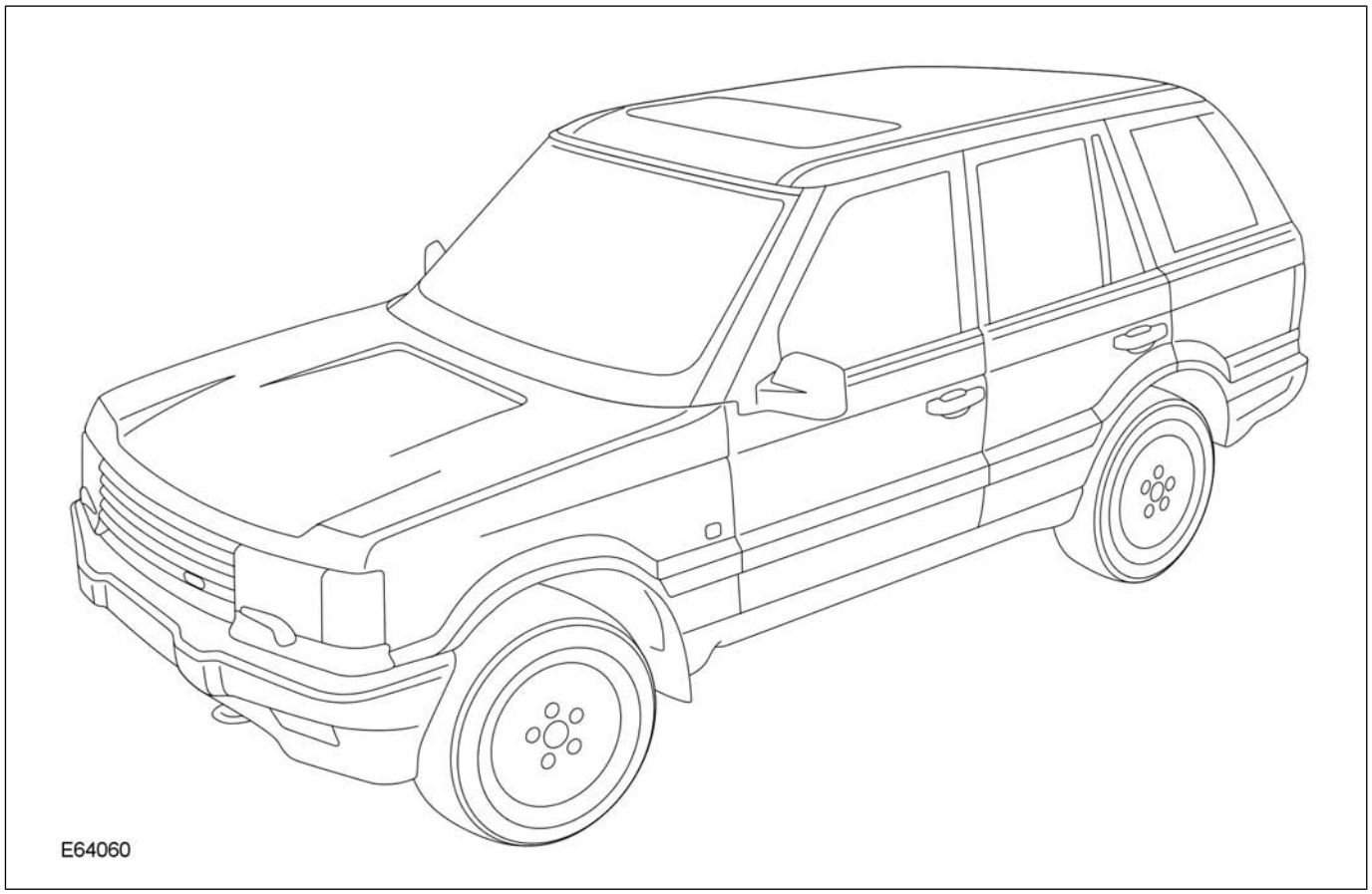
On completing this lesson, you will be able to:

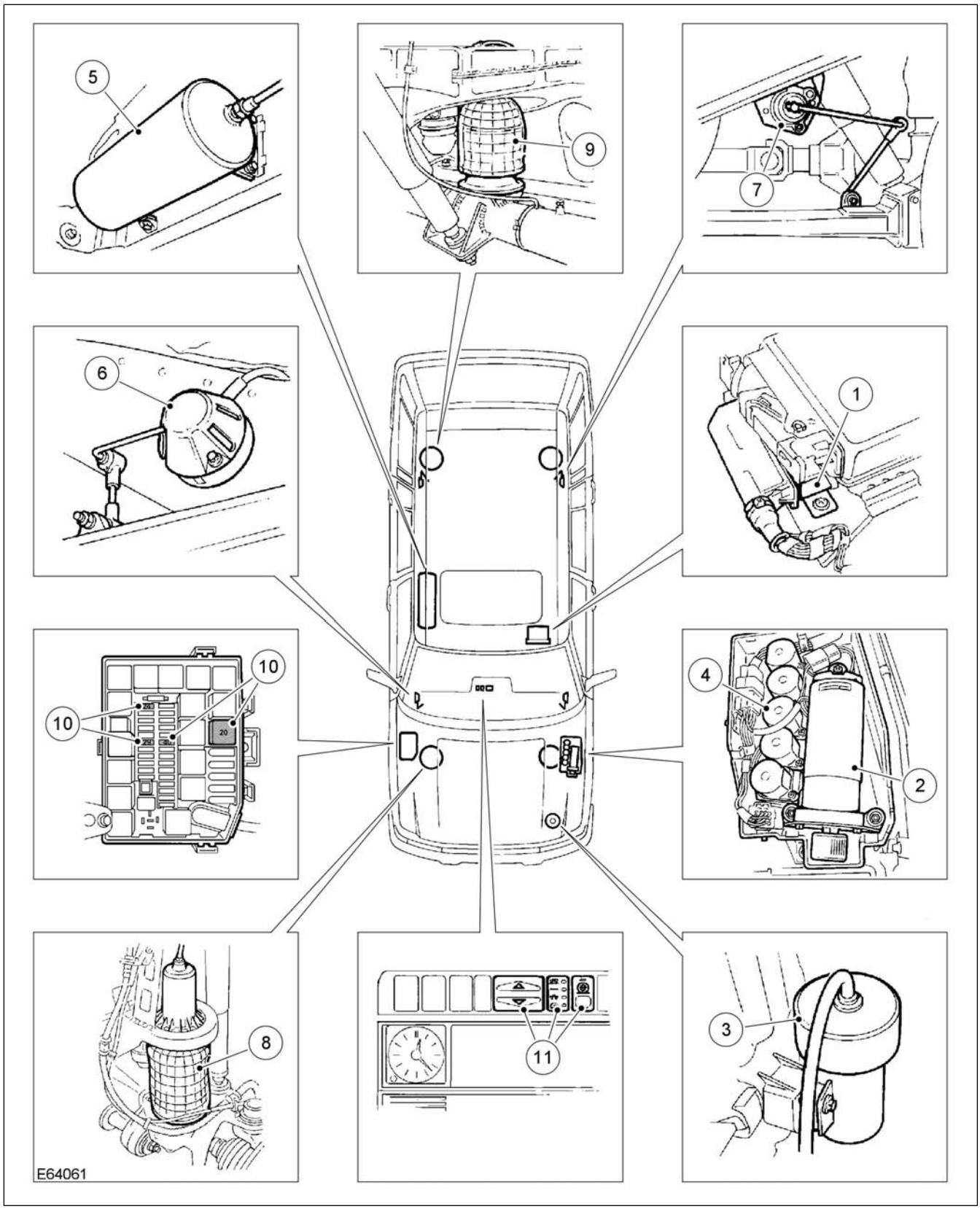
- List all of the major system components.
- Explain at a high level each major component function.

RANGE ROVER (LP)



Components Review

Component Location



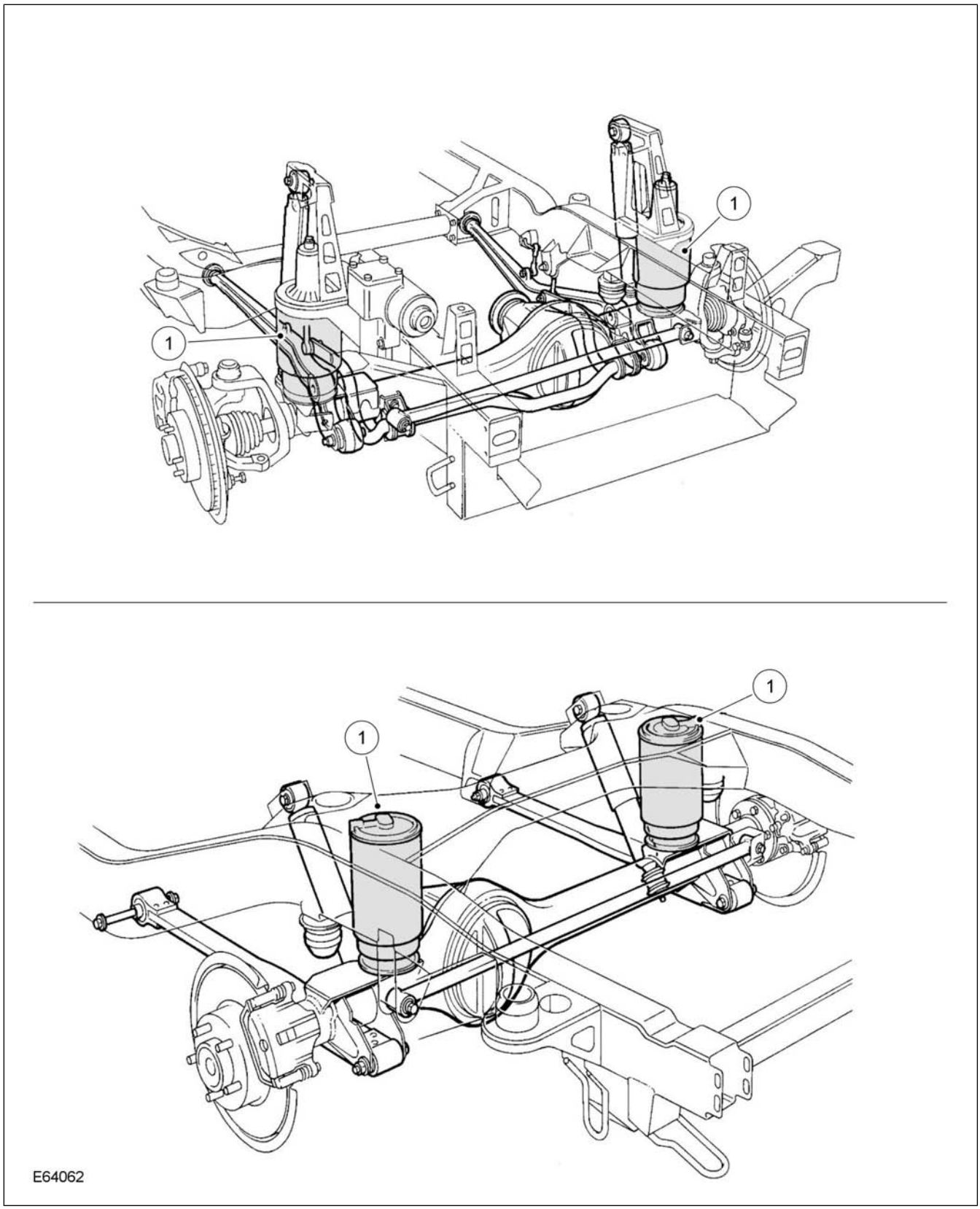
Component Location

Component Location - Legend

Item	Component	Location	Comments
1.	ECU	Below LHF seat	Delay relay in the same vicinity
2.	Compressor	Engine bay LHS	Located with valve block and has serviceable filters
3.	Drier	Next to air cleaner	Replace if water in system
4.	Solenoids	Engine bay LHS	Seven solenoids in total
5.	Reservoir	RHS of chassis	Drain plug fitted to one end
6.	Height sensor	Front axle	Potentiometer type unit
7.	Height sensor	Rear axle	Potentiometer type unit
8.	Air spring	Front axle	Separate to damper unit
9.	Air spring	Rear axle	Separate to damper unit
10.	Fuse box	Engine bay RHS	Stores system relay and fuses
11.	Switch panel	Air suspension control switches on fascia panel	Indicator warning lamp location

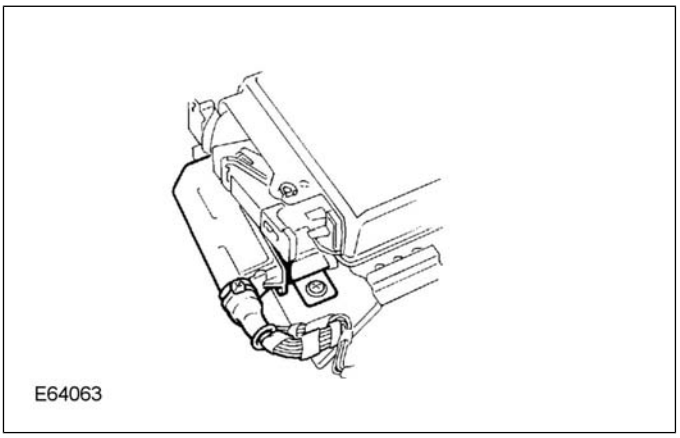
Front and Rear Suspension

Front and Rear Suspension Assembles



EAS ECU

Air Suspension ECU



The EAS ECU is located below the left hand seat.

The ECU maintains the requested vehicle ride height by adjusting the volume of air in each air spring.

Connection of the ECU to the harness is via a 35 way connector.

To ensure safe operation the ECU has extensive on-board diagnostic and safety features.

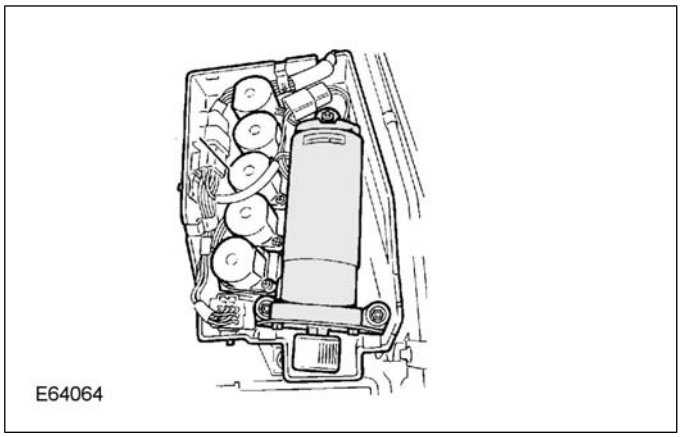
The ECU is not a serviceable item and will require replacement in the event of a failure.

Air Supply

Air supply is delivered by the compressor to raise the vehicle.

The air compressor is located under the bonnet and mounted on the left hand inner wing area.

Air Supply Compressor



A thermal switch is incorporated into the motor which permanently cuts out the compressor operation at temperatures >120°C.

Below the 120°C threshold, the thermal switch monitors the compressor temperature and operates the compressor within the set parameters.

To protect the compressor from dirt ingress an inlet filter is fitted to the compressor head intake port.

On the outlet port a second filter is provided which acts as a silencer.

The compressor filters requires changing at specific times during its service life.

Filter Service

The filters for the compressor require changing at specific times during its service life.

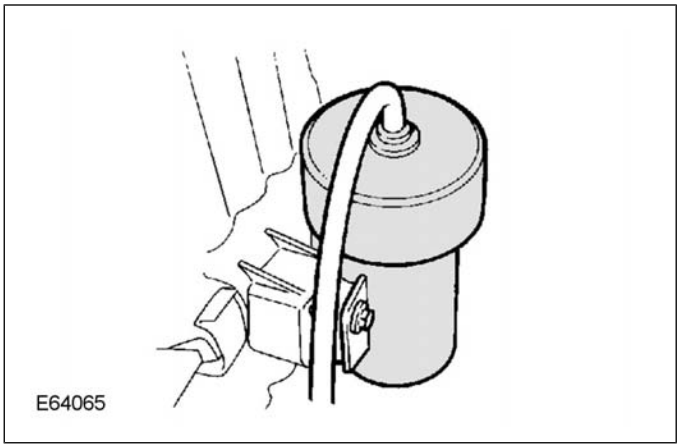
Filter Change Requirements

Distance	Comments
24,000	Miles
39,000	Kilometers
30,000	Miles (USA)

Drier Assembly

The air drier unit is connected into the air line between the compressor and reservoir and is mounted on the engine air cleaner housing.

Drier Unit



The drier removes moisture from the pressurized air entering the air system.

It is important that all exhausted air is expelled through the drier unit in the opposite direction, i.e. to atmosphere.

The air drier unit is not a serviceable item.

It is designed to last the life of the vehicle.

The drier is regenerative, the dry exhausted air expels the moisture from the drier unit back in to the atmosphere.

⚠ **CAUTION: If the air drier unit is removed from the vehicle the ports must be plugged to prevent moisture or dirt ingress.**

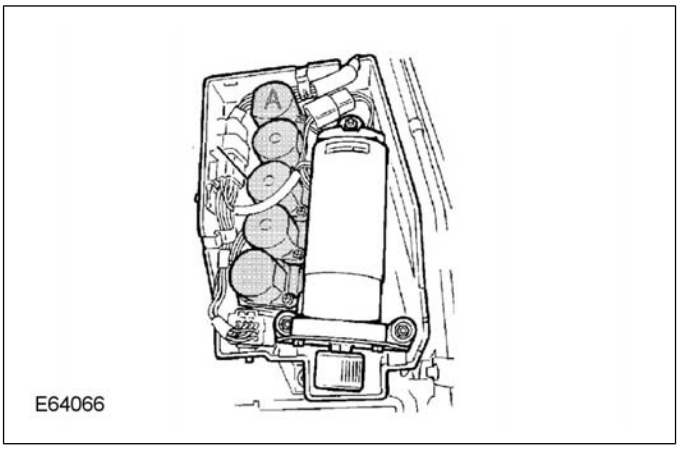
If any water is found within the system then the drier must be replaced.

Valve Block

The role of the valve block is to control the direction of air flow.

It is mounted next to the compressor in the left hand side of the engine bay.

Valve Block Assembly



Air flow to and from the air springs is controlled via seven solenoid operated valves (five visible and two situated underneath).

The solenoids are used for the following:

- One for each air spring (x4)
- Inlet valve (x1)
- Exhaust valve (x1)
- Outlet valve (x1)

In response to signals from the ECU, the valves allow high pressure air to flow in or out of the air springs according to the need to increase or decrease pressure.

A diaphragm valve (Fig 'A' in the diagram) is operated by the outlet valve.

Mounted on the valve block is a pressure switch which senses air pressure and signals the ECU to operate the compressor when required.

The solenoid operated diaphragm valve ensures that all exhausted air passes through the air drier assembly.

