

# M U L T I P U L S E

## Document Transmittal Note No. 399

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MP-C0-00065	GENERAL ARRWNEMENT CAB TYPE 1 CLASS 37 RETB	P1	12.01.15
MP-C0-00066	GENERAL ARRANGEMENT CAB TYPE 2 CLASS 37 RETB	P1	12.01.15
MP-C0-00067	CDR INSTALLTION CAB TYPES 1 & 2 CLASS 37 RETB	P1	12.01.15
MP-C0-00068	HANDSET INSTALLATION CAB TYPES 1 & 2 CLASS 37 RETB	P1	12.01.15
MP-C0-00069	JUNCTION BOX & SPEAKER INSTALLATION CAB TYPE 1 CLASS 37 RETB	P1	12.01.15
MP-C0-00070	ADAPTER PLATE ASSEMBLY & DEAILS CLASS 37 RETB	P1	12.01.15
MP-C0-00071	HANDSET MOUNTING BOX PLINTH ASSEMBLY & DETAILS CLASS 37 RETB	P1	12.01.15
MP-C0-00073	JUNCTION BOX & SPEAKER INSTALLATION CAB TYPE 2 CLASS 37 RETB	P1	12.01.15
MP-C0-00074	JUNCTION BOX ENCLOSURE ASSEMBLY & DETAILS CAB TYPE 1 CLASS 37 RETB	P1	12.01.15

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MP-CO-00075	JUNCTION BOX ENCLOSURE ASSEMBLY & DETAILS CAB TYPE 2 CLASS 37 RETB	P1	12.01.15
MP-CO-00076	MISCELLANEOUS DETAILS CLASS 37 RETB	P1	12.01.15
MP-CO-00077	VHS WHIP & GPS ANTENNAS CAB TYPES A & 2 CLASS 37 RETB	P1	14.01.15
MP-CO-00078	CLASS 37 RETB/NG SCHEMATIC	P1	15.01.15
MP-CO-00079	CLASS 37 RETB/NG SCHEMATIC	P1	14.01.15
MP-CO-00082	RETB CABLE HARNESS FOR VERTICAL WHIP ANTENNA	P1	12.01.15
MP-CO-00083	CLASS 37 - CAN TYPE 2 RETB/NG WIRING DIAGRAM	P1	14.01.15
VMP-RETB-004	CLASS 37 RETB INSTALLATION MODIFICATION AND TEST PROCEDURE	1 REV AD	January 2015
MP HAZID 004	HAZARD IDENTIFICATION CHECK LIST	1	01.11.14
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DG8-CALC-00366	STRUCTURAL CALCULATIONS	A	28.11.14
MP INV 001	RETB NG MATERIALS INVENTORY LIST	4	28.11.14

# M U L T I P U L S E

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## NEXT GENERATION RETB

### CLASS 37 COMPLIANCE FOR NEXT GENERATION RETB INSTALLATION

Ref: MP TECHREP 031

Issue: 2

Date: 15/01/15

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1	28/11/14	First Issue
2	15/01/15	Amended following stakeholder review

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## **1 Introduction**

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 planning 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.

Multipulse Electronics Limited (Multipulse) has recently been awarded the contract to undertake the installation design, approvals and physical installation of the trainborne equipment. Multipulse has subsequently contracted the installation design aspects of the project to dg8 design and engineering limited (dg8), for the purposes of this document all dg8 employees will be known as the Multipulse Installation Design Team.

The Multipulse Installation Design Team is an ISO 9001:2008 and ISO14001:2004 accredited body, and undertakes a wide variety of installation design and approval projects for the railway industry.

## **2 Scope**

This document provides the Railway Group Standards compliance responses for the Class 37 Locomotives, fitted with the RETB NG equipment.

### 3 Abbreviations

CDL	Comms Design Ltd
CDR	Combined Cab Display Unit and Radio
CDSR	Concept Design and Survey Report
CDU	Cab Display Unit
CE	Conformity Engineer
CSR	Cab Secure Radio
DeBo	Designated Body
DMU	Diesel Multiple Unit
EIP	Ergonomics Integration Plan
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
FNL	Far North Line
FOC	Freight Operating Company
FoC	First of Class
FoT	First of Test
GPS	Global Positioning System
GSM-R	Global System for Mobile communications - Railways
ICD	Interface Control Document
NoBo	Notified Body
NRN	National Radio Network
ORR	Office of Rail Regulation
OTDR	On Train Data Recorder
OTMR	On Train Monitoring and Recording
PACS	Propelling Advisory Control System
PSU	Power Supply Unit
RETB	Radio Electronic Token Block
RETB NG	Radio Electronic Token Block Next Generation
RF	Radio Frequency
RIA	Railway Industry Association
ROGS	Railways and Other Guided Systems regulations
TPWS	Train Protection And Warning System
VHF	Very High Frequency (Radio Frequency Band)



