

NEW TRANSFORMER OIL
TECHNICAL SPECIFICATION

1. **SCOPE:** The specification provides for the manufacture, testing before dispatch, supply and delivery of Transformer Oil as per the particulars given in the “Schedule of Materials”.
2. **STANDARD:** The Transformer Oil shall conform in all respects to IS:335/2018 Type -1 (uninhibited)Transformer oil (or) latest version.

COMPOSITION:The oil shall be pure hydrocarbon mineral oil, without any additive, clean and sufficiently free from moisture or other foreign matter likely to impair its properties.

3. **INSPECTION & TESTING:-** In addition to Clause 45, general and financial terms and conditions.
 - (a) The oil samples taken in the presence of a designated officer of A.P.E.P.D.C.L. and your representative at your works before dispatch and/or consignees places after dispatch shall be tested at CPRI, BANGALORE/ERADA, VADODARA at the discretion of A.P.E.P.D.C.L. The test results should be binding on both parties. The testing charges of samples taken at your works and the consignee’s places after dispatch are to be borne by the supplier only.
 - (b) The oil drums offered for inspection shall be sealed immediately after taking samples and dispatched to the consignees only after receipt of satisfactory reports of test results as per GTP.
 - (c) In case of waiver of inspection at your works, after receipt of the consignment at various destinations, oil samples shall be taken by your representative at minimum three consignees to be specified by us in the presence of our Engineers and shall be sealed. These sealed samples shall be brought to CPRI, BANGALORE/ERADA, VADODARA at the discretion of the APEPDCL for testing as per the parameters furnished in the Annexure-I enclosed in the presence of our Inspecting Officer. After testing the test results shall conform generally as per IS:335/2018 Type -1 (uninhibited)Transformer oil (or) latest version and in particular conforming to the parameters furnished in Annexure –I enclosed.
4. **CHARACTERISTICS:-** The characteristics of the oil when it is sampled at the manufacturer’s work and / or at the point of delivery and tested in accordance with the methods referred to in IS:335/2018 Type -1 (uninhibited)Transformer oil (or) latest version shall comply with requirements specified in Annexure-I.
5. **TEST & TEST CERTIFICATES:-** The test shall be carried out as per IS:335/2018 Type -1 (uninhibited)Transformer oil (or) latest version in all respects **OR** the test shall be carried out as per the parameters as mentioned in Annexure – I, in general before dispatch and test certificates shall be furnished for approval.
6. **SAMPLING:-** Sampling of the oil shall be done in accordance with IS-6855/1973.
7. **MARKING:-** Each drum shall be indelibly marked with the following:
 - a) Manufacturer’s name or trade – Mark
 - b) Quantity in litres

- c) Name of the material
- d) The words “ Low viscosity type” and
- e) Identification in code or otherwise to enable the date and lot /batch of manufacturers to be traced back to the factory record.
(and also A.P.E.P.D.C.L. PO No.....and Dt)
- f) Batch No.....Date:.....

8. **PACKING:** Packing shall be done as per the IS:335/2018 Type -1 (uninhibited)Transformer oil (or) latest version and in such a way that the material reaches destination without any damage.

The Transformer Oil shall be packed in new non-returnable steel drums of 209/210 litres capacity made of 18 SWG thick sheet. The drums shall be effectively sealed and they should be non -hygroscopic

The oil drums may be coated from inside with suitable coating (for example: epoxy lacquer, and phosphate) resistant to insulating oil. The outside surface of the drum shall be coated with suitable primer and finishing paint, or hot dip galvanized for protection against atmospheric corrosion.

9. **GUARANTEED TECHNICAL PARTICULARS:-** The bidders shall furnish guaranteed technical particulars as per Annexure –I enclosed and as required in the IS:335/2018 Type -1 (uninhibited)Transformer oil (or) latest version / or the guaranteed technical particulars (i.e. typical test values) as required against the New Insulating (Transformer Oil) mentioned in Annexure – I shall be furnished along with the tender.

