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CONTENTS

1 INTRODUCTION

1.1 Purpose

This document comprises the APC System Maintenance Manual and includes maintenance, fault tracing, corrective maintenance and testing and has been prepared to satisfy the Maintenance requirements within the RSSB Railway Group Standard (RGS) GE/RT2111 [Ref. **Error! Reference source not found.**].

1.2 Scope

The scope of this document is limited to providing guidance on the vehicle maintenance for the APC system.

The Line Replaceable Units (LRU's) included in the scope of this installation specification are listed in Table 1 below.

Table 1: APC LRUs

LRU	Part Number
APC Receiver	TY294/GRP72

1.3 Abbreviations

APC	Automatic Power Control	LRU	Line Replaceable Unit
ARL	Above Rail Level	MSUK	Mors Smitt United Kingdom
BS	British Standard	OTMR	On-Train Monitoring Recorder
ESD	ElectroStatic Discharge	RGS	Railway Group Standard
IEC	International Electrotechnical Commission		

2 SAFETY INSTRUCTIONS

2.1 General Safety

The following safety instructions should be followed when undertaking any servicing, maintenance or commissioning work on the APC System:

- To avoid accidental damage, power to the APC Receiver shall be switched off before disconnecting and reconnecting **ANY** part of the System.
- System LRUs shall not be opened - *All faulty units shall be replaced*.
- To achieve safe operation of the APC System, all equipment shall be correctly installed and tested as per the relevant specifications and documentation.
- Servicing and maintenance activities shall only take place when the vehicle is **NOT** in operation (with or without passengers).
- Test equipment shall **NOT** be connected when the vehicle is in operation (with or without passengers).
- The test personnel shall be familiar with service and maintenance of rolling stock in general, and in particular with the equipment described herein. Appropriate training of personnel associated with undertaking maintenance on the APC System is considered the responsibility of the organization conducting the work.

2.2 Human Health

There are two health hazards pertinent to the APC System, these are:

- Risk of injury from electrocution
- Risk of injury due to dropping equipment

2.2.1 Risk of Injury from Electrocution

All components of the APC system are classified as Extra Low Voltage system according to the International Electrotechnical Commission (IEC 60038). The input supply power to the APC Receiver is 110VDC.

Power should be removed and confirmed that there is no voltage present from the APC System before equipment is disconnected and re-connected.

2.2.2 Risk of Injury due to Dropping the Equipment

A table displaying the weight of each individual system component of the APC System is shown in Table 2 below.

Note: When handling any system component of the APC System, appropriate Personal Protective Equipment must be worn, particularly protective footwear, to protect against the risk of falling equipment.

Table 2: APC System Weights

System Component	Weight (Max.)
APC Receiver (including conduit)	TBC

3 SYSTEM OPERATION DESCRIPTION

The Automatic Power Control system cuts the incoming power supply to a traction unit for short periods. This is required where power supplied from one part of a power distribution system in separated from another by a neutral section. Its fitment prevents damage to the power distribution system or the vehicle. The system detects a track magnet positioned shortly before the beginning of the neutral section and sends a signal to the incoming power circuit breaker controller to open the circuit breaker. Once the system detects a second magnet positioned after the neutral section a second signal is sent to close the circuit breaker. The APC Receiver is a very robust unit and can be mounted on the vehicle main underbody or a bogie.

3.1 APC Receiver

The APC Receiver comprises a single LRU assembly with flying lead. The APC Receiver is located externally beneath the train to detect the magnetic flux emanating from the trackside magnet placed shortly before the beginning of the neutral section break and sends a signal to the incoming power circuit breaker controller to open the circuit breaker.

4 TRANSPORT AND STORAGE

There are no special transportation requirements (Hoisting gear or cranes etc.), or special storage conditions that are required for the APC Reciever. However, MSUK recommend that all LRU's are kept in their original packaging and stored within a dry, safe environment when not in use on a train.

5 RE-ASSEMBLY

-------- not applicable --------

6 MAINTENANCE

Displayed in Table 3 are the replaceable LRU's for the APC system.