#### 4 Reference Documents

Ref No	Document No	Title
1	ICD-1051-01	RETB INTERFACE CONTROL DOCUMENT
2	DG8-CALC-00366	CLASS 37 RETB INSTALLATIONS
3	MP INV 001	NEXT GENERATION RETB MIL
4	MP HAZ ID 004	CLASS 37 HAZARD ID
5	VMP/RETB/004	CLASS 37 RETB INSTALLATION MODIFICATION AND TEST PROCEDURE
6	GE/RT8015	ELECTROMAGNETIC COMPATIBILITY BETWEEN RAILWAY INFRASTRUCTURE AND TRAINS - ISSUE 1
7	GK/RT0036	TRANSITIONS BETWEEN SIGNALLING SYSTEMS - ISSUE 2
8	GK/RT0055	BLOCK SYSTEM INTERFACE REQUIREMENTS - ISSUE 1
9	GK/RT0094	TRAIN VOICE RADIO SYSTEMS - ISSUE 1
10	GM/RT2004	RAIL VEHICLE MAINTENANCE - ISSUE 5
11	GM/RT 2100	REQUIREMENTS FOR RAIL VEHICLE STRUCTURES -ISSUE 5
12	GM/RT2130	VEHICLE FIRE, SAFETY AND EVACUATION- ISSUE 4
13	GM/RT2149	REQUIREMENTS FOR DEFINING AND MAINTAINING THE SIZE OF RAILWAY VEHICLES - ISSUE 3
14	GM/RT2304	EQUIPOTENTIAL BONDING OF RAIL VEHICLES TO RUNNING RAIL POTENTIAL - ISSUE 3
15	MP-C0-00065	GENERAL ARRANGEMENT CAB TYPE 1 CLASS 37 RETB
16	MP-C0-00066	GENERAL ARRANGEMENT CAB TYPE 2 CLASS 37 RETB
17	MP-C0-00067	CDR INSTALLATION CAB TYPES 1 & 2 CLASS 37 RETB
18	MP-C0-00068	HANDSET INSTALLATION CAB TYPES 1 & 2 CLASS 37 RETB
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24	MP-C0-00075	JUNCTION BOX ENCLOSURE ASSEMBLY AND DETAILS CAB TYPE 1 CLASS 37 RETB
25	MP-C0-00076	MISCELLANEOUS DETAILS CLASS 37 RETB



26	MP-C0-00077	VHS WHIP AND GPS ANTENNAS CLASS 37 RETB
27	MP-C0-00078	CLASS 37 RETB NG SCHEMATIC
28	MP-C0-00079	CLASS 37 RETB NG WIRING DIAGRAM - CAB TYPE 1
29	MP-C0-00082	RETB CABLE HARNESS FOR VERTICAL WHIP ANTENNA
30	MP-C0-00083	CLASS 37 RETB NG WIRING DIAGRAM - CAB TYPE 2
31	MP-C0-00022	CL.37 - ERGONOMIC EVALUATION OF CDR UNIT LOCATION 95TH PERCENTILE MALE AND 5TH PERCENTILE FEMALE OPTION 1 – TYPE 1 CAB
32	MP-C0-00023	CL.37 - ERGONOMIC EVALUATION OF CDR UNIT LOCATION 95TH PERCENTILE MALE AND 5TH PERCENTILE FEMALE OPTION 1 – TYPE 2 CAB
33	MP-C0-00024	CL.37 - ERGONOMIC EVALUATION OF HANDSET LOCATION 95TH PERCENTILE MALE & 5TH PERCENTILE FEMALE – OPTIONS 1 & 2 – TYPE 1 CAB
34	MP-C0-00025	CL.37 - ERGONOMIC EVALUATION OF HANDSET LOCATION 95TH PERCENTILE MALE & 5TH PERCENTILE FEMALE – OPTIONS 1 & 2 – TYPE 2 CAB
35	MP-C0-00031	CL.37 – CONCEPT ROOF ANTENNA JUNCTION BOX LOCATION AND CABLE ROUTING – TYPE 1 CAB
36	MP-C0-00032	CL.37 – CONCEPT ROOF ANTENNA JUNCTION BOX LOCATION AND CABLE ROUTING – TYPE 2 CAB
37	GM/RT2161	REQUIREMENTS FOR DRIVING CABS OF RAILWAY VEHICLES - ISSUE 1

## 5 Compliance Requirements and Commentary

Table A - GE/RT8015 - Electromagnetic Compatibility between Railway Infrastructure and Trains - Issue 1

Clause	Topic	Response
All	All	It is reasonable to conclude that the only credible method of coupling energy into Network Rail infrastructure is through EM radiation. There is a presumption that if the RETB conforms to EN50121-3-2 and is installed in line with OEM recommendations then there are unlikely to be any compatibility issues with the infrastructure or other locomotive mounted electrical systems. The exception is the specific emission from the antenna, and is addressed by the isolation of the NRN antenna when RETB is in use.

