

HIGH PERFORMANCE SWITCH SYSTEM (HPSS)

CORRECTIVE MAINTENANCE PROCEDURES: 'POWERLINK' BACKDRIVE PLAIN LEAD SWITCHES: UIC54 & RT60



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1 INTRODUCTION

1.1 Purpose

- 1.1.1 The purpose of this document is to provide comprehensive Corrective Maintenance procedures for the PowerLink Backdrive used on HPSS-based UIC54 and RT60 Plain Switches.

1.2 Scope of Document

- 1.2.1 This document contains sufficient information to allow all variants and build standards (UIC54 and RT60) to be correctly maintained.
- 1.2.2 Any Network Rail documents relating to HPSS (including Maintenance requirements and faulting) are listed in the HPSS Handbook, NR/L2/SIG/11400 (Ref: 13.1).
- 1.2.3 Details relating to the Installation of the HPSS system may be found in 'Installation Manual: HPSS For Plain Lead Switches (UIC54 & RT60)' (Ref: 13.2).
- 1.2.4 Details relating to the Corrective Maintenance of the High Performance Switch Actuator (HPSA) may be found in the 'Corrective Maintenance Procedures: HPSA (Plain Switches)' (Ref: 13.3).
- 1.2.5 Track and Track Support issues are outside the scope of this document.

1.3 Scope of Equipment

- 1.3.1 This document covers all variants of the PowerLink Backdrive manufactured to date, as detailed in Network Rail's Certificate of Acceptance PA05/02456 (Ref: 13.4).
- 1.3.2 This document applies to all PowerLink Backdrive equipment currently in operational use in the UK rail network (Network Rail and High Speed 1).
- 1.3.3 Corrective maintenance procedures for Supplementary Sensors and heaters are contained in IAD Rail Systems Document 'Corrective Maintenance Procedures 'HPSA' Point Machine Plain Lead Switches (UIC54 & RT60)' (Ref:13.3).
- 1.3.4 Details of all spares required to carry out corrective maintenance on the PowerLink Backdrive, including IAD part numbers and PADS numbers, are detailed in IAD Rail Systems' document 'HPSS Spares Catalogue' (Ref:13.5).

1.4 Competence

- 1.4.1 All staff undertaking Corrective Maintenance on the PowerLink Backdrive shall have successfully completed an IAD Rail Systems' endorsed HPSS FLMF (First Line Maintenance and Faulting) course.

1.5 Safety

- 1.5.1 The PowerLink Backdrive has been designed to minimise the risk of injury to staff whilst engaged in corrective maintenance, testing, and manual operation. This relies, however, on competent staff following the procedures detailed in this document.

- 1.5.2 Any component that is found to be damaged or in an apparently unsafe state shall immediately be replaced, or the necessary preventative action carried out.
- 1.5.3 Unless otherwise stated, power to the HPSA shall be isolated before any corrective maintenance activity is undertaken. Full details of the procedures for power isolation and manual operation are contained in IAD Rail Systems document 'Operating Procedure: Power Isolation & Manual Cranking' (Ref: 13.6).
- 1.5.4 The only lubricant used during corrective maintenance is copper based anti-seize compound. COSHH sheets are available from IAD Rail Systems if required.
- 1.5.5 If any of the key sub-assemblies have to be replaced, extreme care shall be taken when removing and replacing them due to the weight of these items. The weight of all key sub-assemblies is as follows:

Sub-Assembly	Weight (kg)
Shear Pin Module	10
Take-Off Assembly	40
Mid-Drive / Rear Drive	50
Torque Tube (UIC54B)	44
Torque Tube (UIC54C)	53
Torque Tube (UIC54D)	56
Torque Tube (RT60C)	61
Torque Tube (RT60D)	78
Torque Tube (UIC54E)	94
Torque Tube (RT60E)	97
Torque Tube (UIC54F)	125 (Supplied in 2 halves)
Torque Tube (UIC54SG)	134 (Supplied in 2 halves)
Torque Tube (RT60F)	141 (Supplied in 2 halves)
Torque Tube (RT60SG)	158 (Supplied in 2 halves)

1.6 Faulty Equipment

- 1.6.1 If an item of HPSA equipment is believed to be faulty it shall be returned to IAD Rail Systems for investigation. To enable a thorough investigation to be carried out the equipment being returned shall be accompanied with a completed Product Return Form (see Appendix A), securely attached to the returned equipment.

