


|  | MODIFICATION PROCEDURE | VMP-RETB-005 |
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CLASS 47 RETB INSTALLATION MODIFICATION AND TEST PROCEDURE

Issue: 1 Revision: AD2

January 2015

Approval and Authorisation

Signature

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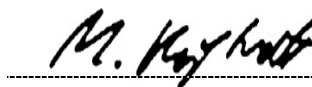
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1. INTRODUCTION

1.1 General


Network Rail are in the process of developing a replacement RETB (Radio Electronic Token Block) radio system, for the Far North Line (FNL) and West Highland Lines (WHL) in Scotland. After a life extension of infrastructure systems, the Next Generation RETB (RETB NG) project is planned to replace the radio system element (NRN) as the frequencies used are due to be returned to Ofcom at the end of 2015. This requires a new train radio and token exchange unit to be installed in all driving cabs of vehicles used on the FNL and WHL.

A varied fleet of Class 47's still remain in use with Direct Rail Services (DRS) and the West Coast Railway Company (WCR), principally operated out of Carlisle and Carnforth Depots respectively. These Locomotives are currently equipped with National Radio Network (NRN) radio and the Legacy RETB System. This modification procedure describes the installation of the new RETB NG system alongside the Legacy NRN System on the WCR owned locos only. The modification design allows inter-changeability between the RETB-NG and Legacy systems. Either of the RETB displays can be fixed to a common display mounting bracket and connected to the appropriate cable harnesses. Those harnesses not in use are stowed on dummy connector fittings, located on a bracket above the RETB display unit.

Two antennas are required for the RETB-NG. One is a VHF whip antenna, and the second a GPS 'puck' antenna. The puck antenna is independent of the existing antennas, but the new whip antenna makes use of the existing NRN base location for its installation. Therefore, if it is necessary to change from legacy systems to RETB-NG or vice versa, the antenna whips must be exchanged, as must the antenna feeders from the respective systems.



Figure 1 - Photograph showing Class 47 Number 47760

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1.2 Purpose and Scope

This procedure details the modification work required to install the RETB NG System onto the Class 47 Locomotives. The main elements of the modification are:

- Installation of 2 off roof-mounted antennas.
- Installation of a junction box.
- Installation of a cab mounted 'Combined Cab Display Unit and Radio' (CDR)
- Installation of a new handset and speaker.
- Installation of a new replacement PSU to supply both the RETB NG system and the existing NRN and RETB systems as required.
- Installation of all associated cabling between the system components being installed.
- Functional testing of the RETB NG system and the existing NRN and RETB systems to confirm correct functionality.


1.3 Safety

When working to this document, it is the responsibility of the Supplier to ensure that all relevant local and mandatory safety instructions are strictly followed. This shall include, where applicable, adherence to Safety Legislation, Railway Group Standards and Industry Standards.

1.4 Cable Idents

Where the scope of work within this Modification involves the addition of new cabling or disturbance to existing cabling, the supplier shall ensure all such cabling is correctly labelled using appropriate cable idents that are legible and suitable for purpose.


Cable installations, connections and repairs shall be in accordance with AT/TI0324 (See Reference Documents Item 1) and all spare or redundant cables shall be end-capped and tied back in accordance with CR/TP1084 (See Reference Documents Item 2).

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1.5 Standard Definitions

Within this document, any of the terms used from the following list shall be regarded as having the definition stated.

| Term | Definition |
|----------------------|--|
| Adjust | Correct to defined limits. |
| Approved Cleaner | Cleaning agent suitable for the task in hand. |
| Caution | Means that negligence may result in material damage or injury. |
| Change | Remove the original and fit a new or overhauled part or assembly in its place. |
| Check | Determine a particular nominated condition before, during or after repair, e.g. completeness, security, position. |
| Clean | Remove all dirt and deposits. |
| Defect/ Defective | Any fault or faults in a component or assembly, which may prevent the component or assembly from fulfilling its designed purpose. |
| Discard | Set aside on dismantling or disconnecting for subsequent disposal (scrap) not to be reused. |
| Dismantle | Take to pieces. |
| Contracts Manager | The nominated representative of Angel Trains Limited. |
| Examine | Determine general condition before repair, e.g. wear, cracks, splits, leaks, scoring, corrosion, erosion, breaks, distortion and looseness. |
| Gauge | Determine a nominated dimension by using suitable measuring equipment. |
| Inspect | Determine conformity to required standards during and after repair. |
| Overhaul | Do what is necessary to make a component or assembly re-usable, i.e. dismantle, strip, clean, examine, fit new parts, repair, re-assemble, test and inspect as required (does not include rewinding or renewal). |
| Re-Assemble | Put together. |