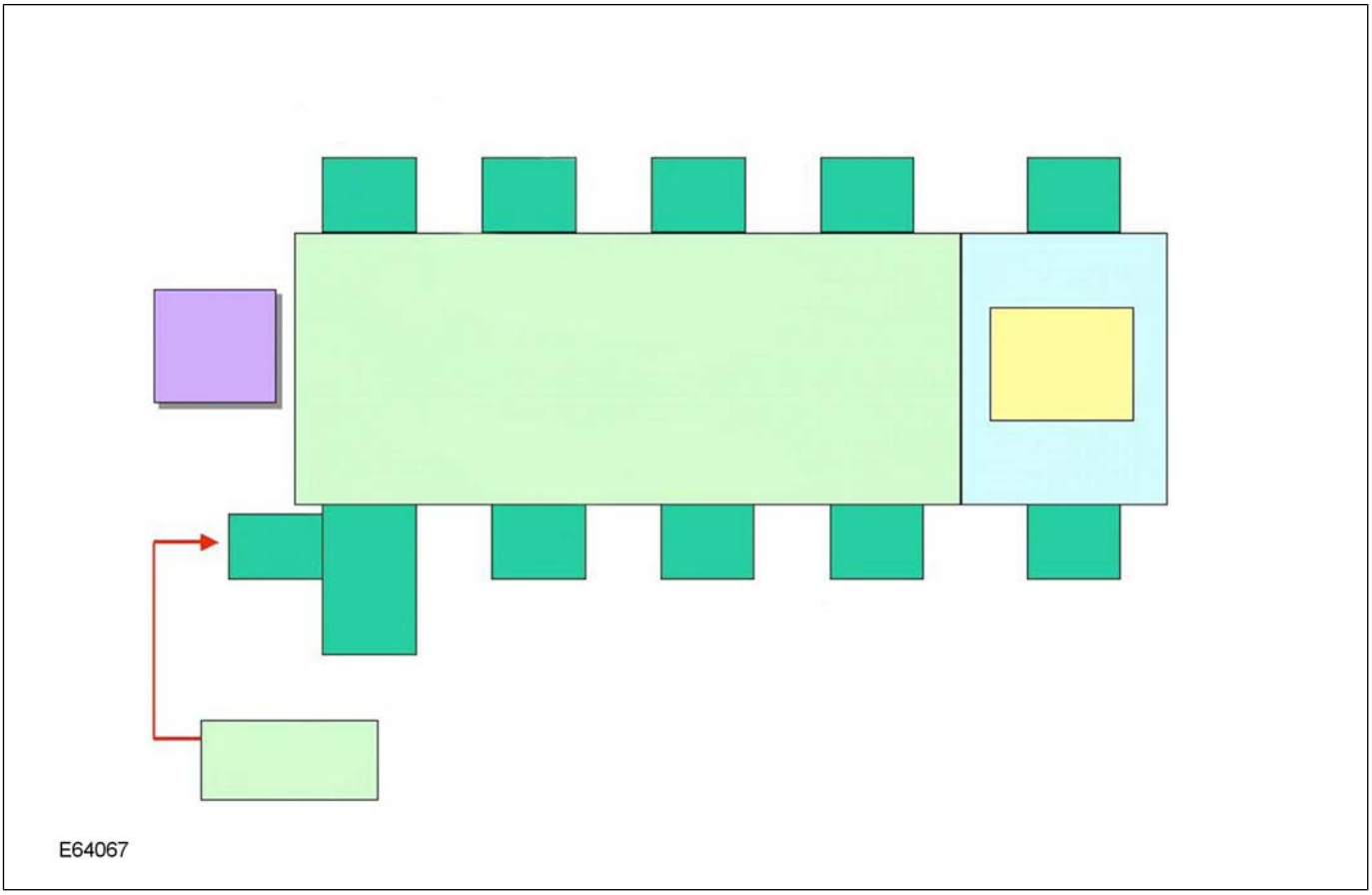
The compressor will operate when the pressure falls between:

- 7.2 and 8.0 bar (104 and 116 psi)

It will cut-out at a rising pressure of between:

- 9.5 and 10.5 bar (138 and 152 psi)

Valve Block Components



Complete the schematic above from the instructors presentation slide

The valve block contains the following serviceable components:

- Solenoids 1 to 6 ('A' not serviceable)
- Drive pack assembly
- Pressure switch 'Green'

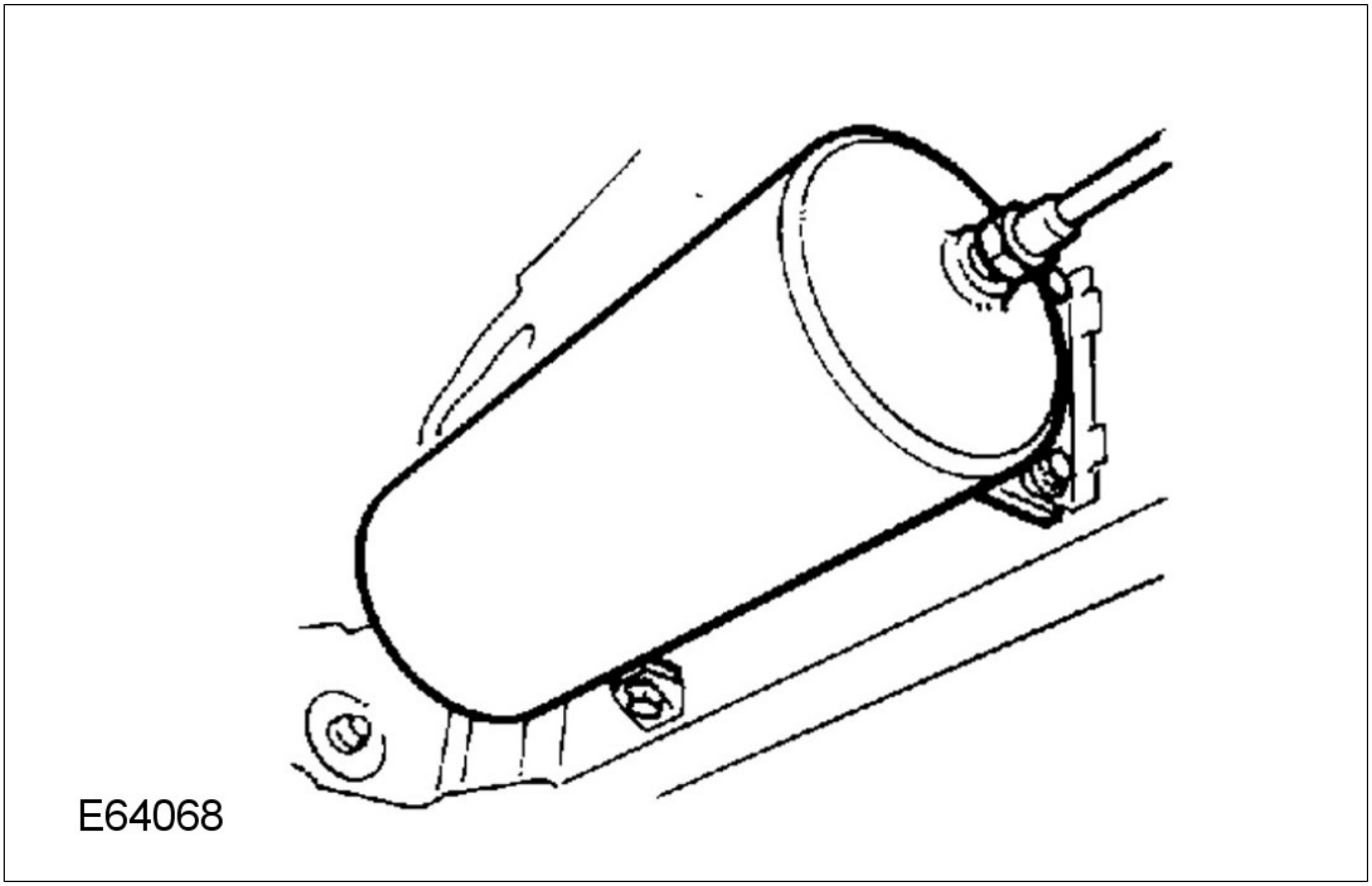
The purpose of the Drive Pack is control of the solenoid valves through drive signals controlled by the ECU.

The solenoid marked 'A' can be identified by its blue fly lead.

Reservoir

Location of the reservoir is on the right hand side of the chassis.

Reservoir



Capacity of the reservoir is 10 liters.

The reservoir stores compressed air between set parameters and has one connection that serves as both the air in and air out.

On the opposite end to the air supply connection is a drain plug.

The drain plug has a service schedule requirement of being removed and checking for moisture content.

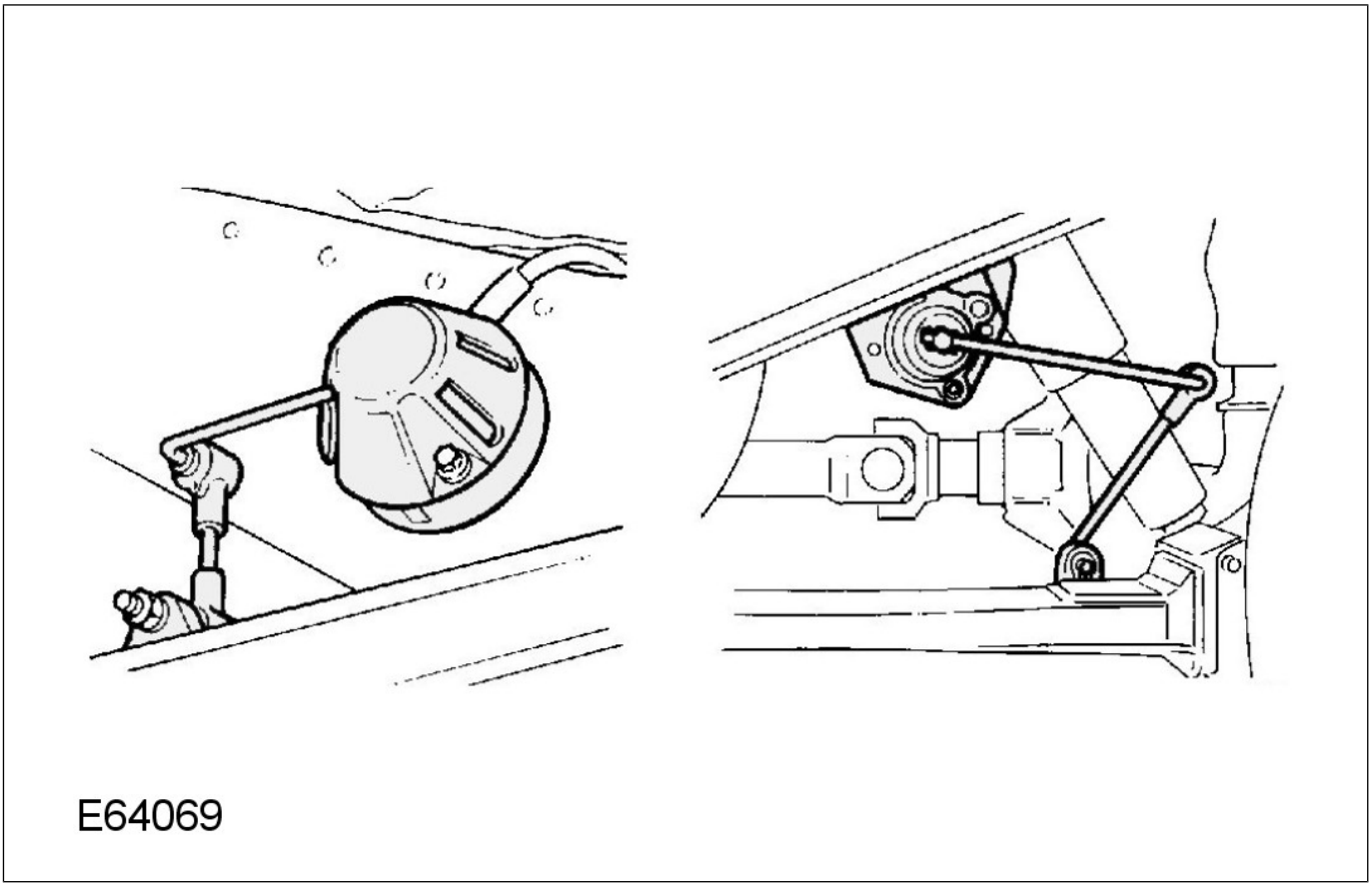
Service Schedules

- 24,000 miles (39,000 km)
- (30,000 miles NAS)

Pressure gauge adaptor LRT 60 001 can be fitted in to the drain port for the checking of system pressures.

Height Sensors

Front and Rear Height Sensors



Four potentiometer type height sensors provide vehicle height information to the air suspension ECU.

The sensors are mounted on the chassis and activated by links to the front radius arms and rear trailing links.

Sensors are color coded to aid fitment to the correct side of the vehicle.

Height sensors when replaced with service replacement units come complete with the actuating arm and drop link.

Earlier sensors originally had fly leads attached, the later service units do not have a fly lead.

When fitting the later style height sensors without a fly lead for a sensor that previously used a fly lead a fitting kit, consisting of a mounting plate and an electrical connector is used.

Height sensors require replacement in the event of a failure and the vehicle re-calibrated to the air suspension ECU using the T4 diagnostic equipment.

T4 diagnostic equipment converts the analogue feedback voltage into a digital value using an A/D convertor.

The reason for the calibration process is to compensate for manufacturing variations as sensors do not all produce the same output.

The generated value is then used by the T4 diagnostic equipment in the form of a count method to calibrate the air suspension ECU.

Each sensor has a five volts supply from the air suspension ECU and a ground return path.

A feedback voltage corresponding to vehicle height is then fed back to the air suspension ECU.

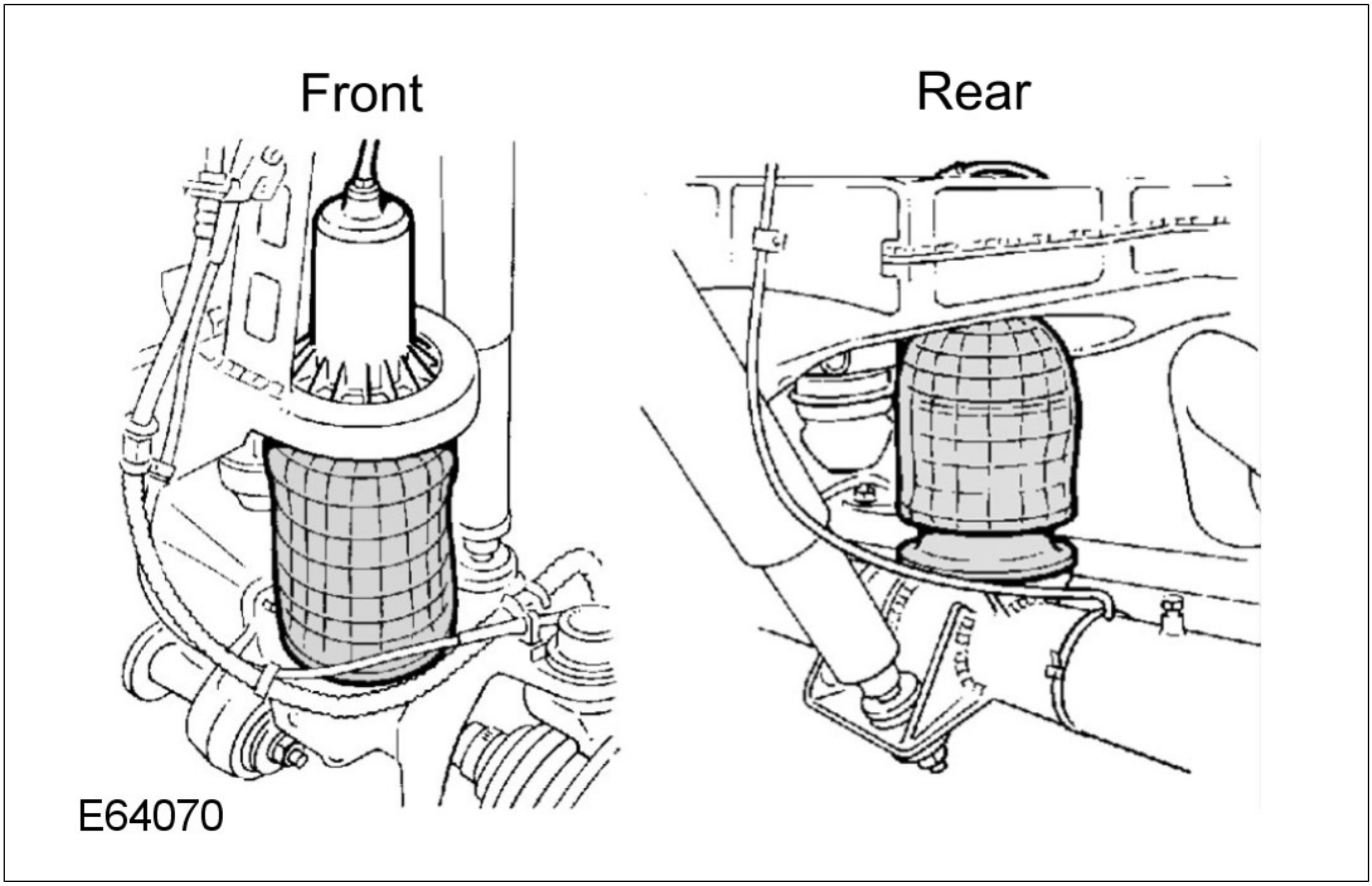
In general terms the height sensor feedback voltage will increase as the vehicle rises.

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.

The rear of the vehicle will rise first, followed by the front thus avoiding any headlamp dazzle.

Air Springs

Air Springs



Spring Construction

The front and rear air springs are of similar construction but not interchangeable.

Air spring diaphragms are not repairable and must be replaced as a complete unit if a failure occurs.

Collet type connectors are used to connect the air spring port to the air harness.

Air Harness Repair

A repair tool is available to repair damaged or leaking air pipes.

Replacement air pipe kit is available with connectors.

Service Kit - RQM 000030

- 10 feet (3 meters)
- 4 connectors

Separate connectors are available using part number: STC 8580.

The service tool number is: LRT 60 002.

To aid air leak detection use GOTEC LDS (Part No: STC 1090), this is the only recommended method for testing for air leaks.

The spray contains corrosion inhibitors and will not damage paint work, metals or plastics.

⚠ **WARNING: Do not use a water based liquid as this can get into the air system and contaminate the solenoid valves causing problems later in service life.**

The damaged section can be cut-out and replaced with a connector repair joint or the collet connector can be replaced as a service kit, consisting of an 'O' ring and collet.

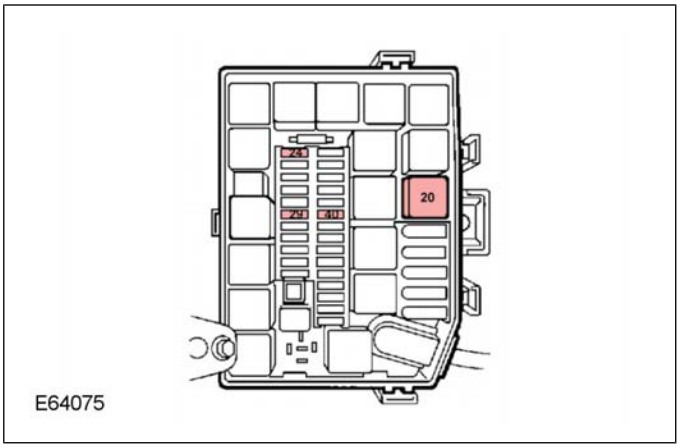
When cutting the air harness pipe: use service tool LRT 60 002 ensures a clean square cut.

NOTE: Two repairs/cuts is the maximum engineering recommendation when repairing a connector.

The use of a pencil sharpener is also recommended to chamfer pipe before fitting joint or collet connector.