2 GENERAL INFORMATION

2.1 Spares Kits

- 2.1.1 All Spares Kits now supplied by IAD Rail Systems contain the primary item(s) of equipment to be replaced plus all the necessary fasteners, and other items needed so that corrective maintenance can be completed efficiently and safely.
- 2.1.2 Details of all spares kits are contained in the HPSS Spares Catalogue (Ref: 13.5).

2.2 Tools

- 2.2.1 The tooling required to carry out corrective maintenance on the PowerLink Backdrive, safely and efficiently, is contained in Section 3.1 (Standard Tools) and Section 3.2 (Special Tools).
- 2.2.2 Each Section of these procedures contains a 'Special Tooling' section that lists the special tools that shall be used in addition to the standard 'toolkit' items listed in 3.1. Failure to use the special tooling may result in an incorrectly maintained PowerLink Backdrive.
- 2.2.3 The HPSA Handset (TDS Recon) is an essential tool used for set-up and diagnostics of the HPSS, including the PowerLink Backdrive. The HPSA Handset Operating Procedure (Ref: 13.7) provides details of the HPSA Handset functions and use (including Datum Reset).

2.3 Cables / Looms

- 2.3.1 All Cables and Looms within the Backdrive Hollow Bearers shall be carefully positioned away from moving components (i.e. Stretcher Bars), and the Supplementary Heaters.
- 2.3.2 Any damaged cable or loom shall be replaced immediately, and under no circumstances shall any repair be attempted.

2.4 Fasteners

- 2.4.1 Self-locking fasteners used on the HPSS are Binx and Philidas nuts and Durlok bolts, as shown in Figure 1.



Philidas Turret Nuts



Binx Nut



Durlok Bolt

Figure 1: Self-Locking Fasteners (HPSS)

- 2.4.2 SNEP DAH Class 8 double slotted self-locking nuts (Figure 2) have been given Network Rail approval as an alternative to Philidas Turret nuts.



Figure 2: SNEP Self-Locking Nuts

- 2.4.3 The manufacturers of these components only guarantee security of connection if they are tightened up once to the correct torque using a torque wrench.
- 2.4.4 Where these procedures state 'Torque tighten....', the torque values for all HPSS 'critical' fasteners are shown in Appendix B of this document. Torque values for critical components are also shown in HPSS SMS Documentation which is referenced in the HPSS Handbook (Ref: 13.1).
- 2.4.5 Once a locking component has been installed and set to its specified torque value it shall be permanently marked (a 'tell-tale' witness mark) using a 'paint pen' or similar.
- Note: This practice will identify any rotation in relation to other components thus indicating loosening. Maintenance teams shall not use torque wrenches to check torque settings of these components; they must use the witness marks or a short spanner to check that the self-locking feature is still functional. Any self-locking (prevailing torque) component(s) that have become loose shall immediately be replaced. Further information is available in HPSS SMS Documentation which is referenced via the HPSS Handbook (Ref: 13.1)
- 2.4.6 Any self-locking (Prevailing Torque) fastener (Durlok bolt, Binx nut, Philidas nut) that is moved, adjusted or removed shall be replaced with a new item and permanently marked as stated in paragraph 2.4.5.
- 2.4.7 If a Durlok bolt has to be removed, the preferred way is to apply a further tightening torque (no more than one quarter of a turn clockwise) in order to release the self-locking, then it can be easily removed.
- 2.4.8 If the Shoulder Bolt has to be removed, initially attempt to 'ease it' by manually cranking the HPSA back and forth (repeatedly operating the crank handle half a turn each way) whilst trying to remove the Shoulder Bolt with a ratchet and the 10mm Hex Bit. If this is not possible the Shoulder Bolt Extractor (IAD Tool 90008 PADS# 086/032920) shall be used.
- 2.4.9 Where stated, Anti-Seize compound shall be copper based.
- 2.4.10 Split Pins shall be fitted as shown in Figure 3.

