

**OUR OILS
POWER UP
A NATION**

The logo for SERVO Transformer Oils is positioned at the bottom center of the advertisement. It features a circular emblem on the left containing the Indian Oil logo and the text 'IndianOil'. To the right of the emblem, the word 'SERVO' is written in a large, bold, white font with a registered trademark symbol, set against a red background. Below this, the words 'TRANSFORMER OILS' are written in a smaller, white, sans-serif font on a dark blue background. At the very bottom of the logo block, the slogan '100% PERFORMANCE. EVERYTIME.' is written in a white, sans-serif font on a white background.

IndianOil **SERVO**[®]
TRANSFORMER OILS
100% PERFORMANCE. EVERYTIME.

HIGH PERFORMANCE TRANSFORMER OILS FROM **SERVO**

Transformer oils, also known as insulating oils, are prepared from highly refined mineral oils. These oils serve mainly two purposes - one as liquid insulation in electrical power transformer and two, dissipate heat of the transformer i.e. act as coolant. In addition to these, transformer oils help to preserve the core and winding as these are fully immersed inside oil and prevent direct contact of atmospheric oxygen with cellulose-containing paper insulation of windings, which is susceptible to oxidation.

High voltage transformers having oil tank above it, often experience gas build up inside the transformer because of overheating of the oil. This gas build up increases the pressure inside the transformer resulting in tripping the protective circuit breaker. The transformer oil must have low volatility and high thermal stability to ensure reduced gas formation at high temperature.

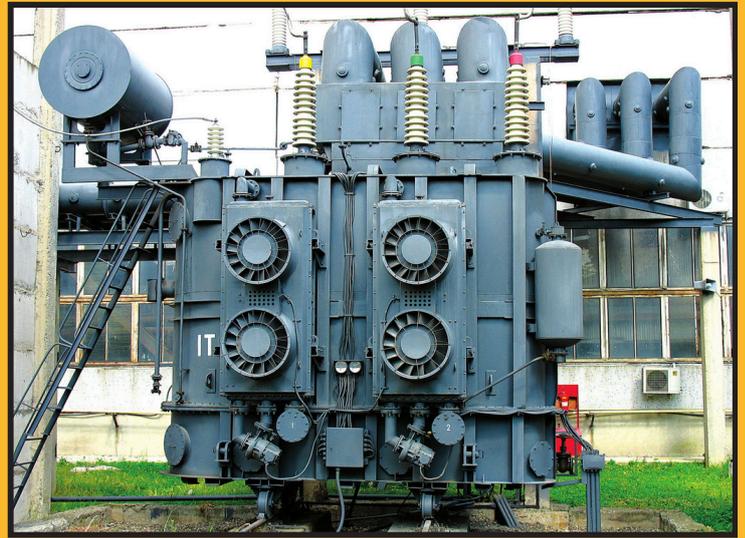
Generally there are two types of transformer oils available in market - Paraffin base transformer oil & naphthenic base transformer oil. The basic differences between paraffinic & naphthenic transformer oils are summarised in the below table:-

PROPERTY	TRANSFORMER OIL PARAFFINIC	TRANSFORMER OIL NAPHTHENIC
Low Temperature Properties	Good/ Satisfactory	Excellent
Viscosity-temperature Characteristics	Excellent	Poor
Oxidation & Thermal Stability	Excellent	Satisfactory
Heat Capacity & Thermal Conductivity	Excellent	Satisfactory
Solvency	Satisfactory	Good
Sludge Dispersion Characteristics	Good/ Satisfactory	Excellent
Volatility	Low	High
Flash Point	High	Low
Polarity	Low	High

Modern refining methods using hydro-catalytic processes lead to manufacturing of new generation paraffinic transformer oil base stocks (Group II). Such base stocks inherently possess superior thermo-oxidative stability, adequate pourability, lower volatility and higher flash point. These base oils are used for production of high performance transformer oils **SERVO** ELECTRA, meeting Indian standard IS:335 (un-inhibited type). **SERVO** ELECTRA exceeds IS:335 specifications and typical data is provided in Table 1.



Superior Electrical Properties: Electrical properties of transformer oils are assessed by various standard tests including Di-electric strength/ breakdown voltage (BDV), di-electric dissipation factor (TAN delta) and specific resistivity. Di-electric strength refers to the ability of the transformer oil to withstand electrical stress without affecting the quality of the oil. The electrical properties of insulating oils depend on the level of refining of the oil as well as the presence of moisture / impurities or external contaminants. **SERVO ELECTRA** has excellent breakdown voltage, di-electric dissipation factor and specific resistivity characteristics indicating superior electrical properties.



Excellent Oxidation Characteristics: The ability to resist oxidation at elevated temperatures in presence of oxygen is assessed by the oxidation test as per test procedure appended in the Annexure C of IS:335. In this test, degree of oxidation is estimated by determining the amount of sludge generated and the neutralization value of oxidized sample. Another test for checking the oxidation characteristics of transformer oil is open beaker oxidation test as per IS:12177 test procedure. The test result for **SERVO ELECTRA** shows superior thermal / oxidation stability and excellent electrical properties of aged oils after the oxidation tests.