Relays and Fuses

Fusebox



RHS Engine Bay Fusebox

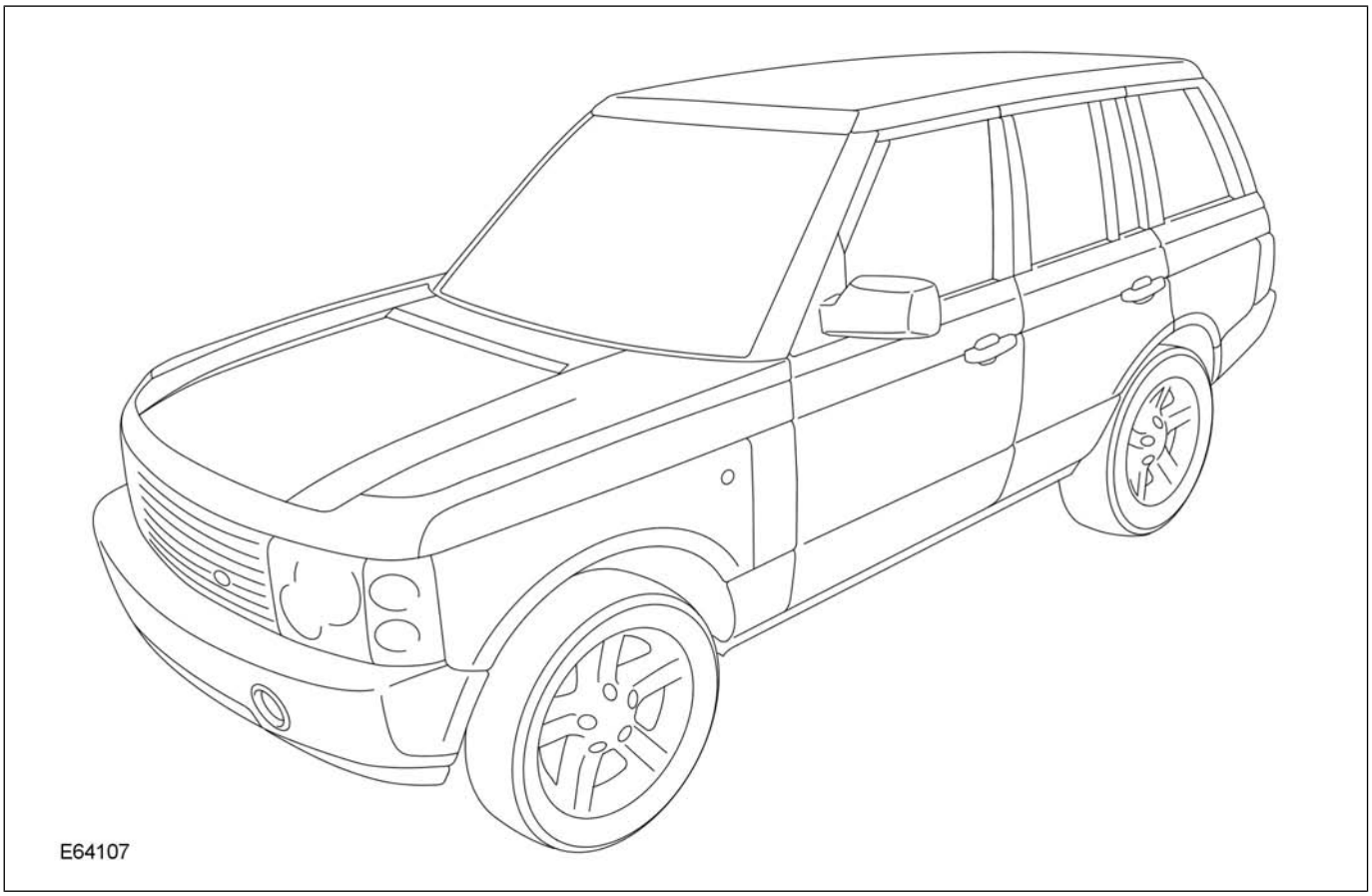
The air suspension relays and fuses are located in the RHS engine bay fusebox.

Engine Bay Fusebox

Relay or Fuse	Rating	Comments
Relay 20		Compressor and valve block supply
Fuse 1	10 amp	Supply to instrument cluster (next to BCU)
Fuse 17	10 amp	Stop lamp switch supply (inhibits height changes)
Fuse 24	5 amp	Ignition supply (Speed signal from BCU and ABS ECU)
Fuse 29	10 amp	EAS delay timer unit
Fuse 35	10 amp	Height change switch and warning lamps
Fuse 40	40 amp	Compressor and valve block supply

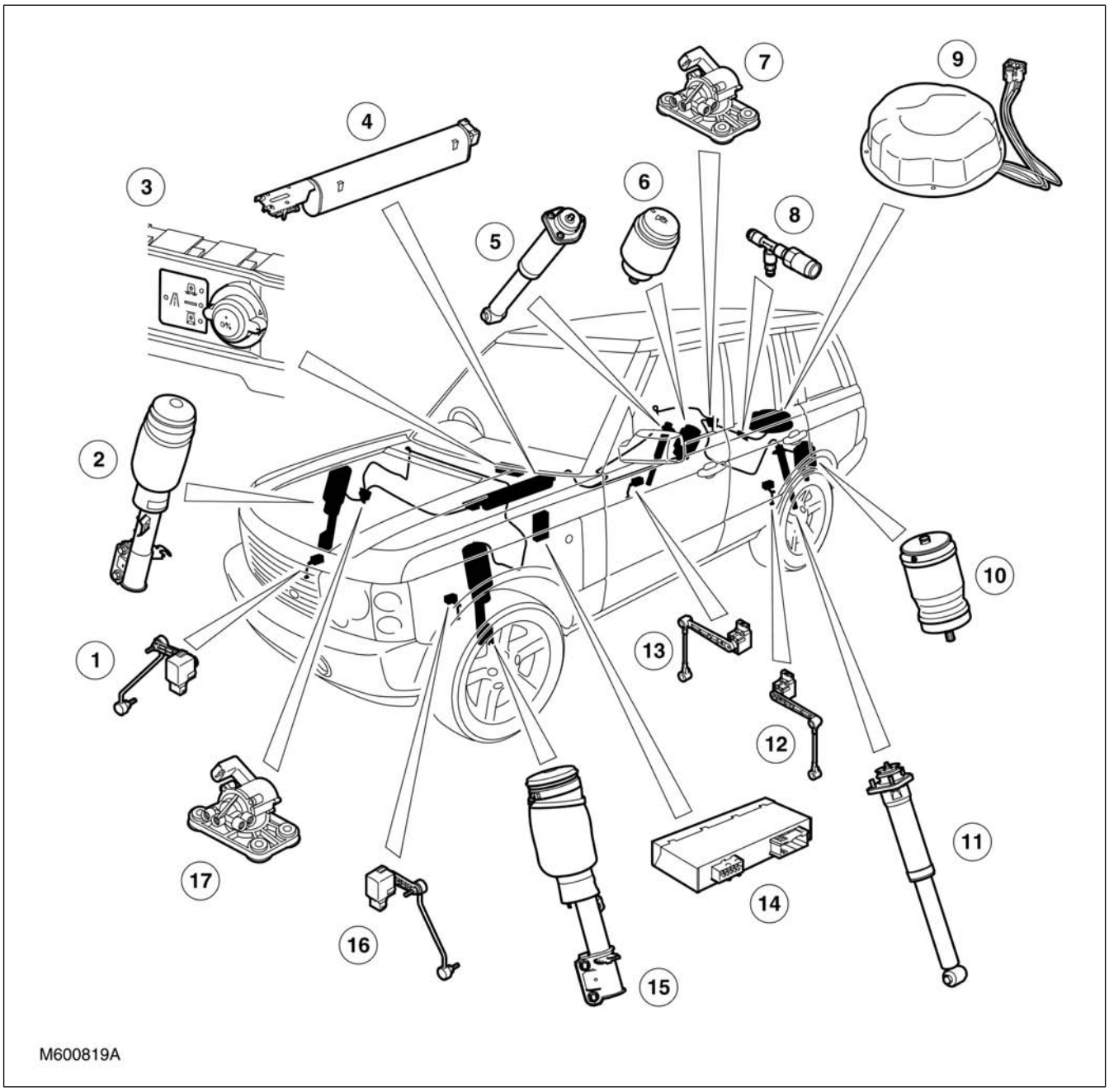
NOTES:

RANGE ROVER (LM)



Components Review

Component Location



NOTES:

Component Location

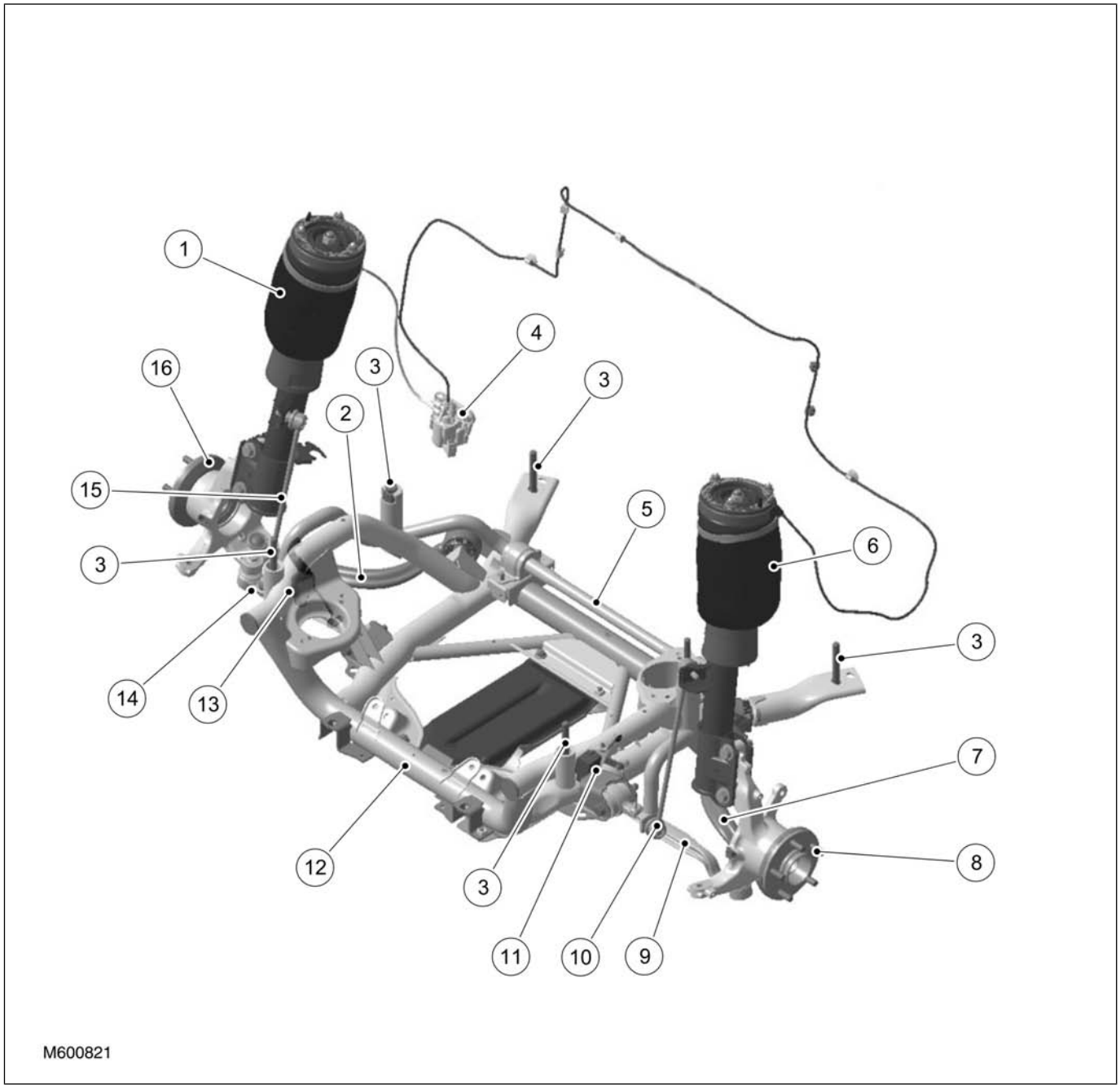
Component Location - Legend

Item	Component	Location	Comment
1.	RHF height sensor	Front subframe to lower control arm	Different units for Xenon headlamps
2.	RHF air spring	Between subframe and lower control arm	Rotary coupling with peg locator
3.	Switch pack assembly	Center console	Separate switch for access mode located in driver's door panel
4.	Reservoir and valve block	RH sill area	Valve block available separately
5.	RHR damper	Between body and lower control arm	Bilstein units
6.	RHR air spring	Between subframe and lower control arm	'D' shaped retaining clip
7.	Cross link valve	Rear wheel arch area	Not driver controlled
8.	Pressure relief valve	Spare wheel compartment	Internal pressure relief valve was 13.7 bar, the external relief valve is 12.3
9.	Compressor	Spare wheel compartment	Sealed unit
10.	LHR air spring	Between subframe and lower control arm	'D' shaped retaining clip
11.	LHR damper	Between body and lower control arm	Bilstein units
12.	LHR height sensor	Between subframe and lower control arm	Check VIN for type of sensor fitted
13.	RHR height sensor	Between subframe and lower control arm	Different sensor for Xenon headlamps
14.	ECU	LH end of fascia	
15.	LHF air spring	Between subframe and lower control arm	Rotary coupling with a peg for locating
16.	LHF height sensor	Between subframe and lower control arm	Check VIN for type of sensor fitted

Item	Component	Location	Comment
17.	Cross link valve	Between subframe and lower control arm	Not driver controlled

Front Suspension Assembly

Front Suspension

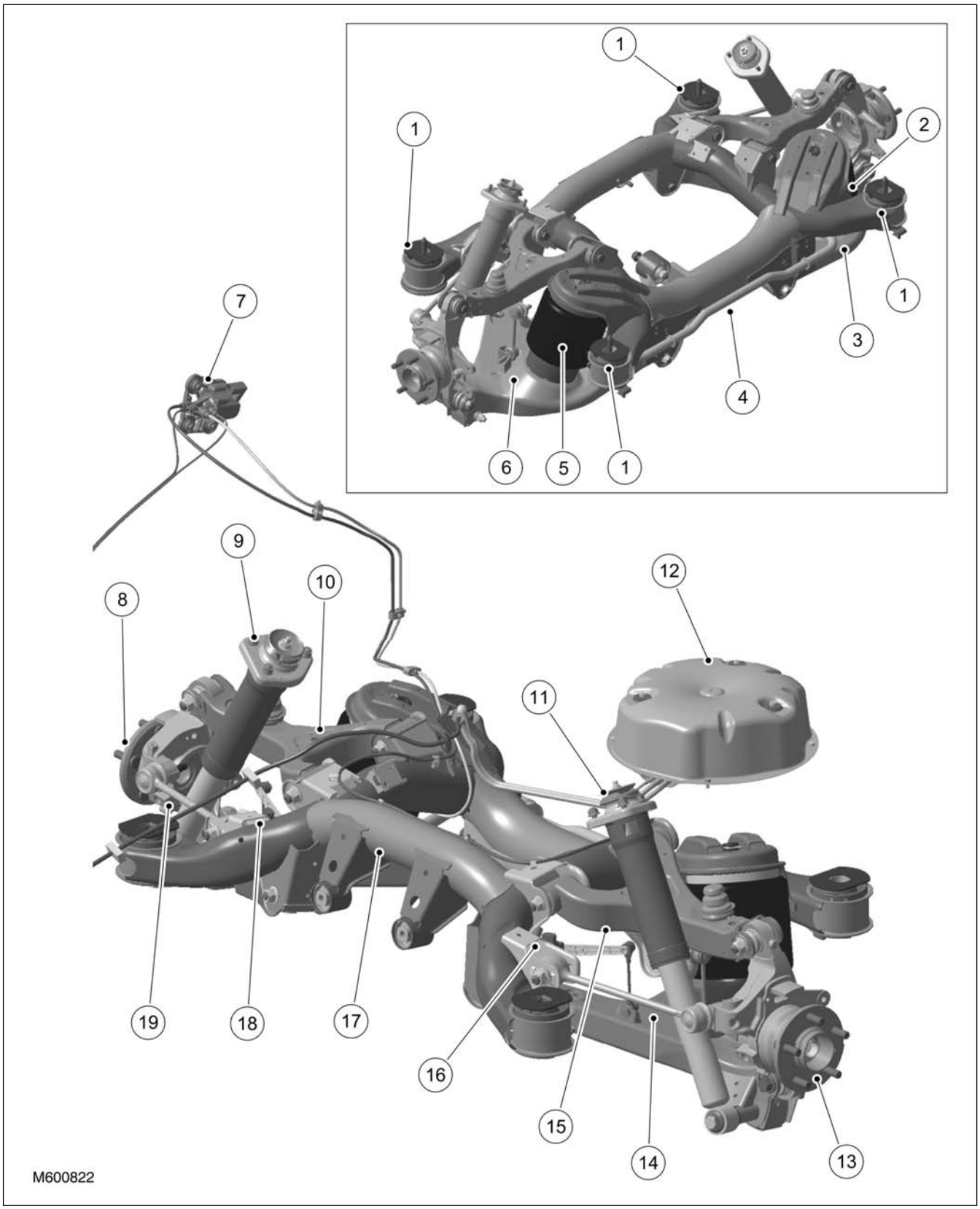


Front Suspension

Item	Description
1.	RHF strut assembly
2.	RH tie rod
3.	Subframe body mounts
4.	Front cross link valves (if fitted)
5.	Anti-roll bar
6.	LHF strut assembly
7.	LH tie rod
8.	LHF hub assembly
9.	LH lower arm
10.	LH anti-roll bar link
11.	LHF height sensor
12.	Front subframe
13.	RHF height sensor (partially hidden from view)
14.	RH lower arm
15.	RH anti-roll bar link
16.	RHF hub assembly

Rear Suspension Assembly

Rear Suspension

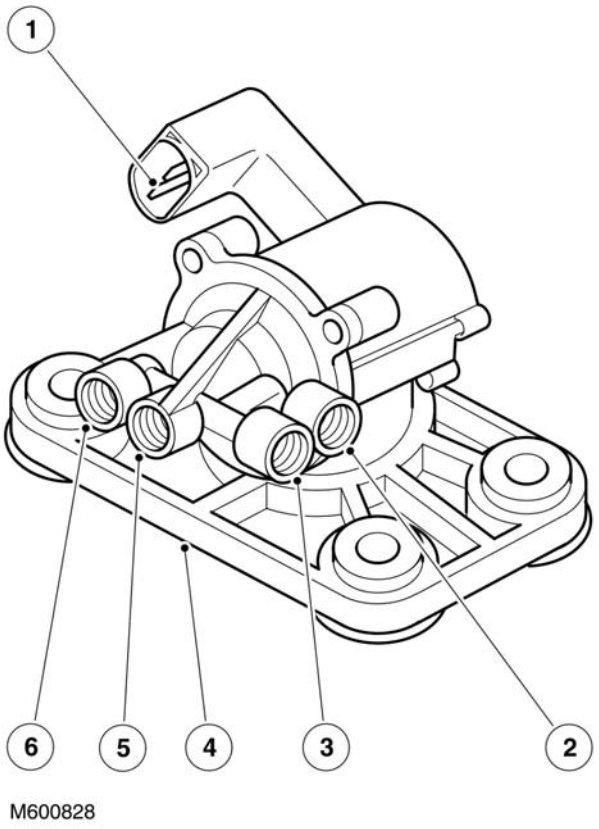


Rear Suspension

Item	Description
1.	Subframe mounts
2.	RHR air spring
3.	RH lower wishbone
4.	Anti-roll bar
5.	LHR air spring
6.	LH lower wishbone
7.	Rear cross link valve
8.	RHR hub assembly
9.	RH damper
10.	RH upper wishbone
11.	LH damper
12.	Compressor assembly
13.	LHR hub assembly
14.	LH toe control arm
15.	LH upper wishbone
16.	LHR height sensor
17.	Rear subframe
18.	RHR height sensor
19.	RH toe control arm

Cross Link Valves

Cross Link Valve



Cross Link Valve - Legend

Item	Description
1.	Electrical connector
2.	RH air spring supply and return
3.	RH air spring supply and return from valve block
4.	Cross link valve body
5.	LH air spring supply and return
6.	LH spring supply and return from valve block

Cross Link Valve Location

The front cross link valve is located at the rear of the RHF wheel arch, behind the wheel arch liner (where fitted).

The rear valve is located towards the top of the RHR wheel arch and is also situated behind the wheel arch liner.

NOTE: On later vehicles, the front cross-link valve was deleted and a modified air harness and air suspension ECU was also installed. The deletion of the cross-link valve affects the following vehicles: VIN 154877 to 154881, VIN 154949 and 154950 and from VIN 155161 onwards.

Attachment of the valves to the vehicle body is by three rubber mounted fixings to isolate solenoid valve operation.

Cross Link Valve Operation

The cross link valves comprise of a single large solenoid valve with connections to the LH and RH air springs and also connections for each air spring from the reservoir mounted valve block.

Each solenoid operated valve is controlled by the air suspension ECU.

When the solenoid valve is energized the cross link valve connects the two air springs together, thus allowing air to flow between them if required.

This feature provides additional suspension articulation which improves the off-road capabilities of the vehicle and an improvement in low speed ride comfort.

The air suspension ECU senses the vehicle is off-road by comparing rapid changes in signals from the ride height sensors.

Cross link valve operation is fully automatic, and requires no driver intervention at any time.

The cross link valves only operate in off-road mode and operation is governed by the off-road mode speed threshold.

Height sensor inputs to the air suspension ECU are used in the decision as to when the cross link valves operate.

With the driver's height control switch in off-road mode position, the system enters a stand by condition until the ECU decides to operate the valves via height sensor information.

