Government of India
Ministry of Railways
Research, Designs & Standards Organisation
Manak Nagar, Lucknow - 226 011

No.EL/3.2.1/3/J6
30.1.1985

SPECIAL MAINTENANCE INSTRUCTIONS NO RDSO/ELRS/SMI/121

REVISED CHARACTERISTICS FOR NEW INSULATING OIL FOR LOCOMOTIV/EMU TRANSFORMER AND ADDITIONAL TESTS FOR MAINTENACE OF OIL IN SERVICE.

1. OBJECT

Railways have reported rapid deterioration of transformer oil conforming to IS: 335-1983 in service due to sharp increase in acidity of the indigenous transformer oil on account of oxidation since the indigenous oil made from transformer oil base stock (TOBS) with paraffine base material, the same has less oxidation stability as compared to the imported transformer oil made from TOBS having base material as Napthalene. In view of this, it has been decided that the characteristics of the new Insulating oil for locomotive/EMU transformers be revised and additional tests conducted to monitor the condition of oil in service.

2. INSTRUCTIONS

(i) New insulating oil for locomotive/EMU transformers shall conform to the characteristics of EHV grade oil. The specification requirements for EHV grade oil are given in annexure I enclosed.

(ii) The EHV grade oil is to be procured from the RDSO approved suppliers only, mentioned in para 2.6 of RDSO/ELRS/SMI/120 dated 23.11.1984.

(iii) Tests on oil samples as per Annexure II, every six months in each transformer and records maintained.

3. REFERENCE

(i) Adviser (Electrical)/Railway board's letter No 84/Elec(TRS)/441/2 dated 3.9.1984.

(ii) Traction Instillation Directorate /RDSO's letter No ETI/PSI/M/4 dt. 24.5.1984.

4. PERIODICITY

(i) Replacement of old oil-POH.

(ii) Test-every six months.

5. INSTRUCTION DRAWING:

NIL.

6. APPLICATION OF CLASS OF LOCOMOTIVE/EMU:

All the Electric Locomotives, and ac EMUs

7. AGENCY OF IMPLEMENTATION:

All the ac Electric loco sheds, ac EMU sheds and workshops holding ac locos/ ac EMUs.

8. DISTRIBUTION:

As per list enclosed.

(M. M. PRAKASAM)
for Director General (Electrical)

ANNEXURE I

REVISED SPECIFICATION FOR NEW EHV GRADE TRANSFORMER OIL, FOR USE IN LOCOS AND EMUs.

SL. NO.	Characteristics	Requirement for EHV grade oil
1	2	3
1.	Appearance	The oil shall be clear and transparent and free from suspended matter or sediments.
2.	Density at 27 ^{0}C, max.	0.89 g/cm^3.
3.	Kinematic viscocity: a) at 27 ^{0}Cmax b) at sub-zero temperature	 27 cst. Under consideration.
4.	Interfacial tension at 27 ^{0}C, Min.	0.04 N/m
5.	Flash point, Pensky-Marten (closed) minimum.	140 ^{0}C
6.	Pour point, Max.	-9 ^{0}C
7.	Neutralization value a) Total acidity, max. b) Inorganic acidity/alkalinity	 0.03mg KOH/g -
8.	Corrosive Sulphur	Non- corrosive
9.	Electric Strength (breakdown voltage with 2.5 mm gap) min. a) New unfiltered oil. b) After filteration	 30 KV (rms) If the above value is not attained, the oil shall be filtered. (60 KV (rms)

1.	2.	3.
10.	Dielectric dissipation factor (tanδ) at 90 ^{0}C max.	0.002
11.	Specific resistance (resisistivity) a) at 90 ^{0}C, Min. b) at 27 ^{0}C, Min.	 35 * 10 ^{12} Ohm cm 1500 * 10 ^{12} Ohm cm
12.	Oxidation stability a) Neutralizaiton value after oxidation, Max. b) Total sludge after oxidation, max.	 0.20 mg/KOH/ gm. 0.05 percent by weight.
13.	Presence of oxidation inhibitor.	The oil shall not contain anti-oxidant additives.
14.	Water content, max.	50 ppm
15.	SK Value, Max.	6 to 8 percent.
16.	Ageing characteristics as per ASTM D-1934 after accelerated ageing (open beaker method with copper catalyst) a)Specific resistance (resistivity) i) at 27 ^{0}C min. ii) at 90 ^{0}C min. b) Dielectric dissipation factor (Tanδ) at 90 ^{0}C, max. c)Total acidity, max. d) Total sludge value, max.	 2.5X10^{12} ohm cm. 0.2X10^{12} ohm cm 0.2 0.05 mg KOH/g 0.05 mg KOH/g

TESTS ON TRANSFORMER OIL IN SERVICE **Annexure II**

SL. No.	Characteristics	Test Method	Permissible limits	To be reconditioned	To be reclaimed/ replaced.
1.	**2.**	**3.**	**4.**	**5.**	**6.**
1.	Dielectric strength (break-down voltage kv)	IS:6792-1972	50KV Min (as per transformer maintenance manual No MI/E-3/01 issued in june 1972.	15 KV-50KV	Below 15 KV
2.	Water content	IS: 335-1983 Appendix E.	35 ppm Max	35-50ppm	Above 50 ppm
3.	Specific resistivity at i) 27 ^{0}C ii)90 ^{0}C	IS: 6103-1971	$10*10^{12}$ ohm cm. min $0.2*10^{12}$ ohm cm. min	$1.0*10^{12}$ -$10*10^{12}$ ohm cm $0.1*10^{12}$ $0.2*10^{12}$ ohm cm	Below$1.0*10^{12}$ ohm cm. Below $0.1*10^{12}$ ohm cm
4.	Dielectric dissipatation factor (Tan dalta)at i) 90 ^{0}C ii)27 ^{0}C	IS:6262-1971	 0.02 Max 0.01 Max	 0.02-0.2 0.01-0.1	 Above 0.2 Above 0.1
5.	Neutalisation value (Total acidity) of oil.	IS:1866-1983 Appendix B.	0.5mg/KOH/g max	0.5mg/KOH/g 1.0 mg/KOH/g	Above 1.0 mg KOH/g.
6.	Interfacial tension at 27^0C.	IS:6104-1971 Appendix D.	0.2 N/m Min	0.02N/m 0.015N/m	Below .015 N/m
7.	Dissolved gas analysis	Under finalisation	Under finalisation	Under finalisation	Under finalisation

Note: 1. The Values of the permissible limits indicated above are given for guidance only.

2. The oil samples should be tested six-monthly in each transformer and records maintained for all the parameters.