled and signed by the manufacturer;
- b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
- c) Sales records for previous five years and reference letters from at least four of the customers;
- 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 third party testing laboratory;
- g) Manufacturer's warranty and guarantee;
- h) Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2008 certificate and other technical documents required in the tender.

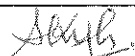
7.2 The successful bidder (supplier) shall submit the following documents/details (from the manufacturer as per tender) to The Kenya Power & Lighting Company for approval before manufacture:

- a) Guaranteed Technical Particulars fully filled and signed by the manufacturer;
- b) Design drawings & construction details of the transformer including 3-D views and as per the requirements of clause 4.2.17;
- c) 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 9001:2008;
- 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 regulations, standards and specification, ensure 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).

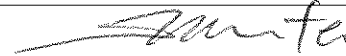
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## ANNEX A: SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR OFFERED TRANSFORMER

(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 for past five years, 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 third party testing laboratory for tender evaluation, all in English Language)

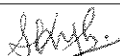
TENDER NO. ....BIDDER'S NAME & ADDRESS .....

Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>	BIDDER'S OFFER				
-	Name and address of the Manufacturer					
	Country of manufacture					
	Manufacturer's Letter of Authorization					
	Model/Type Reference No. of the offered transformer					
	Drawing Reference Number					
	Manufacturer's warranty and guarantee certificate for the offered transformer					
1.	Scope: a) Design, manufacture, test, ship and deliver ground mounted three phase distribution transformer to KPLC store/site as per specification and terms of contract. b) Ensure adequacy of the design, good workmanship, good engineering practice and adherence to standards, specifications and applicable regulations in the manufacture of the transformers for KPLC					
2	Applicable Standards					
3	Terms and Definitions					

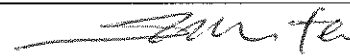
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Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>	BIDDER'S OFFER				
4.1.1	Operating Service Conditions: <i>indicate altitude, temperature range, humidity, pollution and isokeraunic level</i> )					
4.1.2.1 - 4.1.2.3	System Characteristics					
4.2	General Requirements	-	-	-	-	-
4.2.1	Outdoor, oil type, ONAN, core or shell type					
4.2.2	Design Service Life					
4.2.3	Two winding, three phase integral unit					
4.2.4	Types of transformers offered					
4.2.4.1	Hermetically sealed type each with bolted top cover and 100 mm gas cushion of dry air.					
4.2.4.2	Free breathing type, conservator with cobalt free dehydrating breather & oil gauge					
4.2.5	Design to facilitate operation, inspection, maintenance & repairs					
4.2.6	Safety & Regulatory Requirements					
4.2.7	All materials shall be new and of best quality and class					
4.2.8	Corresponding parts to be interchangeable					
4.2.9	Fittings & accessories secured from inside or have openings that do not allow oil siphoning					
4.2.10	No water pockets, rain water do not collect on top, cover with 10mm overlap to conceal gasket					
4.2.11	All connections & contacts of ample section and					

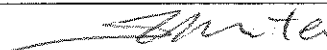
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Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>	BIDDER'S OFFER				
	surface for required currents					
4.2.12	Designed to minimize short circuits by birds & vermin					
4.2.13	Materials used do not lead to acidity in oil					
4.2.14	State value of maximum noise level (BS EN 50464-1)					
4.2.15	Suitable for ground with mounting, steel channel underbase					
4.2.16	Drawings of offered transformer					
	Overall dimensions of offered transformer (length, width & height) in mm					
4.2.17a) to g)	Design drawings for approval before manufacture					
4.3.1	KVA, no-load voltage ratings and frequency					
4.3.2 (a)	Temperature Rise	Top Oil				
		Windings				
4.3.2 (b)	Temperature Rise Test					
4.3.3	Fault level for 2 seconds					
4.3.4	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)					
	Value of symmetrical short-circuit current I as per clause 4.1.2 of IEC 60076-5					
	Duration of the symmetrical short-circuit current as per clause 4.1.3 of IEC 60076-5					
	Maximum permissible					

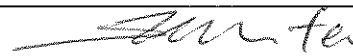
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Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>	BIDDER'S OFFER				
	values of the average temperature of each winding after short circuit as per clause 4.1.4 of IEC 60076-5					
	Short circuit current density (A/mm <sup>2</sup> ) HV winding					
	Short circuit current density (A/mm <sup>2</sup> ) LV winding					
	Average temperature $\theta_1$ attained by each winding after short circuit (calculation of temperature as per clause 4.1.5 of IEC 60076-5)					
	Overload capacity for 2 hours after continuous full load run (indicate clause & standard)					
4.3.5	Type test report for the ability of the offered transformer to withstand dynamic effects of short circuit					
4.4	Windings and connections	-	-	-	-	-
4.4.1	Vector group					
4.4.2	Voltage variations					
4.4.3	Insulating material shall not soften, ooze, shrink or collapse during service. The material shall be non-catalytic & chemically inert in transformer oil					
4.4.4	Primary windings					
	Secondary windings					
	Temperature class of insulation					
4.4.5	Separation of windings for cooling and ease of repair					
	Insulation sleeves					

