

In-process QC Procedure for Onboard Kavach Installation in Electric Lococmotives

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Abstract

This document describes the standard procedure of In-process QC Checklist for Loco KAVACH Installation in Electric Locomotives



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CHANGE HISTORY

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1	In-process QC Checklist for Installation of KAVACH in Electric Locomotives	06.06.2023	Initial Version	1.0
2	In-process QC Checklist for Installation of KAVACH in Electric Locomotives	10.07.2023	Software files Checksum Verification Added.	1.1
3	In-process QC Checklist for Installation of KAVACH in Electric Locomotives	30.12.2023	RFID Assembly details updated	1.2
4	In-process QC Checklist for Installation of KAVACH in Electric Locomotives	01.11.2024	Added CCB Installation details	1.3



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1. Purpose

The purpose of this manual is to specify Onboard KAVACH equipment Quality Inspection procedure to inspect quality issues in respect of Electric 3-phase Locomotives.

2. Scope

Scope of this document is to lay down the quality inspection procedure of onboard KAVACH and its sub-component units during installation and commissioning. Quality incharge shall be responsible for maintaining this document.

3. Quality Check Points:

3.1 Onboard KAVACH:

- 3.1.1 Confirm that the location of the Loco Kavach unit in the loco allows access for easy replacement of PCBs.
- 3.1.2 Check the Loco Kavach unit stand welding without any gaps with respect to the loco surface.
- 3.1.3 Ensure that there is no loose joint between stand to surface during welding.

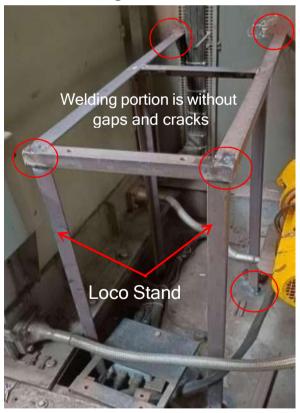






Figure 1: Loco KAVACH Stand Mounting

3.1.4 Ensure that finishing of the welding to be smooth and there is no sharp edges.



- 3.1.5 The welded loco stand shall be made of 5mm thick steel, to withstand Loco vibrations. The structure shall be stable and standing on four legs. Cantilever structures with two legs shall not be used.
- 3.1.6 The stand shall be treated with red oxide coating, before being painted with RAL7032 (Pebble Grey color) paint, to avoid corrosion.
- 3.1.7 Ensure that Loco stand fixing holes(M8) are exactly matching with Loco channel fixing holes(M8).
- 3.1.8 The M8 bolts shall be tightened with 48N-m torque, using a torque spanner. The bolt heads shall be marked with green paint, after the QC inspector checks for proper torque application.
- 3.1.9 Check the cable connections are made as per the labeling without overlaps and wrong connections.
- 3.1.10 Ensure that all the external cable circular connectors are fully locked properly with Loco Kavach receptacles.