Service Requirements

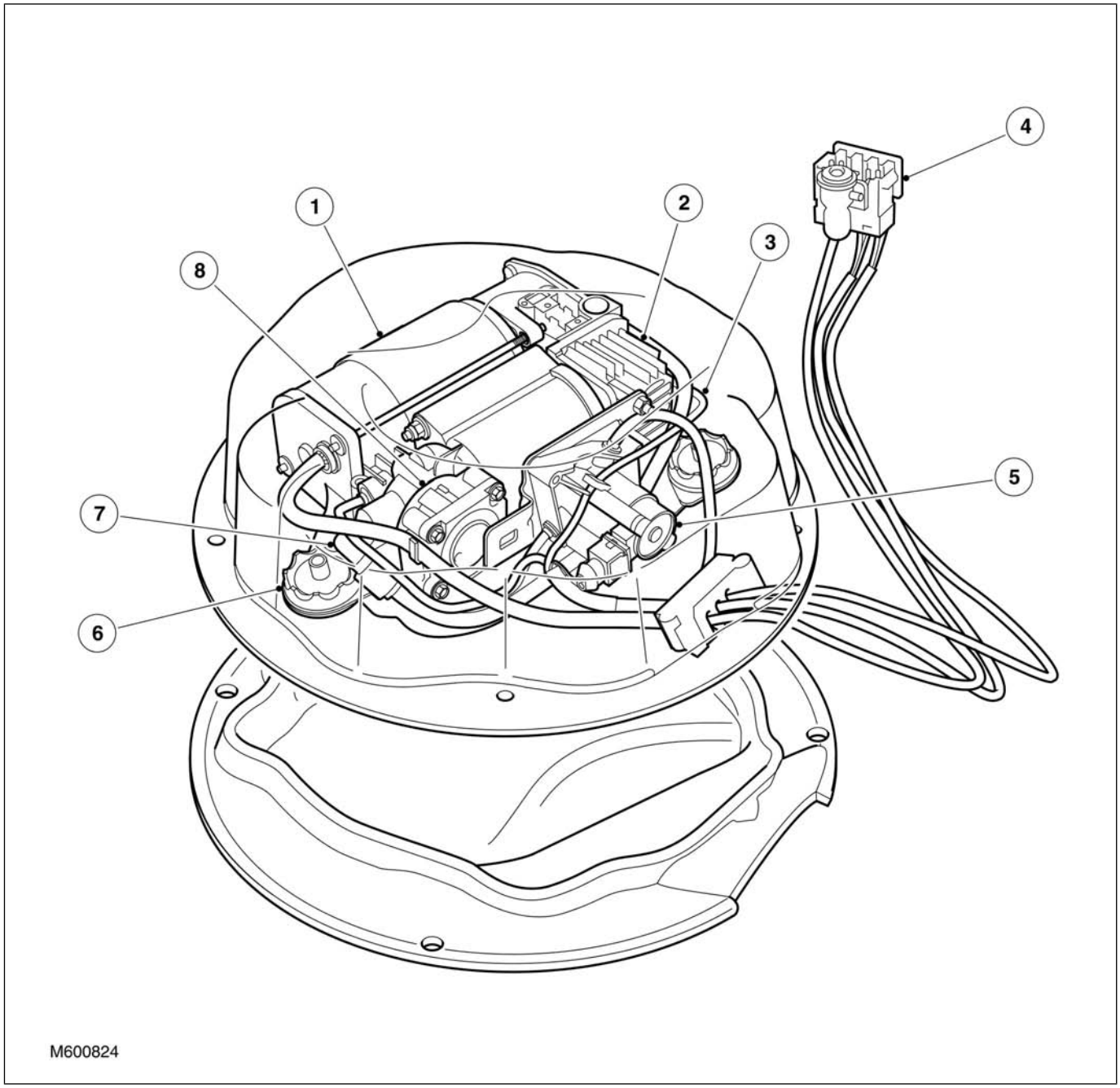
When removing a cross link valve 'DO NOT' depressurize the air suspension system before raising the vehicle.

In the event of having to remove a 'Voss' connector from any air suspension component, the connector must be left attached to the air pipe being removed.

Removing the Voss connector from the air pipe could cause the connector to scratch the pipe and increase the likelihood of air leaks.

Compressor Assembly

Air Supply Compressor



Compressor Assembly - Legend

Item	Description
1.	Electric motor
2.	Compressor
3.	Compressor temperature sensor

Item	Description
4.	Electrical and air supply connector
5.	High pressure exhaust valve
6.	Rubber mountings (x3)
7.	Exhaust hose
8.	Exhaust pilot valve

Air Supply Unit Location

The air supply unit is located in a sealed housing mounted in the spare wheel compartment.

Four bolts secure the air supply unit to the vehicle by threaded inserts in the wheel compartment floorpan.

System Connection

The assembly is connected to the system through a single air supply pipe with wiring harness and multi-plug.

The earlier air pipe connection was superseded by the introduction of a revised pressure relief valve on later vehicles.

Pipe protection as it passes through the wheel well floorpan is through the use of a rubber grommet.

It is important to ensure that this grommet is not disturbed during any service work and that it is correctly installed.

Incorrect installation will allow water to enter the wheel well area leading to possible damage and failure of the air supply unit.

Service Requirements

Removal of the air supply unit does not require the system to be depressurized.

The corner and reservoir valves close-off, thus retaining the air within the air suspension system.

Compressor

The unit comprises of a single piston compressor, a 12v electric motor, a solenoid operated pilot valve, a pressure relief valve and an air drier unit.

The electric motor, compressor, air drier and pressure limiting and exhaust valve are mounted on a frame which in turn is mounted on flexible rubber mountings to reduce operating noise.

Air Supply Operation

The electric motor drives a crank with an eccentric pin to which the connecting rod is attached.

The connecting rod has a piston which fits in the bore of the compressor.

Operation of the motor rotates the crank, moving the piston in the bore of the compressor.

The compressor is attached with special bolts to the motor housing and sealed with an 'O' ring.

A temperature sensor is located on the compressor housing.

The sensor measures the compressor temperature which is then used by the air suspension ECU (this is discussed further in system inhibits).

Air Drier

Attached to the compressor is an air drier unit which contains a silicate box for removing moisture from the compressed air.

All air that is supplied to inflate the air springs passes through the air drier unit.

When the air springs are deflated, the exhausted air also passes back through the air drier assembly, thus removing the moisture from the drier unit and regenerating the silicate material.

Exhaust Valve

Attached to the air drier unit is a solenoid operated exhaust pilot valve which is opened when the air springs are to be deflated.

Located in the same housing as the exhaust pilot valve is a pressure limiting valve which protects the air springs from over inflation.

The valve is pneumatically operated, responding to air pressure applied to it in order to overcome the pressure of the spring located behind the valve.

The pressure limiting valve also operates when the exhaust pilot valve is opened, thus allowing air returning from the air springs to be exhausted.

System Pressure

The compressor is used to supply air pressure to the air suspension reservoir.

The ECU monitors the pressure within the reservoir to maintain a pressure of 12.3 bar (178 psi) when the engine is running.

System Inhibits

There are a number of conditions that will inhibit operation of the air suspension compressor.

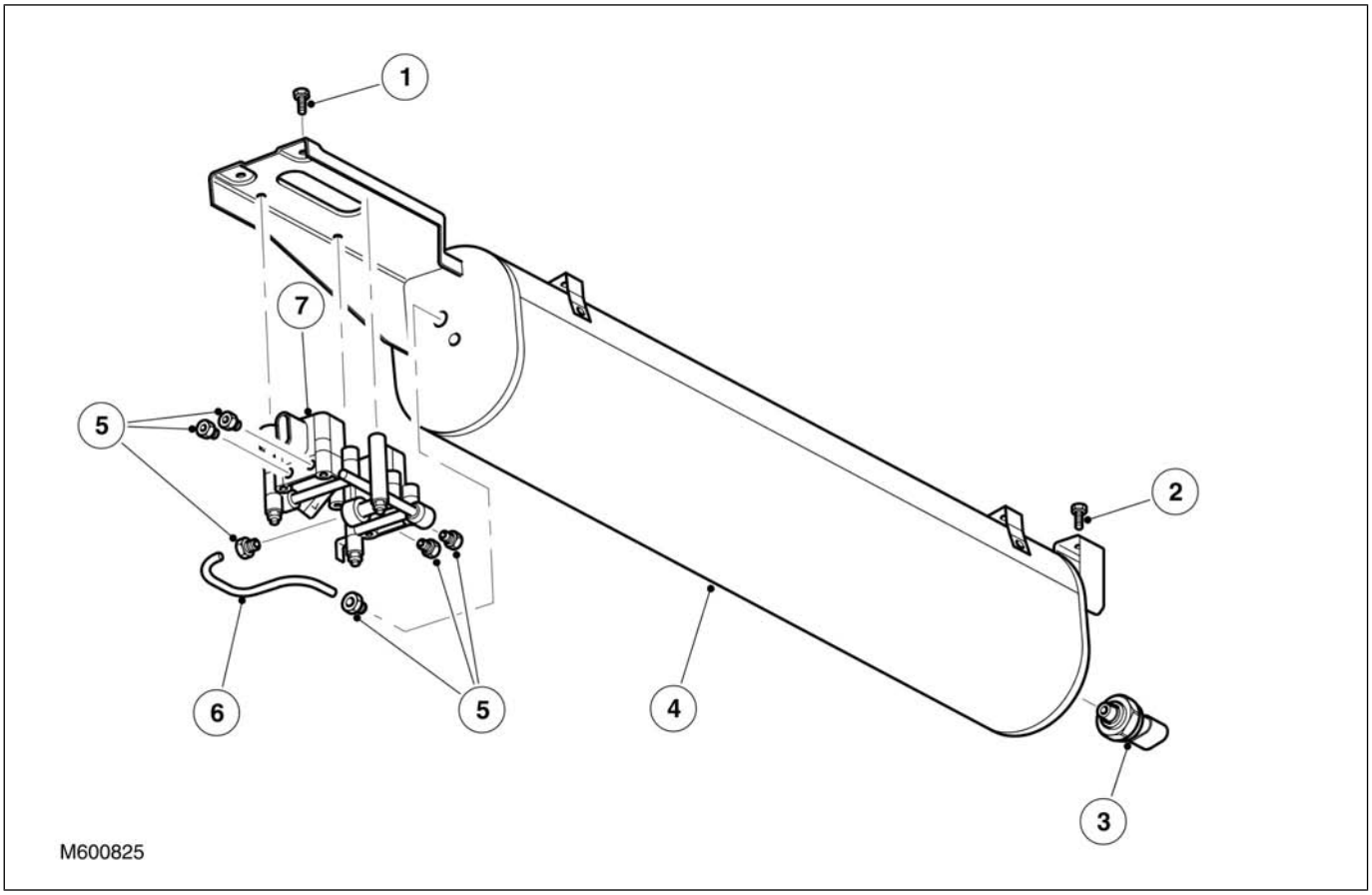
It is vitally important that these inhibits are not confused with a system malfunction.

A full list of compressor inhibits is contained in the air suspension control section.

A temperature sensor is located within the compressor and should the compressor temperature rise above set limits, the ECU will inhibit compressor operation.

Reservoir Assembly

Reservoir Assembly



Item	Description
1.	Reservoir front fixing
2.	Reservoir rear fixing
3.	Air pressure sensor
4.	Reservoir
5.	Air harness connector
6.	Reservoir to valve block air supply pipe
7.	Valve block

The air suspension reservoir is located under the RH sill of the vehicle.

On vehicles up to VIN 171508 the reservoir is fabricated from aluminum.

On vehicles from VIN 171509 the reservoir is fabricated from steel.

The reservoir is secured with four bolts to the underside of the vehicle.

The reservoir has an additional bracket on the forward facing end which provides the mounting for the valve block.

The purpose of the reservoir is to supply pressurized air to the four corner air spring assemblies through the valve blocks, to enable the air suspension system to carry out ride height changes.

A pressure sensor is screwed into the rear face of the reservoir.

The sensor is connected to the air suspension ECU and monitors the pressure within the reservoir.

Bulletin LM204-003 03 states replacement of the pressure sensor is achieved by renewing the sensor as a separate item and does not require the changing the air supply reservoir assembly as a complete component.

Height Control

The ECU controls the operation of the air suspension compressor to maintain a pressure of 12.3 bar (178 psi) only whilst the engine is running.

If an upward height change request is made when the engine is not running, air pressure within the reservoir is used to lift the vehicle.

Should the reservoir pressure drop below 9 bar (130 psi) and an upward height change request is made, the lift procedure is performed by the compressor.

NOTE: Earlier vehicles had a pressure limit of 13.7 bar (199 psi).

However, the system pressure was been reduced to 12.3 bar (178 psi) with the introduction of a separate pressure relief valve, refer to Bulletin A/B/D 293 issued 05.10.02.

When the engine is started, the ECU runs the compressor to increase reservoir pressure to 12.3 bar (178 psi).

Location of the valve block is mounted forward of the air supply reservoir under the RHS sill area of the vehicle.

The reservoir supplies pressurized air to the four corner air spring assemblies via the valve block, to enable the air suspension system to carry out ride height changes.

Three nut and stud fixings secure the valve block to the reservoir bracket.

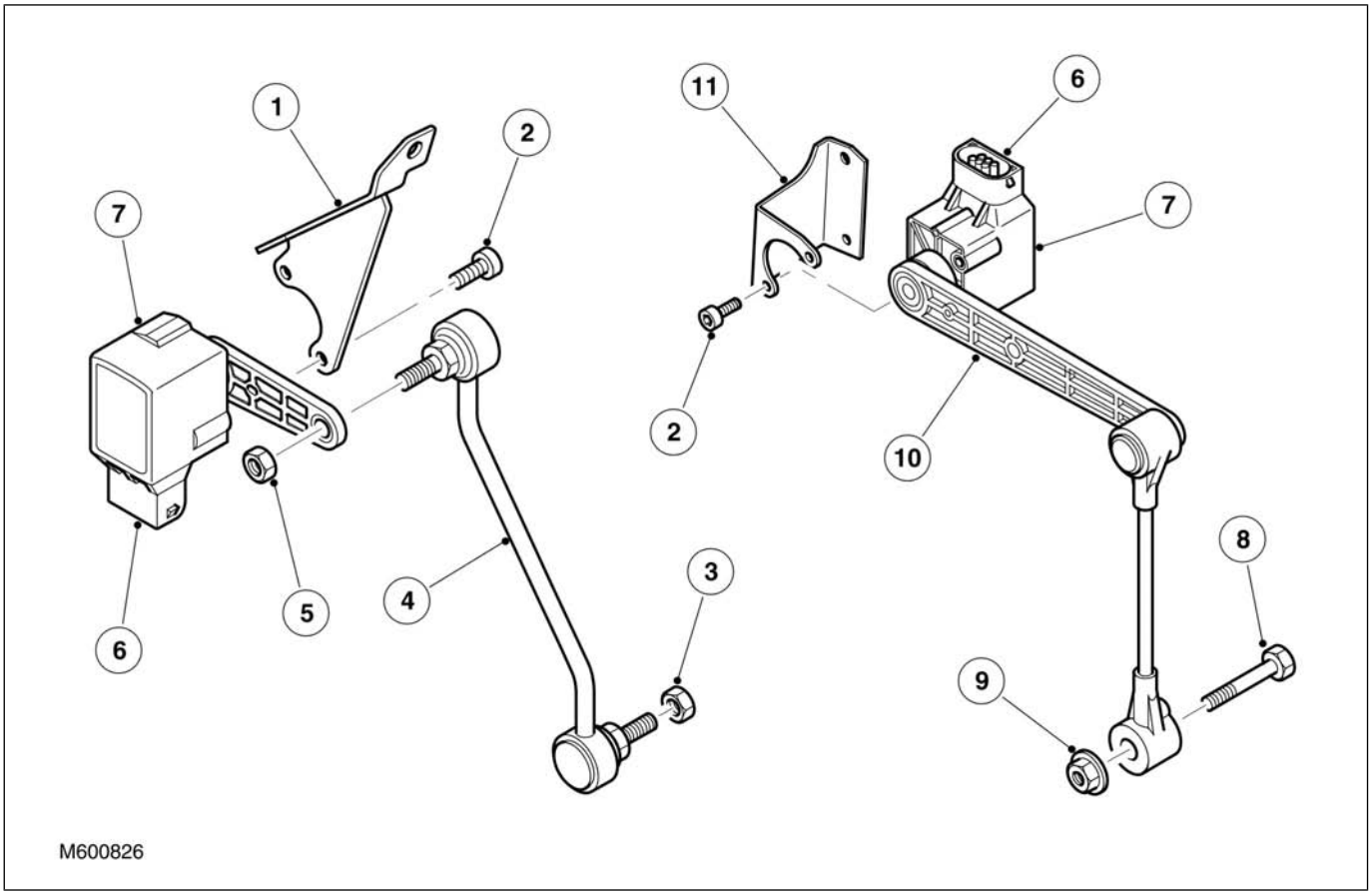
The studs are bonded into rubber mounts which isolates solenoid operation from the vehicle.

Each valve block contains five solenoid operated valves which are controlled by the air suspension ECU.

Four of the valves, known as corner valves, control the air flow to and from the air springs via the cross link valves.

Height Sensors to VIN 174107

Height Sensor Assemblies



Item	Description
1.	Front height sensor bracket
2.	Sensor fixing
3.	Suspension link securing nut
4.	Suspension connecting link
5.	Link arm retaining nut
6.	Height sensor electrical connection
7.	Height sensor
8.	Link arm securing bolt
9.	Suspension link securing nut
10.	Height sensor lever
11.	Rear height sensor bracket

Height sensors are located at each corner of the vehicle to monitor the vehicle ride height changes.

The sensors are mounted on the front and rear subframe, with a mechanical link to the suspension lower arms.

There are six different types of sensors fitted to the Range Rover (LM).

These are as follows:

Sensor Variants	
LHF height sensor	All vehicles
RHF height sensor	Halogen headlamps fitted
RHF height sensor	Xenon headlamps fitted (White stripes for identification)
LHR height sensor	All vehicles
RHR height sensor	Halogen headlamps fitted
RHR height sensor	Xenon headlamps fitted (White stripes for identification)

Height Sensor Attachment

The height sensors are attached to brackets located on the subframe and are connected via links to the lower control arms.

The links enable articulation of the lower control arm to allow for suspension travel.

Connector Configuration

Each sensor is connected by a six pin multi-plug.

Standard height sensors use three of the six available pins.

However height sensors for vehicles fitted with Xenon headlamps utilize all six.

Sensor Differences

The height sensors contain a circuit board with a Hall effect sensor.

The sensor is supplied with a reference voltage from the air suspension ECU which in-turn measures the returning voltage (feedback) to determine the sensor arm position.

Height sensors used on vehicles fitted with Xenon headlamps use a sensor with a second circuit board.

This second circuit board feedback information is used by the Xenon headlamp leveling ECU.

Service Points

The front height sensor ball jointed linkage is a serviceable item.

However, the rear height sensor linkage cannot be serviced and must be changed as a complete height sensor assembly.

NOTE: From 26th May 2004 the height sensors changed on the track from hall effect type to contact type.

The new sensors are fitted to vehicles from VIN 174108.

The impact on service means that there are four new sensor part numbers.

Sensors are handed left to right and identified by white levers for the left hand sensors (same as Discovery 3 / LR3).

Each sensor comprises a sensor body which contains a single track rotary potentiometer, a lever arm and a drop link.

The sensor is supplied with a reference voltage from the air suspension ECU which measures the returned voltage to determine the sensor arm position.

