

SPECIAL MAINTENANCE INSTRUCTION No. RDSO/2008/EL/SMI/ 0253, Rev. ('0')

Title: Periodic Maintenance instructions for improvement in reliability of Twin Beam Headlight and DC-DC Converter during major schedules of electric locomotive.

1.0 Brief History:

- 1.1 Twin beam headlight with DC-DC converter has been introduced in electric locomotives during the year 1998-99 replacing of conventional headlight. since them, all the electric locomotives and EMUs are equipped with twin beam headlight with DC-DC converter. The reliability of DC-DC converter needs improvement and failure on line should be arrested. The twin beam headlight with DC-DC converter are being procured as per RDSO's specification no. **ELRS/SPEC/DC-DC CONVERTER/0021 Rev.'1'** of 2004. Railways have been maintaining DC-DC converter with twin beam headlight as per users' manual/instructions given by the manufacturers. However, there are no uniform periodic checks and predictive or preventive maintenance schedules for headlight.

2.0 Objective:

- 2.1 There is a need to adopt certain minimum maintenance practices during major schedules i.e. AOH/IOH/POH of locomotives so that proper attention is given to headlight & Dc Dc converter for improvement in reliability to avoid failures on line and to weed out the defective component before it fails.

3.0 Preventive action to be taken:**3.1 DC-DC converter:****3.1.1 During AOH:**

- a) DC-DC converter box should be opened for removal of dust & dirt. The heat sink to be cleaned with petrol or Iso- propyl alcohol.
- b) Tightness of input, output connection should be checked.
- c) Condition of input filter electrolytic capacitor should be visually checked. If it is found leaking, same should be replaced.(1000 mfd 200 V for Signotron make and 470 mfd 200 V/1200 mfd 200 V for Matsushi make).
- d) IR value should be checked as given below.

Megger the electronics circuit with respect to earth and check the insulation level with 500V megger. The time of the meggering shall not less then 60 Sec.

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|------------------------------------|--------------|
| - 110 V circuit and earth | : 20 M ohms. |
| - Control and Electronics to earth | : 10 M ohms. |
| - Screen to earth | : 10 M ohms. |
| - Input/Output to earth | : 10 M ohms. |

If IR values are less than the specified values take following actions

- i) Mica insulation between MOSFET and heat sink should be replaced and one layer of Kapton tape of 2 mm thick should be used in addition to the mica insulation.
 - ii) Wiring and connections should be checked.
- e) The performance check by measuring output voltage but keeping constant output current at 15.8 amp should be done as given below.

Input Voltage	Output voltage			
	Input Current	Output Current should be set at 15.8 A by Varying the load	Switch ON / OFF from I/P side 5 times & measure O/P voltage	Switch ON / OFF from OIP side 25 times & measure O/P voltage
70 V	6.2 - 6.6 A	15.8 Amp.	25.5 V \pm 1 %	25.5 V \pm 1 %
110 V	4.0 - 4.5A	15.8 Amp.	-Do-	-Do-
140 V	3.2 - 3.5A	15.8 Amp.	-Do-	-Do-

If the output voltage is not within the range the same should be obtained by adjusting the voltage pot given on PCB before final fitment. If the rated output is not obtained then MOSFET, capacitors, choke coils should be checked and replaced, if found defective.

- f) One cycle conformal coating on condition basis with commercially available CRC spray should be done on PCBs.
- g) The equipment shall be tested to verify the reverse polarity protection at 140 V for one minute by making the connection to reverse polarity and unit shall function normal after restoring the connection to correct polarity.

3.1.2 During IOH:

- a) Follow the instructions as given above for AOH.
- b) The electrolytic capacitor (input filter) should be changed irrespective of its condition. The capacitor of required value for different OEMs (1000 mfd 200 V for Signotron make and 470 mfd 200 V/1200 mfd 200 V for Matsushi make) should be purchased from reputed make like Nippon/ Nichicon/ Micon available commercially in the market.
- c) Conformal coating on condition basis should be done and rubber gasket to be replaced.

3.1.3 During POH:

- a) Follow the instructions as given above for AOH & IOH.
- b) DC-DC converter should be replaced if it has served for 9 years i.e. it should be replaced during POH of freight locomotives and on time basis in passenger

locomotives. However, the replacement of main capacitor should be done irrespective of its condition.

