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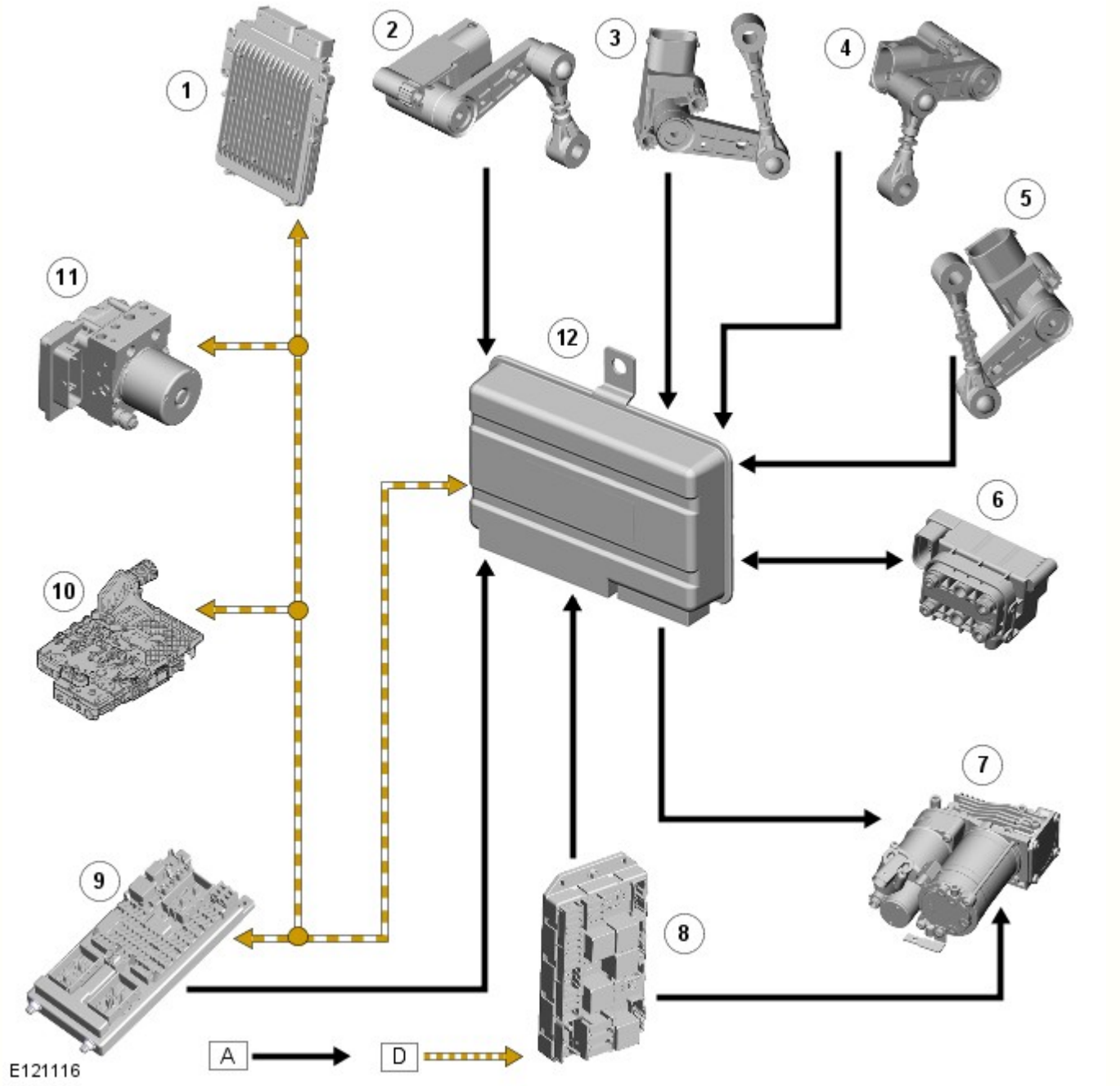
Rear Suspension - Rear Suspension - System Operation and Component Description

Description and Operation

Control Diagram

NOTE: A = Hardwired; D = High speed CAN (controller area network) .

AIR SUSPENSION SYSTEM



Item	Description
1	ECM (engine control module)
2	RH (right-hand) front height sensor
3	RH rear height sensor
4	LH (left-hand) front height sensor
5	LH rear height sensor
6	Valve block
7	Air compressor assembly

8	RJB (rear junction box)
9	CJB (central junction box)
10	TCM (transmission control module)
11	ABS (anti-lock brake system) module
12	Air suspension module