Table B - GK/RT0036 - Transitions Between Signalling Systems - Issue 2

No installation requirements

Table C - GK/RT0055 - Block System Interface Requirements - Issue 1

No installation requirements

Table D - GK/RT0094 - Train Voice Radio Systems - Issue 1

Clause	Topic	Response
2.2.1.1	A train voice radio shall be operable from each cab that is required to be used as a driving cab of a train in service.	The installation has been completed in accordance with Interface Control Document ICD-1051-01 [Reference 1]

Table E - GM/RT2004 - Rail Vehicle Maintenance - Issue 5

Clause	Topic	Response
3.2.6.1	All signalling and communications equipment on the rail vehicle shall be managed to ensure that its integrity and performance remains compliant with its specification, approval and application criteria.	Maintenance information for the Class 37s to be updated to include new equipment.
3.2.6.2	Those performance criteria which are not included in Railway Group Standards shall be specifically set out in the maintenance plan.	Maintenance information for the Class 37s to be updated to include new equipment.
3.2.6.3	The maintenance requirements for each item of trainborne signalling and communication equipment shall be developed by a systematic process. The process shall be capable of demonstrating that they are suitable and sufficient to control the risks which would arise from failure of any item of trainborne signalling and communication equipment.	Maintenance information for the Class 37s to be updated to include new equipment.
3.2.6.4	The maintenance requirements for trainborne signalling and communication equipment shall be documented. They shall form part of the rail vehicle maintenance plan for the rail vehicle in which the equipment is mounted.	Maintenance information for the Class 37s to be updated to include new equipment.
3.2.6.5	The procedures to ensure configuration control of both software and hardware of the trainborne signalling and communications equipment shall be documented in the maintenance plan.	Maintenance information for the Class 37s to be updated to include new equipment.

Table F - GM/RT 2100 - Requirements for Rail Vehicle Structures - Issue 5

Clause	Topic	Response
3.2	<p>3.2.1 Equipment attached to vehicle bodies shall be designed according to the inertia load values set out in BS EN 12663-1:2010 or BS EN 12663-2:2010 for the relevant vehicle category unless otherwise set out in this document.</p> <p>3.2.2 The ultimate strength of the equipment attachments shall be consistent with the inertia load values set out in BS EN 12663-1:2010 or BS EN 12663-2:2010 or the maximum mean deceleration levels for the collision scenarios set out in BS EN 15227:2008, whichever is the greater.</p> <p>3.2.3 The equipment attachment strength shall be formally assessed unless, for minor items of equipment, it can be demonstrated that:</p> <p>a) For a given type or method of attachment, items at or below a given mass will be securely retained for the acceleration loads specified.</p> <p>Or</p> <p>b) A minor item is sufficiently contained or enclosed to prevent it becoming a potential hazard if detached in the event of a collision or derailment or for any other reason.</p> <p>Or</p> <p>c) Service experience in an equivalent or more demanding environment has shown the installation to be satisfactory.</p> <p>3.2.4 Where the failure of an individual mounting could lead to the overload and the potential sequential failure of adjacent mountings, or where a single mounting is used and a resulting failure will create a hazardous situation, secondary fasteners, retention devices or some other equivalent means shall be provided, taking into account the likelihood of detection of an initial failure when in service or during maintenance inspections.</p> <p>3.2.5 Locally generated accelerations, forces and resonances acting within and on equipment shall be accounted for as well as the specified proof and fatigue inertia loads.</p> <p>3.2.6 Sources of locally generated accelerations, forces and resonances to be considered for proof and fatigue loads shall include, but not be limited to:</p> <p>a) Engines, gearboxes, cooler groups and hydrostatic drives.</p>	<p>Structural calculation DG8-CALC-00366 [Reference 2] confirms that the installation meets the structural requirements of GM/RT 2100 Issue 5.</p>

