

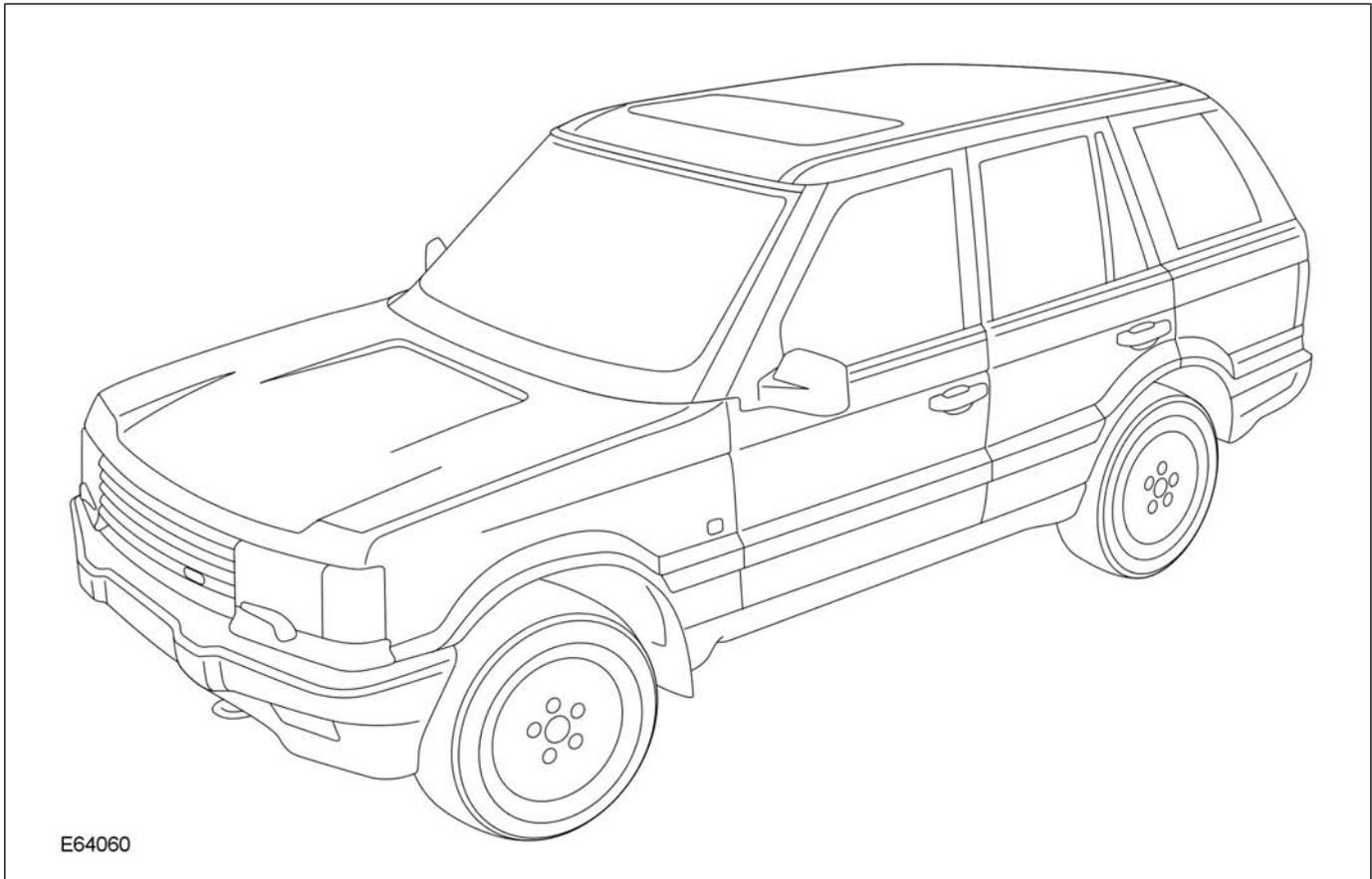
On completing this lesson, you will be able to:

- Describe the features and benefits of air suspension.
- Explain the different air suspension modes of operation.

RANGE ROVER (LP)

System Description

Range Rover (LP)



All Range Rover (LP) derivatives feature a four corner electronic air suspension system.

Electronic Air Suspension (EAS)

The Range Rover (LP) Electronic Air Suspension (EAS) system is already well established.

