

# RS AUTOMATIC OIL REPLENISHMENT SYSTEM



## OPERATING AND MAINTENANCE MANUAL

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# INTRODUCTION

An RS system monitors the oil level in the sump of an engine whether for mobile or fixed plant. If the system signals a low sump level it will automatically deliver a set quantity of oil into the engine.

The RS Systems has been designed, tested and built to ensure it will operate error-free and will continue to do so year after year, even under the most extreme conditions.

The following manual describes the typical RS operation and, in detail, the fitment and set up of the RS system to proving a trouble free installation. To ensure correct operation it is essential that the manual is followed and the RS system is checked in conjunction with the engine maintenance schedule.

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## 1. SAFETY

- 1.1. When installing the RS system ALL relevant national and local safety standards must be compiled with.
- 1.2. Prior to starting ensure all the relevant tools and equipment are available, and of the correct type.
- 1.3. The electrical system of the vehicle or engine MUST be disconnected before installing the RS system.
- 1.4. Adhere to all the regulations and specifications of the engine manufacturer.

## 2. DESCRIPTION

- 2.1. The RS system comprises typically of an oil storage reservoir with an integral electrically driven gear pump and electronic control unit (ECU). The gear pump comprises of an oil metering chamber to accurately deliver a pre-set quantity of oil into the engine. This quantity is factory set to the customer order requirements.

The engine oil level is monitored via a sensor located adjacent to the sump. The pump is operated via a wiring loom connected to a sump oil level sensor and the engine's electrical system. Oil is delivered to the engine using a tube from the pump connected to the engine rocker cover, or other connection if available.

## 3. RS OPERATION

- 3.1. At the time of the engine ignition being switched on the RS performs a system check. This checks the status of the RS reservoir oil level, if there are any alarm conditions signalled from the last cycle and the current temperature.
- 3.2. When the system has been verified the RS then checks the oil level of the sump. If the oil level is correct no further action is taken. If the engine oil level is low then the next time the ignition is switched on the RS will fill its measuring chamber and then deliver this oil into the engine. This process will continue for the pre-set number of fill cycles. Each cycle delivers 300cc into the engine.
- 3.3. After the engine oil is 'topped up' the RS will not activate another fill cycle until the ignition has been switched off for more than 60 minutes. When the ignition is switched on again the system will go through the procedure as described above. This is to ensure that no overfilling of the engine oil takes place.
- 3.4. In extreme environments where the temperature is below  $-25^{\circ}\text{C}$  ( $-13^{\circ}\text{F}$ ) the RS system will not operate. This is due to the high viscosity of engine oil at these temperatures.
- 3.5. To negate any erroneous readings from the oil level sump sensor the RS will not operate with the engine at more than  $10^{\circ}$  to the horizontal in any plane.
- 3.6. The warning lamp and manual override button (if fitted) provide alarm indications showing the status of the system and to manually check it is operating correctly. If the manual override is not fitted the wires still remain for the provision to prime the RS system during set-up.
- 3.7. The RS system carries out all of its functions discreetly with no intervention from the driver being required (unless the status lamp and/or manual override is fitted). The RS is an independent unit that does not interfere with the operation of the engine in anyway.
- 3.8. If 3 consecutive low level signals after each 60 minute ignition off delay and fill cycle are received by the RS systems then a fill inhibit will be activated. This will stop the pump from delivering any further oil into the engine until the problem is rectified.

**THE FACT THAT YOUR VEHICLE IS EQUIPPED WITH A RS SYSTEM DOES NOT RELIEVE ANY PERSON OF THE OBLIGATION TO CHECK AND REPLENISH THE ENGINE OIL ACCORDING TO THE REGULATIONS AS SPECIFIED BY THE MANUFACTURER OF YOUR VEHICLE OR ENGINE.**

- 3.9. The RS ECU initialises a pump cycle in three ways depending upon the requested factory setting.