System Operation

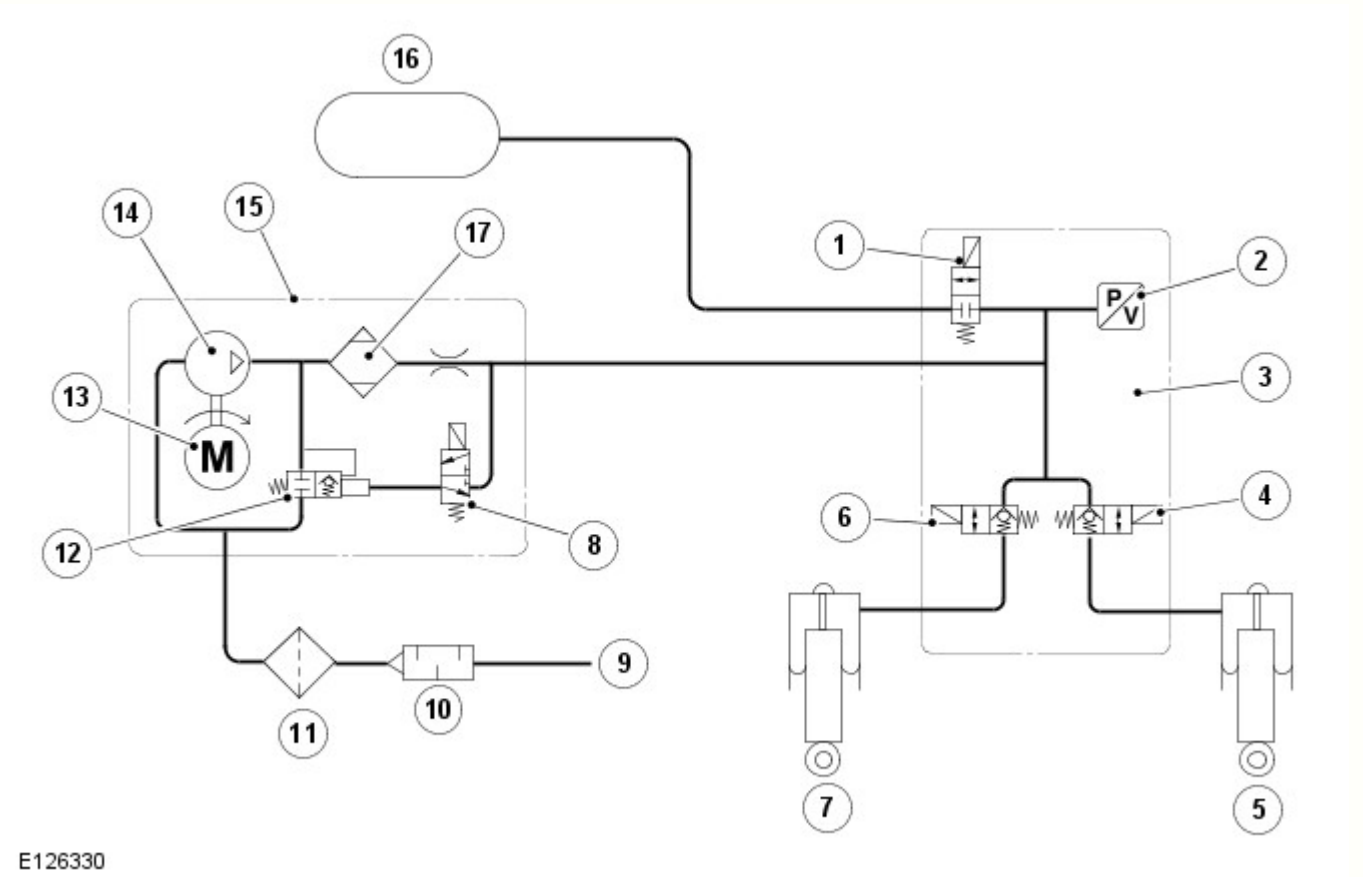
PRINCIPLES OF OPERATION - AIR SUSPENSION SYSTEM

The air suspension module adjusts the quantity of air in the springs to maintain the rear suspension at the required height. The air suspension module calculates a target height for the rear suspension based on the average height of the front suspension. If the actual height of the rear suspension is outside the tolerance band for the target height, for a given length of time, the air suspension module then adjusts the actual height to the target height. The normal tolerance band is ±9 mm (0.35 in.). This changes to ±3 mm (0.12 in.) when the vehicle is parked for 5 minutes with the engine running and all doors closed, or by putting the air suspension module into a special mode using Jaguar approved diagnostic equipment. When a door is open the tolerance band changes to -5/+20 mm (-0.20/+0.79 in.).

To decrease suspension height, the air suspension module opens the exhaust valve in the air compressor assembly and the air spring valves in the valve block to release air from the air springs. To raise the suspension height , the module opens the air spring valves to introduce air into the air springs using air from the reservoir and/or the compressor.

When vehicle speed is 22 mph (35 km/h) or less, the air suspension module normally uses air from the reservoir when it needs to raise the rear suspension. This ensures that the occupants are not disturbed by noise from the air compressor assembly. However, if the rear suspension is more than 30 mm (1.18 in.) below the target height, and there is insufficient pressure in the reservoir, the air suspension module uses the compressor to lift the suspension. When the rear suspension is more than 50 mm (2 in.) low, the air suspension module also sends a signal to the instrument cluster on the high speed CAN bus to display a Suspension Too Low message. If the vehicle is stationary the message is displayed with an amber triangle warning indicator; if the vehicle is moving a red triangle warning indicator is displayed with the message.

Air Suspension System Schematic



E126330

Item	Description
1	Reservoir valve
2	Pressure sensor
3	Valve block
4	RH air spring valve
5	RH air spring

6	LH air spring valve
7	LH air spring
8	Pilot exhaust valve
9	Inlet/Exhaust
10	Silencer
11	Filter
12	Main exhaust valve
13	Electric motor
14	Compressor
15	Air compressor assembly
16	Reservoir
17	Air drier

System Inhibits

The air suspension module is programmed to inhibit normal height change operation under conditions where it is undesirable.

To reduce the trap hazard, height changes are restricted when any of the vehicle doors are open. This restriction is removed if the vehicle speed exceeds 5 mph (8 km/h).

If the vehicle is jacked, the air suspension module detects the condition a few seconds after starting to correct the suspension height. The same logic also detects if the rear of the vehicle is grounded. If it detects one of these conditions, the air suspension module inhibits normal leveling control. If the rear wheels subsequently start to spin, the air suspension module raises the rear suspension to help release the vehicle from grounding. Normal leveling control resumes when the engine is running and the rear suspension is more than 30 mm (1.18 in.) below the nominal kerb weight height, or the vehicle speed exceeds 10 mph (15 km/h).

Diagnostics and Maintenance

When vehicles are set to transportation mode the air suspension system adopts different functionality to optimize the rear suspension height for loading and off-loading clearances. The vehicle can be switched in and out of transportation mode using Jaguar approved diagnostic equipment. In transportation mode, the rear suspension height is set to 25 mm (1 in.) above the nominal design height. If the suspension height is lower than the transportation mode set point, the message Vehicle Too Low is also displayed in the message center. When the correct height is reached (engine running) the Vehicle Too Low message is switched off.

The air suspension system has a number of special modes that may be used during vehicle servicing or repair. These modes can disable the air suspension system, make it operate within tighter tolerances or deflate the air springs and/or reservoir. While one of these modes is active the message Air Suspension Not in Customer Mode is displayed in the instrument cluster. The air suspension system is set in and out of these modes using Jaguar approved diagnostic equipment.

If a fault occurs in the air suspension system, a related DTC (diagnostic trouble code) is stored in the air suspension module. The air suspension module adopts a default leveling strategy which is most appropriate for the fault and vehicle safety. This reduces the functionality of the air suspension system depending on the type and severity of fault. A message is displayed, and an amber or red warning indicator is illuminated, in the instrument cluster. A warning chime may sound when the fault message is displayed.