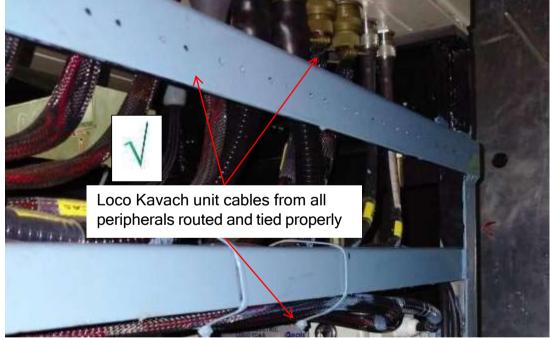




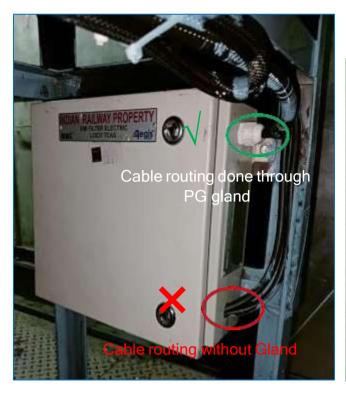


Figure 2: Loco Kavach unit cables routing

3.2 EMI Filter Box:

- 3.2.1 Ensure that fixing of EMI Filter Box to loco stand with (M5x16mm) screws and nuts with torque wrench and maintained torque 12N-m for proper tightness of fixing.
- 3.2.2 Check the cable routing and ensure that there are no sharp bends and stress on cables.
- 3.2.3 Ensure all the cables routed through PG glands and also check all the cables are tied with cable ties.





Improper routing of EMI filter cables

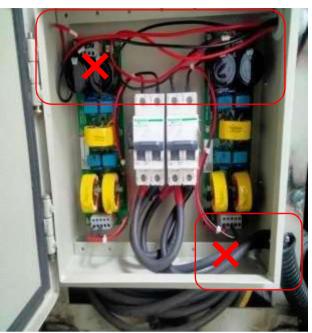


Figure 3: EMI Filter Unit Mounting

3.3 RIB and Cab Input Box:

- 3.3.1 Ensure that enough space available in-between cab input box and RIB unit for easy access of cables.
- 3.3.2 Check the RIB and CAB Input box stand welding should be proper without any gap on welding.
- 3.3.3 The welded loco stand shall be made of 5mm thick steel, to withstand Loco vibrations.
- 3.3.4 Welding portion to be clean and smooth without any cracks and joint breaks.
- 3.3.5 The stand shall be treated with red oxide coating, before being painted with RAL7032 (Pebble Grey color) paint, to avoid corrosion.
- 3.3.6 The M5X16mm bolts shall be tightened with 12N-m torque, using a torque spanner. The bolt heads shall be marked with green paint, after the QC inspector checks for proper torque application.







Figure 4: RIB & CAB I/P BOX Mounting

- 3.3.7 Cables to be routed without any sharp bends, overlaps and tied properly with cable ties.
- 3.3.8 Ensure that cables are connected with respect to labels and ensure circular connectors are fully locked with enclosure receptacles.







Figure 5: RIB & CAB I/P Cable Routing

3.4 DMI/LP-OCIP Mounting:

- 3.4.1 Check the DMI mounted place is good enough at driver desk, which can be operated easily by Loco pilot.
- 3.4.2 Ensure that DMI mounting stand is properly welded without any joint gaps. Ensure that mounting stand can be withstand to loco vibrations.
- 3.4.3 The M5X16mm screws shall be tightened with 12N-m torque, using a torque spanner. The screws heads shall be marked with green paint, after the QC inspector checks for proper torque application.
- 3.4.4 Ensure that projection at bottom side of the stand to be easy to access DMI cable.
- 3.4.5 The stand shall be treated with red oxide coating, before being painted with RAL7032 (Pebble Grey color) paint, to avoid corrosion.





Figure 6: DMI/LP-OCIP Mounting stand

- 3.4.6 Ensure that cable routing done properly without over stress and sharp bends.
- 3.4.7 Ensure that the cable booting is not damaged/peeled out while or after routing the cable.
- 3.4.8 DMI-1 cable shall be connected to MC1 and DMI-2 cable shall be connected to MC3 at Loco Kavach unit.
- 3.4.9 Ensure that the circular connectors are fully locked with DMI unit enclosure receptacles.





Figure 7: DMI/LP-OCIP Cable Routing

3.5 RFID PS Box:

- 3.5.1 The M5X16mm screws shall be tightened with 12N-m torque, using a torque spanner to Loco Kavach stand. The screws heads shall be marked with green paint, after the QC inspector checks for proper torque application.
- 3.5.2 Ensure that cable connections are given at the corresponding location with respect to labels provided at Loco Kavach unit.
- 3.5.3 Ensure that cables are routed properly without hanging and tied properly with cable ties.
- 3.5.4 Ensure the circular connectors are properly locked with RFID box unit receptacles.