	<ul style="list-style-type: none"> <li>b) Body mounted traction motors.</li> <li>c) Transmission units.</li> <li>d) Suspension elements (for example dampers, anti-rollbars, traction linkages).</li> <li>e) Air compressors.</li> <li>f) Door operating equipment.</li> <li>g) Gangways.</li> <li>h) Air conditioning systems.</li> </ul> <p>3.2.7 The fatigue design life for equipment attachments shall be determined. If the fatigue design life is less than the design life of the vehicle, this shall be accounted for in inspection, maintenance and overhaul procedures, whereby life expired items are replaced.</p>	
6.1.6	<p>6.1.6.1 Areas of a vehicle interior which are accessible to passengers, personnel or traincrew in normal service shall be assessed for potential injury due to secondary impact in the event of a collision or derailment. The secondary impact assessment shall include but not be limited to:</p> <ul style="list-style-type: none"> <li>a) Parts of seats, tables and drivers desks outside the scope of dynamic testing requirements (see 6.2, 6.3 and 6.9).</li> <li>b) Panels and panel edges.</li> <li>c) Controls, instruments, switches and indicators (for example driver's desks and guards panels).</li> <li>d) Equipment cubicles or housings.</li> <li>e) Passenger information displays, screens, loudspeakers.</li> <li>f) Luggage racks and luggage stacks.</li> <li>g) Minor items (for example coat hooks, poster frames, magazine racks, light-stick boxes, small equipment housings).</li> </ul> <p>6.1.6.2 The secondary impact assessment shall demonstrate that the risk of injury due to secondary impact is controlled, for impacts in the longitudinal, vertical and lateral directions or combinations of these, by ensuring that as far as reasonably practicable interior surfaces control or eliminate injury risk due to:</p> <ul style="list-style-type: none"> <li>a) Sharp points.</li> <li>b) Sharp corners.</li> <li>c) Protrusions or recesses.</li> </ul>	<p>The profile of the RETB equipment has not changed.</p> <p>Bracketry within the vehicle has been developed to reduce sharp corners and edges but are considered to present a low risk of secondary impact.</p>

	<p>d) Abrupt changes of contour.</p> <p>e) Abrupt changes of stiffness (for example locally rigid areas on panelling).</p> <p>6.1.6.3 It is permissible for the secondary impact assessment to take into account the following considerations:</p> <p>a) The probability of secondary impact occurring due to the location of a given item.</p> <p>b) Functional requirements (for example statutory requirements for handrails).</p> <p>c) Likely use and occupancy of any given part of the interior (for example second man's position in cabs).</p> <p>6.1.6.4 Where items of toughened safety glass are incorporated in a fixture or fitting, secondary impact shall also be assessed assuming that the glass had been broken before impact.</p>	
6.9	<p>6.9.1 General requirements</p> <p>6.9.1.1 In accordance with 6.1.6, cabs and areas occupied by traincrew shall be assessed for the potential for injury due to secondary impact in the event of a collision or derailment.</p> <p>6.9.1.2 The cab seat zone (the area of the cab in which the driver is seated) shall be dynamically tested in accordance with Appendix F to simulate a frontal collision and shall give a satisfactory injury criteria assessment as set out in Appendix H.1 for a 50th percentile male ATD located in the driving position.</p>	<p>The profile of the RETB equipment has not changed.</p> <p>Bracketry within the vehicle has been developed to reduce sharp corners and edges but are considered to present a low risk of secondary impact.</p>

Table G - GM/RT2130 - Vehicle Fire, Safety and Evacuation - Issue 4

Clause	Topic	Response
2.2.3	<p>Material properties shall be determined according to the following classifications and therefore the required performance:</p> <p>a) Materials for OC1: Vehicles shall meet the requirements for BS 6853:1999 Category 2.</p> <p>b) Materials for OC2: Vehicles shall meet the requirements for BS 6853:1999 Category 1b.</p> <p>c) Materials for OC3: Vehicles shall meet the requirements</p>	<p>MP INV 001 [Reference 3] confirms that the equipment meets the fire propagation requirements for OC2.</p>

	for BS 6853:1999 Category 1b. d) Materials for OC4: Vehicles shall meet the requirements for BS 6853:1999 Category 1a.	
2.4.1	The design of the vehicle and its equipment (either located inside the vehicle or located outside), including its structures, systems, equipment, components and materials, and their relative positions and proximities to each other, shall be arranged so that as far as reasonably practicable the risks of ignition are minimised.	MP INV 001 [Reference 3] confirms that the equipment meets the fire propagation requirements.
2.4.2	An assessment of normal operation, foreseeable equipment and component failure modes shall be undertaken to demonstrate that fire risks have been identified and measures adopted to control these risks.	MP INV 001 [Reference 3] confirms that the equipment meets the fire propagation requirements.
2.4.4	The measures contained in BS 6853:1999 section 5 relating to design considerations with the aim of protecting passengers and staff in rail vehicles in the event of a fire on board shall apply to all categories of rail vehicle. The objectives are to minimise the risk of a fire starting, to delay fire development and to control the spread of fire products through the rail vehicle.	The fire barrier has not been penetrated.
2.5.1	The measures contained in BS 6853:1999 section 7 for the control of spread of fire and its products, primarily requirements for fire barriers, shall apply to all categories of rail vehicle.	MP INV 001 [Reference 3] confirms that the equipment meets the fire propagation requirements.  The fire barrier has not been penetrated.
2.8.1	The measures contained in BS 6853:1999 section 6 relating to material properties in terms of their reaction to fire, smoke and toxic emissions shall apply to all categories of rail vehicle and for all products used in the construction of vehicles which may be produced from a single material or from several materials (for example laminates, composites, cables, seats) with the exception of driving cabs and equipment operator seats.	MP INV 001 [Reference 3] confirms that the equipment meets the fire propagation requirements.



