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सत्यमेव जयते

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

No. EL/11.5.5/6 Dated: As signed

Principal Chief Electrical Engineers;

- Central Railway, HQs Office, 2nd floor, Parcel Office Bldg., Mumbai-400 001
- East Central Railway, Hajipur (Bihar)-844 101
- Eastern Railway, Fairlie Place, Kolkata – 700 001
- East Coast Railway, Railway Complex, Bhuvneshwar – 751 023
- Northern Railway, Baroda House, New Delhi-110 001
- North Central Railway, Allahabad – 211 001
- North Eastern Railway, Gorakhpur –273 001
- North Western Railway, near Jawahar Circle, Jaipur – 302 017
- Northeast Frontier Railway, Maligaon, Guwahati – 781 011
- South East Central Railway, Bilaspur-495 004
- South Central Railway, HQs Office, Rail Nilayam, Secunderabad-500 071
- South Eastern Railway, Garden Reach, Kolkata- 700 043
- South Western Railway, Hubli – 580 020
- Southern Railway, Park Town, Chennai – 600 003
- West Central Railway, HQs Office, Opp. Indira Market, Jabalpur-482 001
- Western Railway, Churchgate, Mumbai – 4000 020
- Banaras Locomotive Works, Varanasi – 221004
- Chittaranjan Locomotive Works, Chittaranjan – 713331 (WB)
- Patiala Locomotive Works, Patiala – 147 003

SPECIAL MAINTENANCE INSTRUCTION NO. RDSO/2016/EL/SMI/0297 (Rev. '1')

1.0 Title:

Operational, Maintenance and Trouble Shooting of 2x500 kVA, IGBT based Hotel Load Converter of WAP7 locomotives.

2.0 Brief History:

2.1 Indian Railway is manufacturing 3-phase electric locomotives (WAP5, WAP7, WAG9 and WAG9-H) at various production units i.e. CLW, BLW and PLW. These locomotives take power from OHE through pantograph to traction transformer. Traction transformer of WAP7

locomotive is provided with a hotel load winding to cater for the power supply to coaches (also referred to as Hotel Load).

2.2 With the technological up-gradation and continuous advancements in the field of power electronics, control system and power supply systems, Indian Railways has decided to adopt an energy efficient power supply system for the coaches referred to as Head on Generation (HOG) for Rajdhani/Shatabdi trains, presently having "End on Generation" (EOG) system. LHB type of coaches are best suited for adoption of "Head on Generation" (HOG) scheme as the rake integrity with these coaches are maintained due to the specific design of its inter vehicle mechanical coupling.

2.3 CLW has turned out first hotel load converter equipped electric loco No. 30277 (WAP-7) in the month of July'2010. Further, CLW has started regular cut-in of Hotel Load Converter in WAP7 locomotives. Now, WAP7 class of locomotives are being produced by different production units and regular cut-in of hotel load converter is being done in WAP7 locomotives.

3.0 Object:

To provide Operational Procedure, Trouble Shooting and Maintenance of 2x500 kVA, IGBT based standalone Hotel Load Converter of WAP7 locomotives.

4.0 Maintenance Schedule

The maintenance schedules of WAP7 locomotive being followed by the Electric Loco Sheds shall be as per RDSO letter No. EL/3.6.1 dated 13.10.2020 or latest.

5.0 Schedule for maintenance and activities for Hotel Load Converter:

A comprehensive but not exhaustive checklist for IGBT-based 2x500 kVA Hotel Load Converter in the Minor Maintenance Schedule and Major Overhauling Schedule is outlined below. Electric Loco Sheds are required to inspect the specified points in accordance with the procedures outlined in the Repair and Maintenance Manual provided by the respective supplier of these equipments.