The following table lists the air suspension system warning indicators, messages and chimes:

Triangle Warning Indicator	Message	Chime	Fault	Action
Amber	Suspension Fault	Alert chime when message first displayed	Fault detected that may result in some reduction in system performance or refinement	Rectify fault
Amber	Vehicle Too Low	Vehicle in transportation mode: Information chime repeated while vehicle is too low; chime stops when transportation height achieved	Vehicle rear too low when loading. Displayed when vehicle at rest if too low	Wait until vehicle has risen before driving
Amber	Vehicle Too Low	Vehicle not in transportation mode: No chime	The rear suspension is more than 50 mm (2 in.) below nominal height and the vehicle is at rest	Wait until vehicle has risen before driving
Red	Vehicle Too Low	Vehicle in transportation mode: Information chime repeated while vehicle is too low; chime stops when loading height achieved	Vehicle rear too low when loading and vehicle is moving	Stop until vehicle has risen
Red	Vehicle Too Low	Vehicle not in transportation mode: No chime	The rear suspension is more than 50 mm (2 in.) below nominal height and the vehicle is moving.	Stop or proceed cautiously until vehicle has risen
	Air			

Amber	Suspension Not In Customer Mode	No chime	Air suspension system is in special mode used for vehicle servicing or repair	Change to customer mode with Jaguar approved diagnostic equipment

The following system fault will not necessarily cause a DTC to be set:

Symptom	Possible Cause
Vehicle leans / tilts after being left overnight or for some days	Leak from air spring or air spring valve

Calibration or height setting is the process of adjusting the values stored in the air suspension module for the suspension height sensor offsets for each of the four corners. Each of the suspension height sensors measures the position of the associated wheel with respect to the vehicle chassis and generates a corresponding voltage signal. Each of these voltage signals is read by the module and converted to a height value in millimeters. Ideally this height value would exactly match the actual value for each wheel, however, due to build and component tolerances there can be an offset between these two sets of values.

The calibration process sets the necessary value for this offset for each suspension height sensor so that the actual and calculated values are equal. System calibration is required in the following cases:

- A suspension height sensor is removed or replaced.
- A replacement air suspension module is fitted.
- If the suspension on any corner is dismantled and rebuilt.

The calibration procedure is carried out using Jaguar approved diagnostic equipment and a suspension height measurement tool.

The air suspension module contains a self test function, that can be activated by Jaguar approved diagnostic equipment. The test is primarily an electrical test. Checks for stuck valves or leaking valves etc. are not included.

The test routine activates each output (valves and compressor) in turn, and monitors electrical connections. The routine takes approximately 30 seconds to complete, but may be terminated immediately by switching the ignition off. Operation of the valves during this test may cause small quantities of air flow into or out of the air springs. As a result the vehicle may make small changes in height.

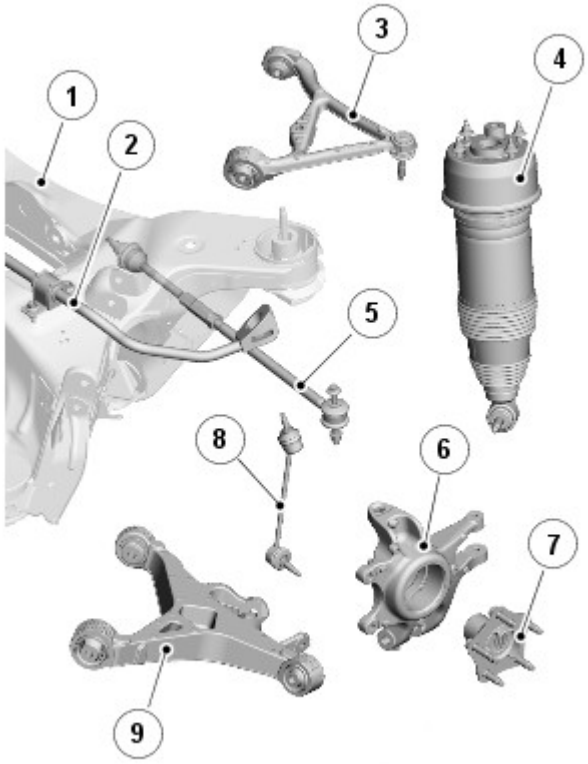
The self test operates in the following sequence:

- Opens exhaust valve 100%, then closes valve.
- Turns compressor on and off.
- Opens rear left air spring valve 100%, then closes valve.
- Opens rear right air spring valve 100%, then closes valve.
- Opens the reservoir valve 100% for 2 seconds, then closes valve.

To de-pressurize the system air is vented through the valve block, the air compressor assembly (which regenerates the air drier), the filter and the silencer to atmosphere. The system is pressurized using the air compressor assembly. The de-pressurization and pressurization of the air suspension system is initiated using Jaguar approved diagnostic equipment.

Component Description

REAR SUSPENSION



E126331

Item	Description
1	Rear subframe
2	Stabilizer bar
3	Upper control arm
4	Spring and damper assembly
5	Toe link
6	Wheel knuckle
7	Wheel hub and bearing assembly
8	Stabilizer bar link
9	Lower control arm

Upper Control Arm

The cast aluminum upper control arm locates to the subframe via one cross-axis joint and one plain rubber bush, and links to the wheel knuckle via an integral ball joint.

Lower Control Arm

The aluminum lower arm locates to the subframe via one cross-axis joint and one plain rubber bush, and to the wheel knuckle via a second plain rubber bush.

The rear of the control arm has mounting points for the damper and the stabilizer link.

Toe Link

Each toe link is located between the wheel knuckle and a bracket on the subframe.

The toe links comprise an inner rod with integral axial ball joint. The inner ball joint has a threaded spigot which locates in the bracket on the subframe and is secured with a locknut. The rod has an internal thread which accepts the outer rod.

The outer rod has a cross-axis joint at its outer end which is located in a clevis on the wheel knuckle, and is secured with a bolt and locknut.

The length of the toe link can be adjusted by rotating the inner rod. This allows for adjustment of the toe angle for the rear wheel. Once set, the inner rod can be locked in position by tightening a locknut on the outer rod against the inner rod.

Wheel Knuckle

The cast aluminum wheel knuckle attaches to:

- The upper control arm via a ball-joint located in the arm.
- The lower control arm via a plain rubber bush located in the arm.
- The toe link via a cross-axis joint located in the toe link.

The wheel knuckle also provides the mounting locations for the:

- Wheel hub assembly.
- Wheel bearing.
- Wheel speed sensor.
- Brake caliper.
- Brake disc shield.

Stabilizer Bar

All vehicles have a 17 mm (in.) stabilizer bar installed to help control the roll rate of the vehicle.

