### Vehicle Dynamic Suspension - V8 4.2L Petrol/V8 S/C 4.2L Petrol -

**Torque Specifications** 

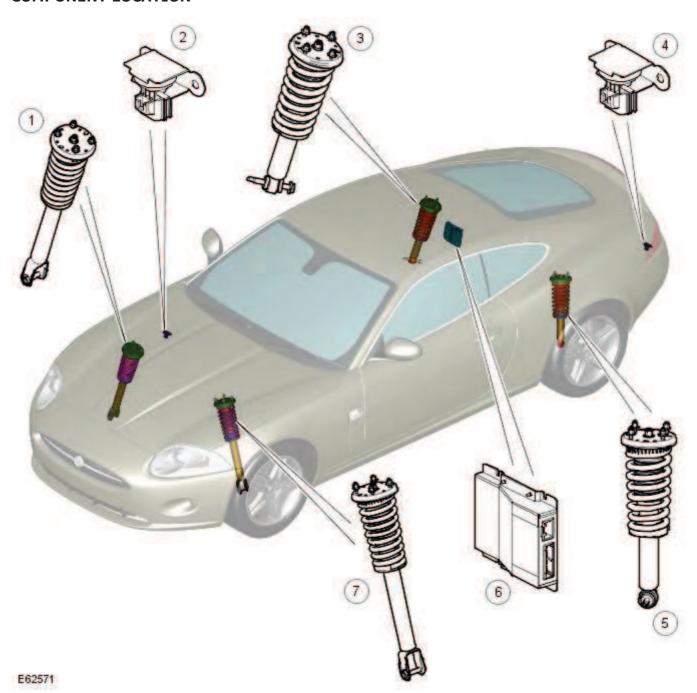
Item	Nm	lb-ft	lb-in
Accelerometer - bolt	8	6	71
Adaptive damping control module - nut			35
Front shock absorber.	-	-	-
For additional information, refer to: Specifications (204-01 Front Suspension, Specifications).			
Rear shock absorber.	-	-	-
For additional information, refer to: Specifications (204-02 Rear Suspension, Specifications).			

Part Number Published: 11-May-2011

# Vehicle Dynamic Suspension - V8 4.2L Petrol/V8 S/C 4.2L Petrol - Vehicle Dynamic Suspension

Description and Operation

### **COMPONENT LOCATION**



Item	Part Number	Description	
1	-	Right Hand (RH) front spring and damper assembly	
2	-	Front vertical acceleration sensor	
3	-	H rear spring and damper assembly	
4	-	Rear vertical acceleration sensor	
5	-	Left Hand (LH) rear spring and damper assembly	
6	-	Adaptive Damping Control Module (ADCM)	
7	-	LH front spring and damper assembly	

### **INTRODUCTION**

An adaptive damping system, known as Computer Active Technology Suspension (CATS) is available on certain models. The CATS system is an electronically controlled suspension system which constantly adjusts the damping characteristics of the suspension dampers in reaction to the current driving conditions.

The system is controlled by an Adaptive Damping Control Module (ADCM) which is located behind the backrest of the RH rear passenger seat. The ADCM receives signals from two dedicated vertical acceleration sensors in addition to inputs from other electronic system components to determine vehicle body motion and driver inputs. These signals are used by the ADCM to control the damping characteristics of each damper from soft to firm to give the optimum vehicle ride.

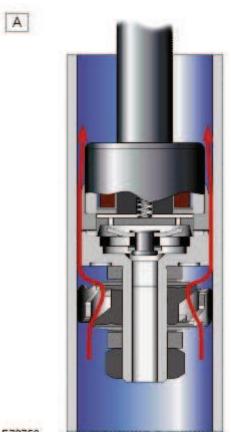
### **DAMPERS**

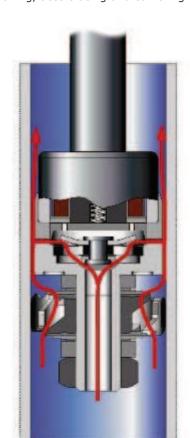
The CATS dampers are monotube, nitrogen gas and oil filled units, manufactured by Bilstein. The dampers have a two-stage adjustment which allows the damping force to be electrically adjusted when the vehicle is being driven. The two stage dampers provide the optimum compromise between performance handling and ride comfort.

