TECHNICAL SPECIFICATION FOR EHV GRADE TRANSFORMER OIL

1.0 SCOPE :

The Specification covers manufacture, testing, supply & delivery of new insulating oil of petroleum origin suitable for use as insulating & heat transfer medium and arc quenching medium in Power/Distribution transformers and other equipments used in West Bengal by WBSEDCL.

The oils covered by this standard are of low viscosity type and completely free from additives. The oil should contain minimum amount of impurities including moisture, sludge etc. and should have some physical and chemical properties as detailed in the specification.

1.1 SERVICE CONDITION:

The transformer oil will be used in WBSEDCL's Power/ Distribution Transformer and Circuit Breakers installed in outdoor sub-stations of various types, which remain exposed to all sorts of seasonal weather variations of the tropical & humid climate of West Bengal and rain, thunder, storms along with impact of dust particles on the transformers. The transformer oil should maintain the desired characteristics despite the operation under severe service conditions of all types of transformers manufactured in India including those fitted with on-load tap changing equipment. The temperature of the oil may rise upto 95°C under extreme conditions.

2.0 COMPOSITION:

The oil shall be pure hydrocarbon mineral oil, without any additive, clean and sufficiently free from moisture and other foreign materials likely to impair its properties. Mineral insulating oil are made from selected 'fraction' of crude oil. The crude oil composed of mainly hydrocarbon, which may differ in their content of the main classes or types of hydrocarbons along with non-hydrocarbons as impurities like paraffin, napthene and aromatics. The transformer oil should contain aromatic hydrocarbons less than 1%. By proper refining, the crude oil consisting of above constituents, the desired characteristics are obtained.

3.0 CHARACTERISTICS :

The characteristics of the oil when it is sampled at the manufacturer`s works and / or at the point of delivery and tested in accordance with IS: 335 –2018 should comply with the results given in the IS specification (IS: 335 –2018) along with its latest amendment) except for certain characteristics for which the required value will be as mentioned in this Technical Specification. The oil will be Type –II (Uninhibited) and LC SET as -10 °C (LC SET as minus ten degree centigrade) as per IS-335 -2018.

4.0 SAMPLING AND TESTING :

Sampling of the oil shall be done in accordance with IS: 6855 – 1973 and the tests shall be carried out in accordance with the test methods mentioned in IS: 335 –2018 with latest amendments in the manufacturer's laboratory with all arrangements made by the manufacturer.

The list of instruments available in the manufacturer's laboratory for rigorous testing should be furnished along with the tender. Any test, which cannot be carried out in their laboratory, should be clearly stated in the offer.

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The manufacturers who have no major testing facilities in their laboratories need not quote.

The manufacturer may submit their own method of test referring to any national / international standard in the guaranteed technical particulars.
All the tests will be conducted by the manufacturer at their works as per IS/Technical Specification of the Tender Document except ***Oxidation stability***

This test shall be done from any unit of CPRI and all the cost shall be borne by the manufacturer.
On the basis of the results of other tests, the Inspection Officer of WBSEDCL may opt for conducting the test for proportion of classes of hydrocarbons in the crude oil. In such case, the test for proportion of hydrocarbons shall be done from any unit of CPRI and all the cost shall be borne by the manufacturer.

4.1 For the tests the samples have to be collected in presence of the representative of WBSEDCL. Inspecting officers of WBSEDCL will take action for sealing of oil barrels on the very first day of their inspection and the manufacturer will deploy his persons with the inspecting officers in this sealing process. Besides the sample testing, the manufacturer will assist the inspecting officers to complete the sealing of oil barrels within 3 to 4 days.

In addition, the manufacturer will submit a list in excel format (Soft as well as hard copy duly signed by them) of all these seals mentioned against barrel numbers on the last day of inspection or before issuance of clearance by the inspecting officers for issuance of DI. The list will also include the serial numbers of damaged seal, if any.

4.2 According to General Conditions of Contract, WBSEDCL reserves the right to carry out inhouse testing of the supplied materials at destination stores, in presence of authorized representative of the Manufacturer. In case they do not be present, company shall Test unilaterally and their result will be binding on them. In case the test results deviates from the inspection result carried out at Manufacturers' Works (more than 2% tolerance as per IS where ever applicable), the Company reserves the right to cancel the specific lot and in that event materials are to be replaced by the Manufacturer free of cost including the transportation from the site to their works and back.