GUARANTEED TECHNICAL PARTICULARS

| Sr.No. | Property | Test Method | IS:335:2018 Type I Transformer Oil (Uninhibited) or latest version |
|---------------|--|-------------------------|---|
| A | Function | | |
| i. | Viscosity at 40 ⁰ C | IS 1448 (Part 25) | 12 mm²/s, Max |
| | Viscosity at 27 ⁰ C | IS 1448 (Part 25) | --- |
| ii. | Viscosity at 0 ⁰ C | IS 1448 (Part 25) | - |
| iii. | Viscosity at -30 ⁰ C | IS 1448 (Part 25) | 1800 mm²/s, Max |
| iv. | Viscosity at -40 ⁰ C | IS 16084 | --- |
| v. | Pour Point | IS 1448 (Part 10/Sec 2) | -40⁰C, Max To be based on LCSET refer Table 1 |
| vi. | Water Content | IEC 60814 | 30 mg/kg/40 mg/kg, Max |
| | Water Content | IS 13567-1992 | |
| vii. | Breakdown Voltage | IS 6792 | 30 kV/70 kV, Min |
| viii. | Density at 20 ⁰ C | IS 1448 (Part 16) | 0.895 g/ml, Max |
| | Density at 29.5 ⁰ C | IS 1448 (Part 16) | |
| ix. | DDF at 90 ⁰ C | IS 16086 | 0.005, Max |
| | | IS 6262-1971 | |
| x. | Particle Content | IS 13236 | No general requirement |
| B | Refining /stability | | |
| xi. | Appearance | - | Clear, free from sediment and suspended matter |
| xii. | Acidity | IEC 62021-1 | 0.01 mg KOH/g, Max |
| | Acidity | IS 1448 (P:2) | |
| xiii. | Interfacial tension | ASTM D971 | No general requirement |
| | Interfacial tension at 27 ⁰ C | IS 6104-1971 | |
| xiv. | Total Sulphur content | ISO 14596 or ASTM D4294 | No general requirement |
| xv. | Corrosive Sulphur | DIN 51353 | Not corrosive |
| xvi. | Potentially corrosive sulphur | IS 16310 | Not corrosive |
| xvii. | DBDS | IS 16497 (Part I) | Not detectable (<5 mg/kg) |

| Sr.No. | Property | Test Method | IS:335:2018 Type I Transformer Oil (Uninhibited) or latest version | |
|----------|--|--|---|--|
| i. | Inhibitors according to IS 13631/ IEC 60666 | IS 13631 | (U) Uninhibited Oil: Not detectable (<0.01%) | |
| | | | (T) Trace inhibited oil : <0.08% | |
| | | | (I) inhibited oils : 0.08% -0.40% | |
| | | | (see 3.6 to 3.8) | |
| ii. | Metal Passivator additives according to IS 13631/IEC 60666 | IS13631 | Not detectable (<5mg/kg), or as agreed upon with the purchaser | |
| iii. | Other Additives | | See ⁷ | |
| iv. | 2-Furfural and related compounds content | IS 15668 | Not detectable (<0.05 mg/kg) for each individual compound | |
| C | Performance | | | |
| v. | Oxidation stability AT 100 ⁰ C | | | |
| | Neutralisation Value after oxidation | Annex C | | |
| | Total Sludge after oxidation | | | |
| vi. | Oxidation stability | IS 12422 (Method C) (U) Uninhibited oil : 164 h (T) Trace inhibited oil : 332 h (I) Inhibited oil : 500 h | For Oils with antioxidant additives and metal passivator Additives (see 6.12) | |
| a. | Total Acidity | 1.9.4 of IS 12422 | 1.2 mg KOH/g, Max | |
| b. | Sludge | 1.9.1 of IS 12422 | 0.8%, Max | |
| c. | DDF at 90 ⁰ C | 1.9.6 of IS 12422 | 0.500, Max | |
| vii. | Gassing Tendency | IEC 60628 Method A | No general requirement | |
| viii. | ECT | See 6.14 | No general requirement | |