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सत्यमेवजयते

भारतसरकार–रेलमंत्रालय
अनुसंधानअभिकल्पऔरमानकसंगठन
लखनऊ– 226011
Govt. of India - Ministry of Railways
Research, Designs & Standards Organization,
LUCKNOW - 226011

No. EL/11.5.5/21 Date: 14.11.2018

1. **General Manager (Design), Diesel Locomotive Works, Varanasi-221004.**
2. **Chief Electrical Engineer,**
   - 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 – 751 017
   - Northern Railway, Baroda House, New Delhi-110 001
   - North Central Railway, Allahabad – 211 001
   - 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
   - Southern Railway, Park Town, Chennai – 600 003
   - West Central Railway, HQs Office, Opp. Indira Market, Jabalpur-482 001
   - Western Railway, Churchgate, Mumbai – 4000 020
   - Chittaranjan Locomotive Works, Chittaranjan – 713 331(WB)

Sub: Minutes of the Meeting held at ELS/TKD/WCR,on 30.10.2018 on performance review of Three Phase Electric Locomotives.

Please find enclosed herewith a copy of Minutes of the Meeting held at ELS/TKD/WCR, on 30.10.2018 on performance review of Three Phase Electric Locomotives for kind information and necessary action.

Suresh 14/11/18

(Suresh Kumar)
For Director General (Elect.)

Encl: As above.

Copy to:

1. **Secretary (Electrical), Railway Board, Rail Bhawan, New Delhi-110 001.**

   (Kind attn.: Shri A.K. Goswami, DEE/RS): For kind information.

Suresh 14/11/18

(Suresh Kumar)
For Director General (Elect.)

Encl: As above.

Minutes of Meeting held at Electric Loco Shed, Tughlakabad on 30.10.2018

Members Present:

Railway Board	1.	Smt. Manju Gupta, AM/L
	2.	Shri Kishore Kumar, EDEE/RS
	3.	" A.K. Goswami, DEE/RS
RDSO	4.	" O. P. Kesari, PEDSE
	5.	" Suresh Kumar, DSE/TPL.
	6.	" P.K. Saraswat, DSE/TM
	7.	" Aseem Kumar, DSE/PN
CLW	8.	" M.K. Gupta, CEE/D&D
	9.	" Vipin Kumar, Dy. CEE/D&D
	10.	" Pankaj Kumar, AEE/D&D
Railways	11.	" Mohit Chandra, CELE/NR
	12.	" Ishaq Khan, CELE/ER
	13.	" J.R. Meena, CELE/ECR
	14.	" A.M. Chaudhari, CELE/SR
	15.	" R.K. Tiwari, CELE/ECR
	16.	" Rahul Pachauri, Sr. DEE/TRS/TKD
	17.	" Manish Sinha, Sr. DEE/TRS/GZB
	18.	" DharamveerYadav, Sr. DEE/TRS/HWH
	19.	" Prashant Kumar, Sr. DEE/TRS/MGS
	20.	" Goverdhan Kumar, Sr. DEE/TRS/TKD
	21.	" Arvind Ray, Sr. DEE/TRS/RPM
	22.	" SatyaPrakash, DEE/TRS/SRC
	23.	" G.K. Srivastava, DEE/TRS/TKD

1.0 Address by AM/L

1.1 Increase in failures of conventional and 3-phase locomotives are cause for serious concern. Electrification is increasing rapidly and at the same time electric loco holdings also increasing. Therefore, there is a need to ensure highest level of reliability. All the Zonal Railways should work in cohesion complying with all the maintenance instructions to ensure reliability of locomotive so that there is no failure of locomotives on line.

1.2 Increased holding of electric locomotive will need the facilities in existing electric sheds to develop maintenance of locomotives. Zonal Railways should gear up by sanctioning the required works for taking up maintenance of electric locomotives in diesel sheds. Similarly, posting of officers in diesel sheds of Junior Scale level may also be tried out to ensure and accelerate building up of infrastructure for maintenance of electric locos.

1.3 Facility for maintenance of 3-phase locomotives in those sheds should be immediately made where these do not exist.

1.4 Zonal Railways are also requested to get the work of electrification sanctioned under umbrella works for tracks, lines for diesel loco sheds.