The stabilizer bar is attached to the top of the subframe with two bushes and mounting brackets. The stabilizer bar has collars crimped into the bar at the inside edges of the bushes. The collars prevent sideways movement of the stabilizer bar.

Each end of the stabilizer bar curves rearward to attach to a ball joint on each stabilizer link. Each link is attached via a second ball joint to a cast bracket on the lower control arm. The links allow the stabilizer bar to move with the wheel travel providing maximum effectiveness.

Spring and Damper Assembly

Each spring and damper assembly is attached to a cast bracket on the lower control arm and to the vehicle body by four studs secured by torque retaining nuts.

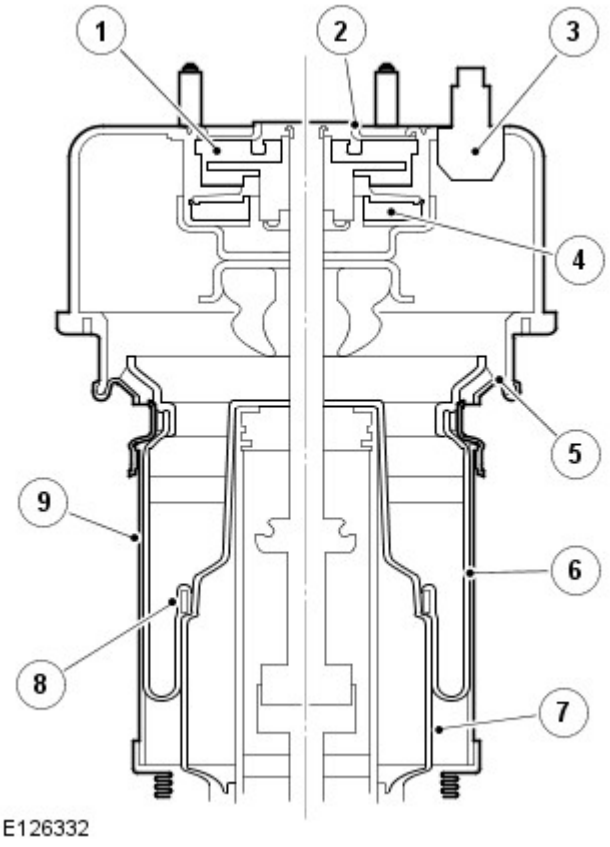
Each spring and damper assembly incorporates:

- An adaptive dynamics damper, which enables the damping characteristics of the suspension to be adjusted. Refer to: Vehicle Dynamic Suspension (204-05 Vehicle Dynamic Suspension, Description and Operation).
- An air spring, controlled by the air suspension system.

AIR SUSPENSION SYSTEM

Air Springs

Section Through Air Spring



Item	Description
1	Top mount assembly
2	Polyurethane damper mounting
3	Pressure retaining valve
4	Damper mounting seal
5	Air spring isolator
6	Air spring rolling sleeve
7	Air spring piston
8	Air spring rolling sleeve to piston crimp ring
9	Decoupled air spring guide

The air springs take the place of conventional coil springs on the rear suspension. In the air spring, a piston compresses the air as the suspension moves into bump/jounce, which cushions the movement. A rubber rolling sleeve is guided by an outer metal support sleeve and assembled around the damper. The metal support sleeve is decoupled from the top mount assembly, which allows greater damper articulation without trapping the air sleeve. This design delivers improved ride characteristics compared to a non-guided air spring, and reduces high frequency generated inputs such as those produced by a coarse road surface, for example.

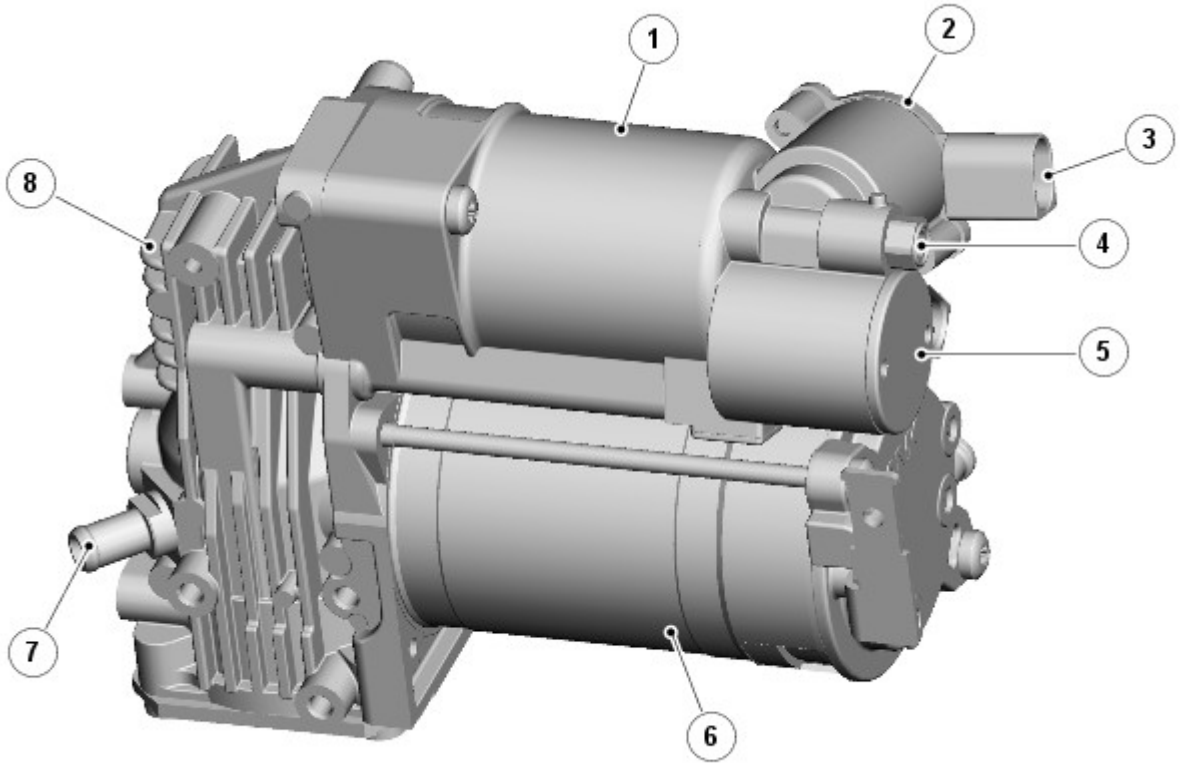
The key sealing points for the air spring are between the:

- Piston and damper body.
- Spring unit and top mount.