2.8.6	<p>Where the requirements set out in 2.8.1 of this document cannot be met in full for a particular product or item of equipment, evidence shall be produced and recorded demonstrating that:</p> <p>a) Full compliance with 2.8.1 of this document would prejudice other safety-critical operational requirements (for example parts of, or equipment fitted to, seats provided for drivers or equipment operators).</p> <p>And / or</p> <p>b) The risk is mitigated by, for example, the provision of fire extinguishing equipment or by other precautions appropriate to the particular installation (for example for driver's or equipment operator's seats by the isolation of equipment when the seat is not used and the protection of the seat from sources of radiant heat).</p>	MP INV 001 [Reference 3] confirms that the equipment meets the fire propagation requirements.
2.11.1.1	<p>When engineering change occurs, subject to compliance with fire performance and testing requirements of any parts of a vehicle repalced on a fleet basis, then:</p> <p>a) The areas subject to change shall meet the requirements of the applicable parts of the GM/RT2130 Standard.</p> <p>Or</p> <p>b) The net effect of the changes shall be such that the performance of the vehicle is not degraded in terms of fire initiation and development.</p> <p>Or</p> <p>c) Where the level of amenity in the vehicle is being increased by the addition of more seats, tables, luggage racks, etc the fire performance of the newly introduced items shall be at least that of the existing items in the vehicle.</p>	MP INV 001 [Reference 3] confirms that the equipment meets the fire propagation requirements.

Table H - GM/RT2149 - Requirements for Defining and Maintaining the Size of Railway Vehicles - Issue 3

Clause	Topic	Response
6.1	<p>The envelopes defining the maximum movements of the vehicle under normal service and fault/failure conditions, shall, unless agreed otherwise with the infrastructure controller, be in the form of swept envelopes appropriately detailed to permit absolute gauging. These shall be derived by determination of the vehicle characteristics in absolute dimensional terms as defined in section B7 of this document.</p> <p>The swept envelope shall be determined relative to the nominal centreline of the track and the plane of the rail, and shall assume a fixed track. The vehicle designer is not required to include any allowances for track tolerances and rail wear, except as specifically required by section B7.3. All positional tolerances and allowances for rail wear are included in the infrastructure's calculation of clearances as required by GC/RT5212.</p> <p>Where specifically agreed with the infrastructure controller, it is permissible to use one of the following methods as a substitute:</p> <ul style="list-style-type: none"> <li>a) reference to a standard vehicle gauge as defined in section B8 of this document</li> <li>b) reference to a comparator vehicle as defined in section B9 of this document.</li> </ul> <p>Where either method a) or b) above are used to define the envelope of the vehicle, the clearance requirements shall be deemed to be implicit in the gauge or reference vehicle agreed. Irrespective of the method used, except with the possible exception of the widely applicable W6a gauge,</p>	<p>The RETB NG antenna is fitted to the bonnet of the locomotive and does not present any gauging infringement as discussed in MP HAZ ID 004 [Reference 4].</p>

	the train operator is advised (though not required) to define the vehicle in sufficient detail to facilitate subsequent transfer to routes where absolute gauging is required.	
6.4	The envelopes of the vehicle, by whichever method established, shall be maintained throughout its operational life by means of maintenance procedures that take full cognisance of the factors identified in section B6.6 of this document as influencing the swept envelopes of the vehicle and their limiting or maximum values for example limits of wear on suspension components.	The RETB NG antenna is fitted to the bonnet of the locomotive and does not present any gauging infringement as discussed in MP HAZ ID 004 [Reference 4].
6.6	The mandatory limits of wear and maximum tolerances specified for all components, assemblies and systems influencing the degree of dynamic movement of the vehicle shall be reviewed, and those combinations identified as having a significant probability of occurrence shall be taken into account in the determination of each vehicle swept envelope.	The RETB NG antenna is fitted to the bonnet of the locomotive and does not present any gauging infringement as discussed in MP HAZ ID 004 [Reference 4].
8.3	The vehicle under consideration shall not infringe the standard vehicle gauge unless the requirements of section B8.4 are met. Where such infringements are accepted, operational restrictions may result. Vehicles of any type may be built to any of the standard vehicle gauges providing they fully comply with the requirements of the chosen standard vehicle gauge. It is permissible for the infrastructure controller to develop additional gauges as circumstances necessitate and the requirements for the development of such standard vehicle gauges are set out in GC/RT5212.	The RETB NG antenna is fitted to the bonnet of the locomotive and does not present any gauging infringement as discussed in MP HAZ ID 004 [Reference 4].
13.1	The train operator shall submit the following to a Conformance Certification Body (CCB) under the process for obtaining a Certificate of Conformance - Design.	The RETB NG antenna is fitted to the bonnet of the locomotive and does not present any gauging infringement as discussed in MP HAZ ID 004 [Reference 4].

