

HIGH PERFORMANCE SWITCH SYSTEM (HPSS)

CORRECTIVE MAINTENANCE PROCEDURES: HPSA POINT MACHINE 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 corrective maintenance procedures for the Plain Switch (UIC54 and RT60) versions of the High Performance Switch Actuator (HPSA) and its associated Supplementary Detection, which are sub-systems of the High Performance Switch System (HPSS).

1.2 Scope of Document

- 1.2.1 There are a number of variants of the HPSA, together with a number of design improvements that have been incorporated since its introduction into the rail network. This document contains sufficient information to allow all variants and build standards to be correctly maintained.
- 1.2.2 Network Rail SMTH procedures relating to the replacement of equipment in-track are referenced within the HPSS Handbook (Ref: 17.1).
- 1.2.3 This document does not contain procedures associated with scheduled maintenance activities as these are covered in Network Rail HPSS SMS Documentation, as referenced within the HPSS Handbook (Ref: 17.1).
- 1.2.4 Details relating to the Installation of the HPSS system can be found in 'Installation Manual: HPSS For Plain Lead Switches' (Ref: 17.2).
- 1.2.5 Details relating to the Corrective Maintenance of the PowerLink Backdrive can be found in the 'Corrective Maintenance Procedures: PowerLink Backdrive' (Ref: 17.3).
- 1.2.6 Track and Track Support issues are currently outside the scope of this document.

1.3 Scope of Equipment

- 1.3.1 This document covers all variants of the HPSA manufactured to date, as detailed in Network Rail's Certificate of Acceptance PA05/00579 (Ref: 17.4).
- 1.3.2 This document applies to all HPSA equipment currently in operational use in the UK rail network (Network Rail and High Speed 1).
- 1.3.3 Details of all spares required to carry out corrective maintenance on the HPSA, including IAD part numbers and PADS numbers, are detailed in IAD Rail Systems' document 'HPSS Spares Catalogue' (Ref: 17.5).

1.4 Competence

- 1.4.1 All staff undertaking Corrective Maintenance on the HPSA shall have successfully completed an IAD Rail Systems' endorsed HPSS Training Course.

1.5 Safety

- 1.5.1 The HPSA 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: 17.6).
- 1.5.4 Lubricants used during corrective maintenance are detailed in Section 3.3. COSHH sheets are available from IAD Rail Systems if required.

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 via the approved repairs route.
- 1.6.2 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, cable ties, and other items needed to ensure that the corrective maintenance can be completed efficiently and safely.

2.2 Tools

- 2.2.1 The tooling required to carry out corrective maintenance on the HPSA, 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 HPSA.
- 2.2.3 The HPSA Handset (TDS Recon) is an essential tool used for set-up and diagnostics of the HPSA. The HPSA Handset Operating Procedure (Ref: 17.7) provides details of the HPSA Handset functions and use (including Datum Reset).

2.3 Datum Reset / FPL Test

- 2.3.1 A Datum Reset and FPL Test shall be carried out following any Corrective Maintenance (except for the replacement of the in-bearer Heaters, provided that no signalling components are adjusted or disconnected).
- 2.3.2 Details of how to carry out the Datum Reset procedure and FPL Testing are contained within Network Rail SMS Documentation which is referenced within the HPSS Handbook (Ref: 17.1) .

2.4 Cables / Looms

- 2.4.1 All Cables and Looms within the HPSA shall be carefully positioned away from moving components (e.g. Gearbox Shaft, Drive Shaft, Carriage), and the HPSA Heater.
- 2.4.2 The tail cables of all Rail Position Sensors (LVDTs) are designed to be a specific length and are calibrated items that form part of the detection system. Any attempt to shorten or repair these cables could affect the accuracy of the detection system and shall therefore never be attempted.
- 2.4.3 From mid 2008 onwards, internal looms and associated external cables on the HPSA were colour coded, to simplify installation. Details of the colour coding are contained in Appendix B.
- 2.4.4 Any damaged cable or loom shall be replaced immediately, and under no circumstances shall any repair be attempted. Prior to replacement ensure that power to the HPSA is isolated.

- 2.4.5 If a cable or loom has to be replaced, snip off the old cable tie with extreme care to prevent damage to any adjoining cable(s). The replacement cable / loom shall be routed in the same way as the faulty cable and secured with cable ties, to prevent accidental damage.

Note: When fitting cable ties, do not over-tighten them as this can damage the cables. Only use the supplied cable ties with locking ridges on the outside.