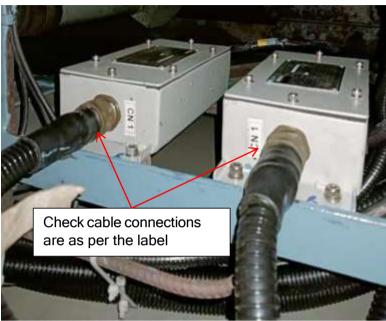


Figure 8: RFID PS Box Fixing and Cable Routing

3.6 Radio & GPS-GSM Antenna's:

3.6.1 Check the Radio antenna's base plate welding done properly without any joint gaps and cracks.

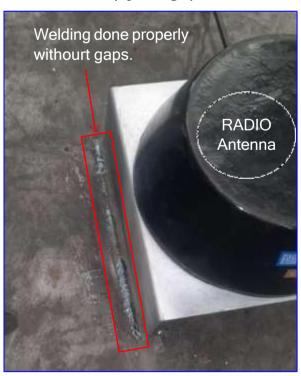




Figure 9: Radio(RF) Antenna Fixing



3.6.2 Ensure that welding done good enough, such that antenna's can be withstand loco vibrations, while running with higher speeds.



Figure 10: GPS&GSM Antenna Fixing

- 3.6.3 Ensure that antenna's are mounted within stipulated height to avoid OHE line contact.
- 3.6.4 Ensure that the LMR400(TX-1, TX-2, RX-1 & RX-2) & LMR200 (GSM1, GPS1, GSM2& GPS2) cables are connected to their respective locations.



3.6.5 Ensure that the cables are routed properly through the 2" steel reinforced pipe/hose to avoid environmental damages and pipe/hose tied to supporting welded rods using cable ties.



- 3.6.6 Ensure that cables are not exposed outside after routing through reinforced pipe/hose. Any locally procured conduit shall be of KONTACT(or Equivalent) make and steel wire reinforced pipe model.
- 3.6.7 Ensure that the all welded portions shall be treated with red oxide coating, before being painted with RAL7032 (Pebble Grey color) paint, to avoid corrosion.

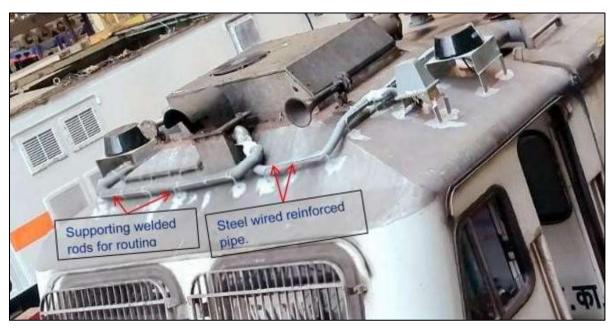


Figure 11: Radio, GSM& GPS antenna cable routing

3.7 Pneumatic fittings and EP Valve, Cocks fixing:

- 3.7.1 Confirm that all pipes and fittings used in the assembly are from the approved BOM, and taken from the I&C kit supplied from the factory. Any locally procured items must be checked for compliance to the approved BOM.
- 3.7.2 Confirm that copper pipes are bent using appropriate bending tool, and that there no kinks or sharp bends in the pipe.
- 3.7.3 Ensure that copper tube length is measured with respect the connectivity from loco pneumatics to EP Valve, BP cock, Horn cock and valve arrangements.