13.1.1	<p>a) confirmation from the infrastructure controller that the method used for determination of the vehicle envelopes is compatible with the definition of the proposed route(s), as indicated in section B6.1</p> <p>b) drawings, calculations, or other references, as appropriate, supporting the data</p> <p>c) evidence that tolerances and limits of wear, beyond which the vehicle would cease to be compliant with the declared envelope, have been identified and recorded for incorporation in the Maintenance Plan for the vehicle under the requirements of GM/RT2000 and GM/RT2004</p> <p>d) the mass of all principal vehicle components, broken down typically into such major items as vehicle body, bogie sprung mass, wheelset mass, as appropriate. Where appropriate, separate values shall be provided for all relevant operating and loading conditions</p>	<p>The RETB NG antenna is fitted to the bonnet of the locomotive and does not present any gauging infringement as discussed in MP HAZ ID 004 [Reference 4].</p> <p>The additional 26kg mass of the RETB equipment will have a negligible effect on the vehicle.</p>
13.1.2	<p>The following data shall be provided:</p> <p>a) a list of the critical features of the proposed routes influencing the accuracy and scope of the swept envelope determination</p> <p>b) an indication and justification of the worst cases considered in determining the swept envelopes, supported by a probability analysis of the cases considered in selecting the significant worst case(s)</p> <p>c) the swept envelope data relevant to the scope of required gauging acceptance as defined in section B13.2 of this document</p> <p>d) a detailed listing of all vehicle parameters and vehicle characteristics which are capable of influencing the size of the swept envelopes of a vehicle, identifying the numerical value of each parameter, including:</p> <p>i) the nominal value</p>	<p>The RETB NG antenna is fitted to the bonnet of the locomotive and does not present any gauging infringement as discussed in MP HAZ ID 004 [Reference 4].</p>

	<p>ii) the tolerance band iii) probability distribution (if appropriate) e) the inertias of the vehicle body, bogies (excluding wheelsets) and Wheelsets in yaw, pitch and roll f) the centre of mass of all principal vehicle components. Where appropriate, separate values shall be provided for all relevant operating and loading conditions g) suspension system linear or rotational force generating elements which produce forces or torques directly proportional to the relative displacement or velocity between the end points of the element h) suspension system linear or rotational force generating elements which produce forces or torques which are not directly proportional to the relative displacement or velocity between the end points of the element. Typical examples are bump and lift stops, dampers with blow-off characteristics, or hysteresis caused by friction i) other vehicle specific parameter types where appropriate for specific vehicle configurations which incorporate such elements as: i) tilt systems, ii) active suspension elements, iii) articulation, iv) hold off devices, v) other novel features.</p>	
13.1.3	<p>The following data shall be provided: a) the standard vehicle gauge data where referenced, together with identification and justification of all areas where comparison with the comparator vehicle is not exact b) confirmation that, where a standard vehicle gauge is used, the vehicle conforms with any underlying assumptions or limitations relevant to that gauge.</p>	<p>The RETB NG antenna is fitted to the bonnet of the locomotive and does not present any gauging infringement as discussed in MP HAZ ID 004 [Reference 4].</p>
13.1.4	<p>The following data shall be provided: a) the swept envelope data necessary to permit comparison between the vehicle and the comparator</p>	<p>The RETB NG antenna is fitted to the bonnet of the locomotive and does not present any gauging infringement as discussed in MP HAZ ID 004 [Reference 4].</p>

	<p>vehicle</p> <p>b) the comparator vehicle data where referenced, together with identification and justification of all areas where comparison with the comparator vehicle is not exact</p> <p>c) confirmation that, where a comparator vehicle is used, the characteristics of the vehicle being evaluated conform with the characteristics of that comparator vehicle.</p>	
13.2	<p>The train operator shall submit to the infrastructure controller a vehicle gauging portfolio containing the swept envelope data or confirmation of the compliance of the vehicle with the standard vehicle gauge or comparator vehicle, as appropriate to the route(s) for which authority to operate is sought. The submission shall include:</p> <p>a) a vehicle diagram, giving an overview of the vehicle concerned (all vehicles)</p> <p>b) details of any non-compliance referred to in sections B8.4 or B9.3 (only for cases where a comparator vehicle or standard vehicle gauge are use)</p> <p>c) a vehicle profile summary drawing, identifying the location of the body plan view and cross sectional profiles (for absolute gauging only)</p> <p>d) vehicle body plan view profiles (for absolute gauging only)</p> <p>e) vehicle cross sectional profiles (for absolute gauging only)</p> <p>f) swept envelopes for each significant track configuration and location relevant to the route(s) along which the vehicle may be expected to operate (for absolute gauging only).</p> <p>The above items are defined in sections B13.2.1 to B13.2.5 of this document.</p> <p>Each item shall have a unique identification reference</p>	<p>The RETB NG antenna is fitted to the bonnet of the locomotive and does not present any gauging infringement as discussed in MP HAZ ID 004 [Reference 4].</p>