- 2.4.6 Following the replacement of any cable or loom, restore power to the HPSA and carry out testing in accordance with Network Rail procedures contained within the HPSS Handbook (Ref: 17.1) (including a Datum Reset and FPL Test).

2.5 Plug Couplers

- 2.5.1 Plug couplers require a firm twist until the lock engages to ensure reliable operation. The plug couplers provide an audible click and 'feel' feedback to confirm that they are correctly locked. Also, gently turning them in the opposite direction will provide confirmation that they are securely locked. If a plug coupler is not fully made up i.e. it is loose, this can result in intermittent contact of the pins and may lead to the points not driving and/or intermittent detection.

- 2.5.2 Care shall be taken to ensure a coupler is not attempted to be connected to the wrong socket. Although each plug coupler and socket are 'unique' and cannot be mis-connected, trying to force the wrong plug and socket together can lead to damage to the plug or socket.

- 2.5.3 All HPSS plug connectors have been chosen to be resilient to wet conditions but are at their most vulnerable when disconnected.

- 2.5.4 If however, any cable ends have been thoroughly soaked (i.e. submerged), they shall be returned to IAD Rail Systems.

- 2.5.5 Internal connectors within the bearers are physically protected by the covers and unlikely to be submerged during transit, storage or installation. Therefore it is important to only remove the covers for a limited time only to protect the internal wiring.

- 2.5.6 External Supplementary cables, Power and detection cables have colour coded bands to prevent incorrect installation. More information is available in Appendix B.

2.6 Megger Testing

- 2.6.1 Under no circumstances shall the ECU or any Rail Position Sensor (Toe or Supplementary) be Megger tested, as this may seriously damage electronic (safety critical) circuitry.

2.7 Fasteners

- 2.7.1 Prevailing torque 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: Prevailing Torque Fasteners (HPSS)

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



Figure 2: SNEP Prevailing Torque Nuts

- 2.7.3 The manufacturers of these components only guarantee security of connection if they are tightened up once to the correct torque using a torque wrench.
- 2.7.4 Where these procedures state 'Torque tighten...', the torque values for all HPSS 'critical' fasteners are shown in Appendix E of this document. Torque values for critical components are also shown in Network Rail SMS documentation referenced from the HPSS Handbook, (Ref: 17.1). Once a prevailing torque 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. Network Rail SMS documentation states that 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 prevailing torque feature is still functional. Any prevailing Torque component(s) that have become loose shall immediately be replaced.
- 2.7.5 Any 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 2.7.4.
- 2.7.6 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 prevailing torque, then it can be easily removed.

2.7.7 If the Gearbox 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 shall be used.

2.7.8 Where stated, Anti-Seize compound shall be copper based.

2.8 Rubber Gaiters

2.8.1 The rubber gaiters that are fitted between the Centre Cover and the foot of each stock rail prevent the ingress of ballast and other contaminants to the HPSA Bearer and in particular the Toe Sensors. It is essential that they are refitted following any corrective action where they have to be removed.

2.8.2 There are currently 2 methods of retention for the Gaiters, as follows:

- a) Retention Plates/Capscrews (Foot of stock rail, and to Centre Cover)
- b) Retention Plate/Capscrews (Foot of stock rail) and Hook/Eyelet (Centre Cover)

2.9 HPSA End Lid

2.9.1 Where a procedure states "Refit the End Lid and secure....", this shall be with RKB221 padlocks only.

Note: Access to the HPSA manual cranking facility is via the End Lid Door, which is secured with an RKB222 padlock.

2.10 Run-Through

2.10.1 In the event of a run-through, key components may be damaged; therefore these items shall be replaced as listed in Network Rail HPSS SMS Documentation referenced from the HPSS Handbook (Ref: 17.1).

2.10.2 The Corrective Maintenance procedure for the replacement of HPSA items to be replaced following a run-through are contained in Section 16 of this document.

2.11 Gearbox

2.11.1 If a Gearbox is replaced (following a run-through or if found to be faulty), it is essential that during installation / set-up, there is a minimum gap of 3.5mm between the Anti-Rotation Bush and the Gearbox casing with the HPSA in its fully retracted position (also see Section 8).

Note: This gap of 3.5mm may reduce during operational service due to movement or wear of the switch / stock rail etc, however the gap shall not be less than 2mm at any time. If the gap is 2mm or less additional Packing Plate(s) must be installed as detailed in Section 8.2.