The CATS dampers can be easily identified by an electrical connector on the end of the piston rod, in the center of the top mount.

The two-stage adjustment is achieved by a solenoid controlled valve. When the solenoid valve is deenergized, the damper is on its firm setting and oil flow is restricted to flowing at a controlled rate through orifices in the damper piston. The restricted oil flow stiffens the damper action improving the handling when braking, accelerating and cornering.

В





E72756

Item	Description
Α	Firm setting
В	Soft setting

The solenoid is connected to a by-pass valve which allows additional oil flow through the damper. When the solenoid is energized, the valve is lifted from its seat, allowing oil to flow through a hollow piston rod in the center of the damper piston and out through additional orifices. The increased oil flow softens the damper action providing a more comfortable ride quality.

The solenoid is operated by a 400 Hz Pulse Width Modulation (PWM) signal from the ADCM. When energized, the ADCM applies a 1.3 Ampere (A) push current for 75 milliseconds to move the valve and then applies a 0.5 A hold current to operate the damper in the 'soft' setting.

For additional information, refer to: Vehicle Dynamic Suspension (204-05, Diagnosis and Testing).

#### **ACCELERATION SENSORS**

Two acceleration sensors are used in the CATS system. The front sensor is located in the rear of the RH front wheel arch, behind the washer reservoir. The rear sensor is mounted in the luggage compartment, in the rear LH corner adjacent to the rear lamp assembly.

The sensors measure acceleration in the vertical plane and output a corresponding analogue signal to the ADCM.

Each sensor is connected to the ADCM via three wires which supply ground, 5 V supply and signal return. The sensor terminals are gold plated due to the low signal currents.

The acceleration sensors are of the capacitive type. The sensing element comprises two parallel plate capacitors. The capacitors alter the peak voltage which is generated by an internal oscillator when the sensor is subjected to acceleration. Detection circuits within the sensor measure the peak voltage and pass an analogue output signal to the ADCM. The sensors output a signal voltage of approximately 1 V/g  $\pm$  0.05 V/g.

For additional information, refer to: Vehicle Dynamic Suspension (204-05, Diagnosis and Testing).

### **CATS SYSTEM FAULT MESSAGE**

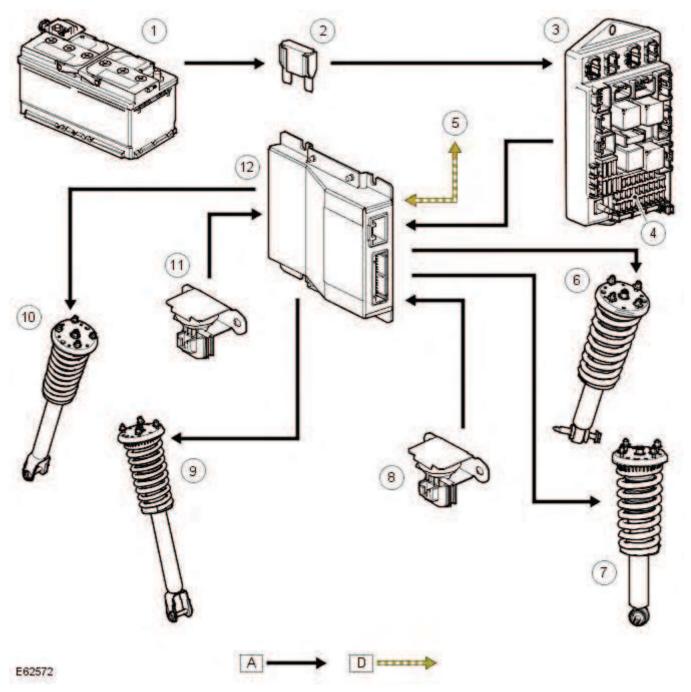
The ADCM has a CAN connection to the instrument cluster. If a fault is detected by the ADCM, a message is sent to the instrument cluster and a message 'CATS SYSTEM FAULT' is displayed.

