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

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**SPECIAL MAINTENANCE INSTRUCTION NO. RDSO/ELRS/SMI/157**

**CONDITION MONITORING OF SOLENOIDS BY SURGE COMPARISON METHOD**

**1. Object.**

**1.1** Solenoids used in electromagnetic relays/ contactors, electro-pnuematic apparatus, circuit breakers, tap changers and electrovalves for many other applications generate surge voltage of the order of 5. KV when their operating currents are interrupted. It has been observed that the insulation provided below the inner lead and terminals and above the outer layer is often inadequate to withstand these surges. As a result, small discharges take place at the weak points every time solenoid is switched off. The cumulative damage of this high poak discharge voltage causes further degradation/deterioration at such weak points and results.eventually, In failure in service at 110V DC.

**1.2** It is therefore recommended to introduce surge comparison tests so that weaks coils already in use may be identified before they fall in service. This SMI suggests a method for this purpose.

**2. Instructions.**

**2.1** The surge comparison tester already being used for auxiliary motor test may be used for this purpose.

**2.2** A good solenoid which has been identified in a previous test should be used as the standard for comprison.

**2.3** The surge test shall be carried out at 5. KV.

**2.4** The comparison standard should be of the same make and same design as the solenoid to be tested.

**2.5** The oscillograph displays of the two damped oscillation in the two solenoids shall be compared. They should coincide or overlap fully. The vertical adjustment control may be operated to bring the two traces together.

**2.6** If there are any local discrepancies or deviations particularly at the voltage peak, the test solenoid should be rejected.

**2.7** If the stock of replacable solenoids is not adequate, the test may be rejected on a rejected solenoid at 3.0 kV. If it passes the 8 kV surge test, the solenoid may be used for a limited period in service. If it fails even 3 KV test also, the solenoid should be rejected.

**2.8** The solenoid used as "standard" in the above test, may be released for service and the test solenoid which has passed the 5. kV test be retained as the standard for further tests on other solenoids. This will ensure that one solenoid is not used repeatedly as the 'standard' for a long period.

**2.9** The surge test is not a destructive test. The surges applied are no wores than those which get applied repeatedly in service. All that is done in a suge test is to measure on a CRT the presence of discharges at weak points.

**2.10** The surge test has a surge repetition rate of 50 or 100 per second. It is not necessary to keep it on for more than a few seconds to detect discrepancies between the wave forms of the 'standard' and the 'test' solenoid. Operating requirements of the surge test device is at Annexure-1.

**3. <u>Instruction Drawing.</u>**

Nil. (Jabbal,s pamphlet, for high voltage surge tester is enclosed at Annexure-2 for guidance only. There are other manufacturers who should be in a position to supply surge testers as per your requirements.)

**4. <u>Application.</u>**

All types of solenoids used on electric loco-motives and EMUs.

**5. <u>Agency for implementation</u>**

All Electric loco sheds ana POH shops for the solenoids already in service.

**6. <u>Periodicity of implementation</u>**

This test may be carried out during every major overhaul. However, Sheds may frame a programme to identify the weak coils as early as possible.

**7. <u>Distribution</u>**

As per mailing list.

Encl: Annexure-1& 2

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**Annexure-1**

**Operation requirements of surge testing device.**

**1.** The device shall generate through suitable RC circuits repetitive surges of peak voltages in the range 1 KV to 7 KV as determined through a control potentiometer.

**2.** The surges shall be applied 50 times per second to the equipment under test and the damped oscillatory currents which result shall be displayed on a CRT.

**3.** The device shall include a switching circuit which will apply the surges alternately to two identical equipments to enable comparison on the same CRT by superimposition of the two traces.

**4.** The energy in each surge shall be kept as small as possible to prevent permanent damate toe the insulation.

**5.** It shall be possible to adjust the two traces on the CRT vertically to check complete superimposition.

**6.** The CRT display shall have diameter of at least 100 mm.

**7.** The testar shall be suitable for use on a poer supply of AC 230 volts $\pm$ 20% and 50 Hz $\pm$ 5%.

**8.** The horizontal time-scale and the vertical voltage scale shall be capable of adjustment to enable display of either the complete damped wave or any desired part of it for detailed examination.