1.5 PUs should gear up for achieving the target of production of 1000 locos as under –
CLW – 500 locos
DLW – 400 locos
DMW – 100 locos

Since electric loco production has been made 1000 locos for the current year, therefore, there is further need for tightening up of maintenance practices so that reliability of locomotive is maintained at highest level.

1.6 While developing the facility of maintenance of electric locos in diesel sheds, training of manpower is also important. Suitable arrangements for training of diesel shed staff for maintenance of electric locos as well as use of training centres of diesel sheds for training in electric loco maintenance should also be developed. Feasibility of posting of an Instructor for training should also be thought of.

2.0 Address by EDEE(RS)/Railway Board

2.1 The failure of conventional as well as 3-phase locomotives has increased quite sharply as compared to previous years. These failures can be reduced by strictly complying with the maintenance practices as given in Manuals and SMIs and technical circulars issued by RDSO from time-to-time. For each and every failure, root cause analysis is to be done. RDSO is also advised to compile the failure of data equipment so that suitable action can be taken up for chalking out the plan.

2.2 The failure portal developed by RDSO for uploading the failure data of locomotives should be done regularly. Similarly, warranty failure should also be entered into CLW Warranty Failure Portal.

3.0 Address by PEDSE/RDSO

3.1 RDSO has issued number of Maintenance Instructions and Reliability Action Plan. All the Zonal Railways are requested to follow. Specification for new design SIV 2x2 130 kVA has been issued and Railway Board has approved its provision in existing locomotives as and when replacement work is planned under RSP sanction or otherwise.

3.2 Annual Maintenance Contract has been given for maintenance of SIVs by Zonal Railways. However, content of the work is also defined in the technical scope of the work issued by RDSO. During the AMC, Electric Loco Sheds should ensure that OEMs are carrying out the maintenance as per the laid-down guidelines.

3.3 During the investigation, it has come to light that most of the power module failures of IGBT Converter are due to temperature rise. There is a need for carrying out temperature rise test again to evaluate efficacy of Converters supplied for propulsion system.

Zonal Railways raised various issues as under: -

4.0 Points related to SIV

Southern Railway:

4.1 CELE/SR apprised that they have analyzed the failures of cards of AAL make SIVs on the basis of the life rendered by the electronic cards. They found all cards except Logger card failed had average life between 6-8 years. Failed Logger card had average life of

around 3 years. He opined that there should be provision of rehabilitation of cards after certain period.

East Central Railway:

4.2 In ELS/MGS, Sr.DEE reported that there were 4 locos received after MTR with new SIV of Hind Rectifier. But the earth leakage current setting was found to be 300 mA instead of 500mA.

4.3 M/s Hind Rectifier is not agreeing on taking AMC at the similar cost, which other manufacturers have offered.

South Eastern Railway:

4.4 M/s Medha is not deploying sufficient trained manpower for carrying out AMC of SIVs.

4.5 In Siemens make SIVs, there is no provision of measuring DC link capacitor directly.

4.6 FRPCPY of M/s Medha is on increasing trend even after AMC taken up the firm.

RDSO will compile make-wise/ service period wise failures carry out component wise failure analysis and will issue RAP accordingly.

5.0 Points related to Traction Motors

South Eastern Railway:

5.1 SER had reported improvement in punctuality cases on TM account from 23 to 18 in Apr to Sep period. There is 0 TM bearing failure compared to 9 in the corresponding period of last year. 11 cases are of Pinion shaft failure; 3 cases are of Inductance variation & 4 cases are of stator earth.

5.2 Problem of Axle box loose lip crack (SKF make) observed in 37003 & 37004. As per firm, fitment procedure followed by DLW is not proper.

5.3 Problem of H type coupler not opening freely reported by SER.

Northern Railway:

5.4 ELS/GZB had reported total 17 cases on TM account, out of which 7 due to speed sensor, 3 bearing failure (2NDE +1 DE), 3 checked found normal, 2 of stator, 1 of rotor & 1 of temperature sensor.