Table 3: APC LRUs

LRU	Part Number
APC Receiver	TY294/GRP57

6.1 Corrective Maintenance Instruction

6.1.1 General

The safety instructions in chapter 2 continue to apply to this section. In the event that a vehicle is equipped with multiple APC Systems and more than one unit of the same kind is to be replaced, then the following procedures shall be completed for each unit before replacing the next.

Always rectify the fault with one unit before moving on to the second unit. This will avoid the mixing up of serviceable and unserviceable units.

When replacing any unit, verify with the applicable Product Version document for the APC System that the resulting system (APC Receiver Hardware) constitutes an approved combination of product numbers and versions (has verified interoperability).

6.1.2 Replacement of the APC Receiver

The APC Receiver shall be replaced in the following manner:

1. Switch off power from the APC Controller connected to the APC Receiver that is to be replaced
2. Unplug the connector at the end of the APC Receiver cable harness
3. Loosen the four M12 mounting bolts with a suitable spanner
4. Remove cable clamps holding APC Receiver cable harness and retain
5. Fully remove the four M12 bolts (retaining all bolts, washers and spacers) and remove the faulty unit from its position
6. Mount the new unit with the four retained M12 mounting bolts, washers and spacers, according to Figure 1 below, and torque to the relevant torque value
7. Attach the cable connector at the end of the APC Receiver cable harness
8. Attached retained cable clamps to hold APC Receiver cable harness in place
9. Undertake visual inspection of the APC Receiver
10. Switch on power to the APC Control Unit

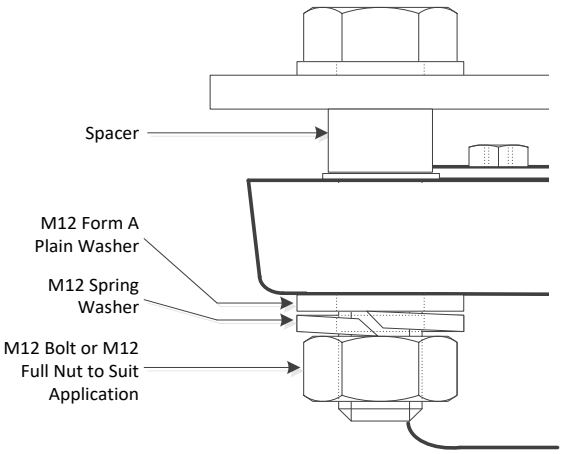

Figure 1: APC Receiver mounting assembly

6.2 Test Equipment

Test equipment TY392-GRP001 – APC/ATR Test Kit is available as an option. Please contact MSUK for additional details.

7 OPERATION

Refer to chapter 3. System OPERATION Description for information about the system operation. APC System is entirely automated therefore the train operator doesn't have to interact with it once the system has been correctly installed, tested and commissioned.

8 PREVENTATIVE MAINTENANCE

8.1 General

Maintenance of the APC System shall be undertaken at regular intervals, or whenever physical damage is suspected with the equipment. MSUK recommends following interval duration as presented on the recommended maintenance plan in Table 4 below.

Table 4: Recommended Maintenance Plan

Frequency / Equipment	Visual Inspection	Cleaning
	Every 3.5 Months	Every 3.5 Months
APC Receiver	X	X

8.2 APC Receiver

8.2.1 Visual Inspection

The purpose of the visual inspection is to check the fastenings and to establish if there is any mechanical damage to the following parts:

- APC Receiver
- APC Receiver conduit
- Cable connectors
- Cable clamp

If the visual inspection identifies any damage, which is considered to have an adverse effect on the APC System functionality and Safety, then the unit shall be replaced. In addition, anything which is considered to impact upon the environmental protection shall be considered as damage and the unit shall be replaced.

The APC Receiver shall not be disassembled; a damaged unit (including the cable harness) should be replaced completely.

Note: The replacement of the APC Receiver is described within section 6.1.2 of this document.

