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भारत सरकार - रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ - 226011
Government of India - Ministry of
Railways
**Research, Designs & Standards
Organization, LUCKNOW - 226011**

EL/3.2.1-3
28.11.2007

Dt.

CHIEF ELECTRICAL ENGINEER,

- Northern Railway, Baroda House, New Delhi-110 001
- North Central Railway, Hasting Road, Allahabad-211 001
- Eastern Railway, Fairlie Place, Calcutta-700 001
- South Eastern Railway, Garden Reach, Calcutta-700 043
- Central Railway, Mumbai CST-400 001
- Western Railway, Churchgate, Mumbai-400 020
- Southern Railway, Park Town, Chennai-600 003
- South Central Railway, Rail Nilayam, Secunderabad-71
- East Central Railway, Hazipur (Bihar)
- East Coast Railway, BDA Colony, Rly Complex, Chandrasekharpur, Bhubaneswar
- South East Central Railway, Bilaspur-495 004
- West Central Railway, Jabalpur-482 001

***SPECIAL MAINTENANCE INSTRUCTION No.RDSO/2007/EL/SMI/0249
Rev(0)***

1.0 TITLE:

Test procedure, lower limit and process of adding inhibitor in transformer oil of in-service traction transformers.

2.0 BRIEF HISTORY:

- 2.1 Due to increased acidity and sludge formation in EHV grade insulating oil conforming to IS:335-1983, RDSO advised railways to switch over to use inhibited oil to IS:12463-1988 and issued SMI No. RDSO/ELRS/SMI/159 vide letter No. EL/3.2.1/3 dt. 2.12.1993 for use of inhibited oil.
- 2.2 The inhibitor used in practice is DBPC (Ditertiary butyl para cresol, food grade) and shall be as per IS:9207-1979 and shall also meet the requirement of clause 2.1 of IS:12463-1988.
- 2.3 Though railways are using inhibited oil since 1993-94 onwards, but do not have facilities for testing of inhibitor content and process of adding the inhibitor in the in-service transformer oil.

3.0 OBJECT:

Determination of inhibitor content of in-service transformer oil and accordingly replenishment of DBPC to take maximum benefit of prolonged service of transformer oil.

4.0 MODIFIED INSTRUCTION:

Quantity of DBPC in transformer oil gets depleted during service and frequency of replenishment of DBPC depends on the severity of use of the transformer in service. To ensure stability of transformer oil, the content of inhibitor should be checked at periodic intervals (every AOH/IOH/POH) and replenishment may be done if required as per details enclosed as **Annexure-A**.

5.0 APPLICATION TO CLASS OF LOCOMOTIVES:

All class of conventional locomotives & EMUs.

6.0 AGENCY OF IMPLEMENTATION:

All electric loco sheds / POH shops and EMU sheds.

7.0 PERIODICITY OF IMPLEMENTATION:

Every AOH, IOH & POH

8.0 REFERENCE:

Item No. 9 of part-III (Review Items)- Minutes of 31st MSG meeting (Electrical Locomotive)

9.0 DISTRIBUTION:

As per mailing list

Encl: As above.

(Hari Narayan)
for Director General (Elect.)

1.0 Test Procedure of Inhibitor:

As per IS: 13631-1992 or IEC: 60666 or ASTM: D-2688-92

2.0 Test Equipment:

FTIR spectrometer

3.0 Source of Equipment:

Details of FTIR spectrometer can be obtained from: M/s Perkin Elmer(India) Pvt. Ltd. B1, Alsa Regency, 165, Eldams Road, Alwarpet, Channai-600018

Tel. : 044-24347008/24320352

Fax: 044-24346328

Email:lipchn@md3.vsnl.net.in

Website:www.perkinelmer.com

- 4.0 Lower limit of Inhibitor:** As per IEC:60296-2003, an oil is classified as inhibited when the inhibitor content(DBPC) is maintained in the oil at minimum of 0.08% by weight. Thus, any oil containing less than 0.08% of inhibitor can not be considered as inhibited oil. Based on above & other references available at RDSO, 0.1% inhibitor content (DBPC) by weight as a lower limit and upper limit as 0.3% by weight as per IS:12463 may be adopted for in-service transformer oil.

5.0 Process of Adding Inhibitor (DBPC) to Transformer Oil:

- i) Inhibited oil is first tested for the inhibitor content.
- ii) After knowing the inhibitor content the quantity of DBPC to be added is calculated as per the total volume in which DBPC is to be added. The quantity of DBPC to be taken shall be inline with the quantity already present and made to the desired level. For computing the weight of the oil, a density of 0.83 gm/ml can be considered to convert the volume of oil into weight. Otherwise the weight of the oil can be taken directly.
- iii) The required quantity of the inhibitor for the whole lot is weighed and is added to a vessel containing approximately 15 to 20 litres oil. The oil is maintained between (60-70)° C for 2 to 3 hours under continuous stirring.
- iv) DBPC in concentrated solution of oil is added when the transformer remains un-energized. After adding the concentrated solution wait for at least 6 hrs before energizing the transformer. This is because a high concentration of say 10-20% DBPC solution has an appreciably low dielectric strength, which might endanger the transformer. Hence, the need to wait for some hours so that the DBPC gets completely dispersed in the oil in the transformer. It is also convenient to add DBPC crystals to the transformer in the service. Here the crystal should be added slowly at intervals and sufficient time must be allowed for crystals to get completely dissolved in oil before the next lot is added.

- v) Finally check the inhibitor content as per test method of inhibited oil. If the inhibitor content is not within the specified limit, repeat from step No (i) onwards. After completion of the above process, it is also recommended that the treated oil shall be tested before allowing the transformer for operation.

Equipments required for the above process are as under.

- a) A vessel of sufficient capacity (20-25 litres)
- b) Heating mantle/hot plate (if solution is made)
- c) Weighing balance (for weighing correctly the DBPC)
- d) A clean stirring rod / motorized stirrer