Eastern Railway:

5.5 ER had reported issues in supply of bearings. RDSO to separately conduct meeting on supply issues of bearings.

5.6 ER had reported that labyrinth jacking hole is not plugged by CLW in new motors.

5.7 ELS/ASN had reported cases of high metal content (though within limits) in Hitachi TMs with FAG bearings.

East Central Railway:

5.8 ELS/MGS had reported 8 cases on TM account, out of which 2 cases are due to wrong connection of power cables by POH/KPA, 2 cases due to balancing weight welding given up, 1 case of TM flashing due to improper bedding of reverser, 1 case of arc horn melting, 1 case of armature earth and 1 case of FAG make PE bearing seizure.

5.9 ELS/MGS had informed that TM flashing cases had been reduced by changing of brush holder springs and ensuring arc horn gap and proper Q20 setting.

CLW/Workshops/Zonal Railways should made all out efforts to reduce bearing failures by adopting correct maintenance practices and using standard tools as advised by RDSO. Dimensions of mating components and other critical clearances have to be ensured as per RDSO's SMI 278.

6.0 Reliability of IGBT Propulsion system

6.1 Issues related to BHEL:

6.1.1 Traction Converter

a. Software version 774 (protection level of monitoring time has been modified from existing 750ns to 1000ns) was supposed to address the **SEPL_max or Status error issues.** Failures of power modules very high. Max failures due to Tmax, SEPL, Stat Err Top/bottom phase.

b. In some of the locomotives, there is coolant level fluctuation even after the coolant has been replaced by BHEL. BHEL to be informed to thoroughly check the coolant path.

c. In some of the identified locos, TE/BE suddenly comes to 'zero' on run and jerk observed on line. No fault message is stored in DDS.

d. In BHEL propulsion system, "harmonic filter current high" message appears. Normally current showing 300 – 325 A, whereas in other make propulsion system, it is within 150– 180 A. Harmonic filter contactor stuck are reported by ELS/GZB.

e. Coolant leakage from Power module were due to contamination in coolant circuit. Firm has taken steps to replace the coolant along with proper cleaning of the radiator. Even after coolant changing T_Max error has been observed in 3 (31341, 32059, 32113) locomotives of ELS/Tata.

f. Energy consumption calculated is different from actual value with BHEL make traction Converters.

g. Frequent problems of VCB stuck up in off position.

h. Messages of LC-1 bogie-1 & LC-2 bogie-2 isolation are available in DDS but in registration of power converter, these message are not found.

6.1.2 Auxiliary Converter and VCU

a. Inverter module & Rectifier module failure in BUR. BHEL claimed that new software version 188.1 addresses the failure of Inverter & Rectifier module. Even after uploading the same, ELS/BNDM & ELS/KZJ experienced failure of Inverter module.

b. Cab redundancy testing in locos of BHEL propulsion system as per MS 0435 not conforming for HBB1, HBB2 & STB1. Only OK for STB2.

c. Isolation of Aux. converter due to contactor logic neither recorded in DDS nor in Aux ACI card. Only pop up message shown, so isolation of Aux. converter due to contactor mal operation could not be identified at shed.

d. Ramp up time of BHEL make auxiliary converter is approx. 16 seconds and monitoring time of BT make traction converter is 15 seconds in software version R-1240 causing several time message of 'TFP oil pressure not OK' and after 3 times leads to "Main Power Off".

e. In BHEL TCN Locos, TM isolation from DDU is possible only from CAB-1. From CAB-2 TM isolation not possible from DDU.

f. DDS messages regarding fault of IGBT Auxiliary converter of BHEL, is not recorded in DDS with BT make IGBT traction Converters. This is an integration issue of BT with BHEL. RDSO indicated that M/s BHEL and BTIPL have carried out trial to resolve this issue with the updated firmware and BHEL has been asked to update the firmware in all the locomotives.

g. Frequent failure of train bus communication in MU operation of MICAS based system with IGBT BHEL traction converter. The failures are transient but repetitive in nature.

h. Multi operation failure in BHEL TCN loco due to reasons like tripping of slave loco &panto lowered, traction not allowed in master & slave loco.

i. Harmonic filter isolation, filter current > maximum problem in BHEL traction converter along with CDAC.