SN	Activities	Maintenance schedule					
		IA	IB	IC	TOH	IOH	POH
1.	Fault log data download before schedules.	√	√	√	√	√	√
2.	Check door gaskets for damages. If found damaged, change the same.	X	X	√	√	√	√
3.	Replace all the gaskets of HLC covers.	X	X	X	X	√	√
4.	Replacement of Gasket of Body side filter.	X	X	X	√	√	√
5.	Check the dust ingress into the HLC panel	X	X	√	√	√	√

SN	Activities	Maintenance schedule					
		IA	IB	IC	TOH	IOH	POH
	and output contactor panel. Use a vacuum cleaner to clean.						
6.	Check the HLC main air entry for IGBT modules & magnetic components and clean thoroughly.	X	X	X	√	√	√
7.	Check the cable tie wraps of the power cables. Check for sign of overheating.	X	X	√	√	√	√
8.	Check functioning of the blowers and churning fans. Replace in case of any abnormality. Check direction if required.	√	√	√	√	√	√
9.	Measure the overall capacitance of each DC link and replace if needed. (12mF ± 5% – Siemens & AAL, 10.8 mF ±5% – Medha, 10.4mF ± 5% – BHEL). Ensure proper tightening torque of fasteners.	X	X	√	√	√	√
10.	Change the bearings of Main blower fan	X	X	X	X	√	√
11.	Replace blower fan	X	X	X	X	X	√
12.	Check tightness of connections at input, output and control cables.	X	X	√	√	√	√
13.	Check the power connection for color changes/overheating and change the cables and sockets, if required.	X	X	√	√	√	√
14.	Check tightness of connections of power cables.	X	X	√	√	√	√
15.	Check the pre-charging contactors for any signs of physical damage, overheating or discoloration. Check for loose connections and ensure that all parts are in good condition.	X	X	√	√	√	√
16.	Check the contacts of the main contactors for any signs of physical damage, overheating or discoloration. Check for loose connections and ensure that all parts are in good condition.	X	X	√	√	√	√
17.	Check the contacts of the auxiliary	X	X	√	√	√	√

SN	Activities	Maintenance schedule					
		IA	IB	IC	TOH	IOH	POH
	contactors for any signs of physical damage, overheating or discoloration. Check for loose connections and ensure that all parts are in good condition.						
18.	Inspect the contact surfaces of main/pre-charge/auxiliary contactors for any sign of wear, pitting or erosion. If the contacts are significantly worn, consider replacing them.	√	√	√	√	√	√
19.	Clean all Suction Filters of hotel load converter.	√	√	√	√	√	√
20.	Clean the heat sinks of HLCs.	X	X	√	√	√	√
21.	After schedule of inspection, erase FDP memory.	√	√	√	√	√	√
22.	Check parameters of HLC in working conditions. • Output voltage: 750V +5%/-2%; • Line to Earth voltage peak : <800V; • O/p Voltage THD: < 10%; • I/p current THD (full load): <5% (up to 20th harmonics); • O/p voltage unbalance: >3%.	√	√	√	√	√	√
23.	Input and output earth fault checking.	X	X	X	√	√	√
24.	Replace the back-up battery of text display unit of HLC, if available.	X	X	X	X	√	√
25.	Check the sealing of the cable entry into the panel (to stop the dust entry).	√	√	√	√	√	√
26.	Check the earth connections of the HLC and Output contactor panels.	√	√	√	√	√	√
27.	Check the tightness of mounting / fixation bolts with the loco body.	X	X	√	√	√	√
28.	Check the tightness/intactness of connectors of the panel.	√	√	√	√	√	√
29.	Check the door locks of the panel.	√	√	√	√	√	√
30.	Check the output contactors and o/p power cable connection for any	X	X	√	√	√	√