The method of achieving a pressure-tight seal between the air spring and the damper means that spring and damper assemblies must be replaced as a complete unit.

The air-tight top mount assembly isolates the damper from the body structure while maintaining pressure within the spring. A pressure retaining valve in the top mount ensures that air cannot be exhausted from the air spring when the pressure is less than 3.0 bar (43.5 lbf/in ^{2}). This ensures that the rolling sleeve does not crease and become damaged. The maximum pressure in the full-bump condition at GVW (gross vehicle weight) is approximately 20 bar (290 lbf/in ^{2}).

Air Compressor Assembly



E126333

Item	Description
1	Air drier
2	Pilot exhaust valve
3	Electrical connector

4	HP (high pressure) outlet port (to valve block)
5	Main exhaust valve
6	Electric motor
7	Air intake/exhaust port
8	Compressor housing

The air compressor assembly is installed in the luggage compartment, on a bracket in the rear right corner of the spare wheel well. For NVH (noise, vibration and harshness) reasons, the air compressor assembly is attached to the bracket by three isolator mountings, each incorporating a rubber snubbing bush and a metal spring.

The air compressor assembly incorporates:

- A two stage compressor driven by an electric motor.
- An air drier.
- A main exhaust valve.
- A pilot exhaust valve.
- An air intake / exhaust port.
- A HP outlet port.

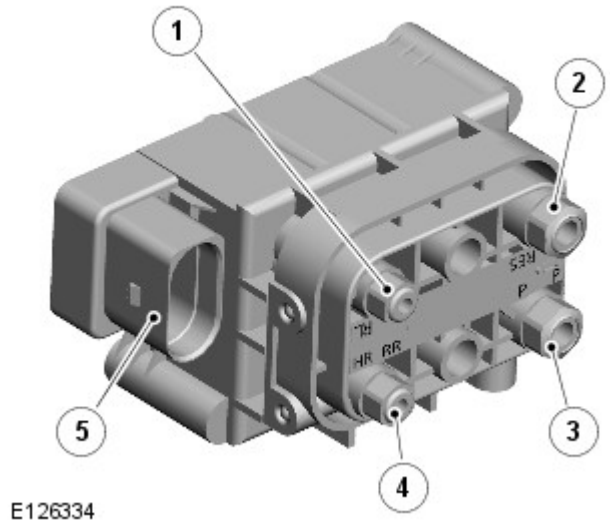
The compressor motor is operated by power from the air suspension relay in the RJB , which is controlled by the air suspension module. To prevent damage caused by overheating, the temperature of the compressor and motor is calculated by a software model in the air suspension module. The calculated temperature is based on compressor operating pressure, voltage, time and ambient air temperature. The air suspension module discontinues compressor operation if the calculated temperature increases to 100 °C (212 °F). Compressor operation resumes when the air suspension module calculates the temperature has decreased to 80 °C (176 °F).

The air drier removes moisture from the air delivered by the compressor to the HP outlet port, and consists of a chamber that contains water absorbing desiccant beads. When the air suspension system is depressurized, air is vented back through the air compressor assembly, to initiate air drier regeneration. The clean dry air vented from the system re-activates the desiccant beads.

The main exhaust valve controls the release of air from the air suspension system through the air intake / exhaust port. It also acts as a PRV (pressure relief valve) and minimum pressure retention valve. The PRV function limits the maximum pressure from the compressor to 17.5 bar (254 lbf/in ^{2}). The minimum pressure retention function limits the minimum pressure in the system to between 0.25 and 1.00 bar (3.75 and 14.5 lbf/in ^{2}).

The pilot exhaust valve is a solenoid operated valve that controls the operation of the main exhaust valve. A PWM (pulse width modulation) signal from the air suspension module controls the pilot exhaust valve to apply system pressure to the pilot chamber of the main exhaust valve.

Valve Block



Item	Description
1	LH air spring pipe connector
2	Reservoir pipe connector
3	Compressor pipe connector
4	RH air spring pipe connector
5	Electrical connector

The valve block is used by the air suspension module to control the flow of air between the air compressor assembly, the reservoir and the two air springs. The valve block is installed in the luggage compartment spare wheel well, on the same bracket as the air compressor assembly. Three isolator grommets locate the valve block mounting plate on the bracket.

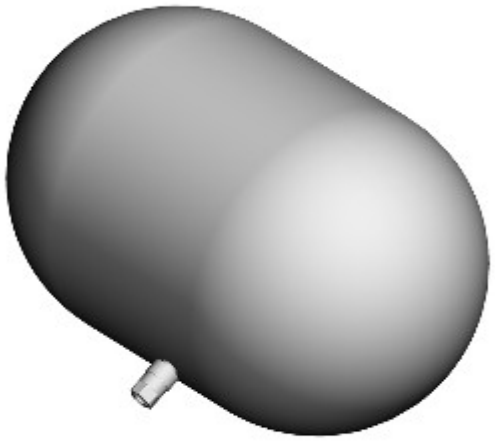
The valve block incorporates:

- Three normally closed solenoid valves, one for each of the rear air springs and one for the reservoir.
- A pressure sensor to monitor the pressure in the line between the air compressor assembly and the three solenoid valves.

The solenoid valves control the air flow into and out of the air springs and the reservoir, and are operated by PWM signals from the air suspension module.

The air suspension module uses the pressure sensor signal to decide when to pressurize the air springs directly from the air compressor assembly, or from the pressurized air stored in the reservoir.

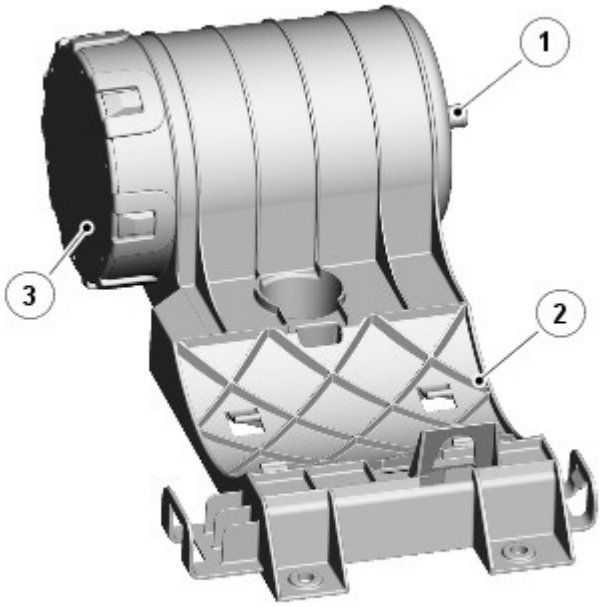
Reservoir



E126335

The reservoir stores a supply of pressurized air for immediate use by the system, which enables quiet system operation at low speeds. The reservoir is installed in the luggage compartment, on a bracket under the spare wheel, and has a capacity of 3.7 liters (226 in. ^{3}). Pressure in the reservoir is controlled by the air suspension module at a nominal maximum of 16.5 bar (239 lbf/in. ^{2}).

