IPOL

# Transformer Oils

Sah Petroleums Limited

# Contents

# Transformer Oils

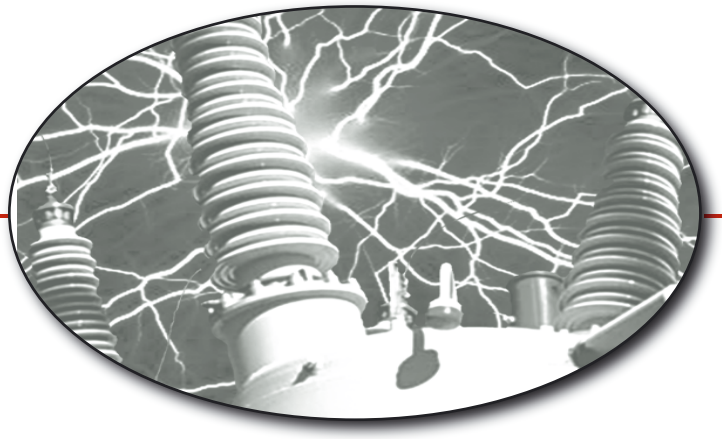
## TRANSFORMER OILS

Sah Petroleums Ltd. manufactures and markets IPOL Transformer Oils .

Routine inspection at each stage ensures a product which fully meets the required specifications. Users must store it in tank/ barrels taking precautions to prevent ingress of moisture and sediments, which can result in the product not meeting specifications.

### IPOL TRANSFORMER OIL MEETING IS : 335-1993

| Typical Inspections | | | |
|---|---|---|---|
| **Characteristics** | **Test Methods** | **IS:335:1993** | |
| | | **Minimum** | **Maximum** |
| Appearance | A representative sample of the oil shall be examined in a 100 mm thick layer at 27° C | The oil shall be clear and transparent, and free from suspended matter or sediments | |
| Density at 29.5° C g/cm$^3$ | IS:1448 (P-16) : 1977 | — | 0.89 |
| Kinematic Viscosity, at 27° C cSt | IS:1448 (P-25) : 1976 | — | 27 |
| Interfacial Tension N/m at 27° C | IS:6104 : 1971 | 0.04 | — |
| Flash Point Pensky-Marten (closed), °C | IS:1448 (P-21) : 1970 | 140 | — |
| Pour Point, °C | IS:1448 (P-10) : 1970 | — | (-)6 |
| Neutralization Value | IS:1448 (P-2) : 1967 | | |
| 1) Total acidity, mg KOH/gm | | | 0.03 |
| 2) Inorganic acidity/alkalinity | | Nil | |
| Corrosive Sulphur Copper Strip, 19 hrs at 140 ± 2° C | Annex-B | Non Corrosive | |
| Electric Strength (breakdown voltage), KV (r m s) | IS:6792 : 1972 | | |
| 1) New unfiltered oil | | 30 | — |
| 2) After filteration | | 60 | — |
| Dielectric Dissipation Factor (tan Delta) at 90° C | IS:6262 : 1971 | — | 0.002 |
| Specific Resistance (resistivity, ohm-cm) | IS:6103 : 1971 | | |
| 1) At 90° C | | 35 x 10$^{12}$ | — |
| 2) At 27° C | | 1500 x 10$^{12}$ | — |
| Oxidation Stability | Annex-C | | |
| 1) Neutralization Value, after oxidation for 164 hrs at 100° C mg KOH/gm | | — | 0.40 |
| 2) Total Sludge, after oxidation for 164 hrs at 100° C. wt % | | — | 0.10 |
| Accelerated Ageing Test (open beaker method with copper catalyst) 96 hrs at 115° C | IS:12177 : 1987 Method A | | |
| 1) Specific Resistance (resistivity) ohm-cm at 27° C | IS:6103 : 1971 | 2.5 x 10$^{12}$ | — |
| 2) Specific Resistance (resistivity) ohm-cm at 90° C | IS:6103 : 1971 | 0.2 x 10$^{12}$ | — |
| 3) Dielectric Dissipation Factor (tan Delta) at 90° C | IS:6262 : 1971 | — | 0.20 |
| 4) Total Acidity, mg, KOH/gm | IS:1448(P-2) : 1967 | — | 0.05 |
| 5) Total Sludge Value | Annex-A of 12177 | — | 0.05 |
| Presence of Oxidation Inhibitor | IS:13631 : 1992 | The oil shall not contain antioxidant additives | |
| Water Content, ppm | IS:13567 : 1992 | — | 50 |
| S. K. Value % wv | IS:335, Annex-D | — | 4 |



