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0.1 Circulation List

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

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
0	2015-07-31	Cancels and replaces issue No. 1 dated 2009-05-18	Michael Apudo Nancy Wairimu	Dr. Eng. Peter Kimemia

FOREWORD

This specification has been prepared by the Standards department and Technical Services Departments both of The Kenya Power and Lighting Company Limited (abbreviated as KPLC) and it lays down requirements for Mineral Insulating Oil (Transformer & Switchgear Oil). It is intended for use by KPLC in purchasing the oil.

The manufacturer shall submit information which confirms satisfactory service experience with products which fall within the scope of this specification.

1. SCOPE

1.1. This specification is for new, unused mineral insulating oil intended for use in transformers, switchgear and similar electrical equipment in which oil is required as an insulant and for heat transfer.

1.2. The specification stipulates the minimum requirements for mineral insulating oil acceptable for use in the company and it shall be the responsibility of the manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the oil for KPLC.

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

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

NOTE: *Mineral insulating oils complying with the requirements of this specification, of the same class and containing no additives shall be compatible with one another and be capable of being mixed in any proportion.*

2. REFERENCES

The following standard contains provisions which, through reference in the text constitute provisions of this specification. Unless otherwise stated, the latest edition (including amendments) shall apply.

IEC 60422: Mineral insulating oils in electrical equipment – supervision and maintenance guidance

IEC 60296: Fluids for Electrotechnical applications – unused mineral insulating oils for transformers and switchgears.

IEC 60156: Insulating liquids – Determination of the breakdown voltage at power frequency–Test method

IEC 60247: Measurement of relative permittivity, dielectric dissipation factor and d.c. resistivity of insulating liquids

IEC 60475: Method of sampling liquid dielectrics

IEC 60666: Detection and determination of specified anti-oxidant additives in insulating oils

IEC 60814: Insulating liquids – Oil-impregnated paper and pressboard – Determination of water by automatic coulometric Karl Fischer titration

IEC 61125: Unused hydrocarbon based insulating liquids – Test methods for evaluating the oxidation stability

IEC 61198: Mineral insulating oils – Methods for the determination of 2-furfural and related compounds

IEC 61619: Insulating liquids – Contamination by polychlorinated biphenyls (PCBs) – Method of determination by capillary column gas chromatography

IEC 62021-1: Insulating liquids – Determination of acidity – Part 1: Automatic potentiometric titration

ISO 2719: Determination of flash point – Pensky-Martens closed cup method

ISO 3016: Petroleum products – Determination of pour point

ISO 3104: Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity

ISO 3675: Crude petroleum and liquid petroleum products – Laboratory determination of density – Hydrometer method.

ISO 2049: Petroleum products- Determination of colour.

DIN 51353: Testing of insulating oils; detection of corrosive sulfur; silber strip test

BS 2000-346: Methods of test for petroleum and its products Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions. Dimethyl sulphoxide extraction refractive index method

3. TERMS AND DEFINITIONS

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

4. REQUIREMENTS

4.1. Service Conditions

The mineral insulating oil shall be suitable for use in transformers and switchgears operating in the following conditions:

a) Continuous outdoor operation in tropical areas at 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 +40°C;
d) Heavy saline conditions along the coast and
e) Isokeraunic levels of up to 180 thunderstorm days per year.

4.2. Properties of oil

4.2.1. The oil shall be pure hydrocarbon mineral oil, clean and free from impurities, such as suspended solid matter, detrimental chemical compounds and water likely to impair its properties and without additives.

4.2.2. The oil shall be chemically stable, PCB (Polychlorinated biphenyls) free and shall conform to IEC 60296 (class 1: un-inhibited oil - mineral insulating oil, containing no antioxidant additives).

4.2.3. The functional properties of the oil which includes - viscosity, density, pour point, water content, breakdown voltage and dielectric dissipation factor – shall ensure total impact on its function as an insulating and cooling liquid.

4.2.4. The oil shall also be suitable for oil circuit breakers and other electrical equipment in which oil is used as insulating medium.

4.2.5. The tests on transformer oil shall be conducted in accordance with the relevant methods detailed in IEC 60296 and shall fully comply with the provisions of this specifications.