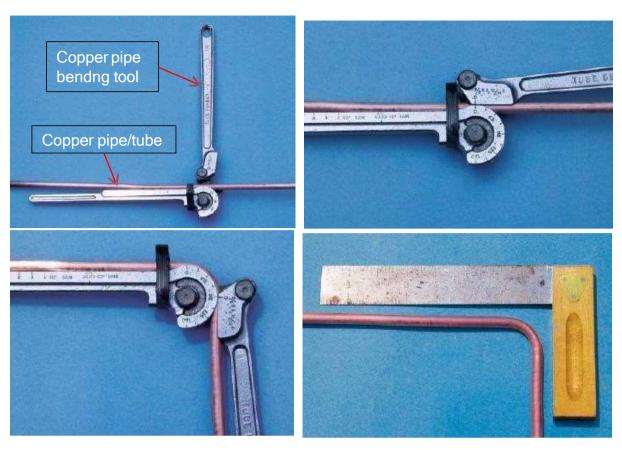


Figure 12: Copper pipe bending process with bend tool

- 3.7.4 Ensure that copper pipe connections made properly with approved make(Ex.Fluid Control)ferrules and TEE-joints used.
- 3.7.5 All threaded connections must be sealed with Teflon paste (**NOT TEFLON TAPE**), which is supplied in the I&C kit.

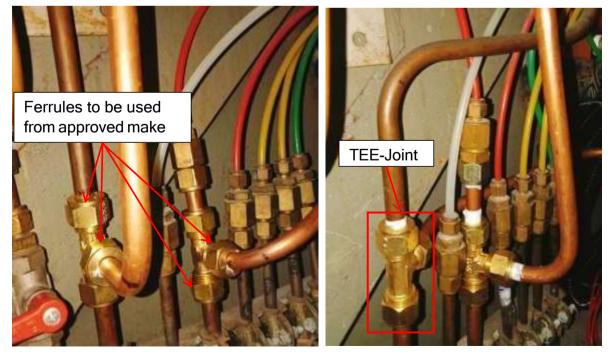
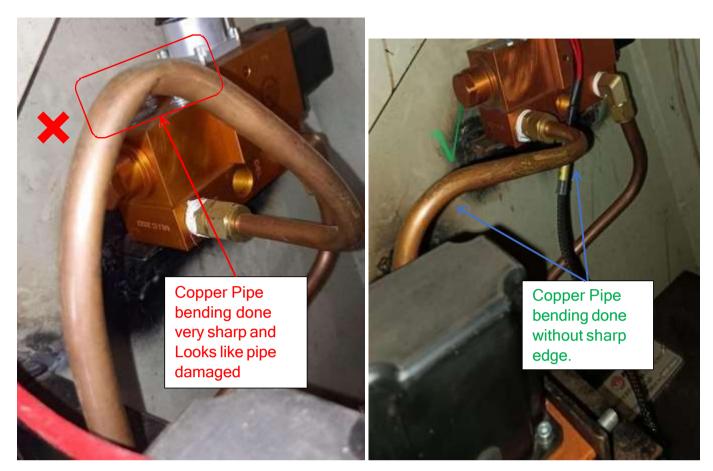


Figure 13: Copper pipe assembly and ferrules fixing

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3.7.6 Ensure that there are no loose connections in the pneumatic lines, by checking with soap solution. No air bubbles shall be seen when soap solution is applied at the joints. After the test, the soap solution shall be wiped clean.