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|----------|---|
| Record | Put down in writing the result of any specified examination, test or inspection or Special Check. |
| Rectify | To set right (does not include rewinding or renewal). |
| Refit | Put back and reconnect. |
| Remove | Disconnect and take off. |
| Renew | Remove and scrap the original part, component or assembly and put a new part, component or assembly in its place. |
| Repair | Restore an original part to the required condition, e.g. by hand tooling, machining, building up, welding, patching, bending and setting, heat treating, re-securing, etc. (does not include rewinding or renewal). |
| Report | Convey to the Supervisor the condition of the item examined. |
| Scrap | Dispose of. |
| Strip | Remove covering, e.g. paint, polish, fabric. |
| Supplier | Reference within this and any related documents to the Supplier shall identify an organisation which is contracted to one of the Rolling Stock Companies and their authorised agents for the purpose of undertaking a specified task. |
| Test | Prove correct operation of component or system. |

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1.6 Supplier's Responsibilities

Safety (See Section 1.3)

Condition on Release

The condition of the vehicle and all components and systems on completion of overhaul and repairs shall be such that the safety of public and staff alike is not endangered and that any risk has been fully assessed and minimised to become as low as reasonably practicable. If any doubt exists remedial action shall be taken by the Supplier.

Railway Group Standards

All applicable Railway Group Standards shall be adhered to, irrespective of whether they are specifically referenced in this document. The Supplier shall advise the Contract Manager if any requirement of a Railway Group Standard conflicts with any requirement of this document or any subsidiary document.

Materials and Components

It is the responsibility of the Supplier to ensure that all repaired components and systems conform to the standards authorised and agreed for the specific contractual use. If the Supplier becomes aware that the contractual issue of a document is not the latest issue, he shall advise the Contract Manager who will determine whether the revised issue is to be implemented for the contract.

The Supplier shall not carry out any design changes or change any processes or materials detailed in this document without the approval of the Contract Manager. Requests for changes will be managed in accordance with the Angel Trains Management of Change procedure E01.

Where a component is required to be cleaned, unless otherwise stated, it is the responsibility of the Supplier to identify the most suitable method, which will ensure that the component is not in any way damaged.


Whenever it is necessary to remove or isolate a faulty or redundant cable the work must be carried out in accordance with Technical Procedure CR/TP1084 (Refer to Reference Documents item 2).

Competence

All work must be carried out by staff assessed as competent in accordance with the principles of ORR Railway Safety Publication 1 "Developing and Maintaining Staff Competence" March 2007.

Sequence of Test

The testing must be undertaken in the sequence indicated.

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If a fault is identified during testing then it should be rectified and the test repeated to confirm that the rectification work has been successful and has not created any other faults.

When the test is repeated it should start from an appropriate point earlier in the sequence to include all of the testing affected by the rectification work. If a suitable point earlier in the sequence cannot be determined then the test should be repeated from the start.

Record of Engineering Changes

Design information (held by the supplier) must be updated for all modifications and any information held in PADS, in accordance with ACOP/EC/01007 (See also Angel Trains Change Management Procedure E01), shall be updated also. The fit, form & function modification status must be visibly recorded on the component.

Welding

All welding shall be to recognised National/International standards. The Supplier shall state the standards and specifications to be used and shall provide documentary evidence to cover the welding procedures, systems and processes. This shall also include preparation of the vehicle and or component prior to welding.

Renewal of Fasteners


All split cotter pins, star washers, locking tabs, spring washers and torque prevailing nuts removed during maintenance or overhaul SHALL BE RENEWED. Unless otherwise specified all other fasteners removed during this overhaul shall be renewed if found to be defective in any way.

Tightening of Threaded Fasteners

Where a torque loading is specified, nuts shall only be tightened by means of a calibrated torque wrench. If the Supplier considers that any joint where torque loadings are not specified is critical, he shall consult the Engineer. Except where otherwise specified, threads are not to be lubricated but a thin film of corrosion inhibitor can remain on the threads.