However, progressive development since introduction has resulted in added features to improve control and operation of the system.

Air springs provide a soft and comfortable feel to the ride and handling of the vehicle.

The use of a microprocessor to control the system exploits the advantages of air suspension even further.

Benefits

Air suspension systems provide a near constant ride frequency under all load conditions.

This results in:

- Improved ride quality
- Consistency in ride quality
- Constant ride height
- Improved headlamp leveling

Height Settings

The system provides five ride height settings, plus self leveling. Each setting is automatically maintained at the correct height by the system with minimum driver involvement.

Vehicle height is sensed by four rotary potentiometer type sensors. Height information from each sensor signals the ECU to adjust each air spring by switching the solenoid valves to increase or decrease air.

The five different height settings are as follows:

- Extended ride height
- High profile
- Standard ride height
- Low profile
- Access/Crawl mode

Ride Heights

All the height settings apart from standard height deviate either up or down from the standard height setting.

- Extended = 70 mm above standard ride height (setting is not driver selectable)
- High is 40 mm above standard ride height
- Standard ride height is designated as zero (0 mm), this is the datum point used for all height reference.
- Low is 25 mm below standard ride height (automatic and not driver selectable)
- Access is 65 mm below standard ride height
- Crawl mode is access ride height available up to 20 mph (32 km/h)

Self Leveling Description

On a coil sprung suspension vehicle the effect of adding weight results in the vehicle leaning.

The lean can either be front to rear or side to side unless the weight is evenly spread.

With an air suspension system the systems ECU detects any body lean and automatically compensates.

The vehicle will self level to the lowest corner height for 20 seconds each time the driver exits the vehicle and closes all the doors.

The system checks the vehicle height every six hours and makes minor corrections, not exceeding 8 mm.

WARNINGS:

 **Before commencing work which requires access to the underside or wheel arches of the vehicle, the suspension must be allowed to re-level.**

 **Re-leveling is achieved by opening and closing any of the doors, while all other doors and tailgate remain closed with the ignition off.**

 **The Electronic Air Suspension (EAS) must be set in 'High Lock' mode using the T4 diagnostic equipment during any work that does not require chassis to axle displacement.**

 **This will hold the suspension in the extended profile height position until reset by the T4 diagnostic equipment. This renders the vehicle safe to work on by preventing system inputs, e.g. pressing the height control switch.**

 **CAUTION: The underside of the vehicle must be kept clear of obstacles whilst the vehicle is parked, as self leveling may result in reduced vehicle trim height.**