4.2.6. The characteristic and performance of the oil shall comply with the following:

Table 1: Required characteristics and performance of the oil as per IEC 60422 and IEC 60296

Property	Units	Test Method	Highest voltage for equipment (kV)		
			< 72.5	72.5 to 170	>170
a) – Function					
Viscosity at 40°C	mm²/s	ISO 3104	Max. 12		
Viscosity at –30°C	mm²/s	ISO 3104	Max. 1800		
Pour point	°C	ISO 3016	-40		
Water content	mg/kg	IEC 60814	Max. 20	<10	<10
Breakdown Voltage	kV	IEC 60156	>55	>60	>60
Density at 20°C	g/ml	ISO 3675	Max. 0.895		
Dielectric dissipation factor at 90°C and 40Hz to 60 Hz	-	IEC 60247	Max. 0.015	Max. 0.015	Max. 0.010
Resistivity at 90°C	GΩ x m	-	Min. 60		
b) – Refining/stability					
Appearance	-	-	Clear, free from sediment and suspended matter		
Colour	-	ISO 2049	Max. 2.0		
Acidity	Mg KOH/g	IEC 62021-1	Max. 0.01		
Corrosive sulphur	-	DIN 51353	Non-corrosive		
DBDS content	mg/kg	-	<5		
Interfacial tension	mN/m	ISO 6295	Min. 35		
Furfural content	mg/kg	IEC 61198	Max. 0.1		
Antioxidant additive	-	IEC 60666	Not detectable		
c) – Performance					
Oxidation stability		IEC 61125 (Method C). Test duration : 164 h			
Total acidity					
Sludge	-				
d) – Health, safety and environment (HSE)					
Flash point	°C	ISO 2719	135		
PCA content		BS 2000 Part 346	Max. 3 %		
Total PCB content	Mg/kg	IEC 61619	Not detectable (< 2mg/kg total)		
DBDS content	mg/kg	-	<5		

4.3. Quality Management System

4.3.1. The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the mineral insulating oil 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 9001:2008.

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

4.3.3. The bidder shall indicate the delivery time of the items, manufacturer's monthly & annual production capacity and experience in the production of the type and size of items being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar type of the mineral insulating oil 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.

5. TESTS AND INSPECTION

5.1. The mineral insulating oil shall be inspected and tested in accordance with the requirements of IEC 60296, applicable standards listed in clause 2 and the provisions of this specification. It shall be the responsibility of the supplier to perform or to have performed the tests specified and whatever other tests he normally performs at works.

5.2. Copies of previous Type Tests 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. The accreditation certificate to ISO/IEC 17025 for the same third party testing laboratory used shall also be submitted with the tender document (all in English Language)

5.3. The mineral insulating oil shall be subject to acceptance tests at the manufacturer's works before dispatch. Acceptance tests shall be witnessed by two Engineers appointed by The Kenya Power and Lighting Company Limited (KPLC). Routine and Sample Test Reports for the oil to be supplied shall be submitted to KPLC for approval before delivery of the goods.

5.4. On receipt of the product, KPLC will perform any of the tests specified in order to verify compliance with this specification. The supplier shall replace without charge to KPLC the oil which upon examination, test or use; fail to meet any of the requirements in the specification.

6. MARKING AND PACKING

6.1 The following information shall be marked indelibly and legibly and in a permanent manner on each container.

i) Manufacturer's Name or Trademark;
ii) Type Designation/Classification;
iii) Specified Characteristics;
iv) Oil Quantity (in liters);
v) Batch Number & Date;
vi) Material Safety Data Sheet.

6.2 The oil shall be packed in 200 or 205 or 210 liters metallic drums protected against corrosion. The drums shall be clean and suitable for the purpose to avoid any contamination.

6.3 Each oil delivery shall be accompanied by a document from the manufacturer specifying at least: manufacturer's designation, oil classification, compliance certificate and indication of the presence (type, concentration) of any additive. Where the material safety data sheet cannot be marked on the container it shall be submitted together with the oil.

ɜ Documentation

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 technical documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Fully filled clause by clause description of the item on offer as per Annex A (Guaranteed Technical Particulars) and signed by the manufacturer;
b) Copies of the Manufacturer's catalogues, brochures, safety and technical data;
c) Sales records for the last five years and at least four customer reference letters;
d) Details of the manufacturer's experience;
e) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025 and a copy of accreditation certificate to ISO/IEC 17025 for the third party testing laboratory;
f) Manufacturers letter of authorization, QMS certificate and other technical documents required in the tender.
g) The manufacturer shall be required to also provide detailed information regarding the products:
   - Materials identification,
   - Ingredients and hazards data,
   - Physical data of the chemicals used,

- Health hazard information,
  - Summary of risks
  - Target organs
  - First aid to various organs such as eye contacts, skin contacts, inhalation and ingestion
- Special precautions.
  - Storage segregation
  - Special handling/storage
  - DOT (Department of Transportation Hazard Classification System) class.