It is essential to check that all bolts, in a multi-hole fixing, carry their allocated proportion of the load. Unless otherwise specified, they shall first be tightened in a staggered pattern from the centre outwards and subsequently re-tightened in the same sequence. This second tightening is necessary since bolts may lose tension when adjacent bolts are tightened.

Unless otherwise specified, slotted or castellated nuts shall subsequently be over tightened if necessary to align the next slot to allow for the insertion of split cotter pins. Under no circumstances shall nuts be eased back.


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Prevailing Torque Nuts

Where prevailing torque nuts of the bent beam type or nylon insert type are used, at least two complete threads of the bolt must protrude through the nut. However, under no circumstances may a nylon insert type nut be used on a bolt that is cross-drilled in threaded section.

Protection of Components

When disconnected and out of service, all electrical, hydraulic and pneumatic connections shall be sealed to prevent ingress of foreign matter.

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2. REFERENCE MATERIALS, SPECIAL TOOLS, DOCUMENTATION & DRAWINGS

2.1 Materials Table


| Materials | | | |
|-----------|---------------------------------|---------|------------------------------|
| Item | Description | Qty/Veh | Cat/OEM Pt No |
| 1 | Cable Tie 186 X 4.7mm | 30 | RS 212-8087 |
| 2 | Cable Tie Bases | 10 | RS 190-3326 |
| 3 | Braided Sheath Cable Protection | A/R | Siegrist-Orell SVSR200 |
| 4 | PSU | 1 | Martek Power– EBR1400-A/1 |
| 5 | M6 Hex Nut, EZP | 6 | 003/175112 |
| 6 | M6 Form A Washer, EZP | 6 | 003/190924 |
| 7 | M6 Spring Washer, EZP | 6 | 003/195108 |

Note 1: All other materials required for the modification are shown on the relevant reference drawing, see Section 2.4.

2.2 Special Tools Table

| Special Tools | | |
|---------------|---|---|
| Item | Description | Cat/OEM Pt No |
| 1 | Torque Wrench 0 -30Nm | Local Supply |
| 2 | Digital Multimeter | Local Supply |
| 3 | Megger (500V) or equivalent | - |
| 4 | Low resistance meter, 4 terminal, resolution 0.1mΩ or better, minimum test current 0.1A | e.g. Cropico DO 4000 |
| 5 | Rig Expert AA-600 VHF Analyser (Or Equivalent) | - |
| 6 | Depot Test Unit (RETB-NG) | - |
| 7 | Approved Avdel Euroserts Insertion Tools | - |
| 8 | 32mm Dia Holesaw | - |
| 9 | M10 Glen Air Insertion Tool | PMTTC10 M10 Glen Air insertion tool (Dubuis). |

Note 2: Where 'Local Supply' is shown against a Special Tool, it is the Supplier's responsibility to obtain this tool to suit their local requirements.

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2.3 Reference Documents Table


| Reference Documents | | |
|---------------------|---------------|---|
| Item | Document No | Title |
| 1 | AT/TI0324 | Cable Connections and Repair |
| 2 | CR/TP1084 | Removal or Isolation of Defective or Redundant Cables and Provision of Spare Cables |
| 3 | TBA | NRN Radio Test |
| 4 | TBA | R.E.T.B. Test Procedure |
| 5 | CR/PE0102 | Repainting of Rail Vehicles |
| 6 | PROC-1051-001 | On-Train Installation Test Procedure - Antenna |
| 7 | PROC-1051-002 | On-Train Installation Test Procedure - System |

2.4 Reference Drawings Table

| Reference Drawings | | |
|--------------------|-------------|---|
| Item | Drawing No | Title |
| 1 | MP-C0-00047 | General Arrangement Class 47 RETB |
| 2 | MP-C0-00048 | Roof Antenna Installations Class 47 RETB |
| 3 | MP-C0-00054 | CDR, Speaker and handset Installation Cab Class 37 RETB |
| 4 | MP-C0-00055 | Junction Box Sub-Assembly Class 57 RETB |
| 5 | MP-C0-00056 | Miscellaneous Details Class 47 RETB |
| 6 | MP-C0-00057 | Junction Box Installation Class 47 RETB |
| 7 | MP-C0-00058 | Class 47 RETB NG Schematic |
| 8 | MP-C0-00059 | Class 47 RETB NG Wiring Diagram |
| 9 | MP-C0-00072 | GPS Antenna Details Class 47 and 57 RETB |
| 10 | MP-C0-00091 | Junction Box Support Fabrication Assembly Class 47 RETB |
| 11 | MP-C0-00092 | Junction Box Cover Assembly and Details Class 47 RETB |


