

IS 1866 OIL IN SERVICE

Table 1 Recommended Limits of Unused Mineral Oil Filled in New Power Transformer
(Clauses 6.1 and 10.3)

Property	Highest Voltage of Equipment (kV)		
	↓ < 72.5	↓ 72.5 to 170	↓ >170
Appearance	Clear, free from sediment and suspended matter		
Density at 29.5°C (g/cm ²), Max	0.89	0.89	0.89
Viscosity at 27° C (cSt), Max	27	27	27
Flash Point, (°C), Min	140	140	140
Pour Point (°C), Max	-6	-6	-6
Neutralization value (mg KOH/g), Max	0.03	0.03	0.03
Water content (ppm), (see Note 1), Max	20	15	10
Interfacial tension (mN/m), Min	35	35	35
Dielectric dissipation factor at 90°C and 40 Hz to 60 Hz (see Note 2), Max	0.015	0.015	0.010
Resistivity (90°C) x 10 ¹² (ohm-cm), Min	6	6	6
Breakdown voltage (kV), Min	40	50	60
Oxidation stability of uninhibited oil			
i) Neutralization value (mg KOH/g), Max	0.4	0.4	0.4
ii) Sludge (percent by mass), Mass	0.1	0.1	0.1
Oxidation Stability for inhibited oil	0.1	0.1	0.1
Induction period (hours)	Similar values as before filling		

Notes :

1. For use in transformers under 72.5 KV class; the maximum water content should be agreed between supplier and user depending upon local circumstance.
2. Higher dielectric dissipation factor values may indicate excessive contamination or the misapplication of solid materials used in manufacture and should be investigated.

Table 2 application and Interpretation of Tests

(Clauses 7.3, 7.7, 10.1, 10.3 and 10.4)

Property (Unit) (1)	Test Venue F = field L=Laboratory (2)	Category of Equipment (3)	Frequency of Tests (4)	Recommended Action Limits (5)	Action (6)	Notes (7)
Appearance	L of F	O,A,B,C,D,E	In conjunction with other quantitative tests	Clear, without visible contamination	As dictated by other tests	
Breakdown Voltage	L of F	O,A,B,C,D,E,F,G.	O,A,B – After filling or refilling prior to energizing – then yearly C.D.E. – After filling or refilling prior to energizing – then yearly F- After filling or refilling prior to energizing – then every four years or 70 000 operations whichever the lower or manufacturer’s instructions. G- Refer to manufacturer’s specifications (see 9.2, 2, Note 2)	O,A,D : > 50kV B, E : > 40 kV C : >30 kV G : > 20kV F a) tap changer of neutral end tap changer O,A,B,C, transformer 25 kV b) Single phase or connected tap c) Changer O,A,B, transformers : >40 kV d) C transformers e) > 30 kV	Recondition oil or alternatively, if more economical or other tests dictate replace oil	Refer to 10.3 and 10.4
Water Content	L	O,A,B,C,D,E	O,A- After filling or refilling prior to energizing – then after three and 12 months, subsequently in conjunction with dissolved gas analysis B,D,E –	O.A.D. : ≤ 20 PPM B : ≤ 40 PPM E : ≤ 30 PPM C : \leq No free moisture at room temperature	Check source of water and consider reconditioning	1. The given values are applicable only where acidity does not

			After filling or refilling prior to energizing – then after 12 months. Subsequently every one year or in conjunction with dissolved gas analysis. Not a routine test : only when break down voltage approaches the rejection level			exceed 0.1 mg KOH/g 2. For variation of water content of (IS 335) transformer oil with oil temperature and acid value. See Fig, 1
Neutralization value	L	O,A,B,C,D,E,F,G	Yearly	O,A,B,C,D,E, Max 0.3 mg KOH/g	Replace or reclaim oil	Perform tests more frequently when neutralization value exceeds 0.2 mg KOH/g
Sediment and Sludge	L	O,A,B,C,D,E	Routine test-yearly	No sediment or precipitable sludge should be detected, results below 0.02 percent by mass may be neglected	Where sediment is detected, recondition oil. Alternatively if more economic or other tests dictate, replace oil. Where precipitable sludge is detected consider	

					replacing or reclaiming existing oil.	
Resistivity	L	O,A,B,C,D,E C,E, -Routine Test - yearly	After filling or refilling prior to energizing – then yearly	At 20°C, Min 1×10^{12} ohm-cm 0.1×10^{12} ohm-cm At 90°C, Min 1 Gohm-m	Investigate	
Dielectric dissipation factor at 90°C and 40 to 60 Hz	L	O.A.B,C,D,E C,E, -Routine Test-yearly	After filling or refilling prior to energizing-then yearly	O,A,D, Max 0.2 B,C, Max 1.0 E, Max 0.3	Investigate	Comply with manufactures instructions if other frequency and limit are recommended.
Interfacial tension	L	O,A,B,C,D,E	O,A,B,C,D,E – After filling or refilling prior to energizing then yearly	O,A,B,C,D,E Min. : 15mN/m	Investigate	
Gas content	L	O,A,B,C,D,E	-	-	-	Comply with manufacturer instructions
Flash Point	L	O,A,B,C,D,E	Yearly	O,A,B,C,D,E, Max decrease 15°C	Replace oil, equipment may require inspection	