In case of EHV Grade Transformer Oil only, if the test results of the inhouse testing deviates from the inspection results (only except for Breakdown Voltage and Water Content) carried out at Manufacturers' Works (more than 10% tolerance), the Company reserves the right to cancel the specific lot and in that event materials are to be replaced by the Manufacturer free of cost including the transportation from the site to their works and back. If the test results of the inhouse testing for Electric Strength (Breakdown Voltage) of the new unfiltered oil (Untreated/ treated) become less than 30/70 KV and those for Water Content become 40 mg/kg., the Company reserves the right to cancel the specific lot and in that event materials are to be replaced by the Manufacturer free of cost including the transportation from the site to their works and back.

4.3 **CALIBRATION:**

According to General Conditions of Contract, the instruments/equipment required for Inspection & Testing should have valid calibration as per following guideline:

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Calibration Certificate issued by Laboratory accredited by NABL may be accepted unconditionally provided the certificate bears an Accreditation body Logo.

a) For Testing equipments, where NABL Accreditation is not available, Calibration Certificate from Educational Institutions like IIT's, NIT's, J.U., C.U., BHU only can be accepted provided they can demonstrate traceability.

Necessary confirmation regarding above is to be given along with inspection offer failing which the inspection offer will not be accepted.

If during inspection & testing, the suppliers fail to produce Calibration Certificate as indicated above the offered lot may be rejected only except the following three tests.

In case of following three tests only, Calibration of the instruments shall be shown by the suppliers during inspection & testing according to the calibration method as stated below:

Sl. No.	*Instrument*	*Calibration Method*
1.	Interfacial Tensiometer	With weights as per instruction manual of the Interfacial Tensiometer according to test method of IS 6104.
2.	Viscometer	With standard liquids supplied by : i) M/s. Merk Limited, .. 56, New Timber Yard Layout, ...Bangalore – 26.
3.	Moisturemeter	ii) M/s. Alliance Technologies, aaNo. 78, 3rd Cross, Sunder nagar, Gokul, Bangalore – 54. iii) M/s. Sigma Aldrich, U.S.A. iv) M/s. CANNON, U.S.A.

5.0 PACKING :

The tenderer should indicate in their offer whether they could supply transformer oil in I.S.I. Marked barrels. If they are not in a position to supply transformer oil in ISI marked barrels, their offer may not be considered. The transformer oil should be delivered in sealed non-returnable epoxy coated new steel barrels each containing 209/210 litres of oil. The barrels should conform to Type A or B of IS: 1783 – 1974.The barrel should be marked with Type-II BIS marking , uninhibited oil, LC SET as -10 °C (LC SET as minus ten degree centigrade)

TEST REPORTS AND TYPE TESTS :

The bidder shall submit complete test reports of all tests (including Type Test) as stipulated in relevant IS with complete identification and date, carried out in Central Power Research Institute on the tendered item.

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Copies of Type Test Report as per latest IS, carried out within five (5) years from due date of Tender, from Central Power Research Institute shall be submitted alongwith the offer as pre-requisites. Otherwise the offer may be rejected.

6.0 CONSUMERS :

List of reputed concerns to whom the transformer oils have been previously supplied alongwith order nos. and quantities should be clearly mentioned in the offer.

7.0 SOURCE OF SUPPLY :

Name & address of the supplier of base product is to be mentioned in the offer.

8.0 REFINERY CENTRE :

Name and address of refinery where the base product is processed are also to be mentioned in the offer.

9.0 MARKING :

Each drum shall be legibly and indelibly marked with the following:

(a) Manufacturer's name, (b) Name of the material, (c) Quantity in litres,

(d) Date and lot of manufacture, (e) ISI Certification mark as "IS-335-2018",

(f) Name of Consignee as "WBSEDCL", **(g) Type –II Uninhibited , LC SET as -10 °C.**

10.0 DOCUMENTS TO BE SUBMITTED AT THE TIME OF PHYSICAL DELIVERY AT CONSIGNEE STORES:

The following documents are to be submitted by the supplier to the consignee stores at the time of despatch to stores by the supplier:-

a) Copy of Purchase Order
b) Copy of Despatch Instruction
c) Inspection Test Certificate
d) Guarantee Certificate
e) Proforma Invoice
f) Calculation Sheet for Price Variation on the basis of IEEMA or CACMAI as applicable with base date of order.
g) Seal list and packing list
h) Challan in triplicate
i) Way bill, if applicable.