2.5 Torque Table

| Item | Section No. | Description | Torque Value Nm |
|------|-------------|--|-----------------|
| 1 | 3.4.3 | Handset Mounting Box | 6Nm |
| 2 | 3.4.4 | Handset to Mounting Box | 6Nm |
| 3 | 3.4.6 | Junction Box | 6Nm |
| 4 | 3.4.7 | Junction Box Sub-Assembly to Bulkhead | 7Nm |
| 5 | 3.4.7 | Junction Box Sub-Assembly | 11Nm |
| 6 | 3.4.8 | Junction Box Conduit Clips to Bulkhead | 4Nm |

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2.6 Cable Bend Radius Table

| Cable Description | Minimum Radii |
|---|---------------|
| Huber and Suhner TENUIS-TW/S 4 x 2.5mm ² (RNG007) | 27mm |
| Huber and Suhner TENUIS-TW/S 2 x 1mm ² (RNG003) | 16mm |
| Huber and Suhner TENUIS-TW/S EMC 4 x 2 x 0.5mm ² (RNG002) | 28mm |
| Huber and Suhner TENUIS-TW/S EMC 6 x (2 x 1)mm ² (RNG004) | 56mm |
| Huber and Suhner TENUIS-TW/S EMC 12 x 1mm ² (RNG001) | 30mm |
| Huber and Suhner SX 04172 B-60 (RNG006 and RNG005) | 25mm |
| Huber and Suhner RADOX 4GKW 6mm ² (RNGE01) | 16mm |

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3. RETB NG SYSTEM INSTALLATION

3.1 Pre-Modification Legacy/ RETB NG Radio Function Test

- 3.1.1 Ensure the vehicle is adequately scotched in accordance with local depot procedures.
- 3.1.2 Switch the BIS and lighting switch in.
- 3.1.3 Ensure the NRN Radio powers up. The NRN powers up by default when the CDU is not connected. Record it has powered up successfully in Appendix A.
- 3.1.4 Undertake NRN full test in accordance with the appropriate VMI task (Refer to Reference Document, item 3). Record it has been completed successfully in Appendix A.
- 3.1.5 Plug the legacy RETB CDU into the existing harness and undertake RETB full test (using the Depot Test Unit – DTU) in accordance with the appropriate VMI task (Refer to Reference documents, item 4). Record it has been completed successfully in Appendix A.
- 3.1.6 Open the BIS and lighting switch.

3.2 Vehicle Isolation and Preparation

- 3.2.1 Open the BIS and lighting switch (if not already done), to ensure the vehicle is fully electrically isolated. Remove any shore supplies.


3.3 Wiring Removal & Re-location of Electrical Equipment

- 3.3.1 Remove existing NRN speaker wiring in accordance with document No. CR/TP1084 (Refer to Reference Documents, item 2) and as per drawing No. MP-C0-00059 (Refer to Reference Drawings, item 8).
- 3.3.2 Remove existing NRN PSU wires in accordance with document No. CR/TP1084 (Refer to Reference Documents, item 2) and as per drawing No. MP-C0-00059 (Refer to Reference Drawings, item 8).

3.4 Installation of Cab Equipment (Mechanical)

With Reference to drawing No. MP-C0-00047 – General Arrangement Class 47 RETB (refer to Reference Drawings, item 1):


Note: The following installation requires the use of an approved Avdel Eurosert Insertion Tool (refer to Special Tools, item 7).