SN	Activities	Maintenance schedule					
		IA	IB	IC	TOH	IOH	POH
	overheating physical damage or discoloration. Check for loose connections and ensure that all parts are in good condition.						
31.	Check the working of display unit of HLCs & functioning of keypad keys.	√	√	√	√	√	√
32.	Check Gate Drive Unit of HLC for its healthiness and cleaning. Measure DB loss of fiber optic cables.	X	X	X	√	√	√
33.	Visually check the sine filter capacitor and measure its value. Ensure proper tightening torque of fasteners.	X	X	√	√	√	√
34.	Visually inspect the RC filter and discharge resistors for signs of overheating.	X	X	√	√	√	√
35.	Visually inspect pre-charge resistor. Replace if found damaged or overheated.	X	X	√	√	√	√
36.	Clean the input and sine filter chokes by blowing with dry air. Remove all traces of dirt, dust and debris. Visually check for any abnormalities and Ensure tightness of same.	X	X	X	√	√	√
37.	Measure the inductance input and sine filter chokes and ensure same should be within tolerance limit as provided by OEMs.	X	X	X	X	√	√
38.	IR test of input and sine filter chokes by 500V Megger.	X	X	X	X	√	√
39.	Visual checking of blower transformer, if available.	√	√	√	√	√	√
40.	Cleaning of front door filters, if provided.	√	√	√	√	√	√
41.	Check both HLCs on load arrangement for ensuring proper working on line. Run HLC on load for 5-10 minutes. Note current and voltage. Check all indication at control box are proper or not.	√	√	√	√	√	√

SN	Activities	Maintenance schedule					
		IA	IB	IC	TOH	IOH	POH
42.	Check phase sequence of all 04 IV couplers.	X	X	√	√	√	√
43.	Check the condition of blocking diode fitted in SB-2 panel as per RDSO MS-488.	√	√	√	√	√	√
44.	Ensure proper working of HOG ON Command Indication lamp provided in D-Panel as per RDSO MS-489.	√	√	√	√	√	√
45.	Check working of fault reset command with the help of control box.	√	√	√	√	√	√
46.	Check air flow at suction filter and exhaust louvers position for ensuring proper working of blower fans. Average suction air flow should be >2.5 m/s for Medha & BHEL make and >3.5 m/s for Siemens & AAL make HLCs. The measurement should be taken at the points mentioned in Figure-1 below:	√	√	√	√	√	√

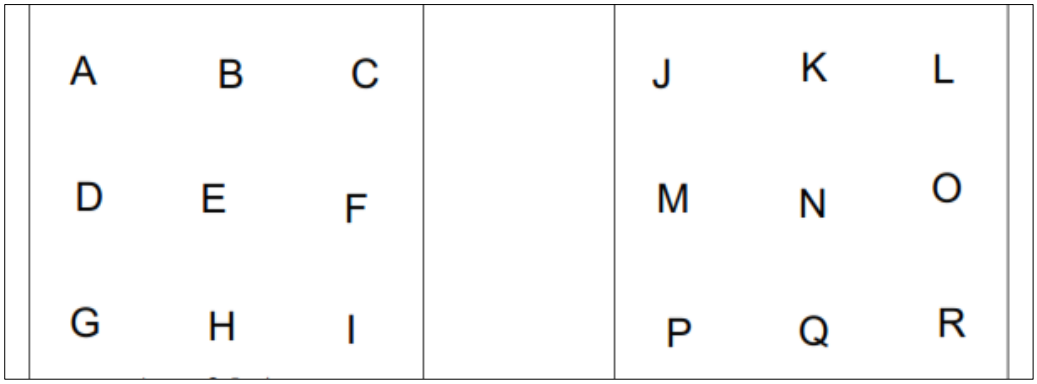

Figure – 1: Air flow measurement from HLC Suction Filters (Loco side wall)

6.0 Maintenance of IV Couplers

A checklist for maintenance of IV Couplers in the Minor Maintenance Schedule and Major Overhauling Schedule is outlined below:

SN	Activities	Maintenance schedule					
		IA	IB	IC	TOH	IOH	POH
1.	Check IV coupler cover/body for any damage and replace if required.	√	√	√	√	√	√

