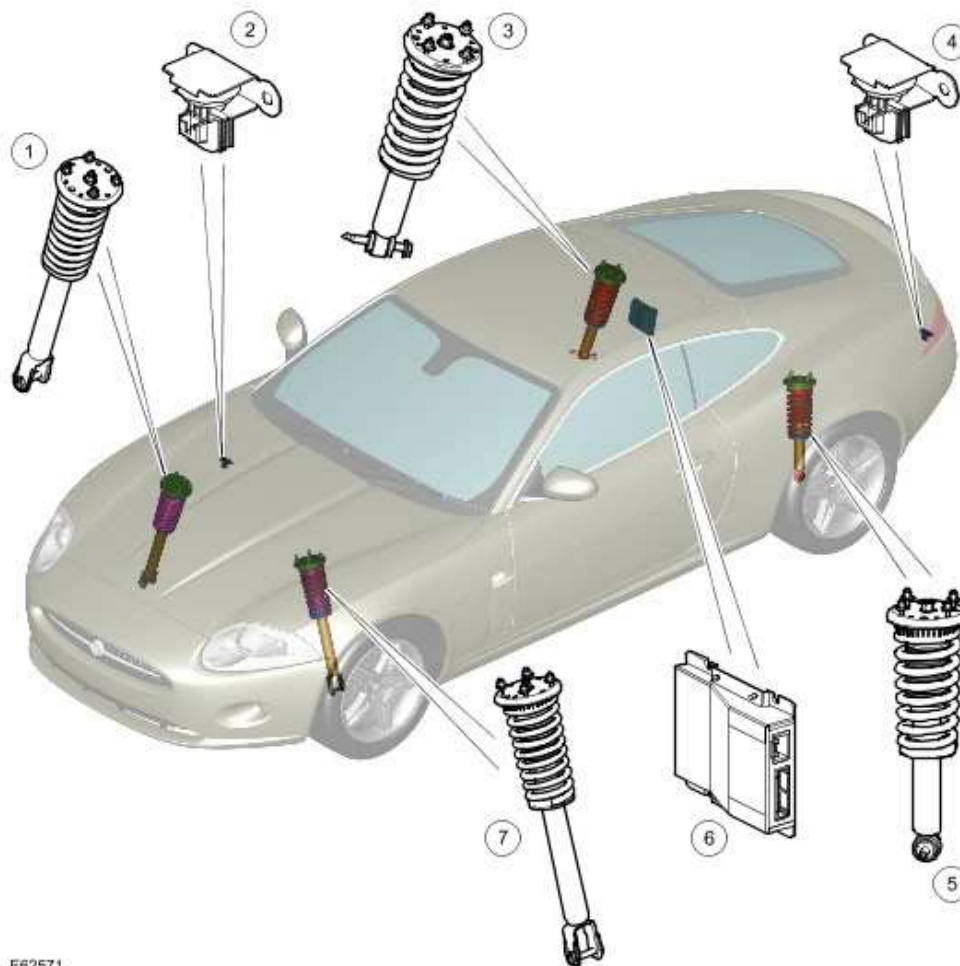


# Vehicle Dynamic Suspension

## COMPONENT LOCATION



E62571

Item	Part Number	Description
1		Right Hand (RH) front spring and damper assembly
2		Front vertical acceleration sensor
3		RH 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.

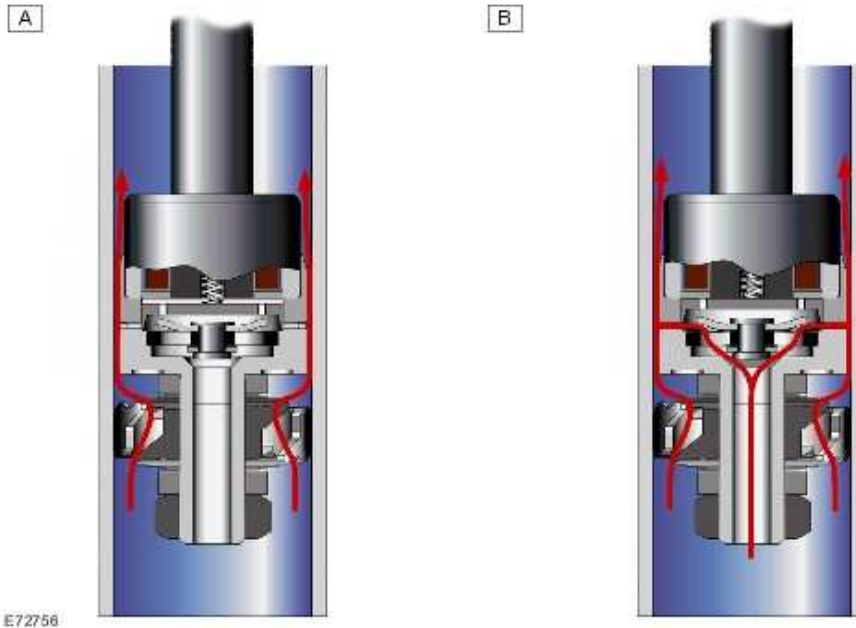
The system is controlled by an Adaptive Damping Control Module (ADCM) which is located behind the backrest of the RH rear passenger seat. The ADCM receives signals from two dedicated vertical acceleration sensors in addition to inputs from other electronic system components to determine vehicle body 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.