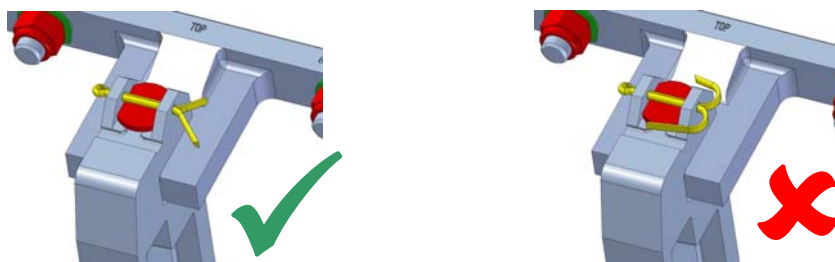


Figure 3: Installation of Split Pins

2.5 Switch Rail Toe Travel

- 2.5.1 There are varying practices in setting the Switch Rail Toe travel dimension (sometimes confusingly referred to as the toe opening). Until an appropriate tool is developed the recommended best method of measuring the toe dimension is with a steel rule placed flat across the top of the switch rail with the end of the rule touching the stock rail at the position where the switch rail touches the stock rail when the switch is closed. The rule shall then be parallel to the baseplate and therefore measuring the gap up to the part of the stock rail where the top of the switch rail makes contact when the switch rail is closed.
- 2.5.2 The required toe travel for HPSS based points is 113mm +/- 1mm.



Figure 4: Measurement of Switch Rail Toe Travel

2.6 Free Wheel Clearance

- 2.6.1 Free Wheel Clearance (FWC) is the minimum gap between the stock and switch rail which will allow the flange of a train wheel to pass through. This shall be measured with a track gauge (Bance or Guismar), which measures 14mm down from the stock rail head, with the gauge placed parallel to the slide chair. FWC on HPSS based points shall be 60 to 66mm for RT60 rail, and 50 to 56 mm for UIC54 rail.

2.7 Datum Reset / FPL Test

- 2.7.1 A Datum Reset and FPL Test shall be carried out following any Corrective Maintenance (except for the replacement of the HPSS or Supplementary Heaters, provided that no signalling components are adjusted or disconnected).
- 2.7.2 Details of how to carry out the Datum Reset procedure and FPL Testing are contained in HPSS SMS Documentation which is referenced via the HPSS Handbook (Ref: 13.1).

2.8 Schwihag Rollers

- 2.8.1 Correct setting of Schwihag rollers is important to the reliable operation and detection of the points. Schwihag document (P8397) for use with HPSS points is attached as Appendix C.
- 2.8.2 The setting of the rollers is a specialised activity and P-Way Material Management (PWMM) based in Chesterfield (Tel: 01246 567219) are willing to provide a setting service. This can be achieved either by PWMM staff attending the site during commissioning or they can train one of the Maintenance team to carry out that task.

2.9 Run-Through

- 2.9.1 In the event of a run-through, key components may be damaged; therefore these items shall be replaced as listed in the HPSS SMS Documentation which is referenced via the HPSS Handbook (Ref: 13.1).

Note 1: If the switch rails appear to be damaged, prior to carrying out any corrective maintenance, do not replace any PowerLink Backdrive components until the entire switch has been assessed by the Track Engineers.

Note 2: If difficulty is found fitting up the switch rail, during the replacement of a PowerLink Backdrive component, it may be necessary check the natural fit of switch to stock rail. If after repeated adjustment a good fit cannot be obtained then disconnect the stretchers to remove the stresses and confirm the natural fit of the switch / stock rails. If the examination of the switch rails highlights a problem, this shall be reported to the Track Engineers prior to proceeding further with any further maintenance work.

- 2.9.2 Corrective Maintenance for the replacement of items to be replaced following a run-through (i.e. Stretcher Bars, Shear Pin Module) are all contained in separate sections of this document.

2.10 Removal of Debris / Contamination

- 2.10.1 When carrying out corrective maintenance always check that all debris and contaminants have been removed from inside the Hollow Bearers, and any ballast that is trapped under the Torque Tube, especially where it may impact on the safe and reliable operation of the points.
- 2.10.2 Replace all Lids, Covers and Fasteners following any Corrective Maintenance, and apply 'good housekeeping' procedures at all times.