### 3.9.1. CHASSIS

Each time the sump level sensor shows a low level on condition that the ignition has been switched off for more than 60 minutes. This method is used for road going vehicles and stationary engines.

### 3.9.2. OFF ROAD

Each time the vehicle is either placed in the neutral position or the accelerator pedal is not used for more than 5 minutes the sump level sensor checks the oil level. If required will deliver the pre-set quantity into the engine. This initial signal is supplied to the pump via a switch mounted to the gear change or accelerator mechanism.

- 3.9.3. If the manual override switch is fitted, pressing this for more than 8 seconds will cause a system cycle.

**CAUTION**-repeated operation of this WILL overfill the engine sump.

- 3.10. When the low level signal from the sump sensor is received by the ECU there is a slight pause and the pump starts its cycle. Initially the gear pump transfers oil from its reservoir into the measuring chamber. When the chamber reaches its correct level the electric motor reverses direction and transfers the oil to the outlet of the pump. When the oil level within the chamber has depleted and the pre-set number of cycles is complete the electric motor is switched off.

## 4. SYSTEM INSTALLATION

**DURING INSTALLATION AND COMMISSIONING OF THE RS SYSTEM ALL RELEVANT HEALTH AND SAFETY REGULATIONS MUST BE ADHERED TO. ENSURE THE BATTERY IS DISCONNECTED PRIOR TO INSTALLATION.**

**THE RS SYSTEM MUST BE FITTED WITH A 3 AMP (12V) OR 2 AMP (24V) TIMED DELAY FUSE ON THE PERMANENT SUPPLY AND 1 AMP ON THE IGNITION SUPPLY.**

**ENSURE THAT THE CORRECT SUMP PLUG THREAD HAS BEEN OBTAINED PRIOR TO INSTALLATION. SEE SECTION 5.7 BEFORE INSTALLATION.**

**THE RS IS PRE-SET AT THE FACTORY. REMOVING THE COVER WILL INVALIDATE THE WARRANTY.**

**SEE SECTION 6 FOR ORDERING AND NON-STANDARD INFORMATION.**

- 4.1. Prior to installing the RS ensure all the correct tools and services are available. The following tools are recommended:
  - 4.1.1. 3/8" drive socket set including 10, 12, 13, 17, 19, 22, 24 & 32 A/F metric sockets.
  - 4.1.2. Full set of combination spanners.
  - 4.1.3. 4, 5, 6 & 8 A/F metric allen keys.
  - 4.1.4. Air or electric drill with Ø7, Ø9, Ø11 & Ø13mm drill bits.
  - 4.1.5. Wire cutters.
  - 4.1.6. Wire stripper.
  - 4.1.7. Terminal crimp pliers.
  - 4.1.8. Pozi drive and flat blade screwdriver set.
  - 4.1.9. Pipe/tube cutter.
  - 4.1.10. Continuity tester (if available).
- 4.2. The RS kit supplied normally consists of the following components:
  - 4.2.1. RS pump reservoir assembly and mounting bracket.
  - 4.2.2. Sump level sensor assembly and mounting bracket.
  - 4.2.3. Sump block (replacing the sump plug)
  - 4.2.4. Oil feed tube assembly with 1/4" BSP connections.
  - 4.2.5. Oil inlet connector (from pump to engine).
  - 4.2.6. Ø8mm semi rigid nylon tubing.
  - 4.2.7. Wiring loom.
  - 4.2.8. Optional test/manual override button and signal lamp.
- 4.3. Before fitting the pump and associated items determine the best location of the pump, oil level bracket/sensor, wiring and oil feed tube therefore allowing an efficient system installation and operation. The pump must be located in a position that will provide adequate protection and to safely operate in its intended environment.

### 4.4. RS RESERVOIR FITTING

- 4.4.1. Using either the mounting bracket as a template or by measurement, mark off the hole centres and drill to the appropriate size. Offer the bracket to the holes and attach using fasteners supplied. Assemble reservoir to bracket. Ensure fasteners are adequately secured.