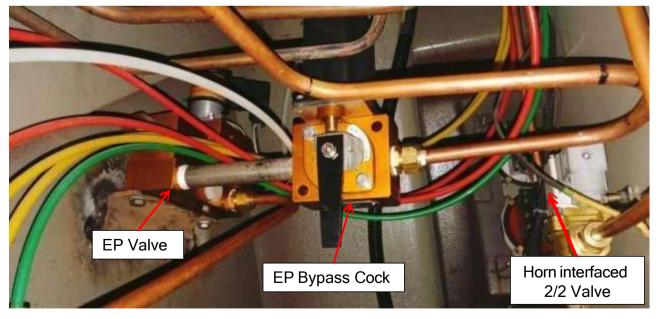


Figure 14: EP Valve, EP Cock and Horn valve assembly



3.8 MR, BP, BC1 & BC2 Pressure sensors fixing at CAB-I:

- 3.8.1 Ensure the MR sensor to be installed on MR pressure gauge copper pipe with 1/2" T-Joint provided with I&C kit, connected with "RED" color pipe. Ensure the sensor range shall be **0-16** Bar.
- 3.8.2 Ensure the BP sensor to be installed on BP pressure gauge copper pipe with 3/8" T-Joint, connected with "GREEN" color pipe. Ensure the sensor range shall be **0-7** Bar.
- 3.8.3 The BC-1 & BC-2 sensors shall be installed to BC pressure gauges, connected with "YELLOW" color two individual pipes for BC-1 & BC-2. Ensure the two BC sensors range shall be **0-7** Bar.
- 3.8.4 Ensure these sensors wiring connection been given as per the labels specified in MC26 connector of RIB external harness.
- 3.8.5 Following image illustrates the Pressure sensors connections.



Figure 15: MR, BP, BC1 & BC2 sensor installation

3.9 IRU(Faively) units Fixing:

- 3.9.1 Check and Ensure that sufficient place available for IRU fixing at bottom of the driver desk of both the CAB's.
- 3.9.2 Ensure that supporting angles for IRU units are welded properly to withstand loco vibrations.
- 3.9.3 Ensure that welded portion should be neat and clean. Check that there is no welding gaps and cracks.







Figure 16: In

- 3.9.4 Ensure that the IRU units fixing holes are matching with supporting angels.
- 3.9.5 Ensure that the welded portion shall be painted with RAL7032 (Pebble Grey color) paint, to avoid corrosion.
- 3.9.6 Check the cables are connected to their respective position.
- 3.9.7 Ensure that cables are routed properly without hanging on ground and tied properly with cable ties.

3.10 PG's and Speed meter boxes fixing:

- 3.10.1 Ensure that PG1 and PG2 are installed on allotted axles(1/2/3/4/5/6) of locomotives on left and right side.
- 3.10.2 Ensue the PG1 is connected left side and PG2 on right side, while sitting from the LP desk at CAB-A side.

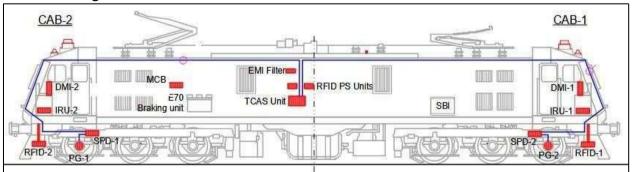








Figure 17: PG1&PG2 Assembly to Loco Axles

- 3.10.3 The PG fixing screws M8X16mm screws shall be tightened with 48N-m torque, using a torque spanner.
- 3.10.4 The screws heads shall be marked with green paint, after the QC inspector checks for proper torque application.
- 3.10.5 Ensure that tightness of the screws used for fixing of PG to loco axles and can be withstand for continuous running of locomotive.
- 3.10.6 Ensure that the PG head(sensor) is coming to top side from ground/rail or left/right side for safety purpose.
- 3.10.7 Ensure that PG cables routing made properly without hanging and tied properly with cable ties.
- 3.10.8 Ensure that the Speedo meter boxes are fixed nearby PG's.
- 3.10.9 Ensure that speedometer supporting clamps are welded without any gaps and cracks.



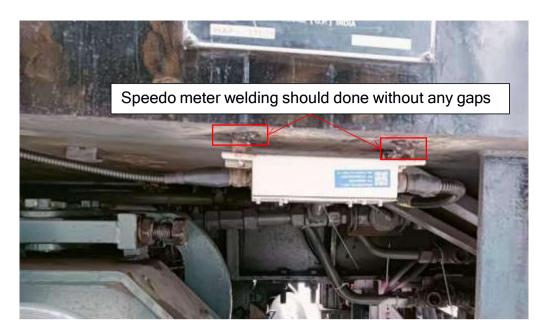


Figure 18: Speedometer Assembly

- 3.10.10 Ensure that speedometer fixing holes are matched with fixing clamps holes, uneven fixing may cause loose connection of speedo meter will leads to peel out from locomotive.
- 3.10.11 Ensure that cables from PG to Speedometers and from speedometer units to Loco Kavach unit are proper.
- 3.10.12 Ensure that PG1 connected to MC8 and PG2 connected to MC22 at loco Kavach unit.
- 3.10.13 Ensure that external cables are routed to their respective speedometer units.
- 3.10.14 Ensure that the external cable circular connectors are properly locked with speedometer box unit receptacles.



