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CEB
SPECIFICATION

UNUSED MINERAL INSULATING OIL FOR TRANSFORMERS AND SWITCHGEAR

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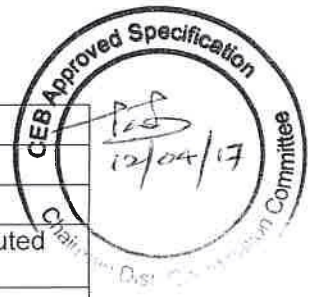
CONTENTS

SPECIFICATION FOR UNUSED MINERAL INSULATING OIL FOR TRANSFORMERS AND SWITCHGEAR

1.0 SCOPE

This specification covers the specifications, supply and delivery of Unused Mineral Insulating Oil (Uninhibited) of Naphthenic base for transformers and switchgear, to use in transformers, switchgear and similar electrical equipment in which oil is required as an insulant or for heat transfer.

2.0 SERVICE CONDITIONS



(a)	Annual average ambient temperature	30 °C
(b)	Maximum ambient temperature	40 °C
(c)	Maximum relative humidity	90%
(d)	Environmental conditions	Humid tropical climate with heavily polluted atmosphere
(e)	Operational altitude	From M.S.L. to 1900 m above M.S.L

3.0 APPLICABLE STANDARDS

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof.

(a)	IEC 60296:2012	Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear.
(b)	IEC 60247:2004	Measurement of relative permittivity, dielectric dissipation factor and d.c. resistivity of insulating liquids.
(c)	IEC 61125:1992	Unused hydrocarbon based insulating liquids - Test methods for evaluating the oxidation stability.
(d)	ASTM D1500-12	Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale).
(e)	ASTM D445-15a	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity).
(f)	ASTM D97-17	Standard Test Method for Pour Point of Petroleum Products.
(g)	ASTM D1533-12	Standard Test Method for Water in Insulating Liquids by Coulometric Karl Fischer Titration.
(h)	ASTM D1298-12b	Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
(i)	BS EN 60247-2004	Insulating liquids. Measurement of relative permittivity, dielectric dissipation factor (tan δ) and d.c. resistivity.
(j)	ASTM D93-16a	Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester.
(k)	BS 2000-346:1996	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.

However in the event of discrepancy, the details given in this CEB specification supersedes above standards.

4.0 BASIC FEATURES

Unused Naphthenic based mineral insulating oil shall be of high quality electrical insulating oil, manufactured using specially selected base stocks to help provide protection against oxidation and sludge formation. It shall be ensured for careful processing and handling so that insulating oil is stable and free of water and other contamination and remains so until it reaches for final use.

The technical requirements and the characteristics of unused mineral insulating oils shall be in accordance with the 'Annex - A: Schedule of Technical Requirements and Guaranteed Technical Particulars' and shall have the following characteristics.

4.1. Category of oil

The category of oil shall be transformer oil class, Uninhibited, as per standards specified in Clause 3.0 to be used for transformers and switchgear.

4.2. Properties

The transformer oil shall be of low viscosity and shall offer the minimum resistance and maximum convective assistance to the flow. The oil shall be thin enough to penetrate into narrow ducts and assist in the circulation through transformer winding to prevent local overheating. It must have low pour point.

The viscosity of oil shall be such that the flow is not significantly impeded. Low volatility for oil is desirable. Oil shall have excellent chemical stability such that degradation due to decomposition of high molecular weighed hydrocarbon molecules into lighter, more volatile fraction shall not occur at normal operating temperatures.

The oil shall have high electrical strength, good impulse strength and good arc quenching properties. It shall be clear, bright but non toxic. It shall be free from thermally unstable sulfur bearing compounds.

5.0 QUALITY ASSURANCE

The manufacturer shall possess ISO 9001:2008 or latest Quality Assurance Certifications valid throughout the delivery period of this bid, for the manufacture of unused mineral insulating oils for the plant where manufacturing is being done. The Bidder shall furnish copies of such certificates certified as true copies of the original by the manufacturer, along with the offer.