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 ½ Dr	90058		1
12mm A/F Hex Bit 3/4 Dr	90173		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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Carriage Shaft Setting Gauges
(1 Pair)

90001

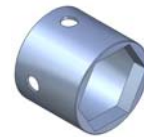
086/032915



Cable Plug Spanner (48mm A/F)

90002

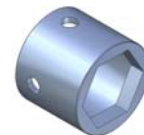
086/032916



Cable Plug Spanner (43mm A/F)

90003

086/032917



Tommy Bar
(For Plug Spanners 90002 & 3)

90004

086/032918



'C' Spanner

90006

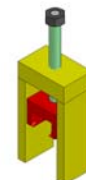
086/035158



Shoulder Bolt Extractor

90008

086/032920



Alignment Bush

90016

086/035159



Description	Part No.	PADS No.	Picture (Not to Scale)
HPSA Drive Unit	10461	086/035161	
Handset Kit	4104	086/035157	
comprising:			
HPSA Handset (TDS Recon)	11065	094/008007	
Handset Cable	10178	086/032913	

3.3 Lubricants

3.3.1 The following lubricants shall only be used on the HPSS system (including the PowerLink Backdrive):

Type of Lubricant	Reason	Where Used
Copaslip Copper based Anti- Seize compound.	To assist with the removal/replacement of components	As specified by this document
PTFE Spray	Prevent freezing of Toe and Supplementary Sensors	Exposed Guide Rod of the Rail Position Sensor

4 CORRECTIVE MAINTENANCE: ELECTRONIC CONTROL UNIT (ECU)

Objective: Removal and replacement of the ECU.

Kit Part No.: PADS No.: 086/035198 (RT60) IAD Part No.: 4113

PADS No.: 086/035199 (UIC54) IAD Part No.: 4114

General Note: This procedure applies to RT60 and UIC54 ECUs, as used on High Lid and Low Lid HPSAs. To ensure that only the correct ECU is used with the appropriate HPSA each variant of ECU has unique plug couplers J1 (Command Interface) and J2 (Detection Interface). This ensures that ECU's are not interchangeable e.g. an RT60 ECU cannot be installed on a UIC54 HPSA, and vice versa.

Safety Note: The ECU contains complex and safety critical electronics. DO NOT attempt any on-site repairs or try to remove any of the lids or connectors. All investigations or repair work must be carried out by IAD Rail Systems. If it is believed that the ECU is faulty it shall be replaced, and the faulty unit returned to IAD Rail Systems for investigation.

Special Tools: HPSS Handset.

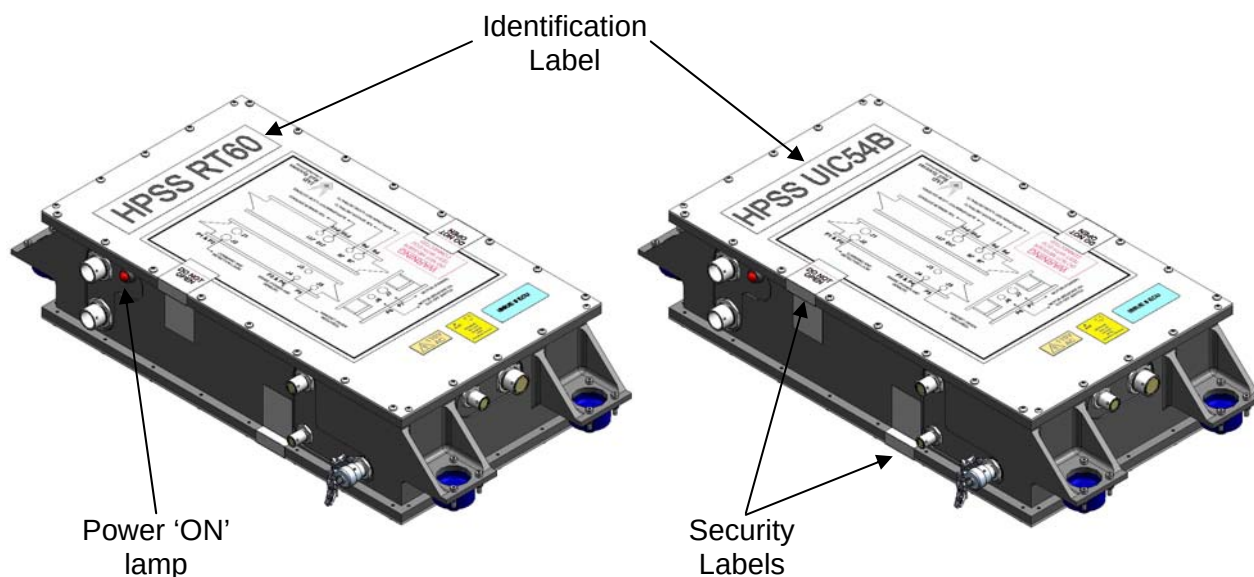


Figure 3: ECU (UIC54 & RT60)