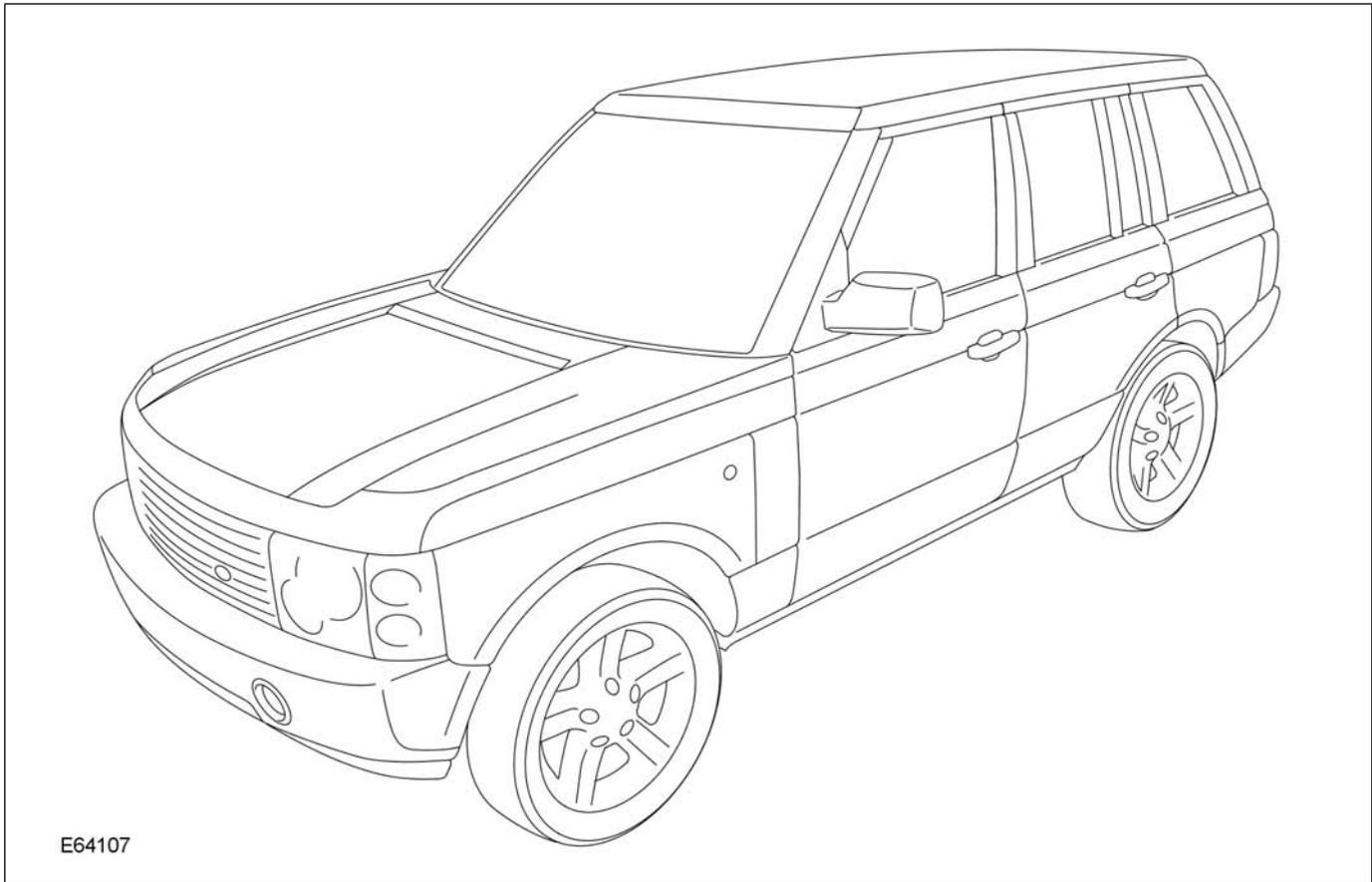
If the vehicle is parked on uneven ground or with a wheel or wheels on the kerb, the system will lower the vehicle to the lowest spring height.

When unloading through the tailgate, the system will self level to compensate for the decreased load after tailgate closure.

RANGE ROVER (LM)

System Description

Range Rover (LM)



All Range Rover (LM) derivatives feature a four corner electronic air suspension system.

Air Suspension Description

The main function of the four corner air suspension system is to maintain the vehicle at the correct ride height, irrespective of vehicle load.

Additionally, the system allows the driver to request ride height changes to improve the off-road performance or ease of access or loading.

The system automatically adjusts ride height settings to improve vehicle handling and dynamics when road speed increases or decreases.

System Height Settings

The system provides four ride height settings:

- Standard (used during most driving conditions)
- Off-Road (highest of the four settings, and raises the front of the vehicle 60 mm and the rear 50 mm)
- Motorway (lowers the vehicle by 20 mm to improve high speed handling)
- Access (lowers the vehicle by 40 mm when stationary or moving at very low speeds in order to improve access to the vehicle)

System Inhibits

The system will temporarily inhibit height adjustments when the vehicle is subject to cornering, heavy acceleration or heavy braking.

The inhibit function prevents unsettling of the vehicle by reducing the effective spring rates.

Height changes are also inhibited for safety reasons, when a door is opened and the vehicle is stationary for example.

Air Suspension ECU

The air suspension system fitted to Range Rover is controlled by an ECU located behind the passenger side of the fascia.

The ECU monitors the height of each corner of the vehicle by four height sensors, which are mounted in-board of each road wheel.