### 4.5. ENGINE OIL INLET

IF THE OIL LEVEL SENSOR BREATHER IS VENTED TO THE ENGINE TWO CONNECTORS SHOULD BE USED IN THE ROCKER COVER, ONE FOR OIL INLET AND ONE FOR THE BREATHER. (See section 4.7.8)

- 4.5.1. If fitting inlet into engine rocker cover ensure a new gasket is to hand prior to removal. Remove cover then clean off oil and dirt. Locate a position for the connector hole that is suitable for face sealing with the Dowty washers supplied. Drill the hole ensuring ALL swarf and burrs are removed. Fit the connector with bolt, sealing washer, rocker cover, sealing washer, flat washer and self locking nut assembled in that order. Fit rocker cover using a new gasket and torque bolts to the recommended setting.

**ENSURE ANY MODIFICATION OF THE ROCKER COVER DOES NOT INTERFERE WITH THE NORMAL OPERATION OF THE ENGINE.**

### 4.6. WIRING LOOM AND OIL FEED PIPE

- 4.6.1. Connect the wiring loom and Ø8 oil feed pipe (long length) to the RS pump. Route the loom and pipe through the chassis adjacent to existing wiring avoiding sharp edges, heat sources. When routing through holes ensure loom and pipe are well protected from damage.
- 4.6.2. Route the oil feed pipe to the engine oil inlet and cut to suit. Do not connect until commissioning.
- 4.6.3. Route the wiring loom until the point at which the loom is separated to the sump level sensor and the fuse panel/ vehicle cab. Cut the conduit cleanly making sure not to damage the wiring inside. Remove the conduit from the wires and put to one side for later use. Take up the 'Y' piece, conduit end seals and securing clips. Place wires through the seal and assemble onto the end of the conduit. Take up the 'Y' piece and route the 2 black wires through one side and the remaining wires through the other side of the 'Y' piece. Slide the wires through the 'Y' and push the seal home inside. Pushing on the conduit insert the securing clip into the 'Y' piece slot until it clips into place. Place a conduit end seal over the supplied pre-cut conduit and slide the black wires through. Pushing the conduit

firmly into place insert another securing clip into the 'Y' piece. Repeat this using the remaining conduit and wires.

- 4.6.4. Route the conduit with the black wires to the approximate position for the engine sump oil level sensor and the other conduit to the intended electrical feed points and if fitted the manual override/test button and signal lamp. See section 5.8.

### 4.7. SUMP BLOCK AND OIL LEVEL SENSOR

- 4.7.1. If the engine oil is cold then this part of the installation should be carried out first. This will reduce the time taken to achieve the correct level sensor position. If the engine has been operating recently ensure that the oil and engine has cooled down significantly, preventing injury.
- 4.7.2. The oil level sensor should be positioned as close as possible to the centre line of the engine sump on either the near side or off side of the engine. See section 5.6.7.
- 4.7.3. Remove the sump bolt and seal from the engine. Drain the engine oil into a container for re-use. Assemble the sump block into the engine orientating it so that the oil feed tube is not exposed to any possible damage. The sump block is fitted with a non-return valve. If the oil feed tube is not connected no oil will flow from the block.
- 4.7.4. Drill the oil level sensor bracket to suit the intended position. Screw the supplied 1/4" connector (straight or elbow) into the bottom of the level sensor. If the elbow connector is used thread sealant must be applied to the thread. Screw the oil breather push-in fitting into the side of the level sensor. Assemble the sensor loosely onto the bracket with the screws supplied. Attach the bracket to the engine.
- 4.7.5. Replace or, if required, renew the engine oil, adding the manufactures recommended quantity.
- 4.7.6. Take up the oil feed hose assembly. This is supplied to the specified length but if required, can be cut to length. Disassemble the hose by using the connector from the level sensor. Attach the hose connector to this and tighten. Unscrew the hose inner connector from the hose and outer connector. Holding the hose unscrew the outer connector, this has a left

handed thread. Cut hose to the new length and reassemble in the reverse order. Ensure connectors are screwed fully home and the integrity of the hose is maintained. Attach one end of the hose to the sump block. As the connector is screwed onto the fitting a small amount of oil will issue as the non-return valve is operated. Temporally attach the hose to the sump so the end is slightly above the oil level.