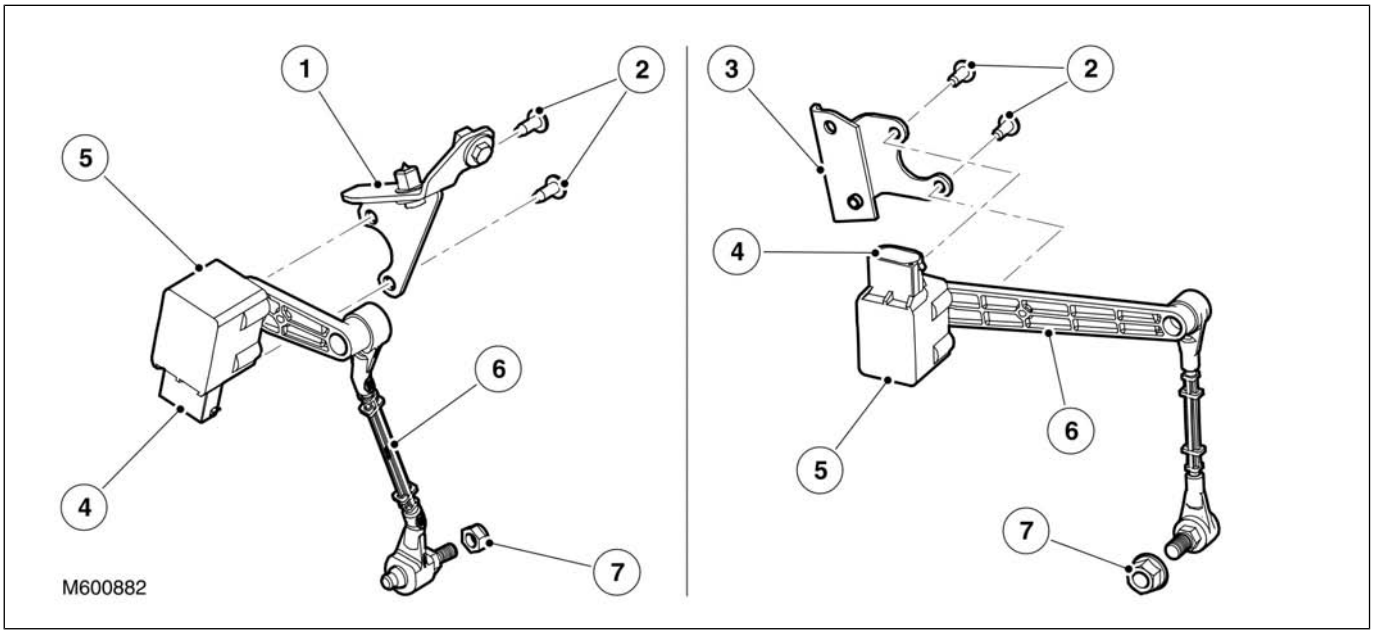
Fixings have also changed (same as Discovery 3 / LR3), i.e. self tap.

Height Sensors from VIN 174108

Parts are interchangeable on vehicles before VIN 174108 and therefore a vehicle can have a mixture of old and new type sensors.

This is only applicable to sensors on vehicles without xenon headlamps.

The new sensors cannot be replaced for the old type sensors with a white identification stripe.



Item	Description
1.	Front height sensor bracket
2.	Height sensor securing fixings
3.	Rear height sensor bracket
4.	Height sensor electrical connection
5.	Height sensors
6.	Height sensor operating link arms
7.	Link securing fixing

Ensure the front height sensor linkage is fitted correctly.

It is possible to locate the arm 180 degrees out of correct alignment.

Air Springs

Each air spring comprises of a top plate assembly, an air bag and a base piston.

Attachment of air bag assembly to the top plate and the piston is by a crimped ring.

The air bag is made from a flexible rubber material which allows the bag to expand with air pressure and deform under load.

Air Spring Assembly

The front air spring top plate assembly comprises the plastic top plate with a spigot which protrudes through a hole in the subframe.

On the side of the top cap is an Voss air connector which allows for the attachment of the air supply pipe from the cross link valve.

The piston is manufactured in plastic and shaped to allow the air bag to roll over its outer diameter.

The base of the rear piston has a splined stud in the center and an offset timing peg for correct orientation of the air spring into the lower wishbone.

Air Spring Fitment

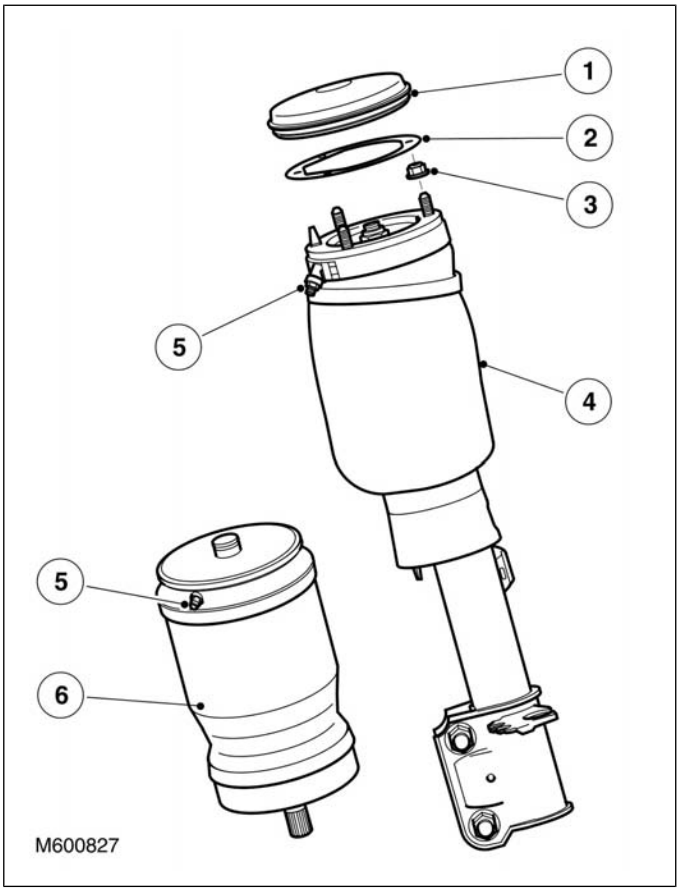
The rear air springs are located rearward of the dampers and are retained between the subframe and the lower wishbone.

Attachment of the rear air spring to the lower wishbone with a screw fixing which is fitted from the underside of the wishbone into the splined stud on the base of the piston.

The top plate for the rear air spring is attached to the subframe via an integral 'D' shaped spigot which is secured with a retaining clip.

Air Spring Components

Air Springs



Item	Description
1.	Aperture cover
2.	Sealing plate
3.	Securing nut
4.	Front air spring
5.	Air pipe Voss connector
6.	Rear air spring

Construction

The air springs on the front and rear suspension are similar in construction.

Both air springs are manufactured from flexible rubber.

Each air spring forms an air tight cavity which provides the required spring rate for each corner of the vehicle.

As the air spring is compressed, the rubber material compresses and rolls down the side of the vertical housing below the spring.

Air Supply Connection

An air connection port is located on the top of each spring and allows air to be added or removed from each air spring as required by the air suspension ECU.

The air connection port is connected using a Voss connector and nylon pipe to the valve block on the reservoir.

When removing the Voss connector from any air suspension component, the connector must be left attached to the air pipe.

Removing the connector from the air pipe could cause the connector to scratch the pipe and increase the likelihood of air leaks.

Service Care Points

When servicing an air spring or the complete air suspension system, depressurization is required.

Replacement of an individual air spring does not require full air suspension system depressurization.

Only the corner concerned need be depressurized.

Before carrying out depressurization of the air suspension system, the vehicle weight must be supported.

Prior to removing the vehicle support, each air spring must be fully pressurized before the weight of the vehicle is re-applied to it.

Air Harness Identification

The air harness system is interconnected via yellow and black nylon pipes.

- Yellow = RHS
- Black = LHS

The pipes are attached to the subframe and vehicle body with clips.

This is to ensure that the correct routing is maintained.

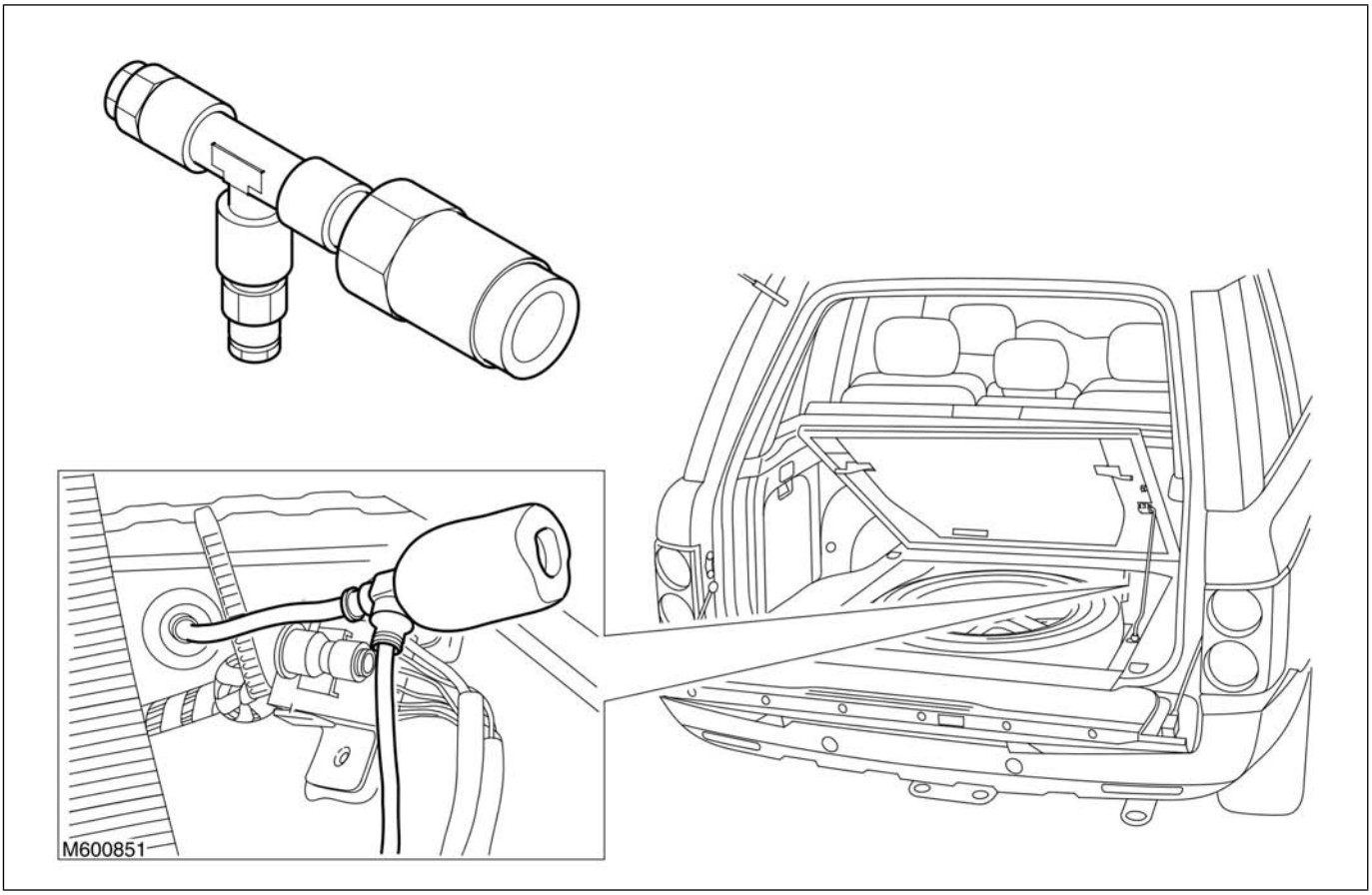
The pipes have timing marks which align with the various clip positions.

The timing marks exist in the form of a white band around the pipe thus indicating the clip position.

If the correct routing is not observed, un-necessary tension at the pipe joints will occur, resulting in possible early failure.

Pressure Control

Pressure Relief Valve



A pressure relief valve is connected to the air pipe between the compressor and the reservoir.

The pressure relief valve is installed in the RHF corner of the spare wheel well and provides a safety back-up for the ECU pressure control function, to limit system pressure.

NOTE: Bulletin A/B/D 293 - issue date 05.10.02 states earlier vehicles had a pressure relief limit of 13.7 bar (199 psi). The pressure relief was reduced with the introduction of an external pressure relief valve and an ECU software upgrade.

If the pressure of the air from the compressor increases above 12.3 bar (178 psi), the pressure relief valve opens and releases the excess pressure to atmosphere.

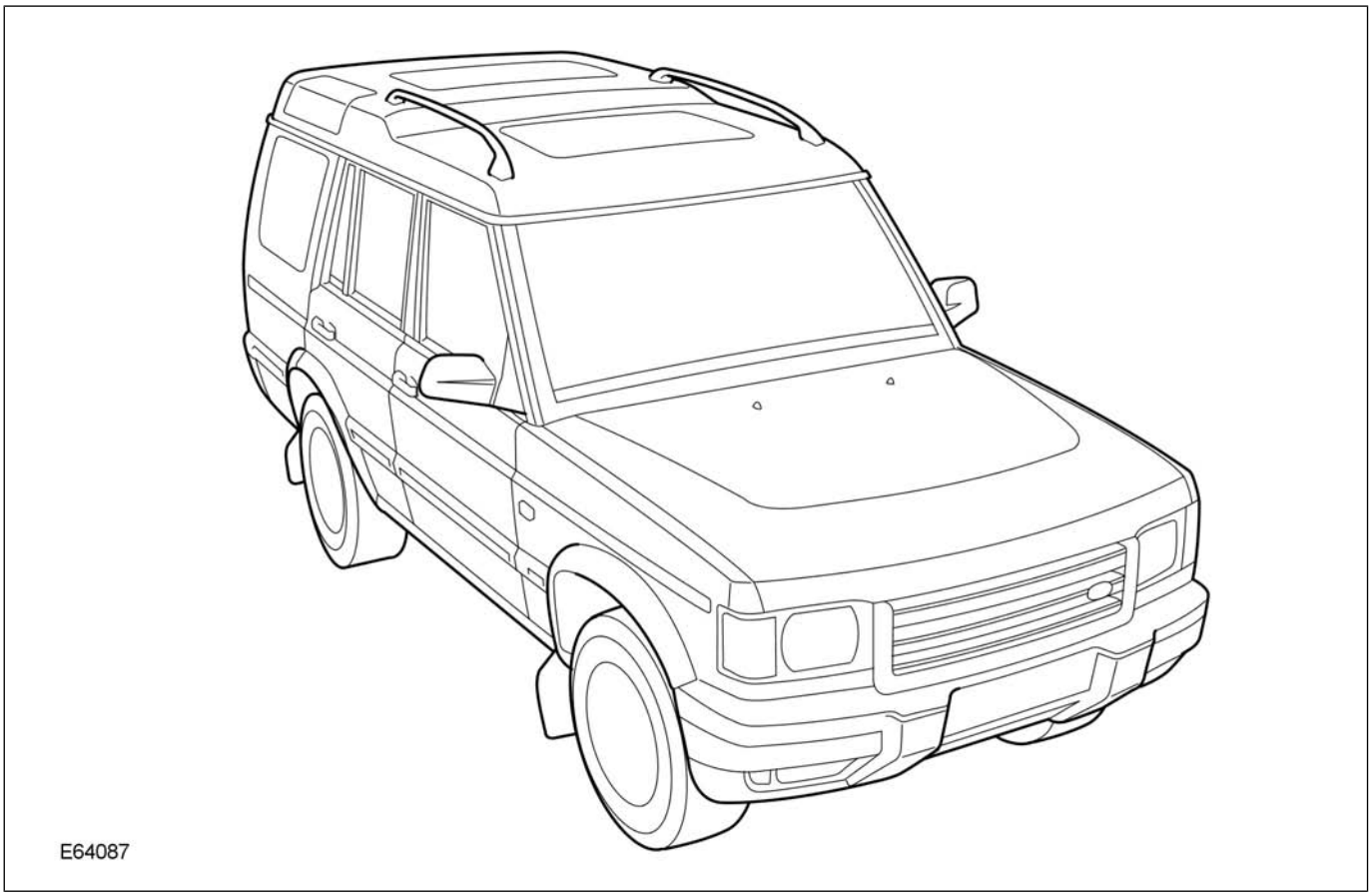
Leak Detection

Air leak detection can be carried out using a Land Rover approved non water based leak detection spray.

If the vehicle appears to be leaking, perform a leak check on all aspects of the system, i.e. air spring pipe fittings and associated connections on the valve block, cross link valves, air spring and reservoir.

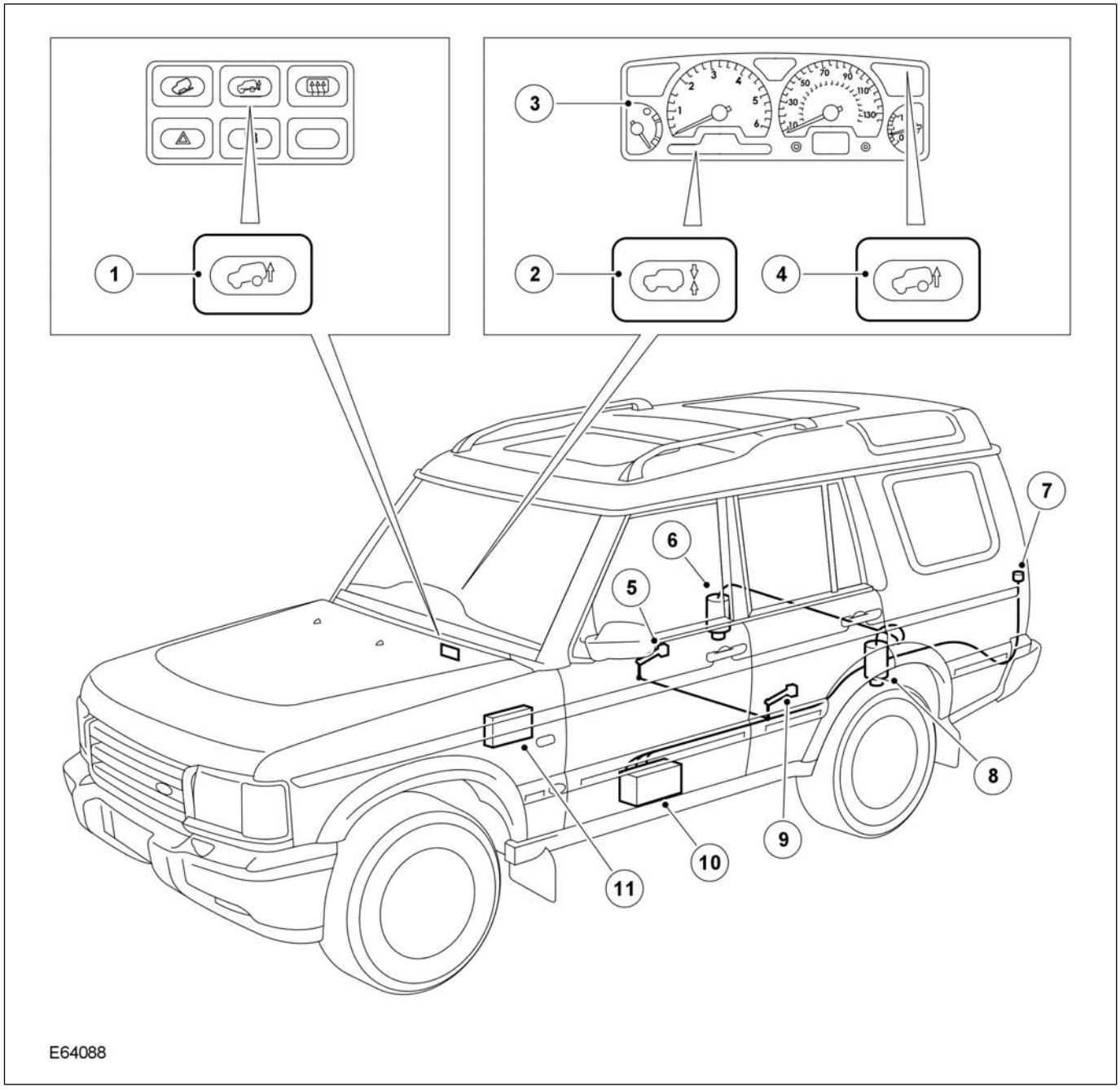
Failure to correctly diagnose leakage will result in un-necessary exchange of serviceable components and re-occurrence of the original problem.