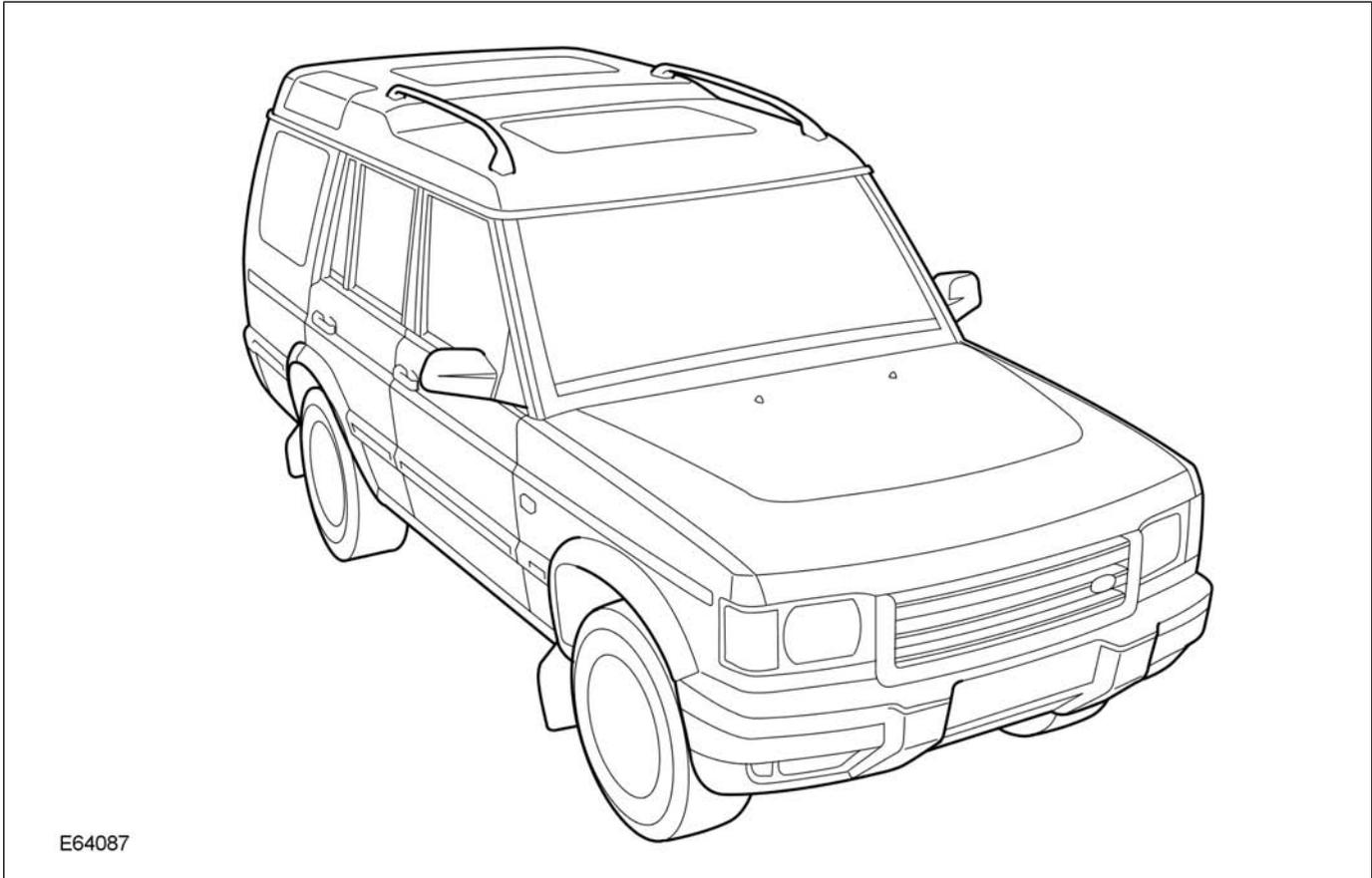
On-board diagnostics perform health checks on the air suspension system.

If faults are detected, codes are stored in the ECU and can be retrieved using the T4 diagnostic equipment (not the hand held unit).

DISCOVERY SERIES II

System Description

Discovery Series II



Self Leveling Suspension (SLS)

An optional feature for Discovery Series II is Self Leveling Suspension system (SLS).

This incorporates air springs for the rear axle with conventional springs fitted to the front of the vehicle.

Operates under control of the Self Leveling / Anti Lock Brakes (SLABS) ECU.

System used during most driving conditions and also provides the vehicle with additional height when traveling off-road.

Additional height is not driver selectable and will operate when a grounded chassis is sensed.