At this point continue fitting the RS reservoir if required.

- 4.7.7. Detach the oil feed hose and slowly lower the end until the oil just starts to flow out. At this level mark off the level sensor bracket. Position the level sensor so the centre line of sight glass is in line with the marked sump oil level. Secure the level sensor in place. Attach the oil feed hose to the level sensor fitting and tighten. If the sight glass is not visible use a continuity tester connected to the level sensor to identify the level.
- 4.7.8. Take up the shorter length of Ø8 flexible tube and push into the breather connector on the side of the level sensor. If the breather is vented to atmosphere route the pipe, vertically, level with the rocker cover and then route downwards in a 'U' shape by 150mm. If the breather is vented to the engine route the pipe to the second rocker cover connector and attach, pushing firmly home.
- 4.7.9. Cut the sensor conduit to the required length. Take up the 2-way electrical connector, male and female terminals supplied. Strip 4mm of insulation from the 2 black wires. Crimp the terminals to the wires and carefully insert these into the 2-way connector ensuring the correct positions. Push the end of the connector into the conduit and secure using a tie wrap. Plug the connector into the level sensor and secure using the small clamp supplied.

### 4.8. ELECTRICAL CONNECTION

- 4.8.1. If the wiring loom is being fed through a plate i.e. knock out, bodybuilder hole etc use the 2 bulkhead conduit connectors and seals supplied. Drill the required hole, cut the conduit to length and assemble one bulkhead connector over the wires as per the 'Y' piece. Feed the wires through the hole and screw the connectors together using the seals provided. Route the wires to their intended positions referring to table 1.

WIRING LOOM	COLOUR	
-VE SUPPLY	BLUE	
+VE SUPPLY PERMANENT	RED	
+VE SUPPLY IGNITION	BROWN	
TEST/MANUAL OVERRIDE BUTTON	GREY	
TEST/MANUAL OVERRIDE BUTTON	GREY	
SIGNAL LAMP +VE	ORANGE	OPTIONAL
SIGNAL LAMP GREEN -VE	GREEN	OPTIONAL
SIGNAL LAMP RED -VE	PINK	OPTIONAL
LEVEL SENSOR	BLACK	
LEVEL SENSOR	BLACK	

TABLE 1

Note: The test button/manual override wires are supplied in the loom as standard for priming the system. If no button is used they should be individually terminate for protection.

- 4.8.2. Connect the permanent +VE supply, using either the fuse panel or an in-line fuse. Connect the -VE supply. Connect the +VE ignition supply using either the fuse panel or an in-line fuse.
- 4.8.3. If used drill and assemble the test/manual override button and signal lamp. Connect the relevant wires using the butt crimps supplied. If the test button is not used ensure the wires are not in contact and are taped up before the electrical system is reconnected.

#### 4.9. COMMISSIONING

- 4.9.1. Recheck the level shown in the level sensor sight glass and if necessary adjust.
- 4.9.2. Fill RS reservoir with the correct engine oil. With the ignition switch turned off, reconnect the electrical system. Wait for approximately 3 minutes allowing the PCB to adjust any internal settings.
- 4.9.3. Place the oil inlet pipe into a suitable container to gather the oil. Turn the ignition switch on, the signal lamp will go green for 3 seconds then extinguish. If the test button is used press for 9 seconds, if not strip and connect the two grey wires together for 9 seconds to start a fill cycle. This will prime the oil inlet tube to the engine rocker cover. After the RS has completed its cycle connect the oil inlet pipe to the rocker cover connector ensuring it is fully inserted. Cut the grey wires and permanently insulate them.