6.2 Issues related to CGL:

6.2.1 Traction converter

a. Failures of power module and cliplam connectors. PDC for modification of cliplam connectors was May'18 but out of 37 locomotives only 20 locomotives could be modified so far in SER.

b. In CGL make auxiliary converters after neutral section the frequency ramps down and takes near about 10 seconds to reach zero frequency. If driver close DJ within 5 seconds before frequency coming down below 35 Hz, auxiliary converter over current message appears and immediately DJ trips. RDSO to make a reference to CGL to implement the logic as per the MICAS.

c. CGL has carried out modification in the INVCC and CCPU card. However, the modifications are not effective and the failures have not stopped.

d. The issue of 'BUR current more than limit' and 'Battery charge current below 10A' is still unresolved. Further, there are cases of BUR isolation due to failure of Rectifier Module, Inverter Module & GDU.

e. Issues with UTIZEN CPU electronics. The problem of isolation of motors/bogie, isolation of harmonic filter, non-logging of fault data in line with the VCU data could be set right so far on converters with UTIZEN electronics.

f. Repeated failure of balancing Resistor / pre-charging resistor of SR. More than 70 cases of overheating of balancing resistors of M/s Kiyosh make have been experienced but no investigation report could be given by the firm so far. M/s HVR Pentagon (imported) make resistors, provided in newly built Loco No. 32115 (DOC-27.06.2018), also failed on 31.07.2018 due to open circuiting.

6.2.2 Auxiliary Converter

a. Failure of INVCC (Inverter control card) cards.

b. Failure of CCPU card (BUR processor card).

c. Wrong generation of fault message of Battery charger current less than 10 A. Modified software has been uploaded by firm in 3 ELS/TATA based locos (31458, 31526 & 31731) for observation.

d. Phase to phase voltage & current variation in same auxiliary converter is large. Perhaps this is the reason of more auxiliary motor failure in locos fitted with CGL make auxiliary converter.

e. Frequent messages of Bur life sign missing.

f. Generation of inverter fault due variation in machine room temperature before given temperature range.

6.3 Issues with CDAC VCU supplied by CGL.

a. In RGCP 'Cut in' condition if VCB gets tripped/made open by BLDJ, Compressor Pressure do not unload before starting of compressor causing drawing of over current leading to Isolation of Aux Converter & MP off.

b. After MVB card modification, for enabling graphical representation, the problem of life sign missing from various processor cards was being experienced. Further, to overcome this problem J5 pin was shorted in power supply cards. However, the problem of life sign missing is still being experienced intermittently.

c. Cab redundancy is not enabled.

d. No fault data of Traction converter & Aux. converter is being recorded in TCN/VCU.

e. Frequent appearing of message 'ACP- Train part'.

f. VCB will not open message showing followed by Main power OFF. While VCB tripped by BLDJ immediate after closing.

g. Formation of MU not possible with same cabs (cab-1 / cab-1 or cab-2 / cab-2).

h. Flickering of graphical display parameters (Loco brake/ Parking brake /Emergency brake/Auto brake).

i. Non-display of master loco node information in slave loco.

j. DJ trips along with lowering of Pantograph, in case of converter oil pressure<limit.

k. During booting spurious messages, like traction with parking brake not allowed / Angle transmitter failed/both cab occupied, get displayed on DDU.

l. Sequence of pantograph wrong from cab-2.

6.4 Issues related to ABB:

6.4.1 Traction converter

a. Frequent messages of filter current > maximum & LC-1 & 2 over-current in PEC Trac version.

b. CDAC VCU with traction Converter giving problem of harmonic filter isolation & filter current > maximum.

c. Frequent generation of Software version mismatch in PEC-TRAC locomotives.

d. Main power off occurs after isolation of one bogie along with message master def. mismatch bogie-2 off.

6.4.2 ABB make CDAC VCU

a. Non-formation of MU with C-DAC VCU

- ELS/TATA is facing difficulties in making MU of CDAC VCU.
- One multi of ABB CDAC was tried with Loco 32051 & 32140. The same failed thrice due to software mis-match, hence the multi had to be split.
- Formation of MU not possible with same cabs (cab-1 / cab-1 or cab-2 / cab-2) as when reverser of master loco is put to forward position both the loco try to move in opposite directions, hence there is no movement.

b. No cab redundancy in C-DAC based VCU.