Vehicle Ride Heights

Standard Ride Height Mode:

- Used during most driving condition

Off-Road Ride Height Mode:

- Provides the vehicle with additional height when traveling off-road

Extended Ride Height Mode:

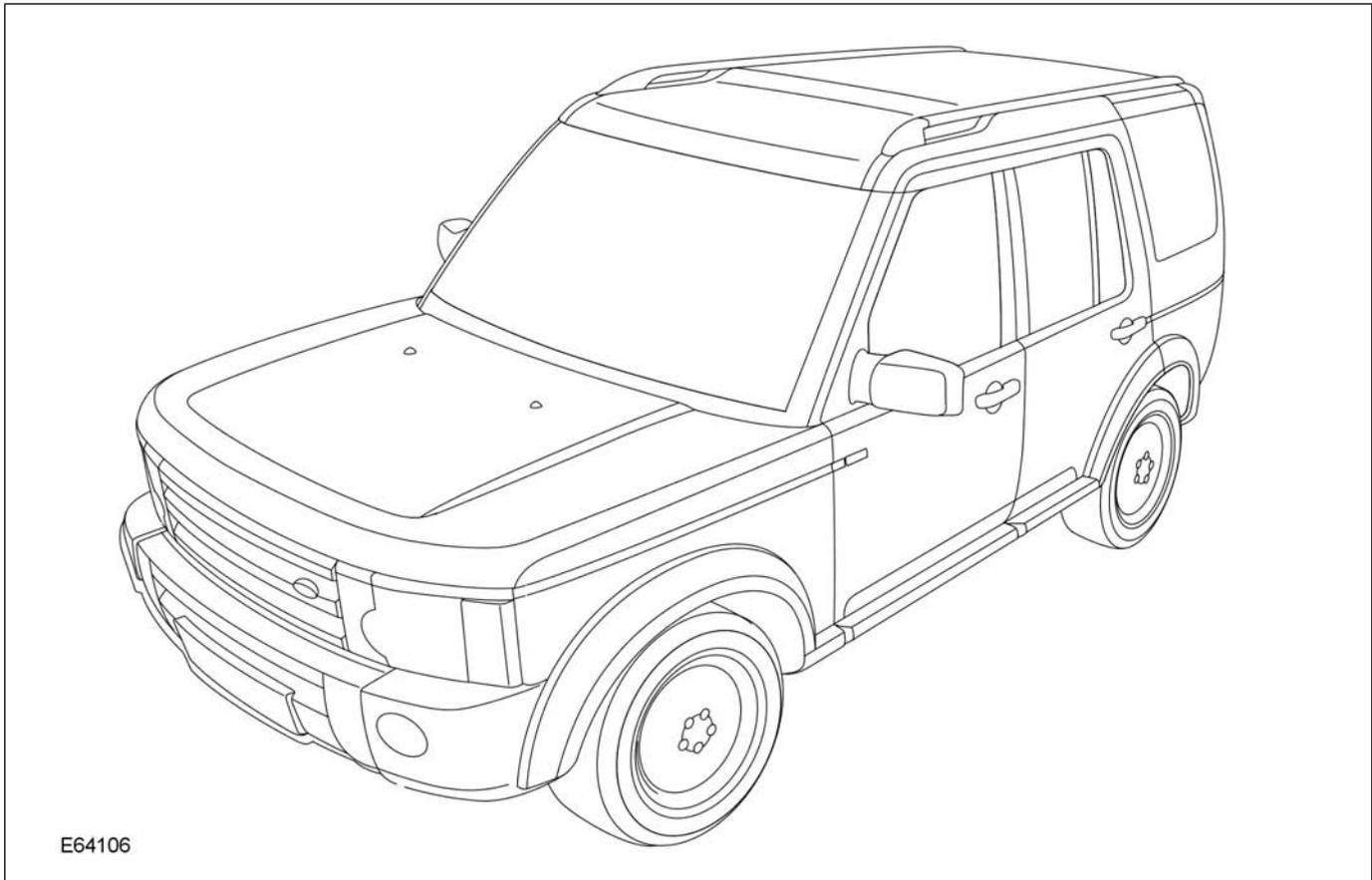
- Operates under direct control of the SLABS ECU
- It is not a driver selectable mode
- Operates when a grounded chassis is sensed

Transportation Mode:

- To be used whenever the vehicle is lashed down by its chassis frame for transportation purposes

DISCOVERY 3 / LR3**System Description**

Discovery 3 / LR3

**System Description**

The dynamic suspension system is a four corner air suspension system which is fitted to higher specification vehicles in place of the conventional damper and coil spring suspension used on non-air suspension models.