4.9.4. If the signal lamp is not used then the operation of the RS pump and level sensor can be checked by firstly draining approximately 300ccs of oil from the sump. Turn on the ignition, wait for 3 minutes to sense the level, and then turn off the ignition for at least 62 minutes. Turn the ignition back on and after a short period the RS will operate. Using the test button and signal lamp is the preferred method to carry out this check. With the ignition switched off press the test button 3 times. The lamp will show a low level. Top up the drained oil in stages using small quantities pressing the test button each time. Ensure the oil has drained down to the sump each time the button is pressed. The signal lamp will show the correct level when all of the drained oil is returned to the engine.

**CHECK ALL CONNECTIONS FOR LEAKS AND RECTIFY IF REQUIRED.**

#### 5. ALARM SIGNALS

5.1. The RS system has a range of warning signals used in conjunction with the warning lamp and manual override/test button. Table 2 shows the alarm status of the warning lamp. An alarm signal will show if the RS system has operated for more than 5 minutes and has not delivered oil into the engine, if the last fill cycle was not completed, the ambient temperature is below -25°C or 3 consecutive fill have been registered.

SIGNAL	LAMP INDICATION
SYSTEM & RESERVOIR OK	GREEN FOR 3 SECONDS
SYSTEM OK & RS RESERVOIR LOW	GREEN ON FOR 3 SECONDS THEN FLASHING AMBER
SYSTEM ALARM & OIL RESERVOIR LOW	RED ON FOR 3 SECONDS THEN FLASHING AMBER
SYSTEM ALARM & OIL RESERVOIR ABOVE LOW LEVEL	RED ON

TABLE 2

5.2. The state and number of fills completed by the system is verified by use of the manual override/test button. By pressing the button a number of times shows if either a low sump level, tilt or low temperature signals were activated during the last ignition on period. Table 3 shows the method of checking the system. The button is required to be pressed within a 3 second period. To check these signals the ignition does not have to be switched on.

CHECK	LAMP SIGNAL	PRESS BUTTON
TILT	GREEN=OK RED=TILT OVER 10°	2 X
LOW SUMP LEVEL	GREEN=OK RED=LOW OIL LEVEL	3 X
LOW TEMPERATURE	GREEN=OK RED=TEMPERATURE < -25°C	4 X

TABLE 3

- 5.3. When the test button is used the green signal will extinguish after 3 seconds but the red signal will remain lit. To remove the red signal press the test button once then release.
- 5.4. Pressing the button 5 times will signal the number of fills the RS has completed. The lamp signal will light up for 1 second and go out for 1 second. It will light up for every fill completed. To erase the memory press the button 10 times.

#### 6. ORDERING INFORMATION

	RS	X		X		X	No OF FILLS PER CYCLE
STANDARD RS SYSTEM	1	12VDC	1	1	1	1	1
RS SYSTEM WITH 5VDC SIGNAL OUTPUT	2	24VDC	2	2	2	2	2
				3	3	3	3
				4	4	4	4
				6	6	6	1
				7	7	7	2
				8	8	8	3
				9	9	9	4

i.e. RS123 gives a standard 24VDC RS system operating 3 times during every fill cycle.

#### 7. TECHNICAL DATA

SYSTEM VOLTAGE	12 VDC	24 VDC
CURRENT (LOAD)	2.6 AMP	1.3 AMP
CURRENT (FREE FLOW)	1 AMP	0.5 AMP
IDLE CURRENT	65mA	
OPERATING TEMPERATURE	-25°C TO + 40°C	
RESERVOIR CAPACITY	15 litres	
PROTECTION	IP66	
OUTPUT PER PUMP CYCLE	0.3 litres	

#### 8. RS DIMENSIONS