2.11 HPSS Checklist

- 2.11.1 If any HPSS performance issues are still evident following the completion of any HPSS Corrective Maintenance, it is recommended that the HPSS Checklist (Appendix D) is used. This list provides a comprehensive set of checks to be undertaken for the whole system, in order to identify the necessary corrective action.

3 RECOMMENDED TOOLING LIST**3.1 Standard Tools**

Description	Part No.	PADS No.	Qty
HAND TOOL KIT , comprising:	4100	086/032912	
22mm A/F 6 Point Socket 3/4 Dr	90043		1
30mm A/F 6 Point Socket 3/4 Dr	90044		1
Short Extension 3/4 Dr	90045		1
Ratchet Wrench	90046		1
Long Extension	90047		1
Short Extension	90048		1
10mm A/F 6 Point Socket	90049		1
13mm A/F 6 Point Socket	90050		1
17mm A/F 6 Point Socket	90051		2
19mm A/F 6 Point Socket	90052		2
19mm A/F 12 Point Deep Socket	90053		1
22mm A/F 6 Point Socket	90054		1
24mm A/F 6 Point Socket	90055		1
30mm A/F 6 Point Socket	90056		1
10mm A/F Hex Bit	90057		1
17mm A/F Hex Bit	90058		1
17mm A/F Hex Bit 3/4 Dr	90077		1
8mm A/F Nut Runner	90060		1
10mm A/F Nut Runner	90061		1
10mm A/F Combination Spanner 12 Point	90062		1
13mm A/F Combination Spanner 12 Point	90063		1
17mm A/F Combination Spanner 12 Point	90064		1
19mm A/F Combination Spanner 12 Point	90065		1
24mm A/F Combination Spanner 12 Point	90066		1
30mm A/F Combination Spanner 12 Point	90067		2
Combination Pliers 200mm	90068		1
Side Cutters 140mm	90069		1
Engineers Flat Screwdriver 10x200	90070		1
4mm A/F "T" Bar Allen Key	90071		1
5mm A/F "T" Bar Allen Key	90072		1
36mm A/F Spanner Black Spanner	90073		2
5m Tape Measure	90074		1
6" Engineers Steel Rule	90075		1
¾ to ½ Adaptor	90059		1
Tool bag	90076		1
0.5 mm Shim	90029		1
1.0 mm Shim	90030		1
2.0 mm Shim	90031		1

TORQUE WRENCH KIT , comprising:	4102	086/035155	
Torque Wrench 60-330 NM	90036		1
Torque Wrench 110-550 NM	90037		1
Torque Wrench 8-60 NM	90099		1

3.2 Special Tools

Description	Part No.	PADS No.	Picture (Not to Scale)
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Cable Plug Spanner (48mm A/F)	90002		
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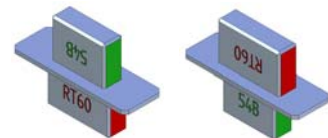
Tommy Bar (For Plug Spanner 90002)	90004		
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8-10mm Handsfree Setting Gauge	90153	086/035401	
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8mm / 33mm Spacers (Pair) (For UIC54 / RT60)	90019		
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HPSA Drive Unit	10461	086/035161	
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Handset Kit comprising:	4104	086/035157	
HPSA Handset (TDS Recon)	11065	094/008007	
Handset Cable	10178	086/032913	



3.3 Lubricants

3.3.1 No lubricants shall be used on any part of the HPSS system (including the PowerLink Backdrive), other than the use of copper based Anti-Seize compound (e.g. Copaslip etc) where specified in this document.

4 CORRECTIVE MAINTENANCE: BEARING BLOCKS

- Objective:** Removal and replacement of a Bearing Block assembly.
- Kit Part No.:** PADS No.: 086/035237 IAD Part No.: 4064
- General Note:** Applicable to all variants of the UIC54 & RT60 PowerLink.
- Safety Note:** Care shall be taken when handling a Bearing Block, due to the hinged Top Cap and the sharp serrations on the bottom face.
- Special Tools:** None required.

