

LOT 6: Transformer Spare Parts and Accessories**Lubricants (Transformer oil)**

- 1.1 The insulating oil shall conform to all parameters either as per IEC-60296 or as specified below, while tested at supplier's premises. No inhibitors shall be used in oil. The supplier shall furnish test certificates from the supplier against their acceptance norms as mentioned below, prior to despatch of oil from refinery to site.

| Sl# | Characteristics | Requirements | Method of Test |
|-----|--|---|--|
| 1 | Appearance | The oil shall be clear and transparent and free from suspended matter or sediment | A representative sample of the oil shall be examined in a 100 mm thick layer, at ambient |
| 2 | Density at 29.5°C (max.) | 0.89 gm/cm ³ | IS: 1448 |
| 3 | Kinematic Viscosity at 27°C (Max.) | 27 cSt | IS: 1448 |
| 4 | Interfacial Tension at 27°C (Min.) | 0.04 N/m | IS: 6104 |
| 5 | Flash point Penskey-Marten (closed) (Min.) | 140°C | IS: 1448 |
| 6 | Pour point (Max.) | -30°C | IS: 1448 |
| 7 | Neutralization value (total acidity) (Max.) | 0.03 mg KOH/gm | IS: 335 Appendix-1 |
| 8 | Corrosive sulphur (in terms of Classification Of copper strip) | Non-Corrosive | IS: 335 Appendix-1 |
| 9 | Electric strength (Breakdown voltage) (Min.) | | |
| a) | New untreated oil | 30 kV (rms) (if this value is not attained the oil shall be treated) | IS: 6792 |



Section V- Schedule of Supply

| | | | |
|------------|--|--|-----------------------|
| b) | After Treatment | 60 kV (rms) | - |
| Sl# | Characteristics | Requirements | Method of Test |
| 10 | Resistivity (Min.) (ohm cm) | | IS: 6103 |
| b) | at 27°C | 1500x10 ¹² | |
| 11 | Oxidation stability | | |
| a) | Neutralization value after oxidation (Max.) | 0.40 mg KOH/gm | |
| b) | Total sludge after oxidation (Max) | 0.10 percent by weight | |
| 12 | Presence of oxidation inhibitor | The oil shall not contain anti-oxidant additives | IS: 335 Appendix-D |
| 13 | Water content (Max.) | | |
| a) | New untreated oil | 50ppm | IS: 2362 |
| b) | After treatment | 15ppm | IS: 1866 |
| 14 | Aging Characteristics after 96hrs as per ASTM-D1934/IS: 12177 with catalyst (Copper) | | |
| a) | Resistivity(Min) (ohm cm) at 27°C at 90°C | 2.5x10 ¹² 0.2x10 ¹² | |
| b) | Tan delta at 90°C (Max.) | 0.2 | |
| c) | Total acidity (Max.) | 0.05 mg KOH/gm | |
| d) | Sludge content wt. (Max.) | 0.05 % (By weight) | |
| 15 | PCB Content | Less than 2 ppm | |

1.2 Subsequently oil samples shall be drawn

- (i) Prior to filling in main tank at site and shall be tested for:
- (1) BDV.
 - (2) Moisture content.



(ii) Prior to energisation at site and shall be tested for following properties & acceptance norms:

| | | |
|-----|---------------------|------------------------------------|
| (1) | BDV (kV rms) | 60 kV (min.) |
| (2) | Moisture content | 15 ppm (max.) |
| (3) | Tan-delta at 90°C | 0.05 (max.) |
| (4) | Resistivity at 90°C | 1 x 10 ¹² ohm-cm (min.) |
| (5) | Interfacial Tension | 0.03 N/m (min.) |

1.3 At manufacturer's works oil sample shall be drawn before and after heat run test and shall be tested for following:

| | | |
|-----|-------------------------------|--------------|
| (1) | BDV | 60 kV (min.) |
| (2) | Moisture content | 15 ppm |
| (3) | Dissolved gas analysis (DGA): | |

Samples for DGA shall be taken from sampling device within 24 hours prior to commencement of temperature rise test and immediately after this test. The acceptance norms with reference to various gas generation rates during the temperature rise test shall be as per IS: 10593 (based on IEC-599).