When this message is displayed a fault has been detected and an appropriate Diagnostic Trouble Code (DTC) will be logged in the ADCM. The faults can be interrogated using the Integrated Diagnostic System (IDS).

When a fault is detected, the ADCM stops outputs to the active dampers and the dampers operate continually on their default 'hard' setting until the fault is corrected.

### **CONTROL DIAGRAM**





Item		Description	
1		Battery	
2		Megafuse (175 A)	
3		Central Junction Box (CJB)	
4		Fuse 14 (15 A) - ACM power supply	
5	High Speed CAN connection to other vehicle systems		
6		RH rear active damper	
7		LH rear active damper	

8		Rear vertical acceleration sensor
9		LH front active damper
10		RH front active damper
11	11 Front vertical acceleration sensor	
12		ADCM

### PRINCIPLES OF OPERATION

The ADCM uses a combination of information from other system modules and data from the acceleration sensors to measure the vehicle motion and driver inputs. Using this information, the ADCM applies algorithms to control the dampers for the current driving conditions.

The ADCM receives signals on the high speed Controller Area Network (CAN) bus from the following system components:

- Vehicle speed Anti-lock Brake system (ABS) module
- Brake switch status Engine Control Module (ECM)
- Brake pressure ABS module
- Gear position Transmission Control Module (TCM)
- Lateral acceleration ABS module
- Throttle pedal position ECM
- Power mode CJB via instrument cluster gateway
- Steering wheel angle Steering angle sensor via ABS module
- Steering wheel speed Steering angle sensor via ABS module
- Engine speed ECM
- Engine running status ECM
- Car Configuration File (CCF) Data Auxiliary junction box via instrument cluster gateway
- Master configuration identification Auxiliary junction box via instrument cluster gateway
- Vehicle information parameters Auxiliary junction box via instrument cluster gateway.

The ADCM also outputs information for use by other systems as follows:

- CATS Fault instrument cluster
- Front left damper status ECM
- Front right damper status ECM
- Rear left damper status ECM
- Rear right damper status ECM.

The ADCM monitors the input signals and operates the damper solenoids. The input signals are compared against algorithms with the ADCM and preset speed thresholds.

The vehicle speed signal is the main input for the ADCM. The ADCM contains upper and lower speed thresholds at which the dampers are set to the firm setting. The gear position signal is also used to determine longitudinal detection and, along with the speed signal, is compared against algorithms to select the appropriate damper setting.

The firm setting has a higher priority than the soft setting. This is because the firm setting provides better vehicle control in any driving condition. The dampers are set to firm when driving at high speed or if a system fault is detected.

When the vehicle is stationary with the engine running, the dampers are set to the soft setting.

The ADCM receives its power supply via a relay in the CJB. The relay remains energised for a period of time after the ignition is off. This allows the ADCM to record and store any fault codes relating to CATS system faults.

### Vehicle Dynamic Suspension - V8 4.2L Petrol/V8 S/C 4.2L Petrol - Vehicle Dynamic Suspension

Diagnosis and Testing

### **Principle of Operation**

For a detailed description of the adaptive damping system operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: <u>Vehicle Dynamic Suspension</u> (204-05 Vehicle Dynamic Suspension - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Description and Operation).

### **Inspection and Verification**

- 1. Verify the customer concern.
- 2. Visually inspect for obvious signs of damage and system integrity.