SN	Activities	Maintenance schedule					
		IA	IB	IC	TOH	IOH	POH
2.	Check visually for any sign of damage, flash mark and overheating. Repair if required.	√	√	√	√	√	√
3.	Check for intactness of sealing ring gasket on socket of locomotive.	√	√	√	√	√	√
4.	Clean IV coupler and lubricate moving parts if found sluggish.	√	√	√	√	√	√
5.	Check IV coupler Ratchet assembly and ensure proper locking/unlocking & ensure intactness of all Hardware (nuts/bolts/washers etc.).	√	√	√	√	√	√
6.	Ensure intactness of both HEX small bolt (bearing screw) and both HEX big bolt (Bearing Pivot Bolt).	√	√	√	√	√	√
7.	Ensure proper working of locking bolt.	√	√	√	√	√	√
8.	Ensure intactness of both Allen screw.	√	√	√	√	√	√
9.	Ensure intactness of insulated base foundation bolt. It should be straight to the holes given on the coupler edge.	√	√	√	√	√	√
10.	Ensure the proper condition of Lever tie bow assembly gap. Check with “NO GO Gauge”.	√	√	√	√	√	√
11.	Check IV coupler mobile contact pin (Phase & control) for flashing/free movement by pressing and replace if stuck up / sluggish.	√	√	√	√	√	√
12.	Clean coupler pins with suitable cleaners.	√	√	√	√	√	√
13.	Ensure that couplers are in closed conditions to prevent cover damage and ingress of water & dust.	√	√	√	√	√	√
14.	Check phase sequence at all 4 couplers.	√	√	√	√	√	√
15.	Replace O ring (sealing gasket) of IV coupler.	X	X	√	√	√	√
16.	Replace control pin of IV coupler (pin no. 7& 10)	X	X	X	X	√	√
17.	Check Insulation between Control Pins (C1 & C2) w.r.t. body of IVC at 500 VDC. This should be >10 M ohm	√	√	√	√	√	√
18.	Check Insulation between high voltage supply pins w.r.t. body of IVC with 1500 VDC megger. This should be >100 M ohm.	√	√	√	√	√	√

7.0 Maintenance of UIC Couplers

A checklist for maintenance of UIC Couplers in the Minor Maintenance Schedule and Major Overhauling Schedule is outlined below:

SN	Activities	Maintenance schedule					
		IA	IB	IC	TOH	IOH	POH
1.	Both sides UIC coupler cover tension to be checked. If found not proper then replace the same.	√	√	√	√	√	√
2.	Ensure proper unlocking/locking of covers of both sides UIC couplers before and after inspection. All nut-bolts should be intact.	√	√	√	√	√	√
3.	Both sides UIC coupler female contact pin to be checked for oxidation/flashing, pin diameter and locking (to be done without opening of UIC coupler).	√	√	√	√	√	√
4.	UIC coupler must be in closed condition to preventing ingress of dust and water.	√	√	√	√	√	√
5.	In UIC coupler, condition of all red colour gaskets needs to be checked.	√	√	√	√	√	√
6.	During load / no load testing of HLCs, functionality of all concerned UIC pins needs to be checked.	√	√	√	√	√	√
7.	Replace Pin No. 11 & 12 of UIC coupler (HLC).	X	X	X	√	√	√

8.0 Must Change Items:

Details of Must Change Items are detailed as below:

SN	Description of Item	TOH	IOH	POH
1.	Replace door filters.	√	√	√
2.	Replace blower fan	X	X	√
3.	Replace all the gaskets of HLC covers.	√	√	√
4.	Replace the back-up battery of test display unit, if provided.	X	√	√
5.	Replace processor battery, if provided.	X	√	√
6.	Replace IV coupler sealing ‘O’ ring.	√	√	√
7.	Replace control pin of IV coupler (pin no. 7& 10)	X	√	√
8.	Replace Pin No. 11 & 12 of UIC coupler	√	√	√
9.	Replace HLC suction filter jali/mesh	X	X	√

9.0 Trouble shooting of Hotel Load converter as per display message in DDU:

SS No.	Fault No.	Fault Message		Effect	Action to be taken by driver
SS05	F0503P1	Earth Fault in Hotel Load Circuit. Hotel load will be isolated.		Hotel Load isolated	Lift BLHO switch to OFF position to open Hotel load contactor. Inform maintenance staff.
SS05	F0504P1	Over Current in Hotel Load Circuit. Try to close the VCB again.	1st		Press BLDJ to close VCB.
			2nd	Hotel Load isolated	Inform maintenance staff.
SS05	F0501P2	Hotel Load Contactor Stuck OFF. Hotel load not available.			Inform maintenance staff.
SS05	F0502P2	Hotel Load Contactor Stuck ON For un/coupling hotel load trip VCB			Inform maintenance staff. Work on hotel load is allowed with VCB open

Note: Driver shall check MCBs of hotel load converter located on Hotel Load Converter panel and shall reset once if converter trips.