6.5 Issues related to Medha:

6.5.1 Propulsion system

a. Investigation report of failure of Power module and DC link capacitor could not be given by the firm.

b. Isolation of line converter (LC) on line with messages 'LIC1: secondary input over current' and 'LIC2: secondary input over current' leads to 'Main power OFF' while parameters corresponding to fault found as normal or within range

c. Automatic isolation of Traction Bogie with fault message MCC: isolation Bogie-1and MCC: isolation Bogie-2 without prior display of priority-1 fault on both bogies.

d. Problem of TM isolation - Fault message F0208P2 (TC1:U/W Top/Bottom gate drive circuit power supply missing/Rx Open) and concern TM got isolate.

e. There are several messages like 'DC link over voltage', which are not available in DDS but available in display unit.

f. There are several cases of isolation and recovery of subsystem automatically due to transient troubles which leads to several attentions.

g. In case of isolation of any Traction converter automatically / manually, filter current increases and ultimately Harmonic filter getting isolated.

h. Resetting procedure of SR oil pump MCB of M/s Medha make propulsion system is different from other propulsion systems. To reset this type MCB it should rotate 90° anticlockwise then set vertically in upward direction.

i. In Medha propulsion system, extra 'earth fault sensing ckt.' in each aux. converter is provided which causes protective shut down of Aux. Conv. In case of earthing of SCTMB, BUR gets isolated, shifting load to other BUR which also gets isolated due to sensing of earth fault & finally loco failed due to MP off.

j. Failure of operating (signal) relay, of OEN make: Main contactor of Micro Electrica, Germany make not operating due to its operating relay of OEN make defective. Firm informed that Operating (signal) relay, of OEN make, was giving repeated trouble and suggested to switch over to Siemens make contactor.

k. Loose connection in Molex Connector: In order to avoid loose connection in Molex Connector of 'Phase Module', additional cable hangers are being provided by firm in new Power Converters. Medha agreed to provide similar arrangement in 02 locos each at ELS/TATA and SRC on trial but did not agree for fleet wide modification.

l. Whenever one of the line contactor gets isolated, the power is reduced by 25% without any popup message to the crew (although recorded in DDU). This may lead to stalling in graded section:

m. In Medha propulsion system the message "Converter oil pressure not ok" does not show in DDS and whenever coolant temperature goes out of limit then directly "Converter oil temperature too high" message appears and the respective SR or Bogie gets isolated. SER suggested to give message related to less oil pressure so that crew may check condition of MCB & physical running of pump.

n. "Harmonic Filter Overcurrent" messages which lead to isolation of Harmonic Filter were noticed at ELS/SRC. Ten cases reported by ELS/SRC (4 in new locos: 30558, 30566, 30564 & 30547). M/s Medha has uploaded modified software, version 2.06 in 2 locos (30547, 30558) at ELS/SRC on trial.

o. Frequent problems of VCB stuck up in off position.

p. Frequent problem of filter contactor stuck on & off and harmonic filter current > maximum.

q. Repeated messages of Regenerative braking failed at the time of regenerative braking.

r. Main power off with single message of VCB stuck in off position. No redundancy available similar to GTO locomotives.

s. Coolant leakage problem.

t. Voltage fluctuations when we switch off MCB of battery output of battery & load shifted to direct to battery charger output.

u. During simulation test whenever the VCB stuck on, then this message is not generated. Straightway main power gets off.

v. ABB make 6 Amp 127.22 MCB giving tripping while BUR load sharing, only Schneider make 10Amp MCB is required for BUR electronics.

w. 6 Amp MCB 127.81 of ABB make has to replace with 10Amp Schneider make due to frequent tripping.

x. Emergency brake pressure switch message does not pop-up. These are logged in registration data only.