The dynamic suspension system is electronically controlled by an air suspension control module which controls the air supply unit, reacting to inputs from four height sensors and distributes air around the system via valve blocks.

System Components

The main air suspension system components are:

- Air suspension control module (Siemens)
- Air supply unit (Tokico)
- Four height sensors (AB electronics)
- Three valve block assemblies (Webber)
- Reservoir (NCJ)
- Air harness
- Four suspension air spring damper modules (Firestone)

Height Control

The four corner air suspension system maintains the vehicle height under all operating conditions by controlling the mass of air in the air springs.

The air suspension control module uses signals from the four height sensors to maintain the correct suspension height.

This is achieved by operating pneumatic control valves to increase or decrease the mass of air in the air spring damper modules.

The air suspension system has three driver selectable, pre-determined ride heights.

A driver interface indicates the selected ride height and direction of movement.

Additional information is also relayed to the driver via the instrument cluster message center (where fitted) and by audible warnings also transmitted by the instrument cluster.

Height changes can only be made when the engine is running and the driver and passenger doors are closed.

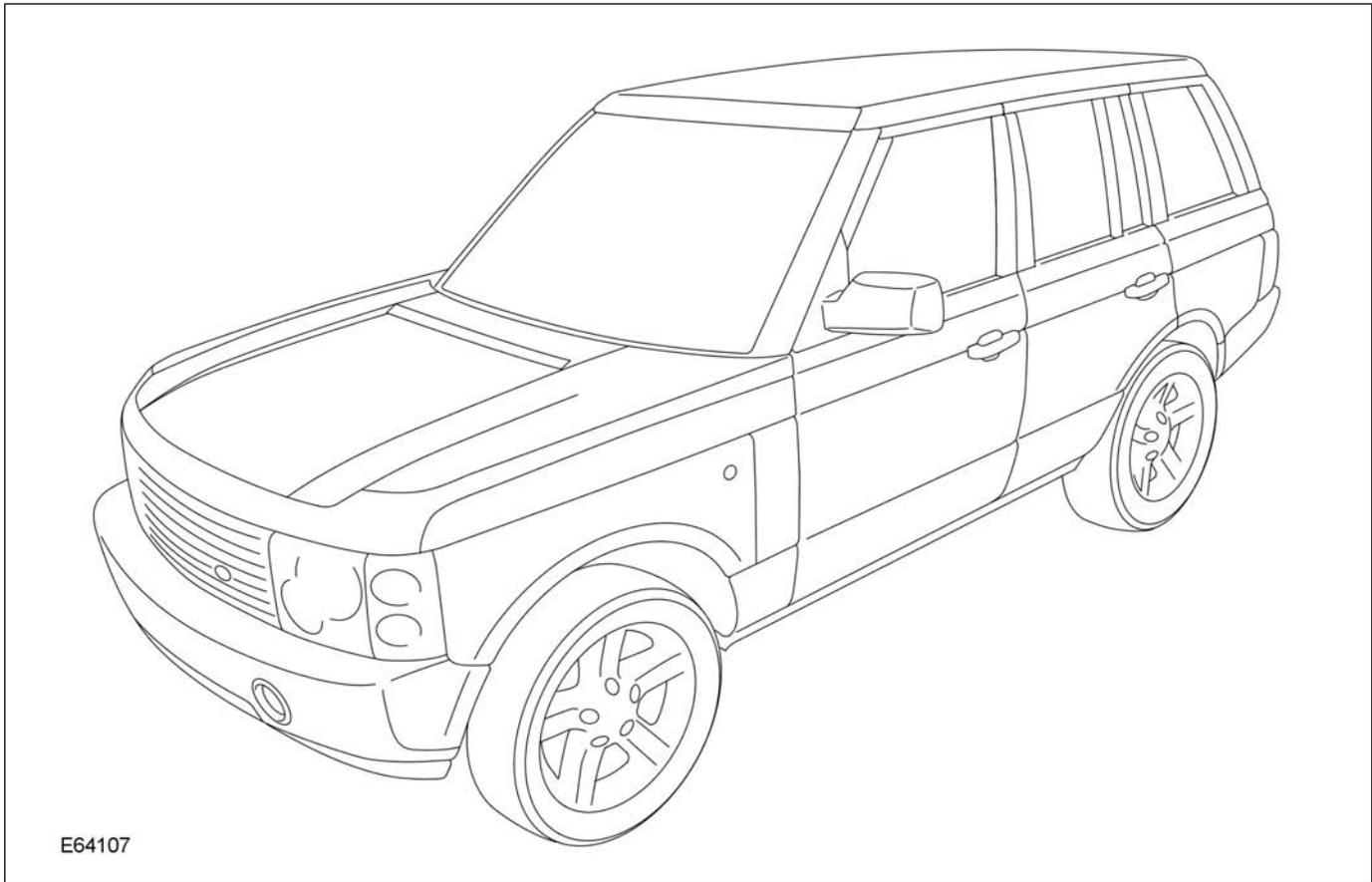
Access height can be selected with the engine not running, within 40 seconds of moving the ignition switch to the off position provided the driver's door has not been opened in this time.

