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

No. EL/11.5.5/5

Date: 12.07.2017

M/s. BHEL Limited,  
Electronics Division, PB.No.2606,  
Mysore Road, Bangalore-560 026

**Sub:** Minutes of the Meeting held at BHEL, Bangalore on 30.06.2017 on Reliability of IGBT based propulsion system of three phase electric locomotives.

**Ref:** (i) MoM dtd. 19.04.17 issued vide this office letter of even no. dtd. 03.05.17.  
(ii) MoM dtd. 12.05.17 issued vide this office letter of even no. dtd. 25.05.17.  
(iii) This office letter of even no. dtd. 22.06.17.

A meeting to discuss and review the progress of action plan as decided in the meeting under reference for reliability improvement of IGBT based propulsion system of M/s BHEL was held at BHEL, Bangalore on 30.06.2017.

Please find enclosed herewith a copy of Minutes of the Meeting of the same for information and necessary action.

*[Handwritten signature]*  
12/07/17

(Suresh Kumar)

For Director General (Elect.)

Encl: As above.

Copy to:

1. **Secretary (Electrical), Railway Board, Rail Bhawan, New Delhi-110 001.** For kind information.
2. **Chief Electrical Engineer, (For information and necessary action)**
  - Central Railway, HQs Office, 2<sup>nd</sup> 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
  - 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)
3. Dy. CEE/I&D, CLW Inspection Cell, DRM office, Bangalore-560023
4. Sr. DEE (TRS), South Central Rly., Lallaguda, Secunderabad 500071

*[Handwritten signature]*  
12/07/17

(Suresh Kumar)

For Director General (Elect.)

Encl: As above.

## Participants

### BHEL (S/Shri)

R K Tiwari, ED/EDN  
B Mahapatra, AGM/PES  
D Apasangi, AGM/SA  
N Manjunatha, AGM/ TE  
L C Meshram, AGM/PMC  
S Chandrashekar, AGM/TrSrGr  
R Shekar, SDGM/TE

### Indian Railways (S/Shri)

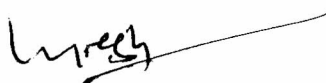
O P Kesari, EDSE (Co-ord)/RDSO  
Suresh Kumar, DSE/TPL RDSO  
Rajeev Mishra, Dy CEE/ Insp/ CLW, SBC  
K Thourya, Sr DEE/TRS/LGD  
J Krishnaji Rao , SSE/LGD

Sub: Reliability Meeting on IGBT make converters held at BHEL/Bangaluru on 30.06.2017.

### Points discussed

1. Sr EDSE/Co-ord asked BHEL to review the status of the minute of meeting held on 12.05.2017 at Railway Board and comply with the decisions taken during the meeting.
2. BHEL indicated that issue of "ASC Pulsing stopped/Transformer Pressure Not OK" has been addressed in software version 371 and 187.2. Joint note from ELS/Bhilai has been submitted to RDSO. The software has been in service for last one year. The performance is noted satisfactory so far.
3. For resolving the issue of "Harmonic filter isolation" BHEL indicated that they have modified the software by increasing the feedback time of the auxiliary signal to 2.0 sec. The modified software (version 773) has been downloaded in loco nos. 30425, 31502, 31410, 30345 and 31493 of ELS/LGD and loco nos. 30479 and 31410 of ELS/RPM. Sr DEE/TRS/LGD confirmed that so far no incidence of harmonic filter stuck on/off have been observed however it requires some more time for the field trial. The modified software may be downloaded in 5 more locomotives in ELS/KYN and 5 more in ELS/BIA for its extensive field trails.
4. **Failure of PCB cards:** There are certain components like surface mounted contactor, resistance, and capacitors which have been identified to have more failures in different PCB cards. RDSO advised BHEL to review the critical component rating of such components to MIL grade in lieu of Industrial grade component currently used. RDSO also asked BHEL to carry out a study for exploring the possibility of use of MIL grade components in PCB cards preferably those components which are failing frequently. BHEL submit the report by 30<sup>th</sup> July 2017.
5. **Power Module failure** – RDSO requested BHEL to study the possibility of increasing the existing monitoring time setting to address SEPL error. BHEL indicated the following actions have been taken to arrest the module failure.

- (i) Review protection levels,.



(ii) To use higher rating components for identified failure prone items

BHEL indicated that the manufacture of modules of one loco for trial purpose shall be ready by 15.07.2017. The same shall be installed in one loco in ELS/LGD.

6. di/dt error in Inverter module. BHEL has indicated that following actions have been taken:

- SW ver187.2 (addressing di/dt issue) implemented
- Assembly process reviewed to prevent damage of IGBT terminals in the module
- Power-up issue in the AMC module reviewed.
- Addressed with increased initializing current

Improved assembly procedure implemented from May'17.

7. **Failure of VIU Card:** BHEL appraised regarding the improvements made in VIU in which they have increased the relay setting to 6A and also informed that one modified card has been put in service in one loco no. 31683 on 28th Jun'2017. Sr DEE/TRS/LGD to closely watch the performance. Details of the modification carried out need to be submitted to RDSO. The modified VIU cards should be populated in 10 locos – 5 Locos at ELS/LGD and 5 at ELS/RPM for field trial.
8. Failures of the ACI card and DCU card need to be studied in details and BHEL to submit the action plan for the same by 31.07.2017.
9. The failure rates of the existing pressure switch is very high. RDSO has already given clearance for use of Honeywell make pressure switch. The pressure switch needs to be replaced in all the locomotives in phased manner. BHEL to indicate the time line for replacement of pressure switch in all the locomotives by 15.07.2017.
10. Railways in process of running the Multi consist with three locomotives (1 master and 2 slaves). BHEL needs to make the necessary changes in the software/firmware and demonstrate the operation in ELS/LGD by 20.07.2017.
11. RDSO raised the issue of long time taken by BHEL in implementation of software modification. RDSO also indicated trials of the software have virtually made the locomotive a laboratory which needs to be strictly forbidden. BHEL has indicated that they are working on creating the loco model on the simulator and will carry out the validation of the modified software on the simulator itself. RDSO may be apprised the periodically about the progress.
12. RDSO appraised BHEL that DC link capacitance in BHEL traction converter is much less as compared with other make traction converter. It was discussed that the high failure rate of the power module may be attributed due to the low DC link capacitance. It was decided that BHEL shall carry out the simulation studies on Matlab by increasing the DC link capacitance and submit the report by 15<sup>th</sup> Jul'2017. Based on the simulation results BHEL shall increase the capacitance in two locomotives for field trial.



13. RDSO has given clearance for use of Vishay make capacitors in the traction converter DC link. BHEL indicated quality issues in M/s Vishay capacitors. RDSO will convene a joint meeting with M/s BHEL and M/s Vishay to sort out the issue.
14. ELS/LGD raised the issue of non-replacement of traction converter removed from 31492 on account of ICAR capacitor failure. The failure was occurred in Sept'16 and still the replacement has not been provided. BHEL informed that the converter will be supplied before 30th July'2017. Sr DEE/TRS/LGD to follow up.
15. BHEL requested RDSO to accord approval for TCN based VCU supplied as prototype against PO 70/2004/1109/022 and installed in Loco 31295 homed at ELS/LGD.

*12/07/17*  
DSE/TPL/RDSO