#### **Visual Inspection Chart**

Mechanical	Electrical
<ul> <li>Coil spring(s)</li> <li>Shock absorber(s)</li> <li>Accelerometer(s) installation</li> </ul>	<ul> <li>Fuse(s)</li> <li>Wiring harness/electrical connectors</li> <li>Accelerometer(s)</li> <li>Adaptive damping module</li> </ul>

- 3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4. If the failure is not visually evident, check the system for any logged Diagnostic Trouble Codes (DTCs) and refer to the DTC index.

### **DTC Index**

CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

#### NOTES:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

Generic scan tools may not read the codes listed, or may read only five-digit codes. Match the five-digits from the scan tool to the first five-digits of the seven-digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

Anspect connectors for signs of water ingress, and pins for damage and/or corrosion.

If DTCs are logged and, after carrying out the pinpoint tests, a fault is not identified, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
-	Front vertical acceleration sensor	sensor circuit - short to power	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check front vertical acceleration sensor circuit for short to power
-	Front vertical acceleration sensor	sensor circuit - short to ground, open circuit	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check front vertical acceleration sensor circuit for short to ground, open circuit
	Front vertical acceleration sensor		Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

DTC	Description	Possible Cause	Action
	Rear vertical acceleration sensor	power	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check rear vertical acceleration sensor circuit for short to power
	Rear vertical acceleration sensor	sensor circuit - short to ground, open circuit	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check rear vertical acceleration sensor circuit for short to ground, open circuit
	Rear vertical acceleration sensor		Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
	Left front damper solenoid	circuit - short to power	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left front damper solenoid circuit for short to power
	Left front damper solenoid	circuit - short to ground, open circuit • Left front damper failure	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left front damper solenoid circuit for short to ground, open circuit. Check and install a new damper as required
	Left front damper solenoid	circuit - short to ground/power, open circuit • Left front damper failure	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left front damper solenoid circuit for short to ground, power, open circuit. Check and install a new damper as required
	Right front damper solenoid	circuit - short to power	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right front damper solenoid circuit for short to power
	Right front damper solenoid	circuit - short to ground, open circuit • Right front damper failure	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right front damper solenoid circuit for short to ground, open circuit. Check and install a new damper as required
C110D1D	Right front damper solenoid	circuit - short to ground/power, open circuit • Right front damper failure	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right front damper solenoid circuit for short to ground, power, open circuit. Check and install a new damper as required
	Left rear damper solenoid	circuit - short to power	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left rear damper solenoid circuit for short to power
1	Left rear damper solenoid	circuit - short to ground, open circuit • Left rear damper failure	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left rear damper solenoid circuit for short to ground, open circuit. Check and install a new damper as required
C110E1D	Left rear damper solenoid	circuit - short to ground/power, open circuit • Left rear damper failure	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left rear damper solenoid circuit for short to ground, power, open circuit. Check and install a new damper as required
	Right rear damper solenoid	circuit - short to power	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right rear damper solenoid circuit for short to power
	Right rear damper solenoid	<ul> <li>Right rear damper solenoid circuit - short to ground, open circuit</li> <li>Right rear damper failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right rear damper solenoid circuit for short to ground, open circuit. Check and install a new damper as required
C110F1D	Right rear damper solenoid	<ul> <li>Right rear damper solenoid circuit -short to ground/power, open circuit</li> <li>Right rear damper failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right rear damper solenoid circuit for short to ground, power, open circuit. Check and install a new damper as required
	Sensor supply voltage	Circuit voltage out of range	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
	High speed CAN communication bus	<ul> <li>Vehicle CAN Bus off condition</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Carry out the CAN network integrity tests using the manufacturer approved diagnostic system
	Lost communications with ECM	Missing message from ECM	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECM power and ground supplies for short, open circuit. Carry out the CAN network integrity tests using the