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Table J - GM/RT2161 - Requirements for Driving Cabs of Railway Vehicles - Issue 1

Clause	Topic	Response
4.1	The driving cabs of vehicles that operate on Railtrack lines shall be designed and maintained so that they provide safe and efficient working environments in which drivers and other authorised staff can carry out their duties safely and effectively.	Drawings MP-C0-00065 and MP-C0-00066 [References 15 and 16] show the modifications have been designed to fit in with the existing cab design. The cab installation design has been subject to review with the operators.
4.2	Driving cabs shall meet the requirements of this standard over the full range of variations in vehicle and track conditions that are likely to be experienced. Account shall be taken of; The influences of cab and vehicle dimensional tolerances, vehicle payload variations, suspension characteristics, normal variations in maintenance condition and wear and cab and vehicle failure modes and conditions. The likely routes of operation and the extent and effects of operation in tunnels. The range of ambient weather, temperature, humidity conditions, daytime and night time conditions and any other relevant variables.	Drawings MP-C0-00065 and MP-C0-00066 [References 15 and 16] show the modifications have been designed to fit in with the existing cab design. The cab installation design has been subject to review with the operators.
4.3	Cabs shall be maintained so that prescribed tolerances for components, assemblies and systems that influence the mandatory requirements for cab performance are sustained over the lives of the vehicles.	Maintenance information for the Class 37s to be updated to include new equipment.
4.4	The dimensions of cab interiors, including their fixtures, furniture, fittings, equipment, instruments etc shall be appropriate for safely accommodating drivers with a wide range of physical dimensions, as specified in accordance with reference 1.	Drawings MP-C0-00022 to MP-C0-00025 and MP-C0-00031 & MP-C0-00032 [References 31 to 36] show that the CDR and the handset can be easily operated by the driver from the normal seated position.



5.2	From the driving position, the driver shall be able to readily operate all primary controls and easily read all primary instrumentation as defined in Section 7, whilst maintaining the vision requirements of Section 6.1.	The handset and CDR can be easily operated by the driver from the normal seated position.
5.4	A driver shall have easy access to the driving position and be able to vacate it rapidly for operational reasons or for emergency escape.	Drawings MP-C0-00065 & MP-C0-00066 [References 15 & 16] show the modification has been designed to fit in with the existing cab design. The cab installation design has been subject to review with the operators.
6.1.1	<p>Seated Drivers.</p> <p>The front windscreen of a cab shall provide, as a minimum, the following clear, unobstructed lines of sight (views) for the driver seated at the driving position, taking into account the variations and tolerances described in Section 4.2. and the requirements of Section 6.2.6.</p> <p>For each viewing case below, a person's eyes shall be considered....</p> <p>Etc.</p> <p>Case (a)</p> <p>Etc</p> <p>Case (d)</p> <p>Etc</p> <p>Note (2) The above viewing cases lead to three usually different viewing points within the reference cube...etc.</p>	Drawings MP-C0-00022 to MP-C0-00025 and MP-C0-00031 & MP-C0-00032 [References 31 to 36] show that the handset and CDR do not interfere with the sightline requirements of GM/RT2161.
7.1	The driving cab shall incorporate appropriate and reliable controls, instruments and audible and visual warning devices to enable the driver to perform his duties safely and effectively, as defined by the Rule Book and other working instructions, and in accordance with the requirements for train safety systems as prescribed in reference 7.	The installation has been completed in accordance with Interface Control Document ICD-1051-01 [Reference 1]