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- 3.4.1 Fit cab equipment CDR unit onto the CDR carrier plate (Item A) as per drawing No. MP-C0-00054 (refer to Reference Drawings, item 3).
- 3.4.2 Install CDR carrier plate to the existing pillar-mounted RETB support bracket in accordance with drawing No. MP-C0-00054 (refer to Reference Drawings, item 3).
- 3.4.3 Install the handset mounting box (Item H) on the side of the NRN pedestal in accordance with MP-C0-00054 (refer to Reference Drawings, item 3). Torque tighten fixings to 6Nm (refer to Torque Table, item 1).
- 3.4.4 Fix the handset to the mounting box in accordance with MP-C0-00054 (refer to Reference Drawings, item 3). Torque tighten to 6Nm (refer to Torque Table, item 2).
- 3.4.5 Remove the existing NRN speaker and discard. Install new cab speaker as per drawing No. MP-C0-00054 (refer to Reference Drawings, item 3).
- 3.4.6 Referring to drawing No. MP-C0-00055 (refer to Reference Drawings, item 4), fix the junction box to the support assembly and Torque tighten fixings to 6Nm (refer to Torque Table, item 3). Loosely fix the bracket assembly (item 02) to the support bracket.
- 3.4.7 In accordance with MP-C0-00057 (refer to Reference Drawings, item 6), install the junction box sub-assembly between the cab structural member and cab/engine room bulkhead on the secondmans' side of the cab. Once in position, torque tighten the 2 off M6 fixings at the cab end to 7Nm (refer to Torque Table, item 4). Align the bracket assembly and support assembly (MP-C0-00055, items 01 & 02) to achieve the installation shown in MP-C0-00057 (refer to Reference Drawings, item 6). Torque tighten 2 remaining bulkhead fixings to 7Nm (refer to Torque Table, item 4). Once in position, torque tighten sub-assembly M6 fixings to 11Nm (refer to Torque Table, item 5).
- 3.4.8 Install the 5 off conduit clips in accordance with MP-C0-00057 (refer to Reference Drawings, item 6). Torque tighten fixings to 4Nm (refer to Torque Table, item 6).
- 3.4.9 Install the conduit and end caps in accordance with MP-C0-00057 (refer to Reference Drawings, item 6).

3.5 Install Replacement NRN/RETB PSU


- 3.5.1 Remove the supply wires 329, 328 and earth connection from the existing PSU (refer to Reference Drawings, item 7). Examine the wires and repair or renew damaged wires in accordance with AT/TI0324.
- 3.5.2 Remove the PSU from the equipment cabinet and return to stores.

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- 3.5.3 Install the new PSU (refer to Materials, item 4) into the equipment cabinet using 6 off M6 nuts, Form A washers and spring washers (refer to Materials, items 5, 6 & 7).
- 3.5.4 Reconnect the supply wires 329, 328 and earth connection to the new PSU as per drawing No. MP-C0-00059 (refer to Reference Drawings, item 8).

3.6 Install RETB NG Antenna & Antenna Cable

- 3.6.1 Install the VHF whip and GPS patch antennas in accordance with drawing No. MP-C0-00048 and the notes included, (Refer to Reference Drawings, item 2). For electrical installation information refer also to drawings No. MP-C0-00058 and 59 (refer to Reference Drawings, Items 7 and 8).
- 3.6.2 Route the Antenna cables (RNG005 and RNG006), from the location of the antennae, through to the cab area. Where possible the antenna cables should not be run alongside other cable bundles, so as to reduce the effects of radiated emissions. Also a minimum 20mm gap should be present between the antenna cables along the route where practical ensuring the two cables are not bundled together. Restrain cables with cable ties where required along route (Refer to Materials, items 1 & 2). Ensure enough free cable is left at the antenna end of the cable to allow removal of the antenna and disconnection of the connectors from outside the vehicle. The cables shall be protected from mechanical damage where necessary, by using a suitable braided sheath (Refer to Materials, item 3).
- 3.6.3 Route the 35mm² earth cables RNGE02 and 03 from the antenna ground planes (see drawing MP-C0-00048 – [Reference Drawings, Item 2] - for the stud arrangement) to the bonding stud already welded to the cab structural member. Access this stud by removing the horn box access panel, which should hinge down once the fixings are removed – take care when opening as debris often lodges in this area of the cab.

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If either stud is not fitted follow the instructions on the wiring diagram (see drawing No. MP-C0-00059 (Reference Drawings, Item 8). If this is the case drill a discretely located hole in the drivers' side of the horn box to route the cables (RNGE02 and 03) through, and use a gland or edging strip to protect the cable from chaffing.