3.2 Headlight:

3.2.1 During AOH:

- a) Clean the headlight by taking out the bulb from inside and outside manually and bulb to be replaced.
- b) Check the condition of reflectors and replace if there are black spots or otherwise physically in bad shape.
- c) The illumination level at 8mtr. should be checked as per clause no. 6.3.7.2.1 of *RDSO specification no. ELRS/SPEC/PR/0024 Rev.'1'* which should be ideally 4800 lux. If the illumination level is less than 4000 lux, sealed reflectors should be changed.
- d) Check the condition of connectors before fitment of bulb in locomotive.
- e) Mounting gasket to be replaced.

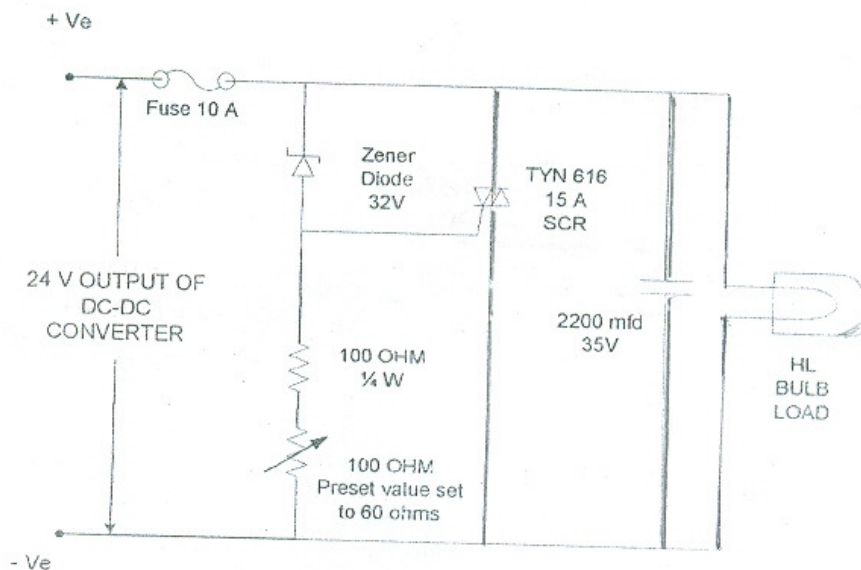
3.2.2 During IOH & POH:

- a) Same as given above in AOH.
- b) All lamp units to be brought to the shop floor and following components are to be replaced during IOH.
 - (i) Sealed Halogen reflector with 4 mm toughened glass.
 - (ii) Front cover toughened glass 6 mm thick
 - (iii) Spring loaded lamp holder
 - (iv) 'U' type neoprene gasket 6 mm thick
 - (v) Strip type sponge gasket
 - (vi) Connector for halogen lamp with PTFE wire & sleeves

3.3 DC-DC converters are having the provision of twin converter i.e. 100% standby which can work independently. Generally, one converter remains in operation till it fails. Therefore, during minor inspection (IA, IB, IC), the position of change over switch should be changed so that converter 1 and converter 2 are in operation alternatively. This is essential to utilize both the converter units during the service life of DC-DC converter.

4.0 To overcome the problem of HL lamps fusing due to short-circuiting of MOSFETS and to enable the driver to use standby circuit of Dc-Dc converter, by adding crow-bar circuit in output of switching mode power supply(SMPS) in main PCB circuit of DC-DC converter.

- (a) One independent fuse of 10A is to be provided in output of Dc-Dc converter main PCB circuit.
- (b) A "CROWBAR" over voltage protection circuit consisting of Zener diode(33V), SCR, capacitor 2200mfd 25V and potentiometer of 30V should be connected between output of Dc-Dc converter main PCB and HL lamp load.
- (c) Thyristor is to be fixed on heat sink and 1.5 mm² PTFE cables are to be used to connect the anode and cathode of the Thyristor to 24V output of Dc-Dc converter.



Whenever output voltage shoots up due to MOSFET failure, the same will exceed the Zener knee voltage(33V) resulting puncture of Zener junction due to which Zener develops SCR gate trigger voltage(30V) with the help of preset threshold resistor. This causes turning 'ON' of SCR resulting in flow of short circuiting current through the output of DC-Dc converter and isolate the HL lamp load.

With the above cdrcuitry modification, the driver can easily go to standby mode during short circuiting of MOSFETs in DC-Dc converters without changing the HL lamp. The modification has been done in 100 locomotives in SCR and found to be successful during field trials.

- 4.0 **Agency of implementation:** All Electric Loco Sheds & POH Shops.
- 5.0 **Materials required:** As stated above and a test bench in electric loco sheds/shops. SCR, Zener diode, variable potentiometer(100 ohms), 100 ohms 1/4 watts resistor, 1 No. 10A fuse, capacitor 2200mfd/32V. The items from M/s RS component to be used.
- 6.0 **Materials rendered surplus:** Nil


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