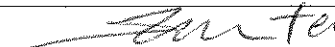
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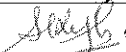
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Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>		BIDDER'S OFFER				
	Interlayer insulation						
4.4.6	Windings & connections braced?						
4.4.7	Drying in vacuum & impregnating with hot oil						
4.4.8	Material of spacer blocks						
4.4.9	All joints to be brazed/ crimped						
4.4.10	Active parts submerged in oil by at least 80mm from minimum oil level mark						
4.4.11	Stage inspection by Kenya Power						
4.4.12	Current density, A/mm <sup>2</sup>	HV winding					
		LV winding					
	Material of winding	HV winding					
		LV winding					
	Conductor area of winding mm <sup>2</sup>	HV winding					
		LV winding					
	Resistance at 20°C	HV winding					
		LV winding					
4.5	Tapping		-	-	-	-	-
4.5.1	Tapping range						
4.5.2	Tapping method and design (4.5.2.1 to 4.5.2.5)						
	Padlock facility						
4.6	Core and Flux Density		-	-	-	-	-
4.6.1	Grade of core steel						
	Thickness of each single lamination						
	Net core area, mm <sup>2</sup>						
	Number of turns on LV, per phase						
	Stack factor/Building factor						
	Weight of core, kg						
	Specific loss in watts/kg (at 1.6T flux density)						

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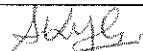
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Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>	BIDDER'S OFFER				
4.6.2	Static discharges & local heating					
4.6.3	Assembled core free from distortion					
4.6.4	Cooling for core					
4.6.5	Movement of core during transportation or in service					
4.6.6	Core clamping					
4.6.7	Lifting lugs for core, winding and complete transformer. Factor of safety at least 2.					
4.6.8	Oil pockets & trapping of air					
4.6.9	Insulation withstand of core to bolts and core to frame					
4.6.10	Effect of primary voltage variations on flux density					
4.6.11	Maximum flux density					
	Lowest limit of flux density					
4.6.12	Allowable maximum flux density	1 min				
		5 s				
4.6.13	Flux density at which core saturates					
4.6.14	Magnetization curve and design calculations					
4.7	Short-circuit Impedence, %					
	Resistance at 75°C of HV Winding in ohms (at normal & extreme taps)					
	Resistance at 75°C of LV Winding in ohms					
4.8.1	Minimum efficiency at 100% load (unity power factor), at 75°C					
4.8.2	Total losses (no-load + load losses) at 100% load					
4.8.3	No-load Losses at 75°C					
	Load Losses at 50% load,					

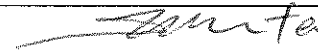
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	75°C					
	Load Losses at 75% load, 75°C					
	Load Losses at 100% load, 75°C					
	I <sup>2</sup> R component of load losses at 100% load, 75°C					
	Load Losses at 125% load, 75°C					
	Stray Losses at 50% load, 75% load, 100% load and 120% load, all at 75°C					
	No increase in no-load and load losses after award & during factory acceptance testing & during inspection/test before acceptance to stores					
4.9	Cable Boxes, Bushings and Clearances	-	-	-	-	-
4.9.1	Bushings	11/0.42kV				
		33/0.42kV				
4.9.2	Cable boxes					
4.9.2.1	Requirements applicable to both HV and LV cable boxes					
4.9.2.2	Requirements applicable to LV (0.42kV) cable boxes					
4.9.2.3	Requirements applicable to HV (11kV) cable boxes					
4.9.3	33kV Bushings					
4.9.4	Air clearances	-	-	-	-	-
4.9.4.1	Adequate to withstand impulse withstand test voltages					
4.9.4.2	Position of fittings & accessories not to interfere with external connection to bushing terminals					
4.9.4.3	Minimum external clearances & creepage	-	-	-	-	-

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Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>	BIDDER'S OFFER				
	LV, mm (cable box)	Phase to phase				
		Phase to earth				
		Creepage distance				
	11kV, mm (cable box)	Phase to phase				
		Phase to earth				
		Creepage distance				
	33kV, mm (open)	Phase to phase				
		Phase to earth				
		Creepage distance				
4.10	Insulation Levels (internal)	-	-	-	-	-
	LV: Power frequency withstand voltage					
	11kV: Lightning impulse & power frequency withstand voltages					
	33kV: Lightning impulse & power frequency withstand voltages					
	External insulation level and altitude correction (indicate offered insulation and altitude correction applied)					
4.11	Transformer Tank & Tank Cover					
4.11.1	Bolted top cover design					
	Minimum thickness of top cover, bottom and sides of offered transformer respectively					
4.11.2	Inside clearance and painting					
4.11.3	Pressure test of tank and test report during delivery					

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TRANSFORMER Part 3:**  
Ground Mounted Three Phase  
Oil Type Distribution  
Transformer

Doc. No.