6.0 ADDITIONAL REQUIREMENTS

6.1. Manufacturing Experience

The manufacturer shall have minimum of 10 years experience in manufacturing unused mineral insulating oil for transformers and switchgear. In addition, minimum of five (5) years experience shall be in manufacturing for orders from outside the country of the manufacturer. The product offered shall have been used in service utilities over past 5 years.

Manufacturer shall furnish a list of purchasers with year and quantity of the product offered with the offer to prove his manufacturing experience.

6.2. Identification and general delivery requirements

Special care shall be taken during packing of oil for dispatch. Oil shall be delivered in drums/barrels and, shall be clean and suitable for the delivery purposes avoiding any contamination.

General identification labeling shall be as per IEC 60296 and shall be marked with the following;

(a) "PROPERTY OF CEYLON ELECTRICITY BOARD"
(b) Bid No. ..... Serial No.....
(c) Manufacturer's identification.
(d) Classification
(e) Oil quantity
(f) Number and year of standard adopted.
(g) Date of manufacturing
(h) Special instructions for handling

All the oil filled steel barrels shall be properly sealed for any ingress of moisture or contamination

such that the oil is delivered free from moisture or any contamination by maintaining uniform quality at user end. If any incident of deterioration of properties at user end is noticed, then it will be at discretion of CEB, to reject whole/part of supply delivered so far.

Each oil delivery shall be accompanied by the documents specifying supplier's designation, oil classification, CEB order no., and compliance certificate.

7.0 TESTING

Following test certificates shall be submitted with the offer as per Clause 3.0 above.

1. **Function**
   - (a) Kinematic viscosity, mm^2/s at 40°C and at -30°C
   - (b) Pour point
   - (c) Density at 20°C
   - (d) Water content
   - (e) Breakdown voltage
   - (f) Dielectric dissipation factor at 90 °C

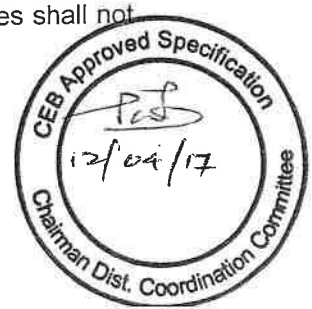
2. **Refining/Stability**
   - (a) Appearance
   - (b) Acidity
   - (c) Interfacial tension
   - (d) Corrosive sulphur
   - (e) Potentially corrosive sulphur
   - (f) Metal passivator additives
   - (g) 2-Furfural and related compounds content

3. **Performance**
   - (a) Oxidation stability
   - (b) Total acidity*
   - (c) Sludge*
   - (d) Dielectric dissipation factor at 90°C*

   (- After oxidation stability tests)*

4. **Health, safety and environment (HSE)**
   - (a) Flash point
   - (b) Polycyclic aromatic (PCA) content
   - (c) Polychlorinated biphenyl (PCB) content

Test certificates referred to shall be from an **accredited independent testing laboratory acceptable to the CEB**. Proof of accreditation by a national/ international authority shall be forwarded with the offer. Test reports shall be complete including all the pages as issued by the testing authority. Test certificates shall be in English language. Parts of test certificates shall not be acceptable.



8.0 INFORMATION TO BE FURNISHED WITH THE OFFER

The following shall be furnished with the offer.

(a) A comprehensive product data sheet.

(b) Test Certificates in accordance with the clause 7.

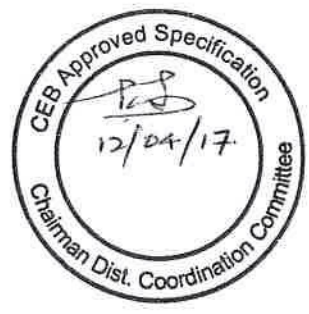
(c) Duly filled and signed 'Annex -A: Schedule of Technical Requirements and Guaranteed Technical Particulars'.

(d) Documents to prove manufacturer's experience in accordance with Clause 6.1.

(e) ISO 9001:2008 or latest Quality Assurance certificates in accordance with clause 5.