DISCOVERY II



Component Review

Component Location

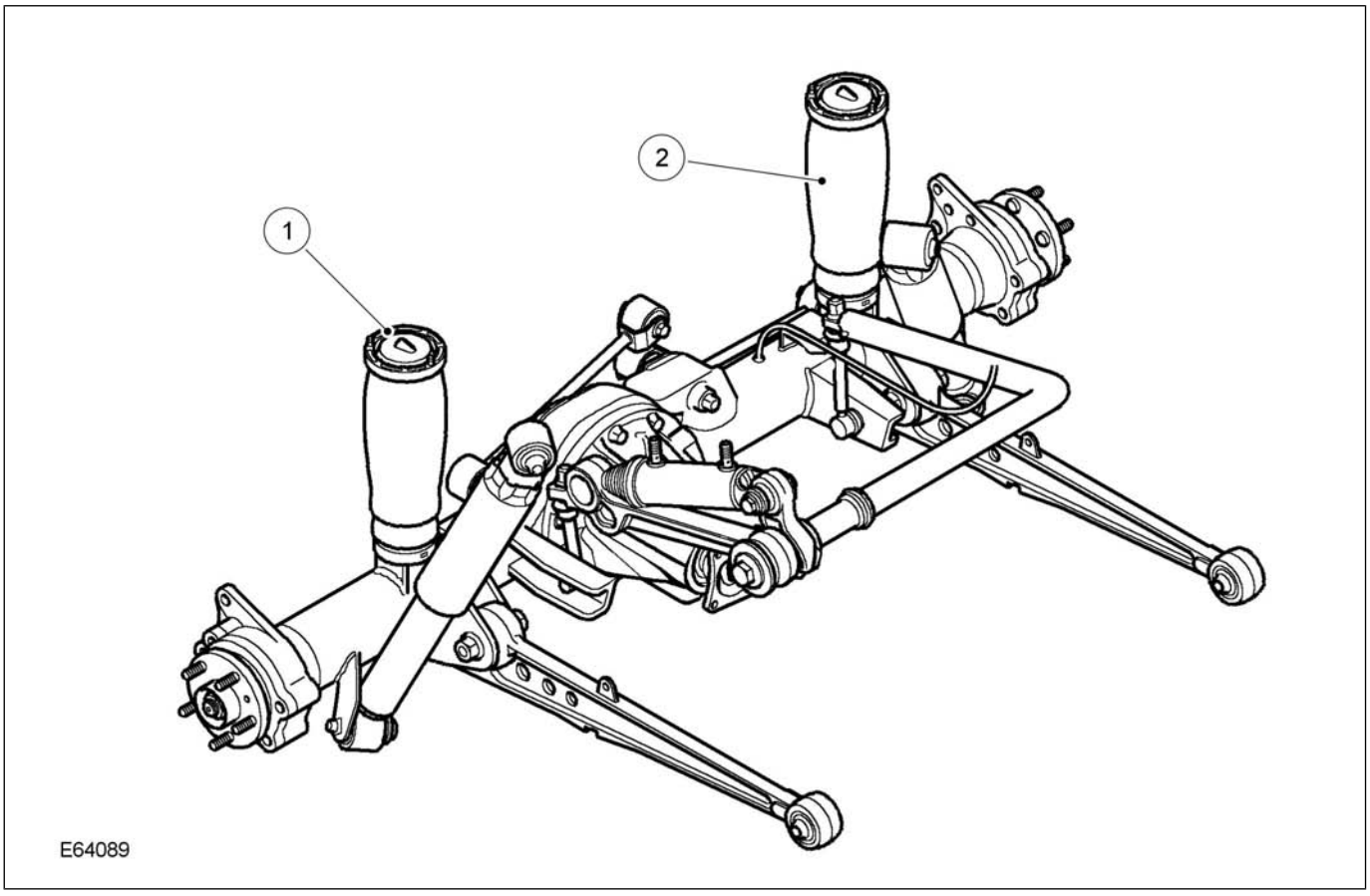


Component Location

Item	Description	Item	Description
1.	Off-Road mode switch	7.	Air intake filter
2.	SLS warning lamp	8.	LHR air spring
3.	Instrument cluster	9.	LHR height sensor
4.	Off-Road warning lamp	10.	Air supply unit
5.	RHR height sensor	11.	SLABS ECU (behind glove box)
6.	RHR air spring		

Self Leveling Rear Suspension

Rear Suspension Components



Item	Description	Item	Description
1.	Air pressure pipe connection (x2)	2.	Air Spring (x2)

Self Leveling Components

Air distribution unit.

Silencer.

Two height sensors.

Two air springs.

Air intake filter.

Air suspension height switch.

Air suspension warning lamp.

Off-road mode warning lamp.

Self Leveling / Anti Lock Brakes (SLABS) ECU.

Air Distribution Unit

The air distribution unit is located on the LH chassis rail, beneath the floor panel.

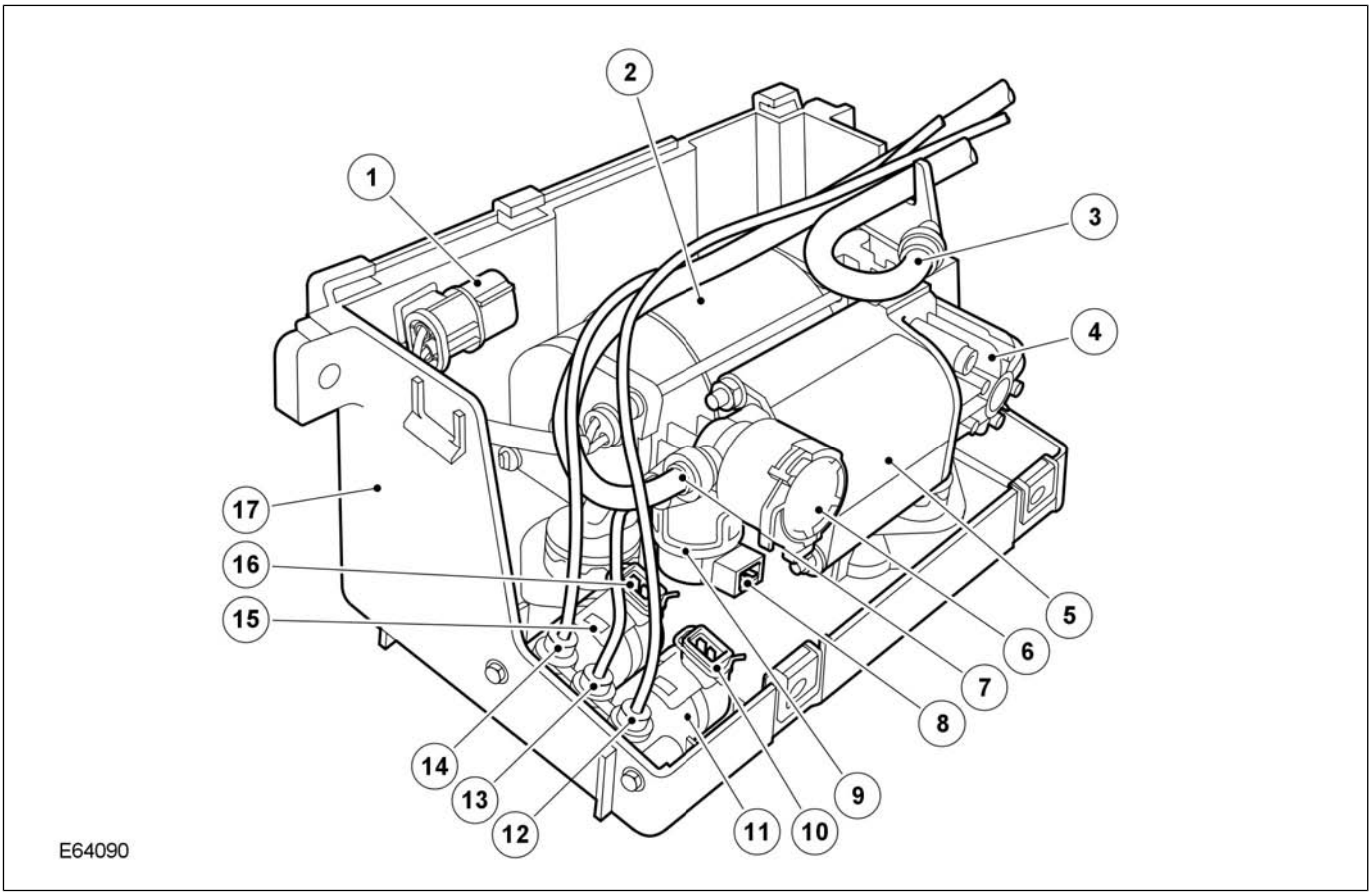
No routine maintenance is required for the assembly.

The housing contains the following components.

Air Distribution Unit:

- Compressor
- Air drier assembly
- Air valve
- Pressure limiting valve
- Electric motor

Air Distribution Assembly



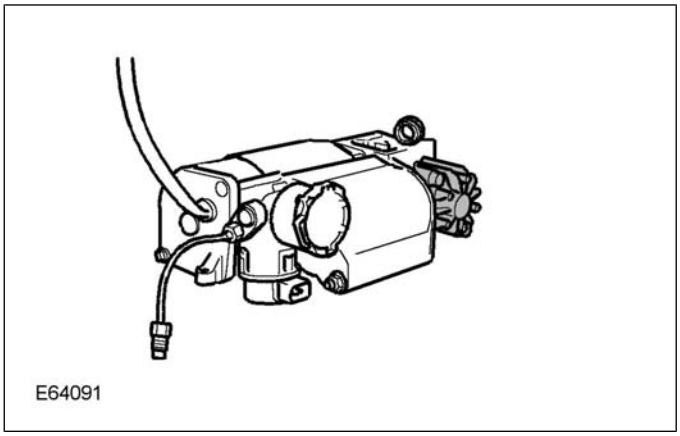
Air Distribution

Item	Description	Item	Description
1.	Compressor electrical connector	10.	LH air valve electrical connector (blue harness connector)
2.	Electric motor	11.	LH air valve
3.	Air intake hose	12.	LH air spring supply pipe
4.	Compressor	13.	Air supply /Exhaust pipe
5.	Air drier unit	14.	RH air spring supply pipe
6.	Pressure limiting valve	15.	RH air valve
7.	Exhaust hose	16.	RH air valve electrical connector (natural harness connector)
8.	Exhaust valve electrical connector (black harness connector)	17.	Air distribution housing
9.	Exhaust valve		

Compressor

The role of the compressor is to supply compressed air to the rear air springs.

Compressor Unit



Power Supply

A relay located in the engine bay fuse box supplies the compressor with its 12v power requirements.

The relay is controlled by the Self Leveling Anti- lock Brake System (SLABS) ECU (the SLABS ECU is located behind the passenger side glove box).

Compressor Operation

The air supply unit consists of a 12v electric motor, a compressor with a drier element, a pressure limiting valve and two air supply control valves.

Exhaust and the air supply control valves are solenoid operated responding to signals from the SLABS ECU.

The electric motor drives a crank with an eccentric pin to which a connecting rod is attached.

A piston connects to the connecting rod and fits into the bore of the compressor.

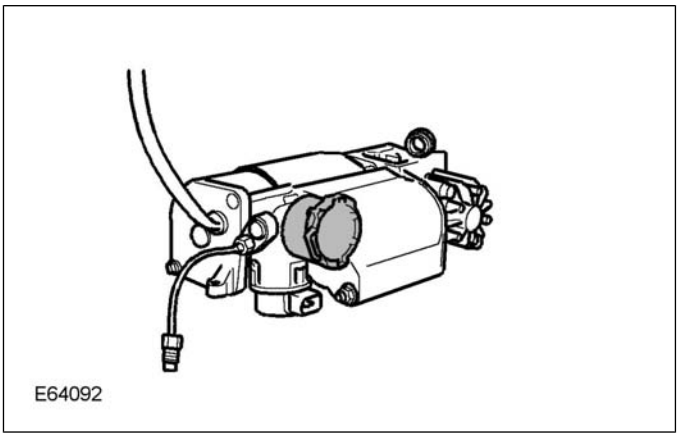
When the motor is operated it rotates the crank, moving the piston in the bore of the compressor.

Air Pressure Limiting Valve

The air pressure limiting valve is attached to the end of the air drier unit.

The limiting valve protects the air springs from over inflation.

Pressure Limiting Valve



When the exhaust valve is opened, the pressure limiting valve also opens.

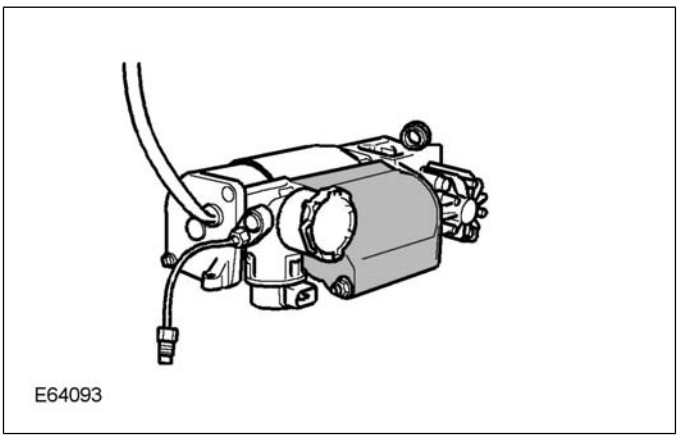
The valve is pneumatically operated, responding to air pressure applied to it.

Air Drier Unit

The air drier unit is built into the compressor assembly.

The air drier unit contains a silicate box which removes moisture from the compressed air entering the system.

Air Drier Assembly



All air exhausted from the system passes through the drier unit in the opposite direction.

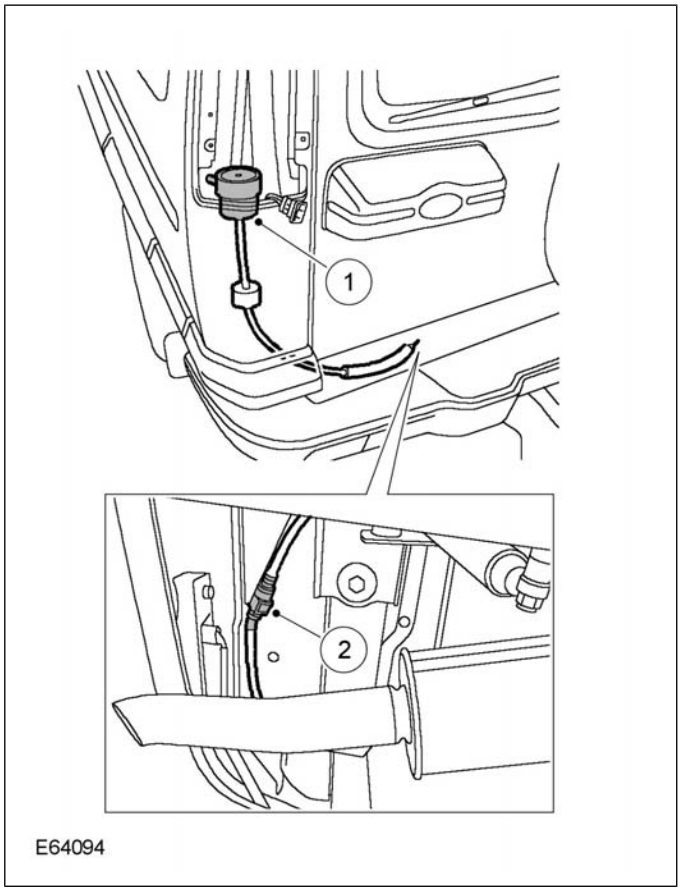
The air drier is regenerative in that exhaust air absorbs the moisture in the drier element and expels it into the atmosphere.

The air drier element is designed to last the life of the vehicle and in non-serviceable.

Air Intake Filter

The air intake and filter for the compressor is located behind the LHR light cluster in the 'E' post.

Air Intake Location



Air Intake System
1. Air intake filter
2. Quick release connector

The plastic molded housing contains a felt and foam air filter and is replaceable (refer to repair procedure in the workshop manual).

The filter removes particulate matter from the air drawn in by the compressor.

For correct service intervals refer to the service maintenance check sheet.

It is recommended that vehicles used extensively in arduous / off-road conditions will require the air intake filter to be replaced at more regular intervals.

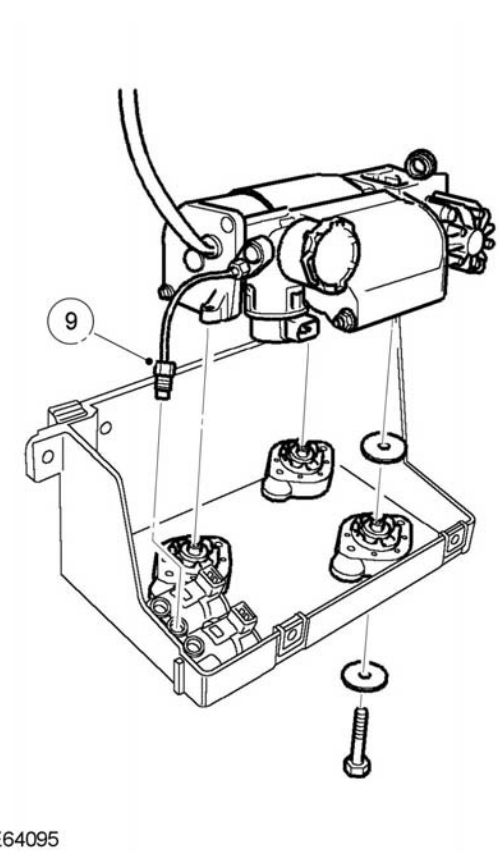
Air Valves

The self leveling suspension system air control valves control the operation of the air springs located at the rear of the vehicle.

There are three solenoid actuated valves incorporated within the air distribution unit.

- Right spring valve
- Left spring valve
- Exhaust valve

Operating Valves



Operating Valves
1. Right air spring valve
2. Left air spring valve
3. Exhaust valve

Vehicle Lifting

For the LHS of the vehicle to rise, the left spring valve is opened and the compressor run.

The same operation with the right spring valve, raises the RHS of the vehicle.

Vehicle Lowering

To lower the LHS of the vehicle, the left hand valve is opened along with the exhaust valve.

Likewise, the same operation is completed for the right hand valve and exhaust valve to lower the RHS of the vehicle.

Valve Location

The LH and RH spring valves are located at the forward end of the air distribution housing.

Valve Control

Each control valve can be individually operated by the SLABS ECU.

The exhaust valve is located with the pressure limiting valve and is solenoid operated by the SLABS ECU.

The exhaust valve directs air from the air spring(s) and control valve(s) to atmosphere when required.

All expelled air passes through the drier element to regenerate the silica material.

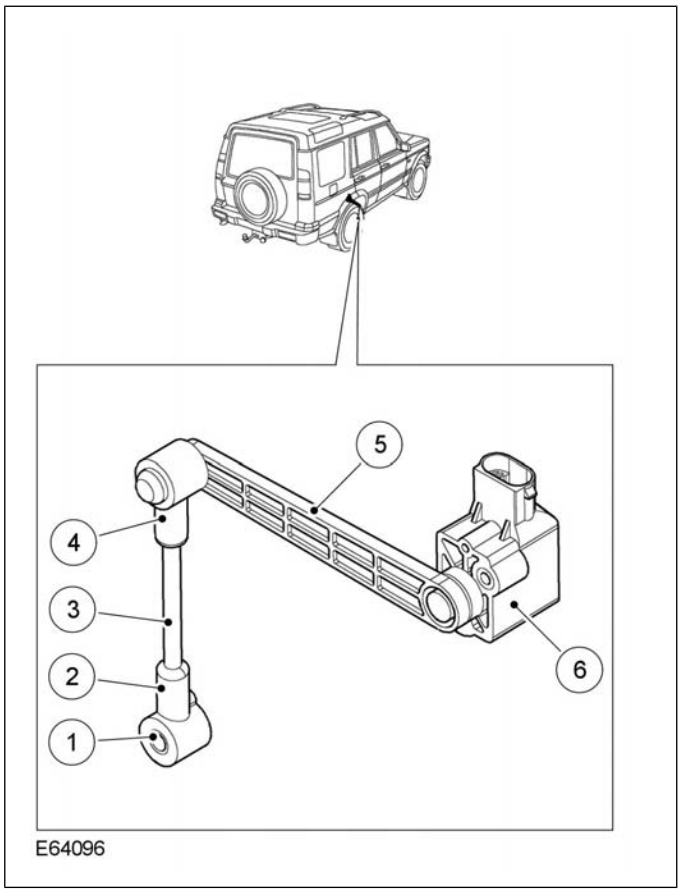
Silencer

The silencer is connected into the air lines behind the air distribution unit.