7.1.1	Controls and instruments should be arranged and operated in a logical and functional manner, to maximise driver effectiveness and to minimise errors.	Drawings MP-C0-00022 to MP-C0-00025 and MP-C0-00031 & MP-C0-00032 [References 31 to 36] show that the CDR and the handset can be easily operated by the driver from the normal seated position.
7.1.2	The designs, locations and modes of operation of controls and instruments should, as far as practicable, be consistent with proven best practices or better.	Drawings MP-C0-00022 to MP-C0-00025 and MP-C0-00031 & MP-C0-00032 [References 31 to 36] show that the CDR and the handset can be easily operated by the driver from the normal seated position.
7.1.3	Controls and instruments should be clearly marked with unambiguous descriptions, pictograms etc. to indicate their functions.	The installation has been completed in accordance with Interface Control Document ICD-1051-01 [Reference 1]
7.1.4	The operation of controls and the viewing of instruments, should not be unduly fatiguing, or require physical or mental abilities beyond the competence standards prescribed for train drivers in ref 1.	The installation has been completed in accordance with Interface Control Document ICD-1051-01 [Reference 1]
7.1.5	Controls and instruments should be appropriately graduated and/or illuminated so that the driver can quickly and accurately detect their operating positions and readings, under all ambient lighting conditions. Where controls and instruments are graduated, the graduations should be sufficiently fine and precise to enable the driver to drive the train accurately and within the permitted speed profiles on its permitted routes.	The installation has been completed in accordance with Interface Control Document ICD-1051-01 [Reference 1]
7.1.6	Illuminated controls and instruments should be so positioned, cowled or dimmed that they do not produce excessive levels of illuminance or produce unwanted reflections off the cab windscreen or off other surfaces that will mislead or distract the driver.	The brackets being installed on the driver's desk are to be finished in a dull matt finish to prevent reflections in the windscreen.
7.1.7	Controls and instruments should be robust and protected against malfunction as far as is reasonably practicable.	The installation has been completed in accordance with Interface Control Document ICD-1051-01 [Reference 1]
7.2.1	The following primary controls and instruments, where required and fitted as essential for the safe driving of the train	The location of the equipment does not impede the use of the

	<p>or vehicle, shall be operable and/or viewable by the driver whilst at the main driving position. Direction and movement control Etc Other controls and instruments which, because of their safety functions, must be operated or viewed whilst the driver is controlling the train.</p>	primary controls on the vehicle.
7.2.2	<p>Wherever practicable, the visual field directly in front of the driver, when in the driving position, should be reserved for the siting of primary controls and instruments vital to the continuing safe operation of the train. Etc. Account should be taken of the amount of driver's head and eye movements needed, with the objective of maximising the driver's visual concentration on track and signals.</p>	The installation of the RETB equipment does not change the visual field directly in front of the driver. There are no changes to the siting of the existing primary controls and instruments.
7.4	<p>Audible and visual warnings inside the cab shall be distinctive and have appropriate loudness and sound qualities and/or light intensities, according to their functions, urgency and importance. They shall not distract the driver's attention unnecessarily from his normal driving duties.</p>	The installation has been completed in accordance with Interface Control Document ICD-1051-01 [Reference 1]
8.1	<p>The driver and other staff, where appropriate, shall be able to gain safe access to and safe egress from the driving cab, under both normal and emergency conditions, in accordance with reference 9</p>	Drawings MP-C0-00065 & MP-C0-00066 [References 15 & 16] show the modification has been designed to fit in with the existing cab design. The cab installation design has been subject to review with the operators
9.1	<p>The driver and others shall be provided with a safe and efficient working environment in terms of; The ergonomic layout of furniture, fittings, controls, instruments and general ambience. Air quality, temperatures and lighting levels, in accordance with reference 10.</p>	Drawings MP-C0-00065 & MP-C0-00066 [References 15 & 16] show the modification has been designed to fit in with the existing cab design. The cab installation design has been subject to review with the operators

	Ride quality, noise and vibration levels and aerodynamic pressure pulses in accordance with reference 8.	
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Table K - GM/RT2304 - Equipotential Bonding of Rail Vehicles to Running Rail Potential - Issue 3

Clause	Topic	Response
B.4.1	Bond impedance	Drawing MP-C0-00078 [Reference 27] shows that the RETB equipment is bonded to the vehicle body via cables RNGE01. Drawings MP-C0-00077 [Reference 26] shows that the antenna is bonded to the vehicle via its fixings.
B.4.2	Bonding provision	Drawing MP-C0-00078 [Reference 27] shows that the RETB equipment is bonded to the vehicle body via cables RNGE01. Drawings MP-C0-00077 [Reference 26] shows that the antenna is bonded to the vehicle via its fixings.
B.4.3	Bonding connection capacity	Drawing MP-C0-00078 [Reference 27] shows that the RETB equipment is bonded to the vehicle body via cables RNGE01. Drawings MP-C0-00077 [Reference 26] shows that the antenna is bonded to the vehicle via its fixings.
B.4.4	Bonding connection design	Designed to best practice using components already used on rail vehicles.
B.4.5	Bonding conductors and terminations	Designed to best practice. Bonds are easily accessible.
B.4.6	Bonding continuity	Class 37 RETB Installation Modification And Test Procedure [Reference 5] details a bonding test to confirm that the RETB equipment is bonded to the vehicle.

B.6.1	Bonding system inspection	Maintenance information for each operators is to be updated to include new equipment.
B.6.2	Bonding system maintenance	Maintenance information for each operators is to be updated to include new equipment.