9.0 ANNEX

Annex –A: Schedule of Technical Requirements and Guaranteed Technical Particulars
Annex –B: Non-Compliance Schedule



Annex- A

SCHEDULE OF TECHNICAL REQUIREMENTS AND GUARANTEED TECHNICAL PARTICULARS

(CEB Requirements shall be filled by the procurement entity and information of the offer shall be filled by the manufacturer)

			CEB Requirement	Test Method	Offered
1.	Name of the Manufacturer				
2.	Country of Origin				
3.	Category of oil		Transformer class, Uninhibited		
4.	Applicable standards		IEC 60296/IEC 60247		
5.	Appearance of oil Colour		Clear, free from sediment and suspended matter	ASTM D 1500 Should be less than 0.5 max ISO units	
	Characteristics/Properties				
	Function				
6.	Kinematic viscosity (maximum)				
	(a) At -30°C	mm^2/s	1 800	ISO 3104	
	(b) At 40°C	mm^2/s	12	ASTM D445/ISO 3104	
7.	Pour point (maximum)	°C	-20	ASTM D 97	
8.	Maximum water content	mg/kg	≤10 prior to transportation ≤ 20 on the delivery	IEC 60814/ASTM D 1533	
9.	Minimum breakdown voltage				
	(a) As delivered	kV/2.5mm	30	IEC 60156	
	(b) After treatment	kV/2.5mm	70	IEC 60156	
10.	Maximum density at 20°C	kg/dm^3	0.895	ISO 3675, ISO 12185, ASTM D1298	
11.	Maximum Dielectric dissipation factor (DDF) 90 °C		0.005	BS EN 60247 IEC61620, IEC 60247	
	Refine/Stability				
12.	Appearance		Clear, free from sediment and suspended matter		
13.	Acidity (Maximum), Neutralization value	mg KOH/g	0.01	IEC 62021-1	
14.	Maximum interfacial tension	mN/m	40	ASTM D 971	
15.	Corrosive sulphur and/or potential corrosivity		Not corrosive	IEC 62535	
16.	Metal passivator additives		Not detectable (< 5mg/kg)		
17.	Total fufurals and furans		Not detectable (< 0.1mg/kg) max	IEC 61198	
	Performance				
18.	Oxidation stability			As per 61125 (Method C).	

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19.	Tests after oxidation stability test				
	- Total acidity (Maximum)	mg KOH/g	1.2		
	- Sludge (Maximum) after 164h at 120°C	%	0.8 max	IEC 61125 method C	
	- DDF at 90 °C (Maximum)		0.500	BS EN 60247, IEC61620, IEC60247.	
	Health, safety and environment				
20.	Flash point (minimum)	°C	140	ASTM D93/ ISO 2719 (closed cup)	
21.	Maximum Polycyclic Aromatics(PCA) content	%	3	BS 2000-346 IP 346	
22.	Polychlorinated biphenyls (PCB) content	ppm	Not detectable (< 2mg/kg)	IEC 61619	
23.	Resistivity				
	(a) At 90°C	GΩm			
	(b) At 40°C	GΩm			
24.	Permittivity at 60°C				
25.	Specific heat at 60°C				
26.	Thermal conductivity at 60°C				
27.	Mean coefficient of expansion				
28.	Whether certified copies of Quality Assurance certificates as per clause 5.0 furnished with the offer?	Yes/No	Yes		
29.	Whether product data sheet provided with the offer as per clause 8.0?	Yes/No	Yes		
30.	Whether the entire Type Test Certificates in accordance with clause 7 furnished with the offer?	Yes/No	Yes		

.....
Signature and seal of the Manufacturer

.....
Date

I/We certify that the above data are true and correct

.....
Signature and seal of the Bidder

.....
Date

Annex – B

NON-COMPLIANCE SCHEDULE

On this schedule the bidder shall provide a list of non-compliances with this specification, documenting the effects that such non-compliance is likely to have on the equipment life and operating characteristics. Each non-compliance shall be referred to the relevant specification clause.

Clause No.	Non-Compliance

.....
Signature of the Manufacturer

.....
Date

I/We certify that the above data are true and correct

.....
Signature and seal of the Bidder

.....
Date

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