## INHIBITED MINERAL INSULATING OILS (FOR RAILWAYS) MEETING IS : 12463-1988

| Typical Inspections | | | |
|---|---|---|---|
| **Characteristics** | **Test Methods** | **IS:12463:1988** | |
| | | **Minimum** | **Maximum** |
| Appearance | A representative sample of the oil shall be examined in a 100 mm thick layer at 27° C | The oil shall be clear and transparent, and free from suspended matter or sediment. | |
| Density at 29.5° C g/cm$^3$ | IS:1448(P-16) : 1977 | - | 0.89 |
| Viscosity, Kinematic cSt 27° C | IS:1448(P-25) : 1976 | - | 27 |
| Interfacial Tension N/m at 27° C | IS:6104 : 1971 | 0.04 | - |
| Flash Point Pensky-Marten (closed), °C | IS:1448(P-21) : 1970 | 140 | - |
| Pour Point, °C | IS:1448(P-10) : 1970 | - | (-) 6 |
| Neutralization Value | IS:1448(P-2) : 1967 | | |
| 1) Total acidity, mg KOH/gm | | | 0.03 |
| 2) Inorganic acidity / alkalinity | | NIL | |
| Corrosive Sulphur | Annex-A of IS:335-1983 | Non Corrosive | |
| Electric Strength (breakdown voltage), KV (r m s) | IS:6792 : 1972 | | |
| 1) New unfiltered oil | | 30 | - |
| 2) After filteration | | 60 | - |
| Dielectric Dissipation Factor (tan Delta) at 90° C | IS:6262 : 1971 | - | 0.002 |
| Specific Resistance (resistivity, ohm-cm) | IS:6103 : 1971 | | |
| 1) At 90° C | | 35 x $10^{12}$ | - |
| 2) At 27° C | | 1500 x $10^{12}$ | - |
| Oxidation Stability | IS:12422-1988 | | |
| 1) Neutralization Value, after oxidation mg KOH/gm | | - | 0.40 |
| 2) Total Sludge, after oxidation, by mass | | - | 0.10 |
| Oxidation Stability (rotating bomb test), minutes | | 195 | - |
| Oxidation Inhibitor Content, % by mass | Appendix D of IS:335-1993 | - | 0.3 |
| Water Content, ppm | IS:2362 : 1973 | - | 50 |

## UNINHIBITED OIL MEETING IEC 296-1982 CLASS I SPECIFICATIONS

| Typical Inspections | | | |
|---|---|---|---|
| **Characteristics** | **Test Methods** | **IEC:296:1982 Class I Uninhibited** | |
| | | **Minimum** | **Maximum** |
| Appearance | — | Transparent clear colourless, odourless liquid free from suspended impurities | |
| Kinematic Viscosity, $mm^2/S$ at 40° C | BS EN ISO 3104 | – | 16.5 |
| Kinematic Viscosity, $mm^2/S$ at -15° C | BS EN ISO 3104 | – | 800 |
| Flash Point °C, Pensky-Marten (closed) | BS EN ISO 2719 | 140 | – |
| Pour Point °C | BS 2000 (P:15) | ≤ (-)30 | |
| Density $kg/m^3$, at 20° C | BS EN ISO 3675 | -- | 0.895 |
| Neutralisation Value mg KOH/g | BS 2000 (P:1) | -- | 0.03 |
| Corrosive Sulphur | DIN 51553/BS 5680 | Non Corrosive | |
| Water Content, mg/kg | IEC 60814 | | |
| 1) Bulk Delivery | | – | 20 |
| 2) Drum Delivery | | – | 30 |
| Anti-Oxidant Additives | IEC 60666 / BS 5984 | Not Detectable | |
| Oxidation Stability, 164 hrs | BS EN 61125 Method A | | |
| 1) Neutralisation Value mg KOH/g | | – | 0.4 |
| 2) Total Sludge % | | – | 0.1 |
| Breakdown Voltage, as delivered, (KV) | BS EN 60156 | 30 | – |
| Breakdown Voltage, after treatment, (KV) (for IEC 296) | | 50 | – |
| Dielectric Dissipation Factor at 90° C | BS 5737 | – | 0.005 |
| Gassing Tendency at 50 Hz after 120 min. $mm^3/min$, Method A | BS 5797 | – | (+)5 |
| Total PCB Content mg/kg | BS EN 61619 | Not Detectable | |
| Total Furans mg/kg | BS 61198 | -- | 1.00 |
| Polycyclic Aromatics % mass | BS 2000 (P:346) | -- | 3.00 |

## UNINHIBITED OIL MEETING BS 148 CLASS I & CLASS II SPECIFICATIONS

| Typical Inspections | | | | |
|---|---|---|---|---|
| **Characteristics** | **BS:148 Class I Uninhibited Oil** | | **BS:148 Class II Uninhibited Oil** | |
| | **Minimum** | **Maximum** | **Minimum** | **Maximum** |
| Kinematic Viscosity, $mm^2/S$ at 40° C | -- | 16.5 | -- | 11.0 |
| Kinematic Viscosity, $mm^2/S$ at 20° C | -- | 40.0 | -- | 25.0 |
| Kinematic Viscosity, $mm^2/S$ at -15° C | -- | 800 | -- | 1800 |
| Flash Point, Pensky-Marten (closed), °C | 140 | -- | 130 | -- |
| Pour Point, °C | -- | (-)30 | -- | (-)45 |
| Appearance | Clear, free from sediments & suspended matter | | Clear, free from sediments & suspended matter | |
| Density, $kg/gm^3$ at 20° C | -- | 0.895 | -- | 0.895 |
| Interfacial Tension, N/m at 25° C | 0.04 | -- | 0.04 | -- |
| Neutralisation Value, mg KOH/gm | -- | 0.03 | -- | 0.03 |
| Corrosive Sulphur | Non Corrosive | | Non Corrosive | |
| Water Content, mg/kg | | | | |
| 1) Bulk Delivery | -- | 30 | -- | 30 |
| 2) Drum Delivery | -- | 40 | -- | 40 |
| Antioxident Additives | Non Detectable | | Non Detectable | |
| Oxidation Stability at 120° C for 164 hrs. | | | | |
| 1) Total Acidity, mg KOH/gm of oil | -- | 1.50 | -- | 1.50 |
| 2) Sludge, % by mass | -- | 1.0 | -- | 1.0 |
| Breakdown Voltage, as delivered, KV | 30 | -- | 30 | -- |
| Breakdown Voltage, after treatment, KV | -- | -- | 50 | -- |
| Dissipation Factor at 90° C and 40 Hz to 62 Hz | -- | 0.005 | -- | 0.005 |
| Gassing Tendency at 50 Hz after 120 min, $mm^3/min$ | -- | (+)5 | -- | (+)5 |
| PCB Content, % mass | Nil | | Nil | |