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

a) Guaranteed Technical Particulars signed by the manufacturer;
b) Chemical composition details of the oil to be manufactured for KPLC.
c) Quality assurance plan (QAP) that will be used to ensure that the chemical and functional properties of the oil, 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) Detailed test program to be used during factory testing;
e) All documentation necessary for identification and general delivery requirements as specified in IEC 60296, clause 5.4 shall be provided with the oil.
f) Manufacturer's undertaking to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the oil for The Kenya Power & Lighting Company;
g) Packaging details (including packaging materials and quantity).

7.3. The supplier shall submit a set of three (3) technical manuals for the oil during delivery specifying at least: supplier's designation, oil classification and compliance certificate. The supplier shall also indicate the presence (type, concentration) of any additive if any, all in the English Language, to KPLC stores.

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ANNEX A: Guaranteed Technical Particulars *(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, four customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test reports for tender evaluation, all in English Language)*

Tender No. .....Bidders Name and address .....

Clause	Description	KPLC REQUIREMENTS	Bidders offer (*indicate full details of the values offered*)
	Name of Manufacturer		state
	Country of manufacture		State
	Type/Model Reference Number		State
1	Scope		state
2	Design standards complied with		state
3	Terms and Definitions		state
4	Requirements		
4.1	Service condition		state
4.2.	Properties of oil		
	Required characteristics and performance		

Property	Units	Highest voltage for equipment (kV)		
		< 72.5	72.5 to 170	>170
a) – Function				
Viscosity at 40°C	mm²/s	Max. 12		
Viscosity at –30°C	mm²/s	Max. 1800		
Pour point	°C	-40		
Water content	mg/kg	Max. 20	<10	<10
Breakdown Voltage	kV	>55	>60	>60
Density at 20°C	g/ml	Max. 0.895		
Dielectric dissipation factor at 90°C and 40Hz to 60 Hz	-	Max. 0.015	Max. 0.015	Max. 0.010
Resistivity at 90°C	GΩ x m	Min. 60		
b) – Refining/stability				

	Appearance	-	Clear, free from sediment and suspended matter	
	Colour	-	Max. 2.0	
	Acidity	Mg KOH/g	Max. 0.01	
	Corrosive sulphur	-	Non-corrosive	
	DBDS content	mg/kg	<5	
	Interfacial tension	mN/m	Min. 35	
	Furfural content	mg/kg	Max. 0.1	
	Antioxidant additive	-	Not detectable	
	c) – Performance			
	Oxidation stability		IEC 61125 (Method C). Test duration : 164 h	
	Total acidity		Max 0.03	
	Sludge	-	Max 0.8%	
	d) – Health, safety and environment (HSE)			
	Flash point	°C	135	
	PCA content		Max. 3 %	
	Total PCB content	Mg/kg	Not detectable (< 2mg/kg total)	
	DBDS content	mg/kg	<5	
4.3.	Quality Management System			
	Quality Assurance Plan			provide
	Copy of ISO 9001:2008 Certificate			provide
5.1	Test standards and responsibility of carrying out tests			provide
5.2	Copies of Type Test Reports submitted with tender			provide
5.3	Acceptance tests to be witnessed by KPLC engineers at the factory before shipment			provide
5.4	Test reports to be submitted by supplier to KPLC for approval before shipment			
5.5	Replacement of rejected low voltage (shackle) insulators.			specify
6.1	Marking			specify
6.2	Packing			specify
6.3	Delivery documents			
7.1	Documents submitted with tender			provide
7.2	Documents to be submitted by supplier to KPLC for approval before manufacture			provide
8.0	Manufacturer's Guarantee and Warranty			provide
9.0	List catalogues, brochures, technical data and drawings submitted to support the offer			provide
10.0	List customer sales records and customer reference letters submitted to support the offer.			provide
11.0	List Test Certificates submitted with tender			provide

12.0	List test reports of the oil to be submitted to KPLC for approval before shipment	provide
13.0	Statement of compliance to specification (indicate deviations if any & supporting documents)	provide
14.0	14.0 List Acceptance Tests to be witnessed by KPLC Engineers at the factory	provide

NOTE:

1) *Bidders shall give full details of the offered values of the items on order as per Annex A. The details provided shall conform to the test reports and their certificates as required by clause 5.2., well labeled drawings complete with dimensions, catalogues or brochures for the purpose of tender evaluation.*
2) *Bidder who shall have not complied by this requirement in bullet 1 shall be automatically disqualified from bidding this item.*

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Manufacturer's Name, Signature, Stamp and Date