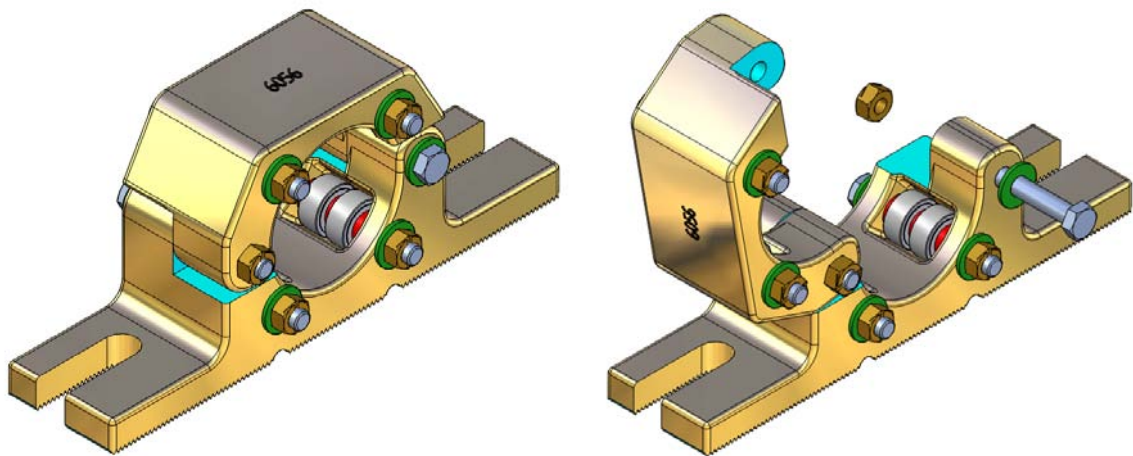


Figure 5: Bearing Block Assembly

4.1 Removal of Bearing Block

- 4.1.1 Isolate power to the HPSA.
- 4.1.2 Remove the Hollow Bearer Centre Cover to gain access to the Bearing Block.
- 4.1.3 Manually crank the HPSA to move the switch rails into their mid position at the toe, as shown in Figure 6 below. This is so that the Torque Tube Lug is vertical in the bearer.(i.e. the Torque Tube is not under any loading).



Figure 6: Switch Toes at Mid-Position (UIC54 & RT60)

- 4.1.4 Slacken off but do not remove the M12x95 Hinge Bolt of the Bearing Block.
- 4.1.5 Remove the second M12 Locking Nut and M12x95 Securing Bolt. This will allow the Bearing Block Clamp to hinge up and over the Torque Tube.
- 4.1.6 Repeat the above procedure for all Bearing Blocks.
- 4.1.7 Remove Torque Tube as detailed in Section 5.
- 4.1.8 Prior to removal of a front or rear Bearing Block, measure the position of the Bearing Block relative to the foot of the straight Stock Rail, as shown in Figure 7. This is to allow accurate refitting of the new Bearing Block.

Note: The measurement to be taken is from the inside of the straight Stock Rail foot to the centre-line of one of the roller bearing retention bolts in the Bearing Block. If the switch is curved, measure from the straighter of the two Stock Rails.

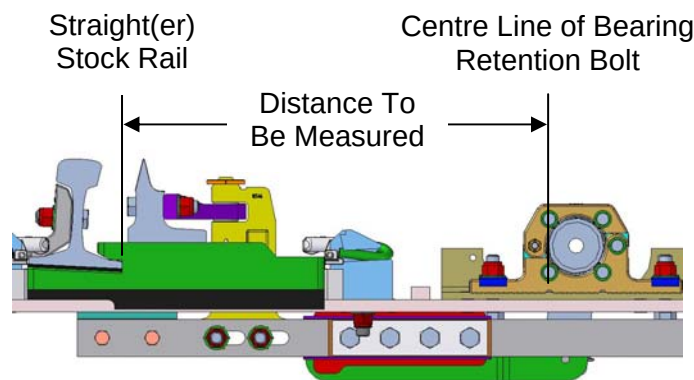


Figure 7: Stock Rail to Bearing Block Measurement

- 4.1.9 Remove the M20 Nuts, Washers plus retaining plate that holds the Bearing Block to the Hollow Bearer flange.
- 4.1.10 Lift the Bearing Block clear from the Serrated Plate.