Silencer



E126336

Item	Description
1	Air intake/exhaust pipe connector
2	Reservoir bracket
3	Air intake/exhaust cap

The silencer is integrated into the reservoir bracket, and functions as an air intake and exhaust silencer. Air is exhausted as the system is leveling down.

Air Distribution Pipes

A series of pipes carry pressurized air between the system components. The air spring pipes are integrated into the electrical harnesses. The air compressor assembly to valve block pipe is separate from the other pipes, while the valve block to reservoir pipe is clipped together with the intake/exhaust pipe. A filter, attached to the underside of the air compressor assembly, is installed in the intake/exhaust pipe.

Air Suspension Module

E126559

The air suspension module uses a combination of information from other system modules and data from the suspension height sensors to measure the vehicle and suspension states. Using this information, the air suspension module applies algorithms to control the rear suspension height required for the current driving conditions.

The air suspension module is installed on the RH side of the luggage compartment, together with the adaptive damping module, on a bracket attached to the rear quarter panel.

The air suspension module receives the following signals on the high speed CAN bus:

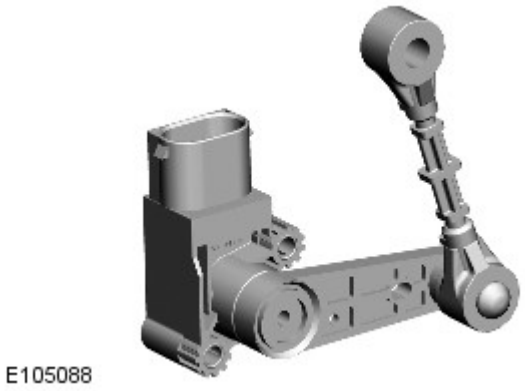
- Vehicle speed - ABS module.
- Wheel speed sensors - ABS module.
- Lateral acceleration - ABS module.
- Steering wheel angle - ABS module.
- Steering wheel angle status - ABS module.
- Engine speed - ECM .
- Gear position target - TCM .
- Vehicle information parameters - CJB .
- CCF (car configuration files) - CJB .
- Power mode (ignition signal) - CJB .

The air suspension module outputs information on the high speed CAN bus for use by other systems as follows:

- Fault message - instrument cluster.
- Individual suspension heights - other systems as required.

Suspension Height Sensors

NOTE: Rear sensor shown, front sensors similar.



Four suspension height sensors are used in the air suspension system, two for the front suspension and two for the rear suspension. A front suspension height sensor is attached to each side of the front subframe and connected by a sensor arm and sensor link to the related lower lateral arm of the front suspension. A rear suspension height sensor is attached to each side of the rear subframe and connected by a sensor arm and sensor link to the related upper control arm of the rear suspension. On each suspension height sensor, the sensor arm and sensor link convert linear movement of the suspension into rotary movement of the sensor shaft.

Each suspension height sensor contains two independent sensors:

- Sensor 1 is used by the air suspension system.
- Sensor 2 is used by the adaptive dynamics system.
  Refer to: Vehicle Dynamic Suspension (204-05 Vehicle Dynamic Suspension, Description and Operation).

The suspension height sensors measure suspension displacement at each corner of the vehicle and output a corresponding analogue signal to the air suspension module. The data from the sensors is filtered and processed by the air suspension module, and used to ensure that the vehicle remains level and at the correct height at all times by regulating the supply of air to each rear air spring unit.

Each suspension height sensor is connected to the air suspension module via three wires, which supply ground, 5 V supply and signal return.

Each sensing element consists of an array of Hall effect devices arranged to measure the direction of the magnetic field of a small magnet attached to the end of the sensor shaft. As the sensor shaft rotates, so do the lines of magnetic flux from the attached magnet. The signals from each of the Hall effect elements are processed by means of a dedicated integrated circuit, to generate an output voltage that varies as the sensor shaft is rotated. The sensor has a measurement range of ± 40° around its nominal position and the nominal sensitivity is 57 mv/° of shaft rotation.