It has two chambers, one to reduce compressor pulsing noises at the air intake filter, the other to minimize exhaust noise.

Height Sensors

Height Sensor



Item	Description
1.	Spacer
2.	Link end
3.	Link rod
4.	Link end
5.	Sensor arm
6.	Sensor body

Sensor Location

The height sensors are located on the chassis, with the sensor arms, a link rod and two link ends attached to the radius arms.

The link ends permits articulation of the arm to allow for suspension travel.

The lower link arm is attached to a lug on top of the radius arm.

Sensor Connector

Each sensor is connected to the main chassis harness by a multiplug.

The three pin multiplug provides the following electrical connections:

- Ground
- 5v supply
- Feedback signal

Sensor Operation

Each sensor operates on the Hall effect principle.

A magnet is attached to the shaft and rotates with the movement of the arm.

The magnetic flux generated acts on a Hall effect sensor and depending on its position, varies the current across the sensor.

The current generated is measured, amplified and passed to the SLABS ECU as a linear output feedback voltage signal.

The voltage signal varies according to the angular position of the sensor arm.

The signal is processed by the SLABS ECU and from this the ECU can determine the height of the vehicle.

Service Points

Height sensor voltage outputs vary from sensor to sensor.

This is a manufacturing variability which has to be compensated for when the sensor is fitted to the vehicle.

If, for any reason, the sensors are replaced, or removed and refitted, a calibration process must be completed.

This is to ensure that the SLABS ECU can determine the correct height value of the vehicle from the height sensor voltage signal.

The calibration procedure involves using T4 diagnostic equipment and a set of special calibration setting blocks (LRT 64-003).

Ride Characteristics

Using air springs provides the vehicle with an improved secondary ride.

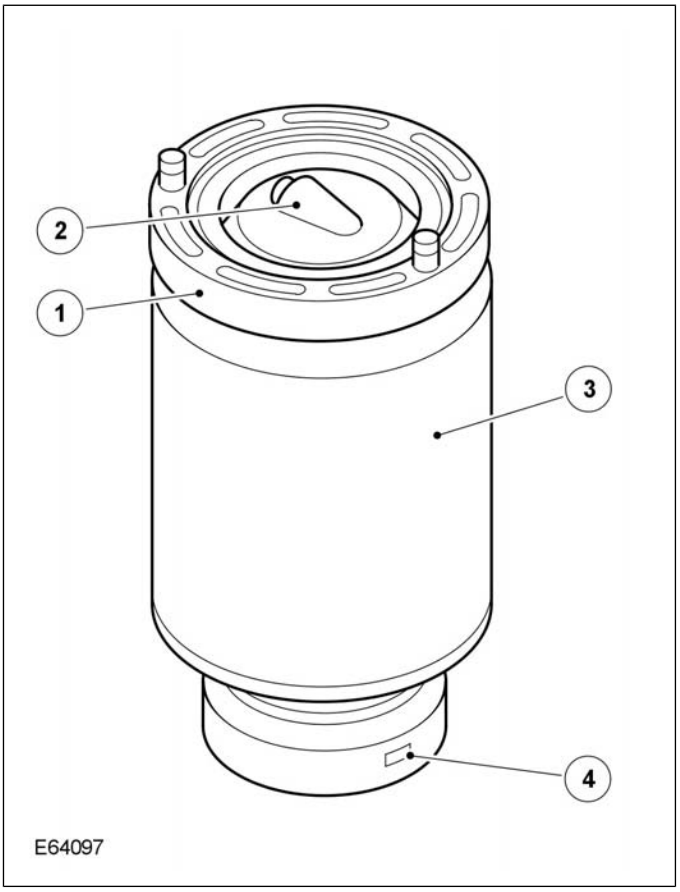
Secondary ride is the term used to describe vibrations / oscillations caused by the vehicle reacting to minor road imperfections.

Air Spring Construction

The rear air springs are manufactured using a light, but, reinforced material for strength and durability.

Air Springs

Rear Air Spring



Rear Air Spring
1. Top plate
2. Voss connector
3. Air bag
4. Piston

Spring Location

Each air spring is located at its base by a fabricated platform on the rear axle.

The top of the spring locates in a fabricated bracket attached to the outside of each chassis.

The plastic base piston is recessed and has a boss with two lugs molded in the center for attachment to the axle.

The piston is secured by locating lugs in a slotted hole in the axle platform and rotating the spring through 90 degrees locates the lugs in the slot.

The plastic top plate has grooved pins which locate through holes in the chassis bracket.

Two spring clips locate on the grooved pins and retain the top of the spring in position.

Spring Assembly

Each air spring comprises a top plate, an air bag and base piston.

The air bag is attached to the top plate and the piston with crimped rings.

The air bag is made from a fibre reinforced flexible rubber material which allows the spring to expand with air pressure and deform under load.

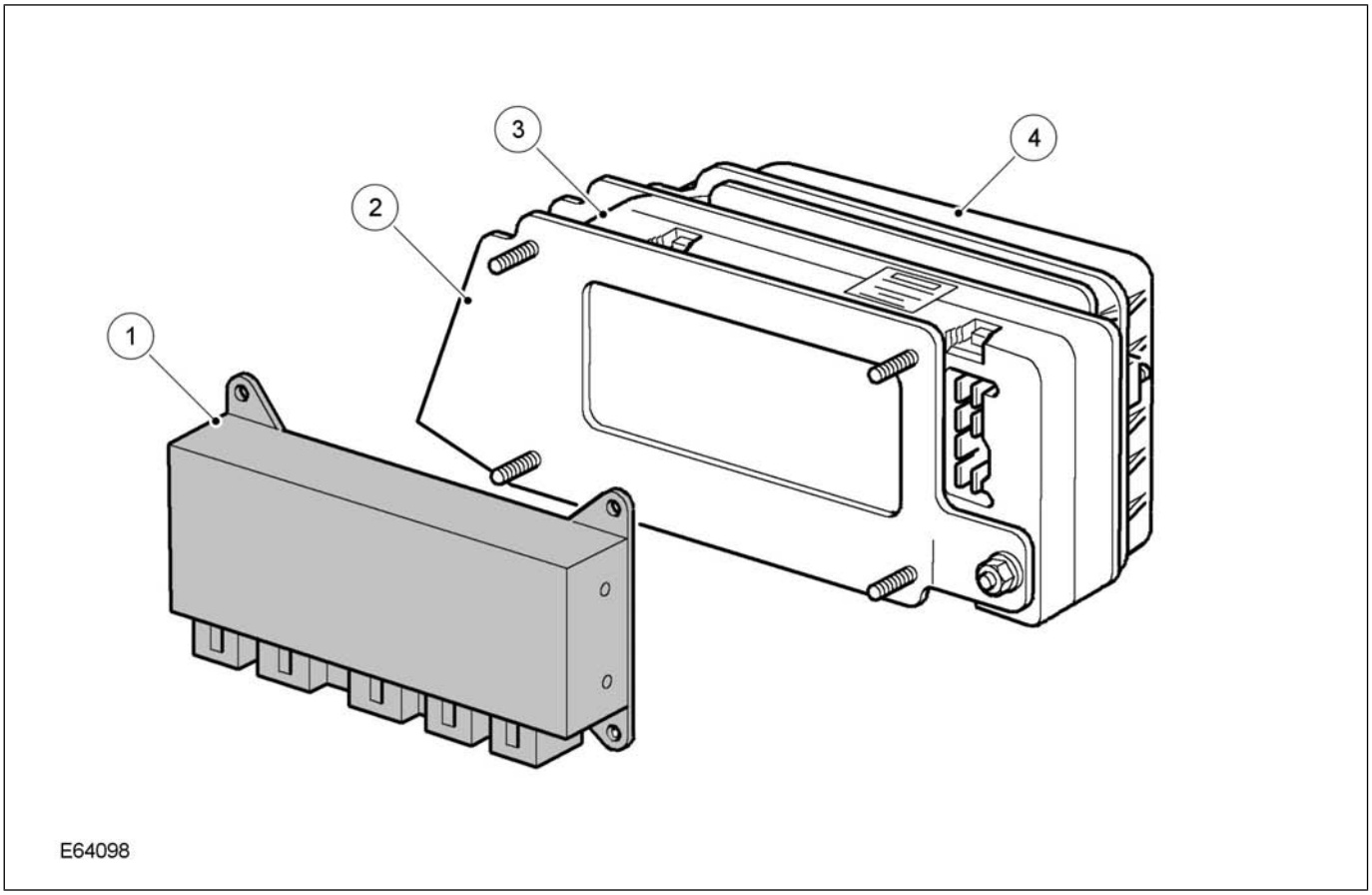
The top plate comprises the two bonded grooved pins and a female Voss connector in the center.

The Voss connector allows for the attachment of the air supply pipe from the air supply unit.

The piston is also plastic and is shaped to optimize the springs characteristics.

SLABS ECU

ECU



Item	Description	Item	Description
1.	SLABS ECU	3.	BCU (ref only)
2.	Bracket	4.	ACE ECU (ref only)

SLABS ECU Location

The SLABS ECU is mounted on a bracket behind the passenger glove box and can be identified from other ECU's by its five connectors.

The five electrical connectors are located on the lower face of the ECU.

The twelve, six and eighteen pin connectors are used to supply inputs and outputs to and from the ECU whilst the remaining two connectors are used for ABS operation.

Battery Power Supply

The SLABS ECU receives a continuous battery supply from 'Fuse 11' in the engine compartment fusebox.

Ignition Power Supply

An ignition 'ON' signal is supplied from the ignition switch via 'Fuse 28' in the passenger compartment fusebox.

The ECU has the ability to control when it requires power and is not reliant on the ignition signal to power up the ECU.

Event Timers

Incorporated into the ECU is a counter which times the operation of the SLS system and prevents the compressor exceeding its duty cycle.

The ECU can remain powered for up to 1.5 hours after ignition off is sensed which allows the counter to continue running to avoid an ignition cycle resetting the event counter.

Door Input

If any of the doors are opened, this will power up the ECU irrespective of the ignition switch position.

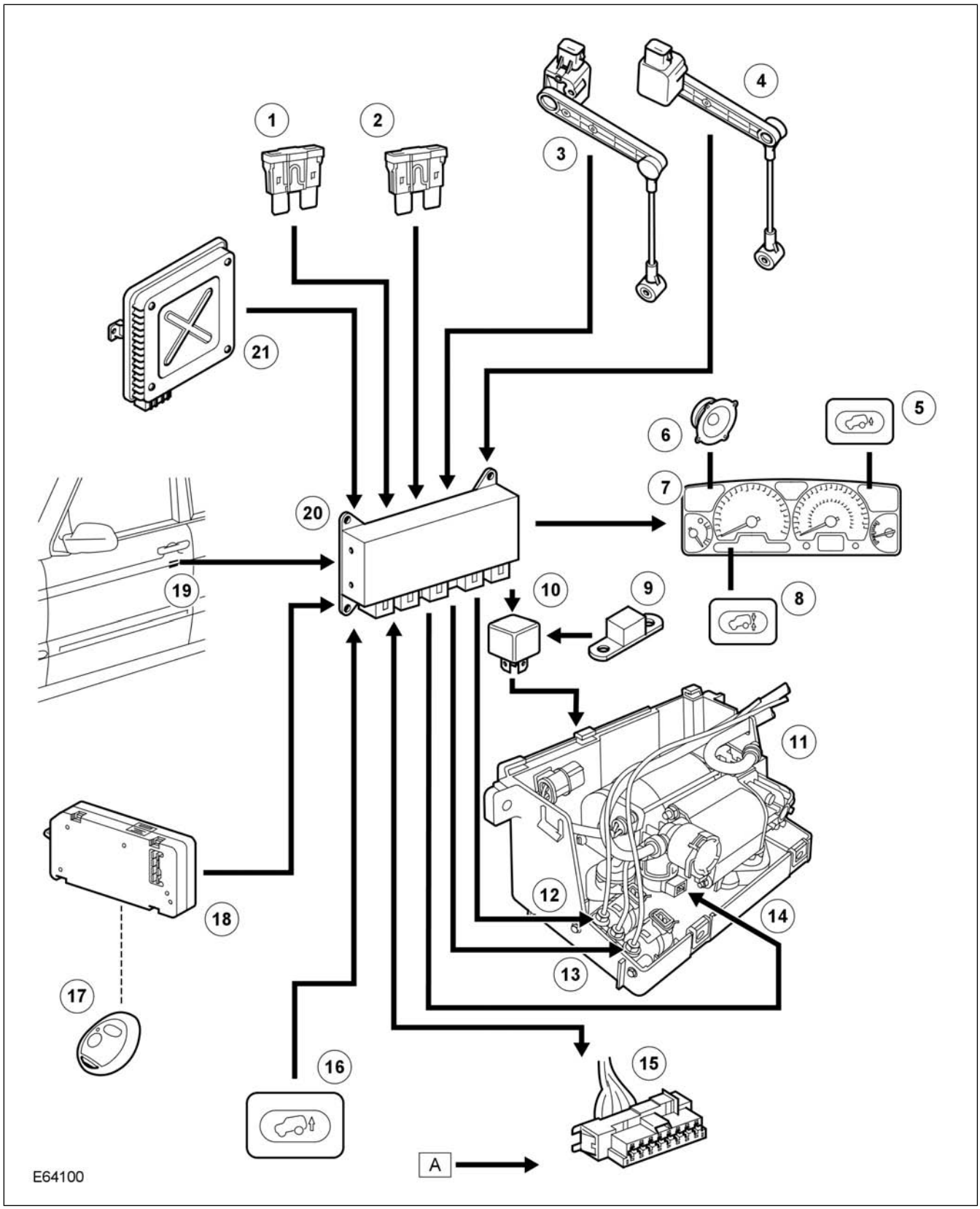
The door open signal is sensed by the door switch completing an earth path which is sensed by the ECU.

The door open signal powers the ECU for up to 30 minutes.

This allows the vehicle to re-level when a load is removed or passengers leave the vehicle.

System Components

System Components Schematic



System Operation

Item	Description	Item	Description
1.	Battery supply (via SLABS relay)	12.	RH air valve
2.	Ignition supply	13.	LH air valve
3.	RH height sensor	14.	Exhaust valve
4.	LH height sensor	15.	Diagnostic socket
5.	Off-Road mode warning lamp	16.	Off-Road mode switch
6.	Audible warning speaker	17.	SLS remote handset
7.	Instrument cluster	18.	Body Control Unit (BCU)
8.	SLS warning lamp	19.	Door switches
9.	Fusible link 9	20.	SLABS ECU
10.	SLS relay	21.	Engine Control Module (ECU)
11.	Air supply unit		

System Operation

Self leveling is accomplished automatically when the engine is running (the engine ECU sends an engine speed signal to the SLABS ECU to indicate when the engine is running).

The height sensors inform the SLABS ECU at what the height the vehicle is currently set.

If the rear suspension is too low, the SLABS ECU switches on the compressor by actuating the compressor relay.

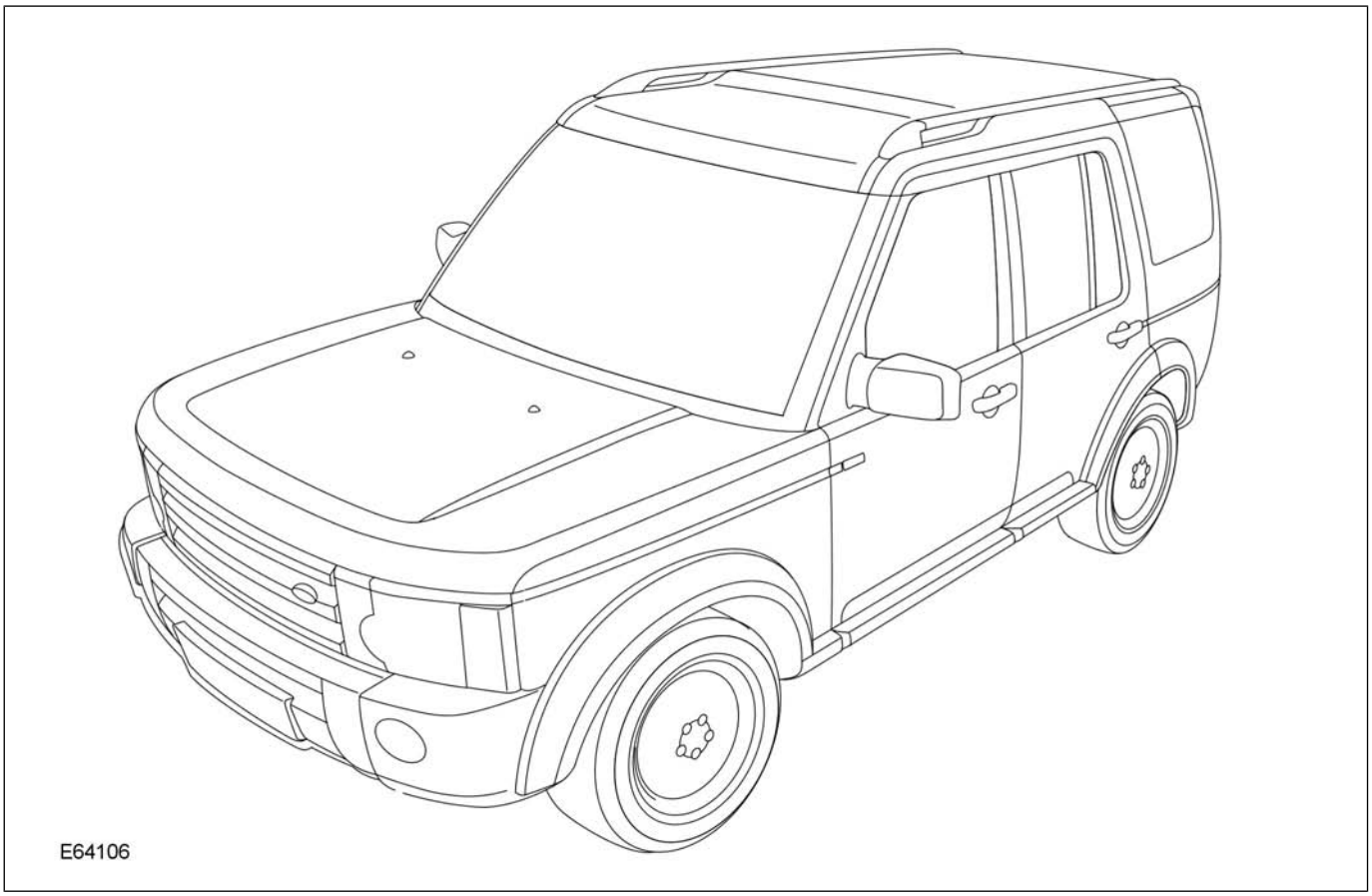
The LH and RH spring valves will open simultaneously (providing the vehicle is on flat ground), allowing compressed air to the air springs.

The exhaust valve will remain closed.

The height sensors then inform the ECU that the target height has been reached, the compressor stops and the valves are closed.