DTC	Description	Possible Cause	Action
			manufacturer approved diagnostic system
U010187	Lost communication with TCM	<ul> <li>Missing message from TCM</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TCM power and ground supplies for short, open circuit. Carry out the CAN network integrity tests using the manufacturer approved diagnostic system
U012187	Lost communication with anti-lock control - stability assist module	<ul> <li>Anti-lock control - stability assist system failure</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ABS module power and ground supplies for short, open circuit. Carry out the CAN network integrity tests using the manufacturer approved diagnostic system
U042286	Lost communication with CJB	• Signal invalid	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CJB power and ground supplies for short, open circuit. Carry out the CAN network integrity tests using the manufacturer approved diagnostic system
U015587	Lost communication with instrument cluster	<ul> <li>Missing message from Instrument cluster</li> </ul>	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check instrument cluster power and ground supplies for short, open circuit. Carry out the CAN network integrity tests using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul> <li>CAN master configuration ID incorrect</li> </ul>	Re-configure the RJB using the manufacturer approved diagnostic system, clear DTCs and re-test. If DTC still logged suspect Adaptive damping module, refer to new module installation note at top of DTC Index
U040186	Invalid data received from ECM/PCM	• Signal invalid	Check for engine management DTCs. REFER to: <u>Electronic Engine Controls</u> (303-14B Electronic Engine Controls - V8 4.2L Petrol, Diagnosis and Testing).
U040286	Invalid data received from TCM	• Signal invalid	Check for transmission DTCs. REFER to: <u>Diagnostic Strategy</u> (307-01 Automatic Transmission/Transaxle, Diagnosis and Testing).
U041586	Invalid data received from ABS control module	• Signal invalid	Check for ABS DTCs. REFER to: Anti-Lock Control - Stability Assist (206-09 Anti-Lock Control - Stability Assist, Diagnosis and Testing).
U042386	Invalid data received from Instrument Cluster	• Signal invalid	Check for instrument cluster DTCs. REFER to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing).
U1A1400	CAN initialisation failure	<ul> <li>CAN network harness short, disconnected</li> </ul>	
	Control module	● General electrical failure	Check integrity of electrical connectors and pins to module. Check damper negative circuits for short to ground. Install a new adaptive damping module. REFER to: Adaptive Damping Module - Convertible (204-05 Vehicle Dynamic Suspension - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Removal and Installation) / Adaptive Damping Module - 2-Door (204-05 Vehicle Dynamic Suspension - V8 4.2L Petrol/V8 S/C 4.2L Petrol, Removal and Installation).
U300049	Control module	Internal electronic failure	Suspect adaptive damping module, refer to new module installation note at top of DTC Index
U300055	Control module	Not configured	Configure adaptive damping module using manufacturer approved diagnostic system
U300281	Vehicle identification number	<ul> <li>Vehicle/component mis-match. Corrupt VIN data being transmitted, module installed from donor vehicle</li> </ul>	Install original module, check for adaptive damping related DTCs and refer to DTC Index
U30031C	Battery voltage	Circuit voltage out of range	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

### Vehicle Dynamic Suspension - V8 4.2L Petrol/V8 S/C 4.2L Petrol - Adaptive Damping Module Convertible

Removal and Installation

#### Removal

#### **WARNINGS:**

To avoid accidental deployment, the restraints control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

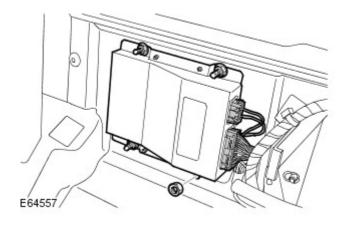
Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.

- Remove the cover and disconnect the battery ground cable. For additional information, refer to: <u>Specifications</u> (414-01 Battery, Mounting and Cables, Specifications).
- 2. WARNING: Make sure that sufficient time has elapsed after disconnecting the battery ground cable(s), before commencing work on the supplemental restraint system (SRS). Failure to follow these instructions may result in personal injury.

Make the air bag supplemental restraint system (SRS) safe.