4.1 Removal of ECU

4.1.1 Remove End Lid from HPSA.

4.1.2 Isolate power to the HPSA.

4.1.3 Disconnect all cables from the ECU plug couplers.

- 4.1.4 Remove 4 off M5 x 30 Socket Head Capscrews and M5 Spring Washers (Low Lid), and remove ECU. ECUs on High Lid HPSAs are retained with M5 x 35 Socket Head Capscrews and M5 Plain Washers.

4.2 Installation Procedure: ECU

- 4.2.1 Install new ECU onto HPSA and secure in place with cap screws and spring washers. Check the integrity of the 4 Shock Mounts (i.e. that the rubber mounts are not damaged and that the central steel core is secure within the rubber).
- 4.2.2 Attach all cables to ECU as identified in Figure 4. Check correct orientation of plugs to sockets and that the plugs are fully mated to their sockets (Plugs must not be forced as this will cause damage).

Note: Check for signs of corrosion / debris, and for any connector pin damage.

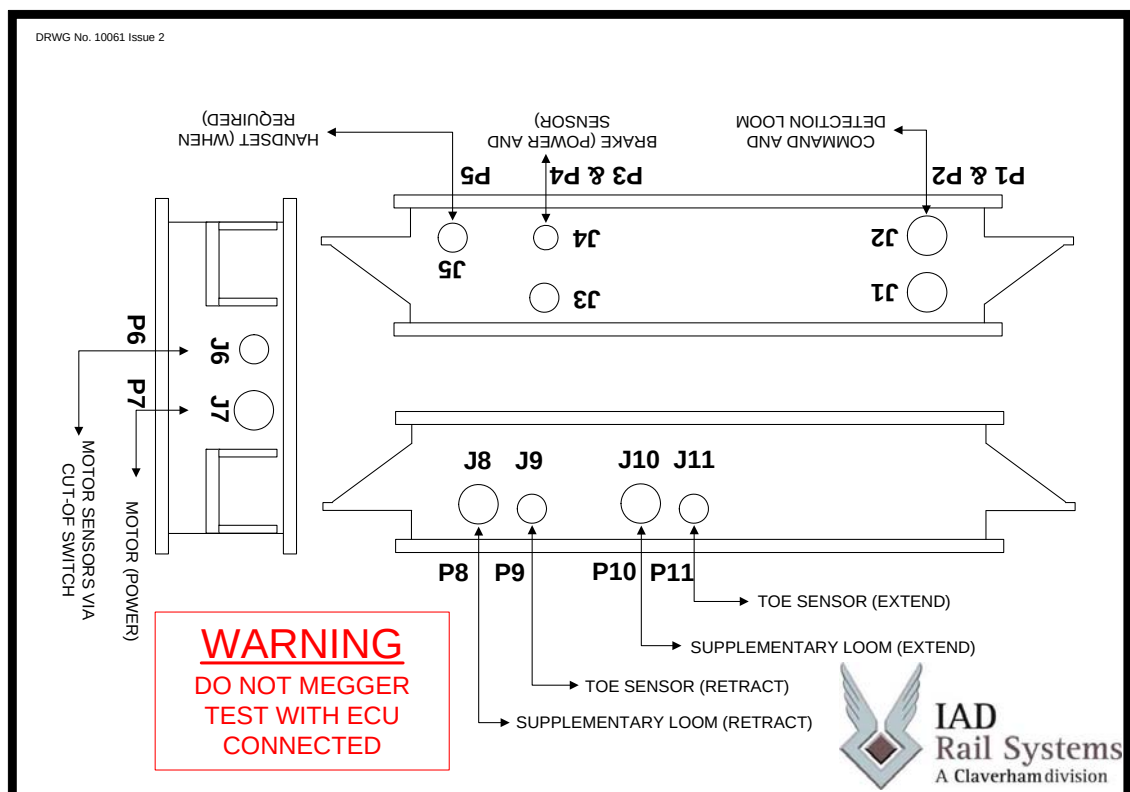


Figure 4: ECU Plug & Socket Layout (Label on Top Lid)