6.6 Issues related to BTIPL:

6.6.1 Traction converter

a. Power module failure in line side in both ALT C & ALT D.

b. Main power OFF due to fault message "Time out DC link circuit charge B1/B2".

c. Fault message "STB1: 0004 VCB will not open" appears while FLG1 node was 605.

d. DDS messages regarding fault of IGBT Auxiliary converter of BHEL, is not recorded in DDS with BT make IGBT traction Converters. This is an integration issue of BT with BHEL. RDSO indicated that M/s BHEL and BTIPL have carried out trial to resolve this issue with the updated firmware and BHEL has been asked to update the firmware in all the locomotives.

e. 'Contactor pre-charge wait time' message is generated during group-wise traction testing and traction not come at that time. Later on, the message goes off and then traction is possible.

f. Two Loco Diagnostic System (LDS), received from CLW/CRJ on 21.09.2018, are not working properly even after attention by firm's representative.

6.7 Issues related to AAL:

6.7.1 Auxiliary Converter

a. Transient messages of battery over-current in BUR-2 & BUR-3 simultaneously causing main power off. Output circuit of battery charger thoroughly checked &meggered in all the cases but no abnormality detected.

b. Firm has resolved the simultaneous tripping of BUR 2 & 3 but reasons for transient battery over current could not be find out. This is happening at the time of ramping up of BUR-3 during compressor operation. Problem appears to be in V/f Control of BUR2/BUR3.

RDSO and CLW to jointly study the issues raised by the Railways as above and resolve the issues in consultation with the firms early in time bound manner.

RDSO will deliberate the reliability issues with propulsion equipment manufacturers and issue item-wise action plan with timeline for implementation.

7.0 Points related to 3-phase loco brake system

Eastern Railway:

7.1 Location of Lead – Trailswitch at Electronic brake valve (EBV) of CCB brake system of M/s KBIL should be shifted to some other place so that there could be no chances of its movement by Loco Pilot inadvertently.

7.2 Failure investigation along with root cause analysis reports are not being provided by M/s FTRTIL to the sheds regarding E-70 brake system failures.

South Eastern Railway:

7.3 There is no provision of BC leakage testing in CCB brake system of M/s KBIL.

7.4 M/s KBIL is studying the problem of brake not releasing in rear loco of Multiple units. The issue has not been resolved by them.

Northern Railway:

7.5 There have many cases where Loco Pilots carry out wrong trouble shooting in acknowledging and resetting a fault in CCB brake systems. It was decided that M/s KBIL has to carry out one round of counseling of Loco Pilots/ LIs. RDSO will issue Railway-wise training program.

7.6 ELS/GZB reported 6 cases of CP – NRV failure in E-70 brake system. M/s FTRTIL has to investigate the root cause and come out with action plan.

It was also decided that RDSO will have to carry out meeting with M/s Knorr &FTRTIL immediately to discuss the reliability issues.

8.0 Other issues

8.1 There was a case of cable lug cut in loco No.30444. Contactor 8.1 Coil negative cable lug cut (at the snubber connecting area) in SR. This was due to sharp bend near connection and more stress near lug area. SR informed that sharp bends were available in most of the locos. Railways should also take up one cycle to check the sharp bend in the cable. CLW may also look into the take action to avoid sharp bend.

8.2 Poor crimping by CLW in the OCB power cable 1121A, leading to failure of loco No.30447 was discussed. CLW may take appropriate action to improve the crimping quality.

8.3 Failure of Loco No.30630 due to MCB 54.1/2 of MRB 2 tripped. The MCB was unable to reset due to infringement with name plate. CLW may take suitable action for properfixation of the name plate.

8.4 Issue of failures of the Sunny make capacitors were discussed. CLW informed that defective lot has been identified and the firm has supplied the modified capacitors to

14/11/18

the sheds. CLW will supply the loco numbers which have the defective lot of the Sunny make capacitors to the sheds.

8.5 Slipping cases have been reported in WAP-7 locos with adhesion improvement software. CLW to revisit the software and ensure the complete implementation of the logic as per RDSO letter No.EL/11.5.5/4 dated 30.03.2016. Trials in the Gurpa-Gujhandisection may be conducted to assess the efficacy of the modification.

8.6 Presently, MRB is operated using the single phase supply from the traction transformer using the capacitor for split phase operation. Cases of burning of this capacitors have been reported by Railways. Sr.DEE/GMO informed that they are using higher capacity capacitors to avoid their failures. ECR may give the details of the capacitors to RDSO for the consideration of their regular use.

14/11/18