- Remove the RH roll over protection unit.
   For additional information, refer to: <u>Rollover Protection Unit</u> (501-20B Supplemental Restraint System, Removal and Installation).
  - 4. Remove the active damping module.
    - Remove the 4 nuts.
    - Disconnect the 2 electrical connectors.



- 1. Install the active damping module.
  - Tighten the nuts to 10 Nm.

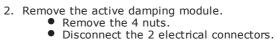
- Install the active damping module.
   Tighten the nuts to 10 Nm (7 lb.ft).
   Connect the electrical connectors.
- 2. Install the rear seat backrest. For additional information, refer to: Rear Seat Backrest (501-10 Seating, Removal and Installation).
  - Connect the electrical connectors.
- 2. Install the RH roll over protection unit. For additional information, refer to: Rollover Protection Unit (501-20B Supplemental Restraint System, Removal and Installation).
- 3. Connect the battery ground cable and install the cover. For additional information, refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

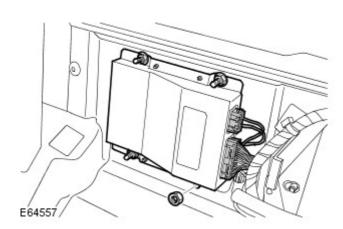
### **Vehicle Dynamic Suspension - V8 4.2L Petrol/V8 S/C 4.2L Petrol - Adaptive Damping Module 2-Door**

Removal and Installation

### Removal

1. Remove the rear seat backrest. For additional information, refer to: Rear Seat Backrest (501-10 Seating, Removal and Installation).





### Vehicle Dynamic Suspension - V8 4.2L Petrol/V8 S/C 4.2L Petrol - Front Suspension Vertical Accelerometer

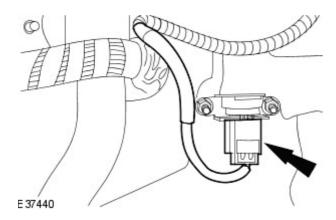
Removal and Installation

### Removal

1. WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the windshield washer reservoir.
For additional information, refer to: Windshield Washer Reservoir (501-16 Wipers and Washers, Removal and Installation).



3. CAUTION: Make sure the accelerometer is not dropped as damage will be caused to the internal components.

Remove the accelerometer.

- Remove the 2 nuts.
- Disconnect the electrical connector.

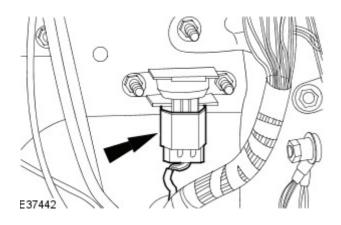
- 1. Install the accelerometer.
  - Tighten the nuts to 8 Nm (6 lb.ft).
  - Connect the electrical connector.
- 2. Install the windshield washer reservoir. For additional information, refer to: Windshield Washer Reservoir (501-16 Wipers and Washers, Removal and Installation).

# Vehicle Dynamic Suspension - V8 4.2L Petrol/V8 S/C 4.2L Petrol - Rear Suspension Vertical Accelerometer

Removal and Installation

### Removal

Remove the LH loadspace trim panel.
 For additional information, refer to: Loadspace Trim Panel Convertible (501-05 Interior Trim and Ornamentation, Removal and Installation) /
 Loadspace Trim Panel - 2-Door (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. CAUTION: Make sure the accelerometer is not dropped as damage will be caused to the internal components.

Remove the accelerometer.

- Remove the 2 nuts.
- Disconnect the electrical connector.

- 1. Install the accelerometer.
  - Tighten the nuts to 8 Nm (6 lb.ft).
  - Connect the electrical connector.
- Install the LH loadspace trim panel.
   For additional information, refer to: Loadspace Trim Panel Convertible (501-05 Interior Trim and Ornamentation, Removal and Installation) /
   Loadspace Trim Panel 2-Door (501-05 Interior Trim and Ornamentation, Removal and Installation).