Compatibility with construction materials: **SERVO ELECTRA** when evaluated with various construction materials i.e. crepe paper, insulating paper, cotton paper and press board as per ASTM D 3455 test procedure and also with increased severity (by increasing the size of construction materials to four times), is found to be compatible & it retains the general physico-chemical and electrical properties of the oil.

Other than above, **SERVO ELECTRA** possesses superior cooling property, higher flash point, lower pour point & low aromatic content. It is free from Poly Chlorinated Biphenyls (PCBs). **SERVO ELECTRA** is approved and well accepted by Transformer OEMs and users for use in generation and transmission transformers of EHV (Extra High Voltage) class up to 400 kV and distribution transformers to various ratings. It has validation from reputed Transformer OEMs like BHEL, Crompton Greaves, ABB, Schneider Electric, Voltamp, Marsons Electrical, Servomax India, Tesla Transformers and many others, as well as users like APGENCO/APTRANSCO/APCPDCL/APNPDCL, TNEB, JSEB, UHBVN/DHBVN, MAHADISCOM, PVVNL, KSEB, APDCL, Power plants like Anpara, Parichha, Torrent Power, DVC, Renusagar etc. and many other industries like TISCO, Coal India, ONGC, Hindalco, HAL, BILT, Usha Martin etc.



Transformer Oils Marketed by IndianOil

Product	Meeting Spec. Requirements
Servolectra	✓ IS:335 – 1993
Servolectra Plus	✓ IS:12463 – 1988
Servolectra Super	✓ BHEL TRE 158
Servolectra UX	✓ IEC 60296 (Un-inhibited) – 2012, NTPC, BS 148 (C I & C II)
Servolectra LPT	✓ IEC 60296 (Trace Inhibited)
Servolectra IX	✓ IEC 60296 (Inhibited) – 2012, BS 148 (C IA & IIA)
Servolectra Power (I)	✓ PGCIL

To ensure desired performance of the transformer oils, regular monitoring of oil quality for break down voltage and moisture content testing is required. Regular maintenance of the system by way of checking the breather seal, centrifuging and dehydration of oil will help in maintaining the quality of the transformer oil as well as its performance. This condition monitoring will also help in establishing the optimum drain interval of the oil.

Table 1

	PROPERTIES	METHOD	SERVOELECTRA	IS: 335 - 1993 (FOURTH REV RA 2000) (SPEC LIMITS)
1	Appearance	Visual	Clear	The oil shall be clear and transparent and free from suspended matter or sediments
2	Density @ 29.5 0C, g/ml	IS: 1448 [P:16]	0.8338	0.89 Max
3	Kinematic Viscosity @ 27 0C, cSt	IS: 1448 [P:25]	20.11	27 Max
4	Interfacial Tension @ 27 0C, N/m	IS : 6104	0.048	0.04 Min
5	Flash Point, PMCC, 0C	IS: 1448[P:21]	170	140 Min
6	Pour Point, 0 C	IS: 1448[P:10]	(-) 18	(-) 6 Max
7	Neutralization Value a) Total Acidity, mg KOH/gm b) Inorganic Acidity/Alkalinity	IS:1448[P:2]	0.01 Nil	0.03 Max Nil
8	Corrosive Sulphur	Annex B	Non-corrosive	Non-corrosive
9	Electric Strength (breakdown voltage) a) New Unfiltered Oil, kV (rms) b) After Filtration, kV (rms)	IS: 6792	47 kV 68 kV	30 kV Min If the above value is not obtained, the oil should be filtered, 60 Min
10	Dielectric Dissipation Factor (TAN delta) at 900C	IS: 6262	0.0007	0.002 Max
11	Specific Resistance (resistivity) a) at 900C, ohm-cm b) at 270C, ohm-cm	IS: 6103	192 x 10 ¹² 6602 x 10 ¹²	35x10 ¹² Min 1500x10 ¹² Min
12	Oxidation Stability a) Neutralization Value after Oxidation, mg KOH/gm b) Total sludge after oxidation, % by weight	Annex C	0.04 0.002	0.40 Max 0.1 Max.
13	Ageing characteristics after accelerated ageing (open beaker method with copper catalyst) a) Specific Resistance 1) at 270C, ohm-cm 2) at 900C, ohm-cm b) Dielectric Dissipation Factor at 900C c) Total Acidity, mg KOH/gm d) Total Sludge, % by weight	IS: 12177 IS: 6103 IS: 6262 IS: 1448 [P:2] Annex A	280 x 10 ¹² 57 x 10 ¹² 0.002 0.03 0.002	2.5 x 10 ¹² Min. 0.2 x 10 ¹² Min. 0.20 Max 0.05 Max. 0.05 Max
14	Presence of Oxidation Inhibitor	IS: 13631	Nil	The oil shall contain antioxidant additives
15	Water content, ppm	IS: 13567	19	50 Max
16	sK Value	Annexure D	Nil	--