To route RNGE02 and Harness RNG005 (GPS antenna feeder) down the front of the cab, work from the horn box and guide the cables down the void between inner and outer roof shell until they can be accessed from the antenna cover plate area. If expanding foam has been used locally, this should be removed carefully using a suitable instrument.

Both cables should be protected by sheathing (refer to Materials, Item 3).

Note: Before connecting antenna cables to the antenna, carry out cable continuity tests as detailed in Section 4.1.

3.6.4 Connect the antenna end of the antenna cables into the antenna.

3.6.5 Install the antenna. Take absolute care to not trap the antenna cables.

Note: Before connecting antenna cables to the CDR, carry out low-ohm tests as detailed in Section 1.1.

3.6.6 The loose (Radio) end of the antenna cable should be secured onto the dummy connectors, until required for testing.

3.7 Install New Wiring


3.7.1 Install new RETB NG radio wiring harnesses (RNG 001, RNG 002, RNG 003, RNG 004, RNG 005, RNG 006 and RNG 007) as per drawing Nos. MP-C0-00058 and MP-C0-00059 (Refer to Reference Drawings, items 7 and 8).

3.7.2 Install the new earth connection (RNGE 01) between the junction box earth stud and the local vehicle earth stud in the vehicle cab.

3.7.3 Loom the new cables using cable ties and bases (Refer to Materials, items 1 and 2), attaching the new wiring to existing looms and existing vehicle trunking where possible. Protect cable where required with a suitable braided sheath (Refer to Materials, item 3). Always ensure bend radius on cables are not tighter than the minimum radius detailed in Section 2.6.

Note: Before connecting cables, carry out cable insulation tests as detailed in Section 4.

3.7.4 Complete Installation Record Sheets in Appendix A.

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4. RETB SYSTEM TESTING

Complete Test Record Sheets in Appendix A

4.1 RETB NG Antenna Cables Point to Point Continuity Test

- 4.1.1 Using a Digital Multimeter (Refer to Special Tools, item 2) ensure that the two harnesses which service the antenna (RNG005 and RNG006) have continuity between the following:

Conductor Pin/Socket at each end.
Sheath outer at each end

- 4.1.2 Ensure an open circuit exists between the following:-

Conductor Pin/Socket and harness sheath outer.
Outer Sheath and Vehicle Welded Structure
Conductor Pin/Socket and Vehicle Welded Structure

Record the results in Appendix A.

Return to installation procedure section 3.6.4.

4.2 RETB NG Cables Insulation Test (Excluding RF Cables RNG 005 and RNG 006)

- 4.2.1 Electrically connect all new conductors together using bonding wire.

- 4.2.2 Clean a suitable local area of vehicle structure to reveal bare metal to be used as a test point.


Note: Following insulation testing detailed in section 4.2.3 refinish the area of exposed structure in accordance with CR/PE0102 – Repainting of Rail Vehicles (refer to Reference Documents, item 5).

- 4.2.3 Using the Megger Insulation Tester set to 500V (Refer to Special Tools, item 3), measure between the following points:-

Vehicle structure and bundled new cable.

Record the result in Appendix A.

If the reading is not equal to or in excess of 20MΩ, the reason for the low value must be identified and remedied before proceeding further.

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4.3 VSWR – VHF Harness (RNG006) only

Note: Under no circumstances should a VSWR measurement be attempted on the GPS antenna feeder as this will irreparably damage the antenna. Take care to identify the correct VHF feeder (QN-type connector) and avoid the GPS feeder (BNC connector).

- 4.3.1 Undertake an antenna test as described in procedure PROC-1051-001, (refer to Reference Documents, Item 6).


Record the results in Appendix A

4.4 VHF (Whip) Antenna and GPS (Puck) Antenna – Electrical Bonding

- 4.4.1 Ensure the antennas are fully installed in accordance with Section 3.6
- 4.4.2 Using a low-ohm meter (refer to Special Tools, item 4); measure the resistance between the loco' welded structure and the VHF antenna ground plane (BNC connector). Place one connector of the low-ohm meter to a clean part of the loco body structure and the other to the BNC antenna connector. Ensure this is 10mΩ or less.
- 4.4.3 Using a low-ohm meter (refer to Special Tools, item 4); measure the resistance between the loco' welded structure and the GPS antenna ground plane (Threaded fixing). Place one connector of the low-ohm meter to a clean part of the loco body structure and the other to the threaded connector. Ensure this is 10mΩ or less.

