**LOT 1: Lubricants**

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 20C (max.) | 895 kg/m³ | IEC 60296 |
| 3 | Kinematic Viscosity at 27C (Max.) | 27 cSt | IS: 1448 |
| 4 | Interfacial Tension at 27C (Min.) | 43mN/m | IEC 60296 |
| 5 | Flash point Pensky-Marten(closed) (Min.) | Min 135C | IEC 60296 |
| 6 | Pour point (Max.) | -40C | IEC 60296 |
| 7 | Neutralization value (total acidity) (Max.) | 0.03 mg KOH/gm | IS: 335Appendix-1 |
| 8 | Corrosive sulphur (in terms of Classification Of copper strip) | Non-Corrosive | IEC 60296 |
| 9 | Electric strength (Breakdown voltage) (Min.) | | |
| a) | New untreated oil | 30kV (rms) (if this value is not attained the oil shall be treated) | IS: 6792 |
| b) | After Treatment | 60kV (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) | 0.05% | IEC 60296 |
| 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)<br>at 27°C<br>at 90°C | <br>$2.5x10^{12}$<br>$0.2x10^{12}$ | |
| b) | Tan delta at 90°C (Max.) | 0.05 | |
| c) | Total acidity (Max.) | 0.03 mg KOH/gm | IEC 60296 |
| 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: | |

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).