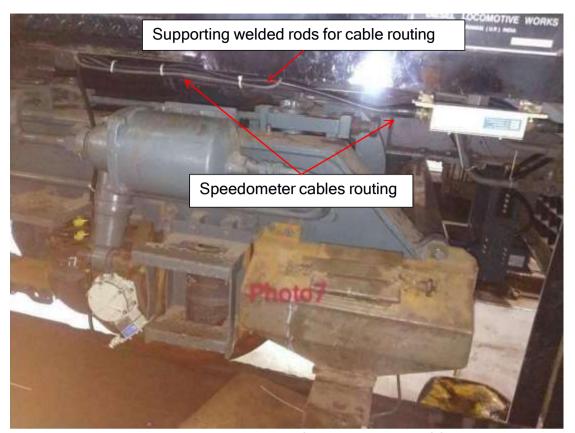


Figure 19: PG & Speedometers Assembly

3.11 RFID Reader Assembly:

- 3.11.1 Check the RFID Reader brackets are welded bottom of the locomotive at both the CAB's.
- 3.11.2 Ensue that bracket's welding done without any gaps and joint breaks.
- 3.11.3 Ensure that welding done properly, such that the RIFD Reader can be withstand for loco vibrations during running.
- 3.11.4 Check the tightness for channels fixing screws(M8X16mm) by using torque wrench by maintaining torque 48N-m to confirm that the tightness is good enough.
- 3.11.5 The installation of RFID reader would be done with the vertical distance from bottom of RFID reader to top of the rail level is **450mm**. **±50mm**.
- 3.11.6 Ensure that all welded portions to be painted properly with Grey color paint to avoid corrosion.



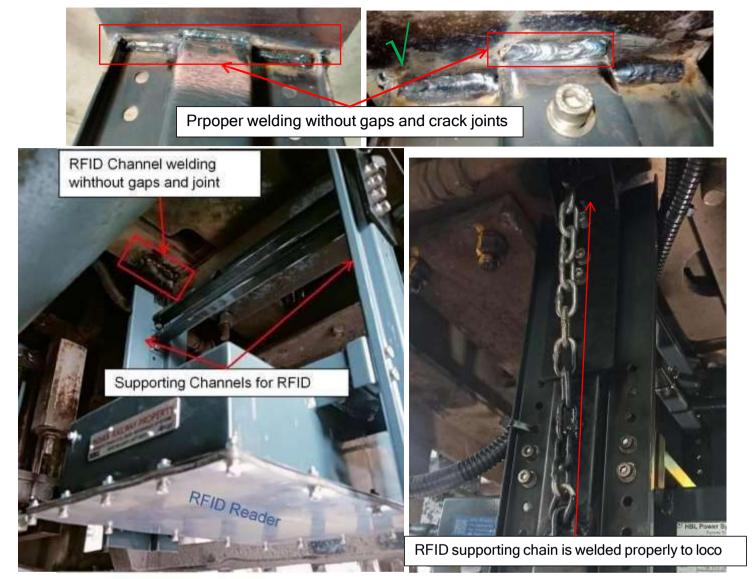


Figure 20: RFID Reader assembly

- 3.11.7 Check and Ensure that RFID reader cables are routed properly through the loco trench without any overlaps and over stress.
- 3.11.8 Ensure that cable shall not have any sharp bends in routing and also ensure that cables shall not have any damages while routing.
- 3.11.9 Ensure that mil connector booting was not damage in routing.
- 3.11.10 Ensure that mill connectors connectivity is as per the wiring at loco side and RFID Reader side.
- 3.11.11 Ensure that RFID Reader-1 is connected to MC6 and RFID Reader-2 connected to MC7 at Loco Kavach.
- 3.11.12 Ensure that the circular connectors are properly locked with RFID box unit receptacles.