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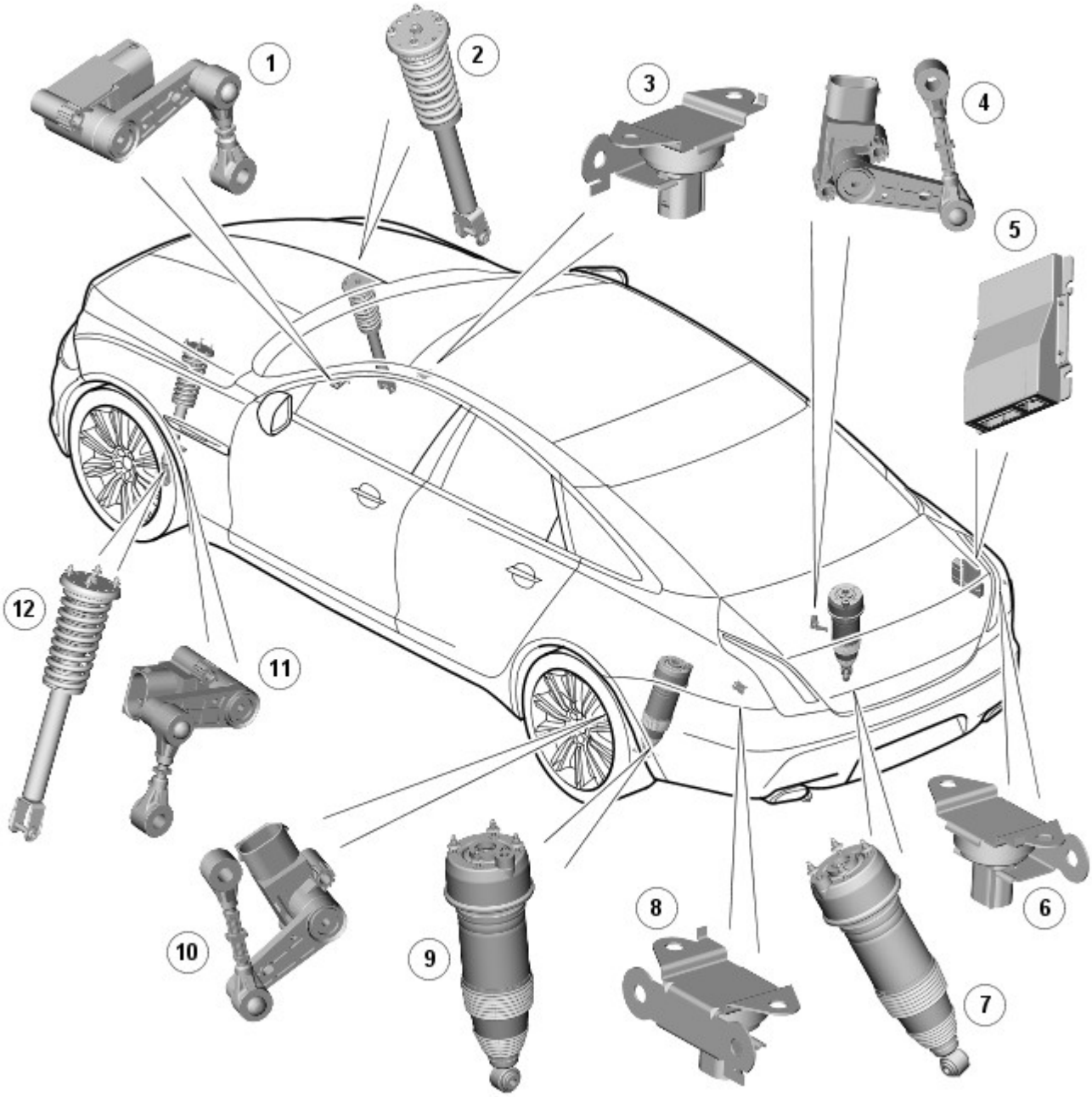
Vehicle Dynamic Suspension - Vehicle Dynamic Suspension - Component Location

Description and Operation

COMPONENT LOCATION



E121118

Item	Description
1	RH (right-hand) front suspension height sensor
2	RH front spring and damper assembly
3	Front vertical accelerometer
4	RH rear suspension height sensor
5	ADM (adaptive damping module)
6	RH rear vertical accelerometer
7	RH rear spring and damper assembly
8	LH (left-hand) rear vertical accelerometer
9	LH rear spring and damper assembly
10	LH rear suspension height sensor
11	LH front suspension height sensor
12	LH front spring and damper assembly

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Vehicle Dynamic Suspension - Vehicle Dynamic Suspension

Diagnosis and Testing

Principle of Operation

For a detailed description of the adaptive damping system and operation, refer to the relevant Description and Operation section of the workshop manual.
REFER to: Vehicle Dynamic Suspension (204-05 Vehicle Dynamic Suspension, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

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

1. Verify the customer concern.

2. Visually inspect for obvious signs of damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Coil spring(s) • Shock absorber(s) • Accelerometer(s) installation	• Fuse(s) • Wiring harness/electrical connectors • Accelerometer(s) • Adaptive Damping Control Module

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 cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC index.

Symptom Chart

Symptom	Possible Message	Possible Other Warnings	Possible Causes	Action
Vehicle on bump stops	• Suspension fault	• Two chimes repeated regularly Red indicator permanently illuminated	• Water ingress to wiring harness or connectors • Air leak(s) • Vehicle in transportation mode • System not calibrated or calibration corrupt • Implausible articulation symptoms detected • Failure of multiple height sensors • Air suspension control module failure	Visually inspect the wiring harness and connectors for water ingress. Visually inspect the system for air leakage. Check the system mode and calibration using the approved diagnostic system. Check for implausible articulation symptoms, i.e. height sensor or linkage fault, deflated air spring, under inflated tire etc. Note implausible articulation symptoms may be caused by an un-calibrated height sensor. Check for height sensor DTCs and refer to the DTC index. Refer to the warranty policy and procedures manual if a module is suspect.
Vehicle does not sit level	• Suspension fault	• Two chimes repeated regularly Red indicator	• Water ingress to wiring harness or connectors • Air leak(s) • Calibration corrupt • cross-link valve fault • Height sensor fault • Reservoir valve stuck open	Visually inspect the wiring harness and connectors for water ingress. Visually inspect the system for air leakage and refer to the guided diagnostic routine on the approved diagnostic system. Check the system calibration using the approved diagnostic system. For front and rear cross link valve tests refer to the guided diagnostic routine on the approved diagnostic system. Check for height sensor DTCs and refer to the DTC index.

		permanently illuminated	• Exhaust valve stuck closed • Corner valves stuck open • Air suspension control module failure	For reservoir and exhaust valve tests refer to the guided diagnostic routine on the approved diagnostic system. Check for corner valve DTCs and refer to the DTC index. Refer to the warranty policy and procedures manual if a module is suspect.
Vehicle sits too low	• Suspension fault • Dynamic stability control (DSC)	• Two chimes, amber indicator permanently illuminated • One chime • DSC amber indicator permanently illuminated • ABS indicator permanently illuminated	• Water ingress to wiring harness or connectors • Air leak(s) • Air suspension compressor temperature sensor fault • Inlet air filter blockage/restriction • Air suspension compressor fault • Exhaust valve stuck/sticking • Air suspension control module lost communication with ABS module • ABS fault. • Air suspension control module failure	Visually inspect the wiring harness and connectors for water ingress. Visually inspect the system for air leakage. For air compressor temperature sensor, inlet air filter, exhaust valve and air compressor tests refer to the guided diagnostic routine on the approved diagnostic system. For Air suspension control module lost communication with ABS module, refer to the lost communication codes statement at the end of this table. Check for ABS DTCs, Refer to the relevant section of the workshop manual. Refer to the warranty policy and procedures manual if a module is suspect.
Vehicle sits too high	• Suspension fault	• Two chimes, amber indicator permanently illuminated	• Reservoir valve stuck open • Exhaust valve stuck closed • Corner valves stuck open • Air suspension control module failure	For reservoir valve and exhaust valve tests refer to the guided diagnostic routine on the approved diagnostic system. Check for corner valve DTCs and refer to the DTC index. Refer to the warranty policy and procedures manual if a module is suspect.
System detects extended mode unnecessarily when lowering	• -	• -	• Crossed gallery and air spring pipes • Incorrect valve block installed to front or rear • Damage or blockage in air harness	Refer to the guided diagnostic routine on the approved diagnostic system.
Vehicle leans/tilts after being left over-night or for some days	• -	• -	• Leaking air spring(s) • Leak from corner valve to gallery • Exhaust valve stuck open	Refer to the guided diagnostic routine on the approved diagnostic system.
After vehicle left over-night or for some days system regularly indicates "Suspension vehicle raising slowly" when first driving off	• Suspension vehicle raising slowly	• -	• Leaking air spring(s) • Leaking reservoir	Refer to the guided diagnostic routine on the approved diagnostic system.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Adaptive Damping Module (SUMB) (100-00, Description and Operation).