4.2 Installation Procedure: Bearing Block

- 4.2.1 Position the new front or rear Bearing Block onto the Serrated Plate; and move laterally along the serrations to obtain the same dimension as measured in paragraph 4.1.8. Check that the Bearing Block serrations locate fully with those on the Serrated Plate and that they are free from contaminant and damage.

Note 1: The Bearing Block shall be re-fitted to the Serrated Plate with the narrow section of the Bearing Block on the inner edge of the Bearer as shown in Figure 8.

Note 2: Check that the measured distance is made to the same bearing retention bolt as was measured on the front (or rear) Bearing Block, thus ensuring that the Torque Tube will be mounted parallel to the straight stock rail. For curved switches, measure from the same stock rail used to take the measurement to the front (or rear) Bearing Block.

Note 3: On some switch layouts it may not be possible to achieve the identical mounting dimension for the rear Bearing Blocks. In such cases, the rear Bearing Blocks shall be positioned as close to the 'ideal' position as possible.

Note 4: The edge of the Bearing block mounting flange shall be no further than the last serration on the Serrated Plate.

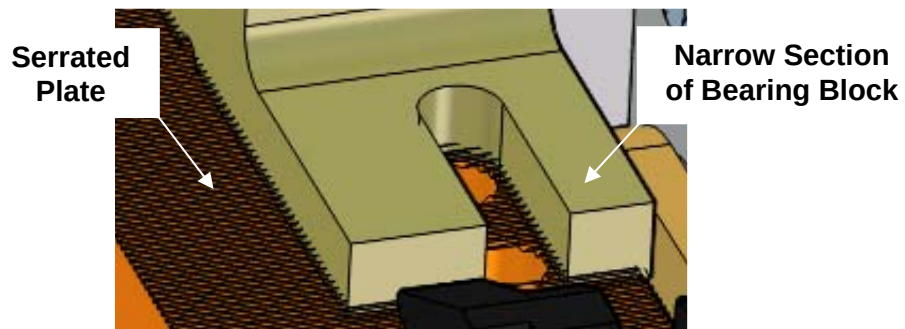


Figure 8: Mounting of Bearing Block

- 4.2.2 Mid Bearing Blocks ('E', 'F' and 'SG' switches) shall be placed in position on the Serrated Plate, and aligned with the front and rear Bearing Blocks using a length of string tightly attached between the two blocks.
 - 4.2.3 Secure the Bearing Block in this position by using the M20x100 Bolts, new Philidas Nuts, Washers plus retaining plate.
 - 4.2.4 Recheck the dimension from the foot of the Stock Rail to the centre of the Bearing Block bolt, adjust if necessary.
 - 4.2.5 If more than one Bearing Block is being replaced repeat the procedure detailed in paragraphs 4.2.1 to 4.2.4.
 - 4.2.6 Install the Torque Tube into the Bearing Blocks, with the drive lugs facing upwards (i.e. not engaged in the Clevis Arm), and visually check that it sits evenly within the Bearing Block(s).
 - 4.2.7 Re-attach Torque Tube to the Stretcher Bars as detailed in Section 5.
 - 4.2.8 Close the Bearing Block hinged top cap and refit the M12x95 bolt, washer and secure with a new M12 Lock Nut checking that the washer is fitted under the head of the bolt.
 - 4.2.9 Whilst tightening both of the Lock Nuts, apply a downwards pressure onto the top of the clamp to help reduce excessive free play within the Bearing Block and to check that the clamp sits evenly on the Torque Tube.
 - 4.2.10 Torque tighten the Bearing Block(s) onto the Hollow Bearer.
 - 4.2.11 Adjust the switch set up if necessary (Refer to Section 11).
- Note: It is recommended that power to the HPSA is restored and the points driven several times and check that the Backdrive is driving to the correct position at both Normal and Reverse.
- 4.2.12 Restore power to the HPSA and carry out testing in accordance with Network Rail procedures (including a Datum Reset).
 - 4.2.13 Refit all Lids and Covers.