10.0 Procedure for attachment of loco to power car and operation of HOG system from power car

Following procedure shall be taken in account to operate HOG system:

a. Connect both the IV coupler between loco and power car and ensure coupler engagement is proper;

b. Connect UIC couplers (HOG) between loco and power car and ensure coupler engagement is proper;

c. Communicate with the loco pilot to raise the pantograph and switch ON the Converters by BLHO switch of loco;

d. The I/P Contactor ON indication is displayed by H7 indication lamp on the HOG control panel of power car;

e. Select the SW1 and SW2 to converter A and converter B of HOG control panel – Enabled respectively;

f. Select the SW3 and SW4 to converter A and converter B – ON respectively;

g. Working of converters is indicating by glowing of H1 and H2 indication lamps (red color);

h. Availability of output from the converter A and Converter B can be ascertained by glowing of H5 and H6 indication lamps respectively (green color);

i. Check the converter output on voltmeter provided on the Power Panel (select converter mode);

j. Ensure that there is 'NO' 750 V power supply from DG sets of rear end power car;

k. Switch 'ON' NET 1 or 2 for power car supply;

l. Switch 'ON' both set safety loop switch;

m. Switch 'ON' both set feeder contactors;

n. Ensure availability of 3phase supply in the coaches.

Picture: HOG Control Panel

11.0 In case of non-working of any one of the converter, following procedure is to be followed:

a. In case of failure of any one of the converters, the H3/H4 indication lamp shall glow indicating fault in converter 'A'/Converter 'B' respectively (red color);

b. Reset the fault by pressing corresponding HLC Reset push button.

c. If still H3/H4 indication lamps glows, selection of the switches SW1 and SW2 shall be made to enable the corresponding DG set for the failed Converter. DG set 'A' corresponds to Converter 'A' and DG set 'B' corresponds to Converter B.

d. Selection of the switches SW3 and SW4 shall be made so as to switch off the faulty converter.

e. Ensure glowing of H7 (amber) with H1 (red) and H5 (green) or H2 (red) and H6 (green) indicating working of the healthy converters. (H3/H4 red for converter tripping or fault).

f. Check the working converter output on voltmeter provided on the power panel;

g. Ensure that there is 'NO' 750V power supply coming from the corresponding DG sets of working converters from rear end power car;

h. Switch ON corresponding net contactor for working converter;

i. Switch ON safety loop switch for working Converter;

j. Switch ON feeder contactor for working converter;

k. Ensure availability of 3 phase supply in the coaches;

l. Start the corresponding DG set of the faulty converter;

m. Charge the ACB of working DG set;

n. Ensure radiator and vent fan motor running;

o. Switch ON corresponding safety loop push button;

p. Switch ON corresponding feeder push button;

q. Ensure 750-volt power supply in coaches.

12.0 Application to the Class of Locomotives:

WAP-7 locomotives fitted with 2x500 kVA, hotel load converters.

13.0 Agency of Implementation:

All Electric Loco Sheds Holding 3-Phase Electric Locomotives (WAP-7).

14.0 Periodicity of Implementation:

Minor Schedule Inspections (IA/IB/IC), TOH, IOH, POH Overhauling Schedules and any other unscheduled maintenance.

Encl: Nil

-sd-
For Director General (Elect.)

Copy to:

Secretary (Electrical),
Railway Board, Rail Bhawan,
New Delhi – 110 001

Digitally Signed by Amit Kumar Saraf
Date: 13-11-2024 10:20:03
Reason: Approved
For Director General (Elect.)