The air suspension can be controlled manually by the driver using a switch on the center console to select the required height change.

2006MY Range Rover (LM)

System Description

Range Rover (LM)



The air suspension system is a four corner air suspension system which is fitted to all Range Rover 2006MY variants.

The system is electronically controlled by an air suspension control module which controls the air supply unit, reacts to inputs from four height sensors and distributes air around the system via valve blocks.

System Components

The main air suspension system components are:

- Air suspension control module
- Air supply unit
- Four height sensors

- Three valve block assemblies
- Reservoir
- Air harness
- Two front struts incorporating air spring damper modules
- Two rear air spring damper modules.

Height Control

The four corner air suspension system maintains the vehicle height under all operating conditions by controlling the mass of air in the air springs.

The air suspension control module uses signals from the four height sensors to maintain the correct suspension height, irrespective of vehicle load.

Additionally, the system allows the driver to request ride height changes to improve off-road performance or ease access or loading.

The system automatically adjusts the ride height to improve the vehicle handling and dynamics when speed increases or decreases.

This is achieved by operating pneumatic control valves to increase or decrease the mass of air in the air springs.

The air suspension system has three driver selectable, pre-determined ride heights and an automated high speed ride height.

A driver interface indicates the selected ride height and height change movement. Additional information is also relayed to the driver via the instrument cluster message center and by audible warnings also transmitted by the instrument cluster.

Most height changes can only be made when the engine is running and the driver's and passenger doors are closed.

Access height can be selected with the engine not running, within 40 seconds of moving the ignition switch to the off position provided the driver's door has not been opened in this time.

The air suspension can be controlled manually by the driver using a switch on the center console to select the required height change.

The system will temporarily inhibit height adjustments when the vehicle is subject to cornering, heavy acceleration or heavy braking.

The inhibit function prevents unsettling of the vehicle by reducing the effective spring rates.

Height changes are also restricted for safety reasons, when a door is opened and the vehicle is stationary for example.

Control Module

The air suspension system fitted to Range Rover is controlled by the air suspension control module which is located adjacent to the passenger compartment fusebox, behind the instrument panel.

The control module is housed in a plastic bracket attached to the 'A' pillar.

The control module monitors the height of each corner of the vehicle via four height sensors, which are mounted in-board of each road wheel.

The control module also performs an 'on-board diagnostic' function to perform 'health checks' on the system. If faults are detected, codes are stored in the control module and can be retrieved using T4.

Tolerance Control Bands

The air suspension control module has two ride height tolerance control bands:

Tolerance Band Settings:

- Normal tolerance
- Tight tolerance.

The tolerance bands are as follows:

- Normal ± 10 mm
- Tight ± 3 mm.

The tight tolerance band is only used if set by T4 for diagnostics or when the vehicle has been stationary for more than 5 minutes.

The control module considers the vehicle to be at target height if the current height is within the appropriate tolerance band.

Height adjustments are not made until the vehicle height falls outside of the tolerance band for a pre-determined time.

The time period is different depending on if the vehicle is moving or stationary.

Geometry Changes

off-road to access heights.

The suspension geometry changes when moving from

Refer to the following table for data:

Geometry Changed	Front	Rear
Toe change	30 mins	10 mins
Camber change	90 mins	90 mins