Record the result in Appendix A. If this is not achieved investigate the cause, rectify and re-test.

Return to installation procedure section 3.6.6.

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4.5 Electrical Bonding

4.5.1 Using a low-ohms meter (Refer to Special Tools, item 4), set the current to 10A and measure the resistance between the following:-

- Junction box bonding stud to vehicle test point (RNGE 01).
- PSU stud to vehicle test point

Record the result in Appendix A.

If the reading is not equal to or less than 10mΩ, the reason must be identified and remedied before proceeding further.

4.6 RETB Legacy & RETB NG Radio Point to Point Continuity Test

4.6.1 Using a Digital Multimeter (Refer to Special Tools, item 2) carry out a point to point test (Continuity <0.5Ω) on all new harnesses, using the drawing No. MP-C0-00049 (Refer to Reference Drawings, item 9) as a guide, check for continuity.

Note: For harnesses terminated in special connectors, use a suitable mating half, wired with flying lead ends to undertake continuity tests.

Record the result in Appendix A. If this is not achieved investigate the cause, rectify and re-test.

4.7 RETB NG Function Test

4.7.1 Ensure the RETB NG CDR is NOT connected (all three flying leads disconnected).


4.7.2 Switch the BIS and lighting switch in.

4.7.3 Ensure the NRN Radio powers up.

4.7.4 Plug in the CDR connections. Ensure the NRN powers down.

4.7.5 Using the CDR menu screen and navigating the options with the 'Up' and 'Down' arrow keys, in the 'Select Signaller' menu select 'NRN Mode' by depressing the 'Menu/Select' button.

4.7.6 Ensure the NRN powers up. Carry out NRN basic full test in accordance with the appropriate VMI task (Refer to Reference Document, item 3).

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- 4.7.7 Undertake a system test of the RETB NG as described in procedure PROC-1051-002 (refer to Reference Documents, Item 7).

Record the outcome of the tests in Appendix A.

- 4.7.8 Remove the CDR unit and stable the free connectors on the dummy connectors in the cab.

- 4.7.9 Ensure the NRN has once again powered up by default.

- 4.7.10 Plug the legacy RETB CDU into the existing harness and undertake RETB full test (using the Depot Test Unit – DTU) in accordance with the appropriate VMI task (Refer to Reference documents, item 4). Record it has been completed successfully in Appendix A.

Record it has been completed successfully in Appendix A.

- 4.7.11 Open the BIS and lighting switch.


- 4.7.12 Fit Cover. Install enclosure cover as per drawing No. MP-C0-00057 (refer to Reference Drawings, item 6), Torque tighten junction box fixings to 6Nm (Refer to Torque Table items 6). Witness mark the fasteners with a paint pen.

4.8 Final Vehicle Inspection

- 4.8.1 Ensure all equipment and tooling has been removed from the vehicle.

- 4.8.2 Undertake a visual inspection of the vehicle in the areas where modification work has been undertaken. Ensure there is no damage to panels, all panels are secure and clean and the vehicle has been left in the condition that it was received in at the beginning of the modification.

Record it has been completed in Appendix A.

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5. APPENDICES


5.1 Appendix A -Test Record Sheets (RETB)

INSTALLATION, TORQUE, WIRING AND POINT TO POINT TEST RECORD

Locomotive No. 47

INSTALLATION CHECK

| REF. | DESCRIPTION | | |
|-------|--|--------------------------|------|
| 3.3 | WIRING REMOVAL & RE- LOCATION OF EQUIPMENT TO DRAWING. | <input type="checkbox"/> | OK ✓ |
| 3.4 | INSTALL CAB EQUIPMENT TO DRAWING | <input type="checkbox"/> | OK ✓ |
| 3.4.6 | INSTALL JUNCTION BOX AND COVER TO DRAWING | <input type="checkbox"/> | OK ✓ |
| 3.5 | INSTALL REPLACEMENT NRN/RETB PSU | <input type="checkbox"/> | OK ✓ |
| 3.6 | INSTALL RETB NG ANTENNA & ANTENNA CABLE TO DRAWING | <input type="checkbox"/> | OK ✓ |
| 3.7 | INSTALL NEW WIRING TO DRAWING | <input type="checkbox"/> | OK ✓ |

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| Locomotive No. 47 |
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TORQUE CHECK REF.