- 4.2.3 Restore power to the HPSA and carry out testing in accordance with Network Rail procedures (Ref: 17.1) (including a Datum Reset and FPL Test).
- 4.2.4 Check all cables are secure (cable tied, or secured within the cable troughing if fitted) and will not be damaged during the refitting of the End Lid.
- 4.2.5 Note. When connecting the Handset for the Datum Reset, ensure that J5 (Handset Comms.) is connected last to enable internal ECU Comms. to be established.
- 4.2.6 Refit End Lid and secure with padlocks.

5 CORRECTIVE MAINTENANCE: BRAKE

Objective: Removal and replacement of the Brake assembly.

Kit Part No.: PADS No.: 086/032924 IAD Part No.: 4002

General Note: Used on all variants of the HPSA.

Safety Note: Check that the original splined hub (if it becomes detached from the old Brake) and Key are removed from the Gearbox. Do not fit the new Brake until a new Key has been fitted to the Gearbox.

The Key forms part of the secondary lock function of the HPSS. Failure to fit the Key could lead to the points becoming unlocked.

Special Tools: None required.

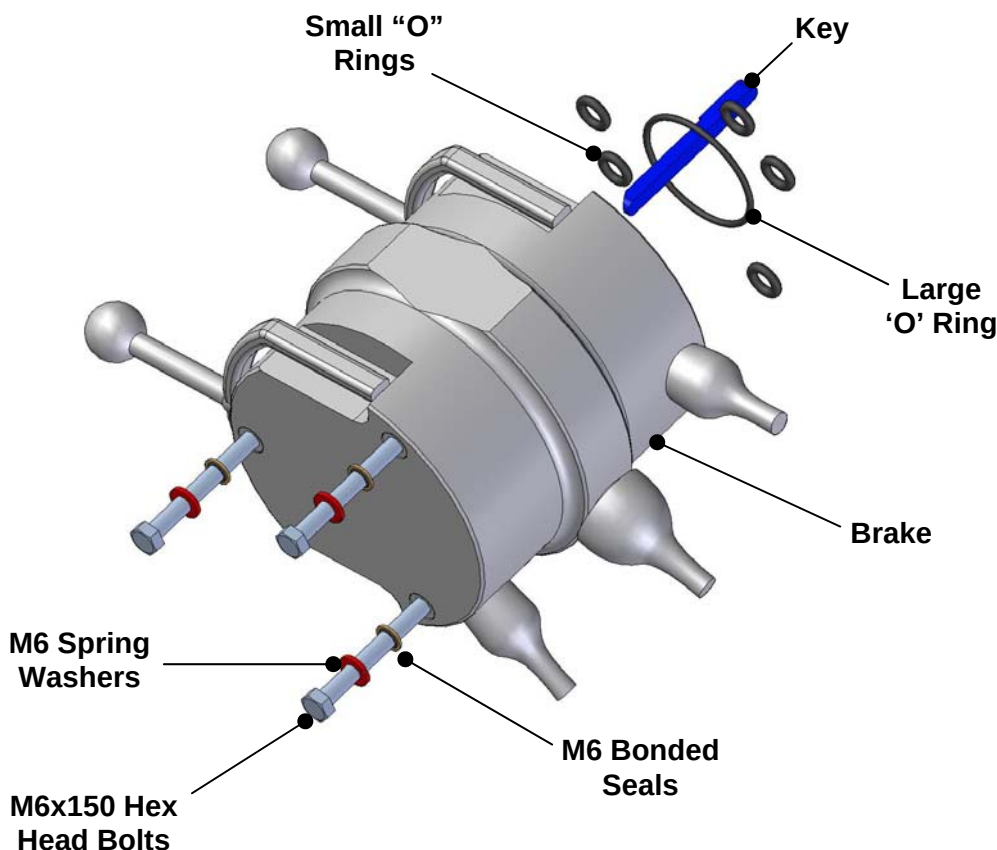


Figure 5: Brake Assembly

5.1 Removal of Brake

5.1.1 Remove End Lid from HPSA and isolate power to the HPSA.

5.1.2 Remove ECU (High Lid / Straight Crank variant only).

- 5.1.3 Remove Right Angle Gearbox and Coupling Shaft, as shown in Figure 6 (Low Lid / Side Crank variant only).