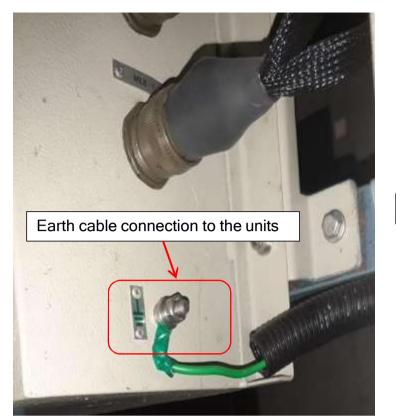


Figure 21: RFID Reader cable assembly and routing

3.12 Earthing:

- 3.12.1 Ensure that earthing done with 4Sq.mm Y/G cable for Loco Kavach main unit, RIB unit, CAB Input Box, LP-OCIP units on both the cabs.
- 3.12.2 Ensure that cable continuity, lugs crimping and tightness of earth cable.
- 3.12.3 Ensure that the earth cables are routed through the conduit and routed properly and tied with cable ties.





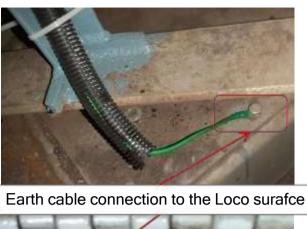


Figure 22: Earth cable connectivity for all units

3.13 Installation of CCB modules:

3.13.1 PSJB & TPM module Installation:

- 3.13.1.1 On Loco CCB Brake panel, there is already installed Junction box, PSJB box and MPIO modules.
- 3.13.1.2 The factory supplied PSJB box shall be installed on the CCB brake panel by removing the existing PSJB box and the TPM module shall be installed on the right side of the MPIO module as shown in the below figure.
- 3.13.1.3 Ensure the installation shall be made with proper hardware provided along with the modules.
- 3.13.1.4 Ensure the connection for modules given, as per the labels mention on the harness cables.
- 3.13.1.5 Ensure to hand over the removed PSJB modules to Loco Shed officials.



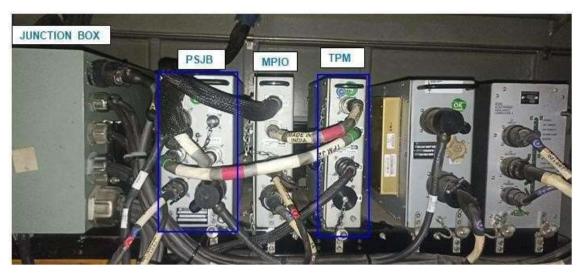


Figure 23: PSJB & TPM module Installation

3.13.2 Installation of SIFA valve

- 3.13.2.1 The SIFA valve will be supplied along with the mounting frame, the frame shall be welded under A9-DBC (Driver Brake Controller) on CAB-I side and fix the 1/2" elbow fitting at SIFA valve IN port location on the mounting frame.
- 3.13.2.2 Ensure the mounting location of the SIFA valve shall be easy for operations and maintenance.
- 3.13.2.3 Ensure the Isolation cock shall be fixed to SIFA valve for easy operation by loco pilots.
- 3.13.2.4 Ensure the copper pipes bending done with proper tools to avoid wrong bending or damages.
- 3.13.2.5 Ensure the fixing of copper pipe using T-Joint(1/2") at BP pipe line and Elbow (1/2") at SIFA valve in port as shown in the below figure.



Figure 24: SIFA Valve Installation