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REQUIRED SPECIFICATION OF NEW INSULATING OIL

Sl. No.	CHARACTERISTICS	VALUES PROPOSED AS PER TENDER SPECIFICATION
	A. FUNCTION	
1.	Type of Oil	**TYPE- II**
2.	Viscosity at 0°C (Max.)	1800 mm^2/s
3.	Viscosity at 40°C (Max.)	15 mm^2/s
4.	Pour point in °C (Max.)	(-) 20
5.	Water Content (Untreated/ treated)	40 mg/kg
6.	Breakdown Voltage (Untreated/ treated)	30 /70 KV (Min)
7.	Density at 20°C (Max.) gm/ml.	0.895
8.	DDF at 90°C (Max.)	0.005
	B. REFINING/ STABILITY	
9.	Appearance	Clear, free from sediment and suspended matter
10.	Acidity	0.01 mg KOH/gm. (Max.)
11.	Interfacial tension	40m N/m (Min)
12.	Corrosive Sulphur	Not corrosive
13.	DBDS	Not detectable (<5 mg/ kg)
14.	Inhibitors according to IS-13631/ IEC - 60666	(U) Uninhibited Oil : Not detectable <0.01%
15.	Furfural and related compounds content	Not detectable (<0.05 mg /kg) for individual component
	C. PERFORMANCE	
16.	Oxidation stability.	Uninhibited oil
17.	Total acidity	1.2 mg KOH/g, Max
18.	Sludge	0.8%, Max
19.	DDF at 90°C	0.500, Max
	D. HEALTH, SAFETY and ENVIRONMENT (HSE)	
20.	Flash Point	135°C Min
21.	PCA content	3% Max
22.	PCB content	Not detectable (<2 mg/kg)

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The values are tentative and there is scope for further improvement in the stability characteristics of the oil, which may increase the service life of the oil.

Tenderer shall furnish their guaranteed values along with method of tests (which shall be as per standard procedure) for the above characteristics of Transformer oil, along with their offer.
The tenderer shall also furnish:

(a) Proportion of classes of hydrocarbons in the crude oil including content of aromatic hydrocarbons.

(b) Details of barrel (Size, gauge inside/outside, coating, weight of empty drum not less than 18 Kg.)

(c) List of equipments for testing of oil as per revised IS.

d) Electric strength (breakdown voltage) KV (Min.)

i) Value of the fresh sample in the supplied sealed drums KV (Min.)
ii) Value after filling in transformer upto & within 3 months (Min.)

12 Reference IS Specification:

IS:335 -2018 , IS:1448 –1967, IS:1448 –1976, IS:1448 -1977, IS:6103 -1971, IS:6104 -1971, IS:6262 -1971, IS:6792 -1992, IS:12177 -1987, IS:13557 – 1992, IS:13631-1992, IS 13236-2013.

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GUARANTEED TECHNICAL PARTICULARS

Sl. No.	Characteristics	Guaranteed Particulars
1.	Appearance	
2.	Density at 20°C (Max) gm/cc	
3.	Viscosity, Kinematic at 0 °C (Max)	
4.	Viscosity, Kinematic at 40 °C (Max)	
5.	Interfacial Tension at 27 °C (Min) Newton/M	
6.	Flash point, Pensky Marten (closed) in °C (min)	
7.	Pour point in °C (Max)	
8.	Neutralisation value	
	a) Total acidity, mg KOH/gm (Max)	
	b) Inorganic acidity / alkalinity	
9.	Corrosive sulphur (Copper strip) 19 hours at 140 °C	
10.	Electric strength (Breakdown Voltage) KV (rms)	
	a) New unfiltered oil (min)	
	b) After filtration (min)	
11.	Dielectric dissipation factor (Tan Delta) at 90 °C (Max)	
12.	Oxidation stability	
	a) Neutralisation value, after Oxidation for 164 hours at 100°C mg KOH/gm (Max)	
	b) Total sludge, after 164 hours at 100 °C wt. % (max)	
13.	Presence of oxidation inhibitor	
14.	Water content, ppm (max)	
15.	i) Proportion of classes of hydrocarbons in the crude oil including content of aromatic hydrocarbons	
	ii) Details of Barrel (Size, gauge inside/outside, coating, weight of empty drum not less than 18 kg.)	
	iii) List of equipments for testing of oil as per revised IS	
	iv) Electric Strength (Break down voltage) KV (Min)	
	a) Value of the fresh sample in the supplied sealed drums in KV (Min)	
	b) Value after filling in transformer upto & within 3 months (Min)	
16.	DBDS	
17.	Furfural and related compounds content	
18.	PCA content	
19.	PCB content	

Signature .....

Name .....

Seal of the Firm .....

Name of the Firm .....

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