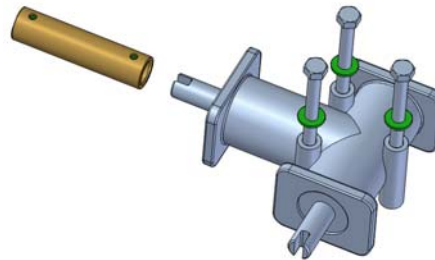


Figure 6: Right Angle Gearbox / Coupling Shaft

- 5.1.4 Carefully snip off cable ties and disconnect Brake cables J3 and J4 from ECU.
- 5.1.5 Remove 3 off M6 x 150 hex head bolts, then slide Brake off shaft.

Note: In order for the Brake be removed without fouling the Power Isolation Paddle, rotate the body of the Brake so that the Handles face upwards.

5.2 Installation Procedure: Brake

- 5.2.1 Install new Brake using components supplied in the Brake Kit, comprising:

- Large "O" Ring 1 off
- Small "O" Rings 5 off
- Key 1 off
- M6 Bonded Seals 3 off
- M6 Spring Washers 3 off
- M6 x 150 Hex Head Bolts 3 off

Note 1: Check that the Stepped Brake Key is correctly installed on the Gearbox shaft as shown in Figure 7.

Note 2: Prior to fitting Brake it is recommended that a very small amount of Anti-Seize Compound is applied to the shaft (wipe off any excess to prevent ingress to the Brake). Do not use any other lubricant or this may affect the locking integrity.

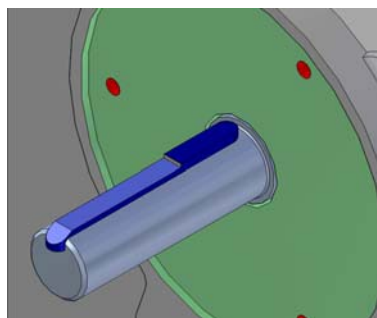


Figure 7: Installation of Brake Key

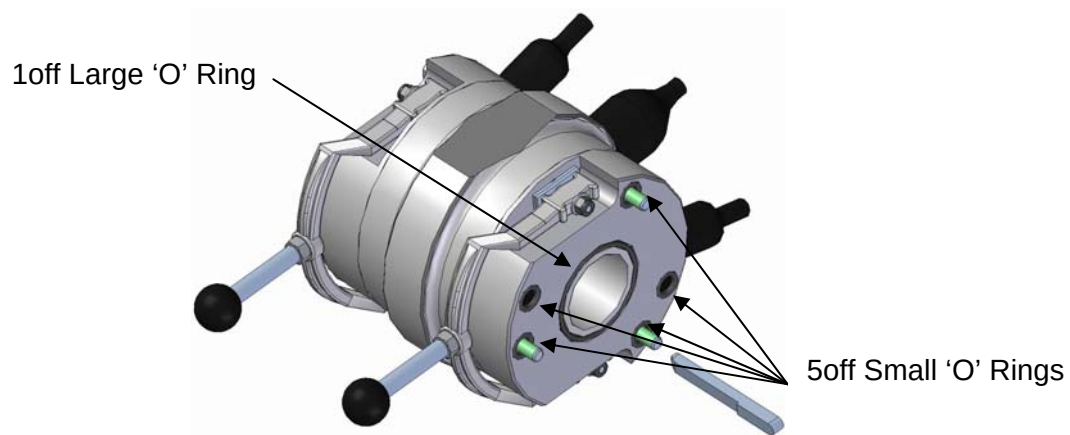


Figure 8: Installation of 'O' Ring seals

- 5.2.2 Tighten bolts (See Appendix E).
- 5.2.3 Refit ECU (High Lid variants only).
- 5.2.4 Reconnect cables J3 and J4 to ECU and secure with cable ties.
- 5.2.5 Refit Right Angled Gearbox and coupling shaft (Side Crank variant only).

Note: Check that the Coupling Shaft has a small amount of 'play' (i.e. moves freely end to end). Tighten the M8x70 Hex Head Screws using 13mm A/F Socket and re-check that the Coupling Shaft still moves freely end to end.

- 5.2.6 Restore power to the HPSA and carry out testing in accordance with Network Rail procedures referenced in HPSS Handbook (Ref: 17.1) (including a Datum Reset and FPL Test).
- 5.2.7 Refit End Lid and secure with padlocks.

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