U3003-1C	Battery voltage - Circuit voltage out of range	Voltage at adaptive damping control module < 10.5v or Supply Voltage at adaptive damping control module > 18v for 30s)	• Check the battery is in good condition and fully charged, refer to the battery care manual. Refer to the starting and charging section of the workshop manual and check the performance of the charging system. Refer to the electrical circuit diagrams and check power and ground circuit to adaptive damping control module for faults, including intermittent high resistance
U3003-62	Battery Voltage - Signal compare failure	• High Resistance Connections • Adaptive Damping Control module Internal Failure	• Check the battery is in good condition and fully charged, refer to the battery care manual. Refer to the starting and charging section of the workshop manual and check the performance of the charging system. Refer to the electrical circuit diagrams and check power and ground circuit to adaptive damping control module for faults, including intermittent high resistance

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Vehicle Dynamic Suspension - Vehicle Dynamic Suspension

Diagnosis and Testing

Principle of Operation

For a detailed description of the adaptive damping system and operation, refer to the relevant Description and Operation section of the workshop manual.
REFER to: Vehicle Dynamic Suspension (204-05 Vehicle Dynamic Suspension, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

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

1. Verify the customer concern.

2. Visually inspect for obvious signs of damage and system integrity.

Visual Inspection

Mechanical	Electrical
• Coil spring(s) • Shock absorber(s) • Accelerometer(s) installation	• Fuse(s) • Wiring harness/electrical connectors • Accelerometer(s) • Adaptive Damping Control Module

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 cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC index.

Symptom Chart

Symptom	Possible Message	Possible Other Warnings	Possible Causes	Action
Vehicle on bump stops	• Suspension fault	• Two chimes repeated regularly Red	• Water ingress to wiring harness or connectors • Air leak(s) • Vehicle in transportation mode • System not calibrated or calibration corrupt	Visually inspect the wiring harness and connectors for water ingress. Visually inspect the system for air leakage. Check the system mode and calibration using the approved diagnostic system. Check for implausible articulation symptoms, i.e. height sensor or linkage fault, deflated air spring, under inflated tire etc. Note

		indicator permanently illuminated	• Implausible articulation symptoms detected • Failure of multiple height sensors • Air suspension control module failure	implausible articulation symptoms may be caused by an un-calibrated height sensor. Check for height sensor DTCs and refer to the DTC index. Refer to the warranty policy and procedures manual if a module is suspect.
Vehicle does not sit level	• Suspension fault	• Two chimes repeated regularly Red indicator permanently illuminated	• Water ingress to wiring harness or connectors • Air leak(s) • Calibration corrupt • cross-link valve fault • Height sensor fault • Reservoir valve stuck open • Exhaust valve stuck closed • Corner valves stuck open • Air suspension control module failure	Visually inspect the wiring harness and connectors for water ingress. Visually inspect the system for air leakage and refer to the guided diagnostic routine on the approved diagnostic system. Check the system calibration using the approved diagnostic system. For front and rear cross link valve tests refer to the guided diagnostic routine on the approved diagnostic system. Check for height sensor DTCs and refer to the DTC index. For reservoir and exhaust valve tests refer to the guided diagnostic routine on the approved diagnostic system. Check for corner valve DTCs and refer to the DTC index. Refer to the warranty policy and procedures manual if a module is suspect.
Vehicle sits too low	• Suspension fault • Dynamic stability control (DSC)	• Two chimes, amber indicator permanently illuminated • One chime • DSC amber indicator permanently illuminated • ABS indicator permanently illuminated	• Water ingress to wiring harness or connectors • Air leak(s) • Air suspension compressor temperature sensor fault • Inlet air filter blockage/restriction • Air suspension compressor fault • Exhaust valve stuck/sticking • Air suspension control module lost communication with ABS module • ABS fault. • Air suspension control module failure	Visually inspect the wiring harness and connectors for water ingress. Visually inspect the system for air leakage. For air compressor temperature sensor, inlet air filter, exhaust valve and air compressor tests refer to the guided diagnostic routine on the approved diagnostic system. For Air suspension control module lost communication with ABS module, refer to the lost communication codes statement at the end of this table. Check for ABS DTCs, Refer to the relevant section of the workshop manual. Refer to the warranty policy and procedures manual if a module is suspect.
Vehicle sits too high	• Suspension fault	• Two chimes, amber indicator permanently illuminated	• Reservoir valve stuck open • Exhaust valve stuck closed • Corner valves stuck open • Air suspension control module failure	For reservoir valve and exhaust valve tests refer to the guided diagnostic routine on the approved diagnostic system. Check for corner valve DTCs and refer to the DTC index. Refer to the warranty policy and procedures manual if a module is suspect.
System detects extended mode unnecessarily when lowering	• -	• -	• Crossed gallery and air spring pipes • Incorrect valve block installed to front or rear • Damage or blockage in air harness	Refer to the guided diagnostic routine on the approved diagnostic system.
Vehicle leans/tilts after being left			• Leaking air spring(s)	

over-night or for some days	• -	• -	• Leak from corner valve to gallery • Exhaust valve stuck open	Refer to the guided diagnostic routine on the approved diagnostic system.
After vehicle left over-night or for some days system regularly indicates "Suspension vehicle raising slowly" when first driving off	• Suspension vehicle raising slowly	• -	• Leaking air spring(s) • Leaking reservoir	Refer to the guided diagnostic routine on the approved diagnostic system.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Adaptive Damping Module (SUMB) (100-00, Description and Operation).