8.2.2 Cleaning

Due to the external location of the APC Receiver, cleaning the outside surface of the APC Receiver mechanical enclosure is necessary to undertake a visual inspection. A water jet (of less than 70 bars at a distance of at least 1 meter), or brush and mild detergent can be used to clean the unit from the outside. Pressurised air or vacuum system can also be utilised if necessary. Removal of the unit from its application to access the top side is only necessary if the equipment is considered suspect.

IMPORTANT

- Never use chemical solvents for cleaning
- Never open the enclosure

8.2.3 Position Check

To check that the APC Receiver is correctly positioned relative to the rail, the following measurements shall be done:

8.2.3.1 Measuring Conditions

When performing any measurements, the vehicle shall be positioned on a straight, level plane track and with the wheels centered on the rails.

The measurement points at the APC Receiver are to be measured from the x, y and z axis reference marks according to Figure 2 below. (note: axes drawing for reference only – connector composition may vary)

Figure 2: APC receiver reference axes

8.2.3.2 APC Receiver Position

Mors Smitt recommends that the APC Receiver is installed as per the requirements set in GE/RT2111 as following:

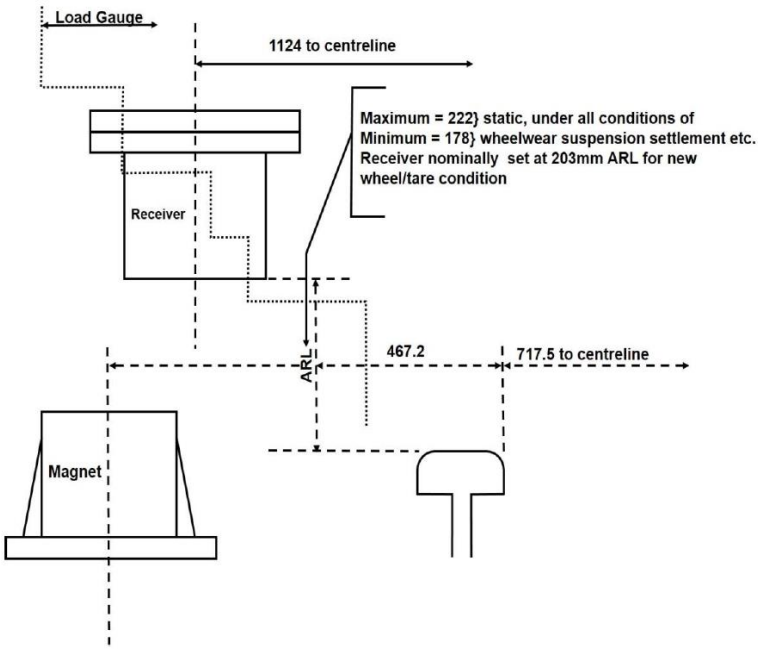

Figure 3: GE/RT2111 installation requirements

9 DECOMMISSIONG

When the fault is located, the instructions within chapter 0 shall be followed to replace the faulty item.

If the fault is isolated to a unit, the unit shall NOT be disassembled for further fault tracing. Faulty units are to be sent back to the supplier's customer support department together with a description of the fault and with a reference to which project and vehicle the unit was taken from. MSUK operate a RMA system which can be accessed through the MSUK website.

The unit shall be sent back in an ESD safe package and protected from mechanical damage during transport.

10 DISMANTLING

There are no dismantling requirements for any LRU stated within this document. Under no circumstance should a unit be dismantled/disassembled. All Units shall be replaced in their entirety and returned to MSUK for investigation and repair. Any damage to train side connectors shall be replaced.

11 DISPOSAL

All units shall be disposed of responsibly at the end of life. This includes adhering to rules on recycling or safe disposal of components (i.e. adhering to Waste Electrical & Electronic Equipment regulations etc.).

No hazardous materials are used in the APC System LRUs.

12 ERROR IDENTIFICATION

Table 5: Error Identification Table

Fault / Problem	Possible Causes	Action
APC Receiver		
Impact Damage	Damage caused by impact to the Receiver	Replace LRU and return for repair
No response to APC signal	Damaged cabling Damaged APC Receiver	Replace LRU and return for repair

13 APPENDIX

-------- not applicable --------

14 SUBJECT INDEX

-------- not applicable --------