Item	Part Number	Description
A		Firm setting
B		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)

## 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  $1 \text{ V/g} \pm 0.05 \text{ V/g}$ . For additional information, refer to Vehicle Dynamic Suspension (204-05)

### **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.

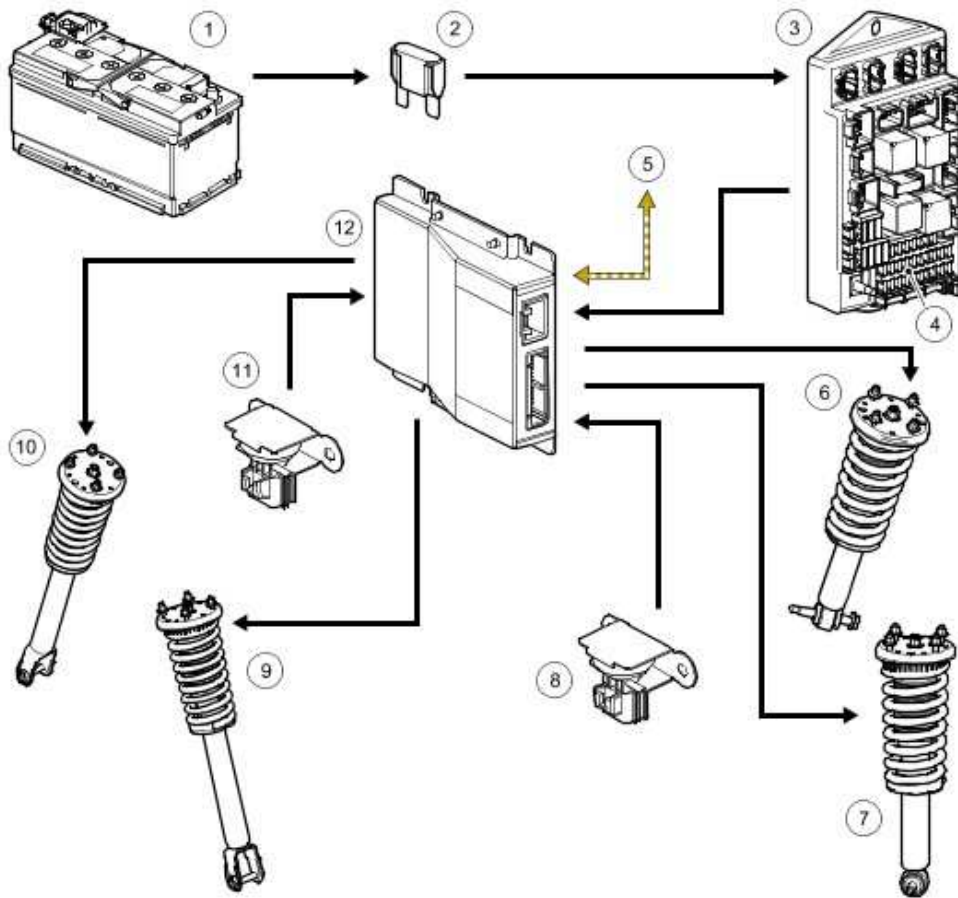
When this message is displayed a fault has been detected and an appropriate Diagnostic Trouble Code (DTC) will be logged in the ADCM. The faults can be interrogated using the Integrated Diagnostic System (IDS).

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**

**NOTE:**

**A** = Hardwired; **D** = High speed CAN bus



E62572



Item	Part Number	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		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.