KP1/3CB/TSP/10/001-03

Issue No.

3

Revision No.

1

Date of Issue

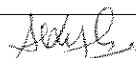
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Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>	BIDDER'S OFFER				
4.11.4	Lifting lugs and factor of safety					
4.11.5	Steel radiators					
4.11.6	Top cover design, non-accumulation of rain water, gasket & non-standard bolts and nuts					
4.11.7	Removable jumper of 25mm x 1.2mm tinned copper & stainless steel bolt & nut					
4.12	Paint Work	-	-	-	-	-
4.12.1	Method of cleaning before painting					
4.12.2	Final colour of exterior surfaces and paint thickness					
4.12.3	Cleaning and painting of interior of tank and other oil filled chambers					
4.12.4	Degreasing & treatment of radiators with anti-rust inhibitor					
4.12.5	Final colour of exterior of radiators & paint thickness					
4.13	Fittings and Accessories	-	-	-	-	-
4.13 (a)	Pressure Relief Device & location					
	Pressure at which pressure relief device operates					
4.13 (b)	Oil Level Gauge & location					
4.13 (c)	Earthing Terminals: location & to have stainless steel bolt, nut & washer and tinned copper terminal lug for 50mm <sup>2</sup> conductor					
4.13 (d)	Separate Lifting lugs for core, top cover, conservator & complete transformer					
4.13 (e)	Off-circuit tap changer & location					

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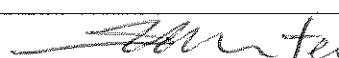
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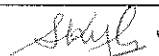
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Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>	BIDDER'S OFFER				
	Padlock facility for tap changer					
4.13 (f)	Tinned copper jumper size and materials					
4.13 (g)	Rating and diagram plate					
4.13 (h)	Clamp connectors					
4.13 (i)	Thermometer pocket					
4.13 (j)	Jacking Lags					
4.13 (k)	Combined drain plug and sampling device					
	Features to deter oil vandalism					
4.14	Transformer Oil	-	-	-	-	-
4.14.1	ONAN					
4.14.2	Transformer to be supplied filled with new oil					
4.14.3	Class and standard of oil					
	Quantity of oil in liters					
4.15	Quality Management System	-	-	-	-	-
4.15.1	Quality Assurance Plan to be based on ISO 9001:2008					
4.15.2	Declaration of conformity to IEC 60076					
	Copy of ISO 9001:2008 certificate submitted					
	Monthly & annual production capacity					
	List of previous customers					
	Reference letters from at least four previous customers					
5.	Tests and Inspection	-	-	-	-	-
5.1	Test Standard					
	Responsibility of testing transformer & manufacturer's capability to carry out specified tests					
5.2	Copies of type test reports	-	-	-	-	-

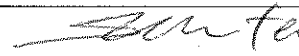
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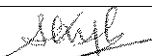
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Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>	BIDDER'S OFFER				
	to IEC 60076					
	Lightning impulse withstand test					
	Short circuit withstand test					
	Temperature rise test <i>Note: Temperature rise test to IEC 60076 if conducted at the manufacturer's premises shall be in the presence of representatives of ISO/IEC 17025 accredited third party testing laboratory; who shall sign and stamp the certificates and test reports</i>					
5.3	Acceptance tests at manufacturers premises	-	-	-	-	-
5.3.1	Routine tests to IEC 60076					
5.3.2	Type tests to IEC 60076					
	Temperature rise test					
	Lightning impulse withstand test					
5.3.3	Additional tests (sample test)					
	Sampling					
5.4	Contact details for testing authority					
5.5	Complete test reports for approval before shipment					
5.6	Inspection or test by KPLC during delivery before acceptance to stores					
6.	Marking, Labeling & Packing	-	-	-	-	-
6.1	Packing: mounted & bolted on wooden base blocks					
6.2	Dispatch fully assembled & oil filled					
6.3	Assemble & package of items suitably marked					
6.4	Permanent Rating & Diagram plate indelibly marked (by etching,					

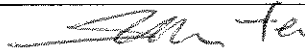
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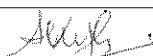
Clause Number	Description <i>Indicate KVA &amp; voltage ratings in columns on the right →</i>	BIDDER'S OFFER				
	engraving or stamping)					
6.5	Content of marking					
Other details required with the tender	Weight of complete transformer, kg					
	Weight of tank, kg					
	Material of tank					
	Weight of oil, kg					
	Weight of core, kg					
	Weight of windings (without insulation), kg					
	Weight of insulation, kg					
	Manufacturer's experience					
	Detailed list of all the required fittings and accessories indicating type/model number, manufacturer and quantities					
	List catalogues, brochures and technical data submitted to support offer					
	Deviations from tender specifications (indicate supporting documents submitted)					

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

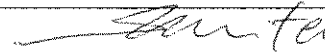
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