DESCRIPTION

| | | | |
|-------------|--|----------------------|------|
| MP-C0-00054 | Handset Mounting Box installation fixing screws, M5, 3 off, 6Nm. | <input type="text"/> | OK ✓ |
| MP-C0-00054 | Handset fixing screws, M5, 2 off, 6Nm. | <input type="text"/> | OK ✓ |
| MP-C0-00055 | Junction Box to Support Assembly, M5, 4 off, 6Nm. | <input type="text"/> | OK ✓ |
| MP-C0-00057 | Junction Box Sub-Assembly to bulkhead fixing screws, M6, 4 off, 7Nm. | <input type="text"/> | OK ✓ |
| MP-C0-00057 | Junction Box Sub-Assembly fixing screws M6, 4 off, 11Nm. | <input type="text"/> | OK ✓ |

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Pre-Modification Legacy RETB Function Test

3.1 RETB Pre Modification Tests to Completed OK

OK✓

| Antenna Cables Point to Point Continuity Test | Recorded Value | Pass Value |
|--|------------------------|---------------------------|
| 4.1.1 Conductor Pin/Socket each end | <input type="text"/> Ω | must be $\leq 0.5\Omega$ |
| 4.1.1 Sheath Outer each end | <input type="text"/> Ω | must be $\leq 0.5\Omega$ |
| 4.1.2 Conductor Pin/Socket each end and Harness Sheath Outer | <input type="text"/> Ω | must be $\geq 20M\Omega$ |
| 4.1.2 Outer Sheath and Vehicle Welded Structure | <input type="text"/> Ω | must be $\geq 20M\Omega$ |
| 4.1.2 Conductor Pin/Socket and Vehicle Welded Structure | <input type="text"/> Ω | must be $\geq 500k\Omega$ |
| Cables Insulation Test | Recorded Value | Pass Value |
| 4.2.3 Vehicle structure and bundled cable | <input type="text"/> Ω | must be $\geq 20M\Omega$ |
| VSWR – VHF Harness (RNG006) only | Recorded Value | Pass Value |
| 4.3.3 VSWR @ 185MHz | <input type="text"/> | must be $\leq 3:1$ |

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| Antenna Earth Bond Tests | Recorded Value | Pass Value |
|-----------------------------------|-------------------------|----------------------|
| 4.4.2 VHF Antenna Earth Bond Test | <input type="text"/> mΩ | <i>must be ≤10mΩ</i> |
| 4.4.3 GPS Antenna Earth Bond Test | <input type="text"/> mΩ | <i>must be ≤10mΩ</i> |

| Electrical Bonding | Recorded Value | Pass Value |
|---------------------------------------|-------------------------|----------------------|
| 4.5.1 Junction Box Bond Test (RNGE01) | <input type="text"/> mΩ | <i>must be ≤10mΩ</i> |
| 4.5.1 PSU Bond Test | <input type="text"/> mΩ | <i>must be ≤10mΩ</i> |

Continuity Test


| | |
|---|---------------------------|
| 4.6.1 All Harnesses Point to Point Continuity Test as per Schematic Diagram | <input type="text"/> OK ✓ |
|---|---------------------------|

RETB Systems Function Test

4.7 RETB Function Test

Test Completed OK OK ✓

4.8 Final Inspection OK ✓

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| DATE | TESTERS NAME (PRINTED) | TESTERS SIGNATURE |
|------|------------------------|-------------------|
| | | |

| DATE | WITNESS NAME (PRINTED) | SIGNATURE |
|------|------------------------|-----------|
| | | |

| DATE | OWNING COMPANY REPRESENTATIVE NAME (PRINTED) | SIGNATURE |
|------|--|-----------|
| | | |

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6. REVISION LETTER

This revision letter details the changes made in issuing VMP-RETB-005 to Issue 1, Revision A.

| Section | Page | Change | Reason for Change |
|---------|------|--------------|-------------------|
| All | All | New Document | First Issue |