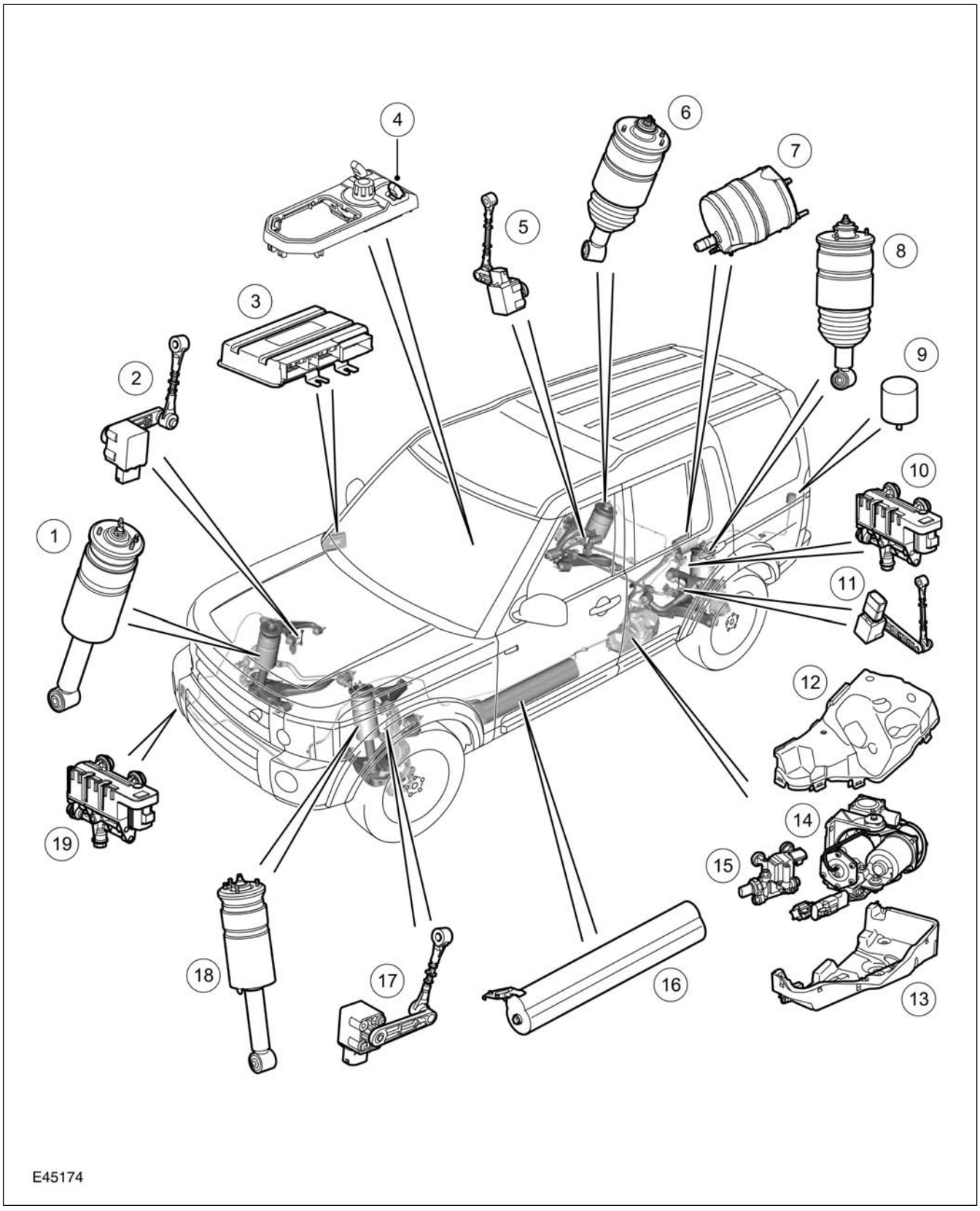
If the air suspension is too high, the LH and RH spring valves will open, along with the exhaust valve, purging air until the height sensors inform the ECU that the target height has been reached.

DISCOVERY 3 / LR3



Component Review

System Components

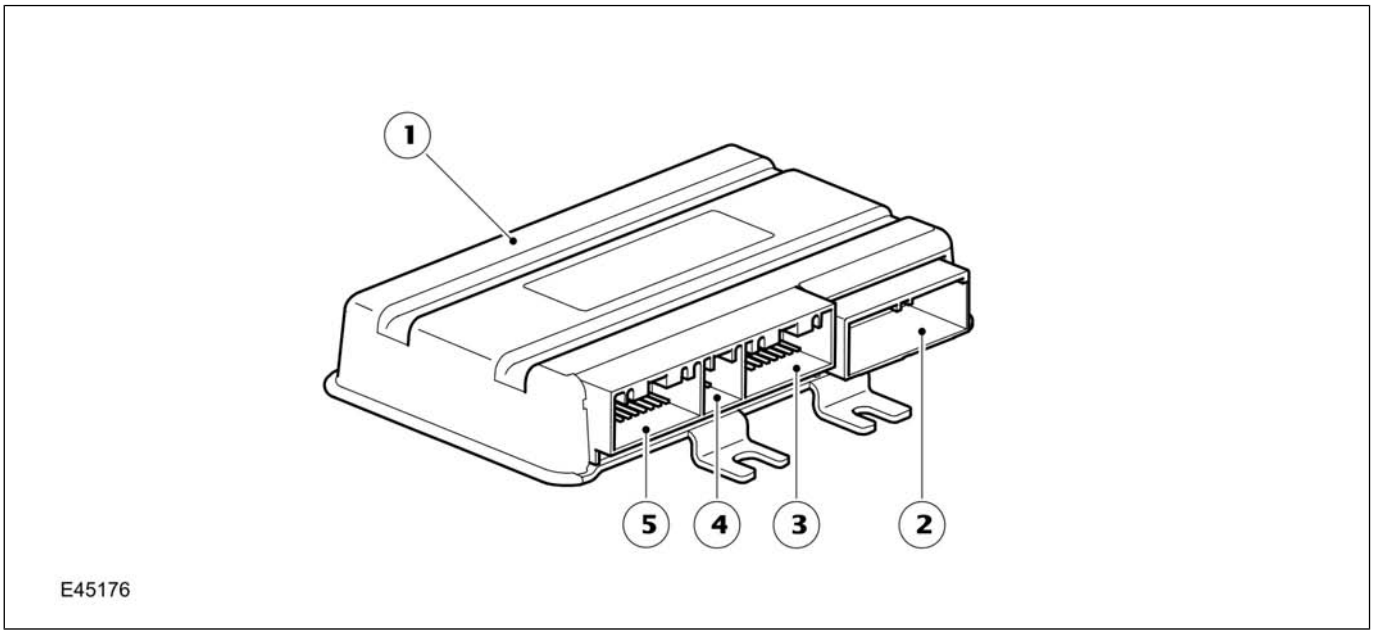


Component Location

Item	Description	Item	Description
1.	Front RH air spring damper module	11.	Rear LH height sensor
2.	Front RH height sensor	12.	Upper acoustic cover
3.	Air suspension control module	13.	Lower acoustic cover
4.	Air suspension control switch	14.	Air supply unit
5.	Rear RH height sensor	15.	Reservoir valve block
6.	Rear RH air spring damper module	16.	Air reservoir
7.	Air supply unit silencer	17.	Front LH height sensor
8.	Rear LH air spring damper module	18.	Front LH air spring damper module
9.	Air intake filter	19.	Front valve block
10.	Rear valve block		

Control Module

Air Suspension Module



Item	Description	Item	Description
1.	Air Suspension Control Module	4.	Connector C2030
2.	Connector C0867	5.	Connector C2321
3.	Connector C2320		

Control Module Location

The air suspension control module is located behind the instrument panel, on the driver's side 'A' post.

Attachment to the 'A' post is via a single fixing and two plastic clips.

Calibration

A calibration routine is performed using the T4 diagnostic equipment to access the position of each corner of the vehicle and record the settings in the ECU memory.

Once set, the calibration is not required to be performed again unless:

- Air suspension control module is removed or replaced
- Height sensor is removed or replaced
- Suspension arm to which the sensor is connected is removed or replaced

If the removed height sensor is subsequently refitted, the calibration procedure will have to be performed to ensure the integrity of the system.

If the air supply unit, the reservoir, a valve block, a damper module or the air harness is removed or replaced, the system will not require recalibration.

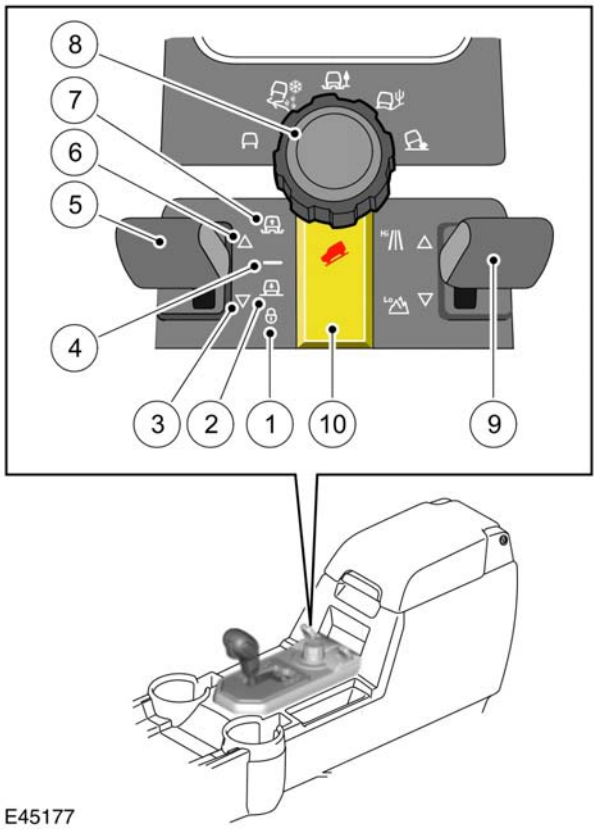
Inputs and Outputs

Four harness connectors are used by the air suspension control module for all inputs and outputs.

The following tables show the details of the signals or electrical supplies on each connector pin.

Air Suspension Control

Air Suspension Control Switch



Control Switch

Item	Description	Item	Description
1.	Crawl mode lamp	6.	Raising lamp
2.	Access mode lamp	7.	Off-road mode lamp
3.	Lowering lamp	8.	Terrain Response™ rotary control
4.	On-road mode lamp	9.	Transfer box range switch
5.	Air suspension switch	10.	Hill Descent Control (HDC) switch

The air suspension control switch is located in the center console, behind the manual or automatic transmission selector lever.

The switch is a three position, non-latching switch which allows selection of the following driver selectable modes.

Selection Modes:

- On-road mode
- Access mode
- Crawl (locked at access) mode

The air suspension switch can be moved forwards or backwards from its central position.

The switch is non-latching and returns to the central position when released.

The switch completes an earth path to the air suspension control module when operated.

This earth path is completed on separate wires for the raise and lower switch positions, allowing the control module to determine which selection the driver has made.

The air suspension switch has six symbols which illuminate to show the current selected height and the direction of movement.

The raise and lower symbols will flash and a warning tone will be emitted from the instrument cluster sounder when a requested height change is not allowed, i.e. vehicle speed too fast.

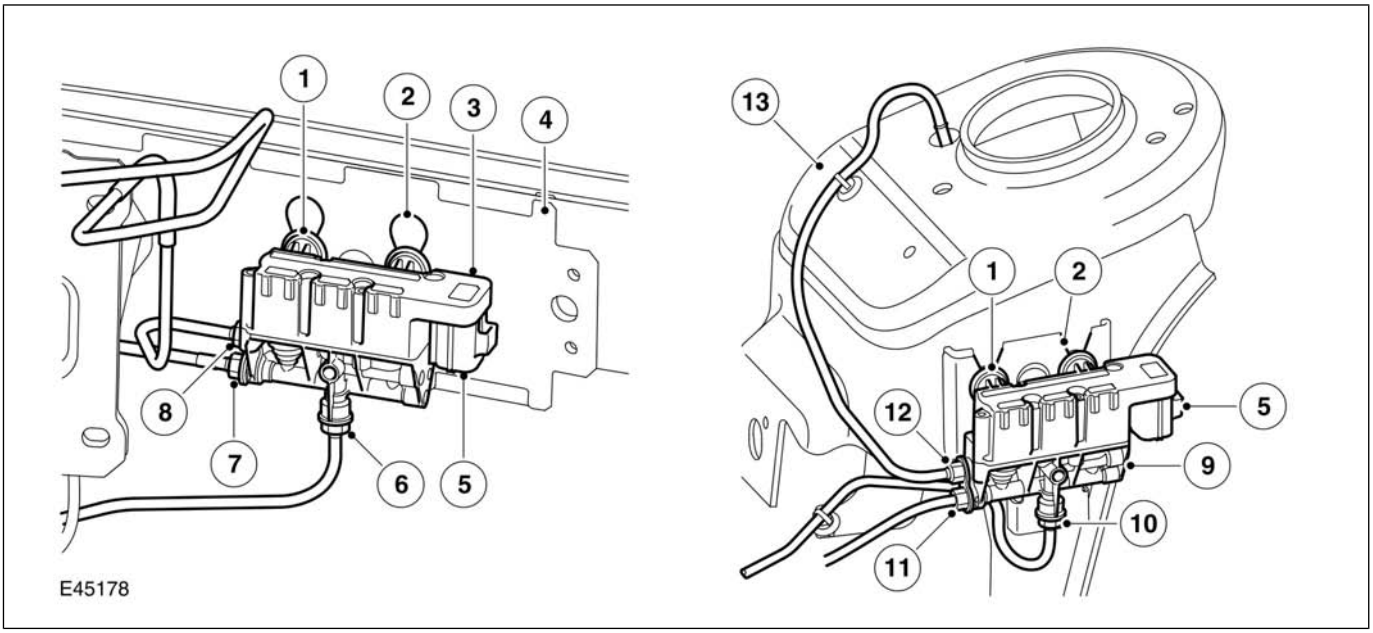
A flashing symbol indicates that the air suspension system is in a waiting state or that the system will override the driver's selection because the speed threshold is too high.

The driver can also ignore the system's warnings signals and allow the height to change automatically.

For example, increasing the vehicle speed to more than 25 mph (40 km/h) will cause the control module to automatically change the ride height from off-road mode to on-road mode.

Valve Blocks

Front and Rear Valve Blocks



Item	Description	Item	Description
1.	Isolation rubber mounts (x3)	8.	RHF air spring, air harness connection
2.	Location slots	9.	Rear valve block, valves and solenoid assembly
3.	Front valve block, valves and solenoid assembly	10.	RHR air spring, air harness connection
4.	Front bumper	11.	Air inlet /outlet connection
5.	Electrical connector	12.	LHR air spring, air harness connection
6.	LHF air spring air harness connection	13.	Rear suspension turret
7.	Air inlet /outlet connection		

The front and rear axle valve blocks are similar in their design and construction and controls air supply and distribution to the front or rear pair of air spring damper modules respectively.

The difference between the two valve blocks is the connections from the valve block to the left and right hand air spring damper modules and the valve sizes.

It is important that the correct valve block is fitted to the correct axle, otherwise leveling will be impaired due to the different valve sizing.

Fitting valve blocks incorrectly would not actually stop the air suspension from functioning. But will result in slow raise and lower times and uneven raising and lowering between the front and rear axles.

Valve Block Location

The front valve block is attached to the right hand end of the front bumper.

The rear valve block is located on the forward face of the left hand suspension turret.

Connection

Valve blocks are fitted with isolation rubber mounts to reduce possible operational noise from being transmitted.

The front and rear valve blocks each have three Voss type air pipe connection fittings.

One connection is an air pressure inlet / outlet from the reservoir block.

The remaining two connections provide the pressure connections to the left and right air spring assemblies.

Each valve block contains three solenoid operated valves: two corner valves and one cross link valve.

Each solenoid valve is controlled individually by the air suspension control module.

The solenoids have a resistance value of 2 Ohms @ 20°C (68°F).

Corner Valves

The corner valves control the flow of air into and out of the individual air springs.

When the solenoid is de-energized, the corner valves are held in a closed position by internal springs.

When the solenoid is energized, the valve armature moves and allows air flow into or out of the air spring.

Cross Link Valves

The cross link valves provides a connection between the two air springs on the same axle.

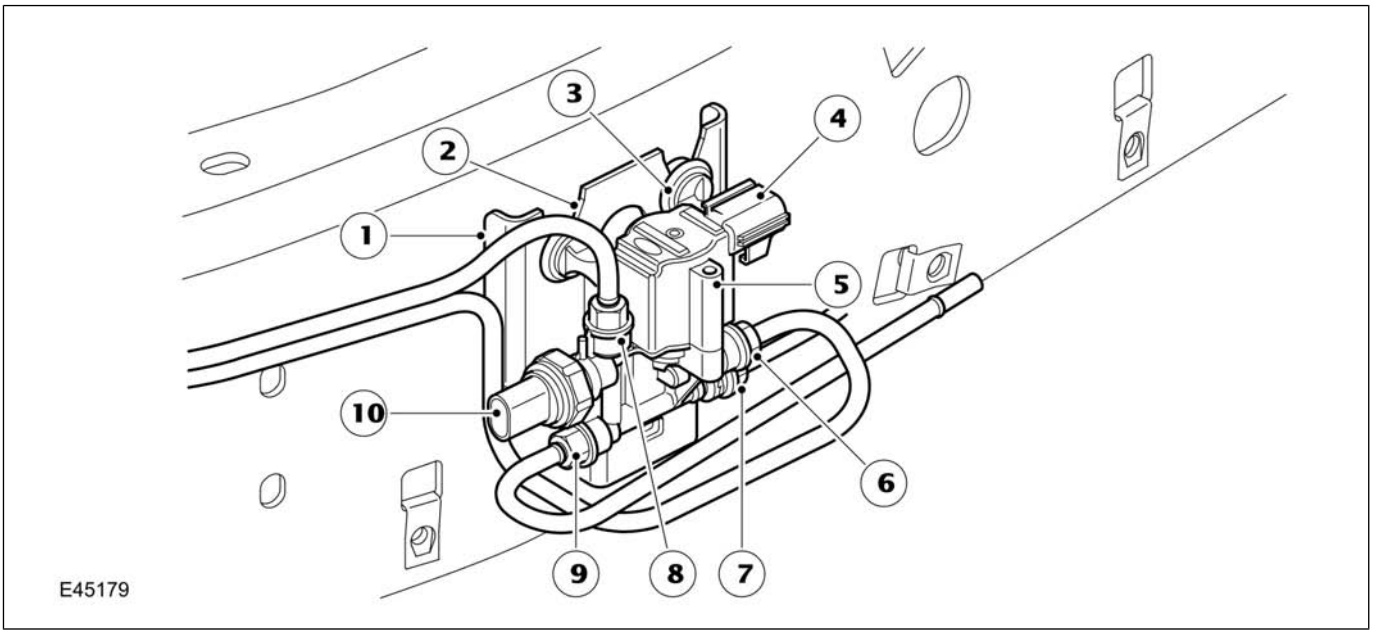
When de-energized, the cross link valve prevents air passing from one air spring to another.

When the solenoid is energized, the valve spool moves and allows air to pass from one air spring to the other.

This increases wheel articulation and improves ride comfort at low vehicle speeds.

Reservoir Valve Block

Reservoir Valve Block



Item	Description	Item	Description
1.	Chassis mounting bracket	6.	Reservoir connection
2.	Location slot	7.	Rear valve block connection
3.	Isolation rubber mounts (3 off)	8.	Front valve block connection
4.	Electrical connector	9.	Air supply unit connection
5.	Reservoir valve block, valves and solenoid assembly	10.	Pressure sensor

Reservoir Valve Block

The reservoir valve block controls the storage and distribution of air to and from the reservoir.

The valve block also contains the air suspension system pressure sensor.

Valve Block Location

The reservoir valve block is attached to a bracket on the outside of the left hand chassis rail.

Position of the valve block is between the reservoir and the air supply unit.

The valve block is located within the air supply unit acoustic box to protect it from dirt ingress and damage from stones.

Valve Block Attachment

The valve block has three attachment lugs which are fitted with isolation rubber mounts which locate in the chassis bracket which has three slotted holes.

The isolation rubber mounts locate in the 'V' shaped slots and are pulled downwards into positive location in the slots.

Connections

The valve block has four air pipe connections which use 'Voss' type air fittings.

The connections provide for air supply from the air supply unit, air supply to and from the reservoir and air supply to and from the front and rear valve blocks.

The connections from the air supply unit and the front and rear control valves are all connected via a common gallery within the valve and therefore are all subject to the same air pressures.

Operation

The reservoir supply is utilized as much as possible to aid speed of response from the system.

However, the system will alternate between reservoir and compressor supply as dictated by system pressures.

The reservoir valve block contains a solenoid operated valve which is controlled by the air suspension control module.

The solenoid valve controls the pressure supply to and from the reservoir.

The solenoid has a resistance value of 2 Ohms at a temperature of 20°C (68°F).

When energized, the valve spool moves allowing air to pass in or out of the reservoir.

Reservoir Pressure

The reservoir valve block also contains a pressure sensor which can be used to measure the system air pressure in the air springs and the reservoir.

The pressure sensor is connected via a harness connector to the air suspension control module.

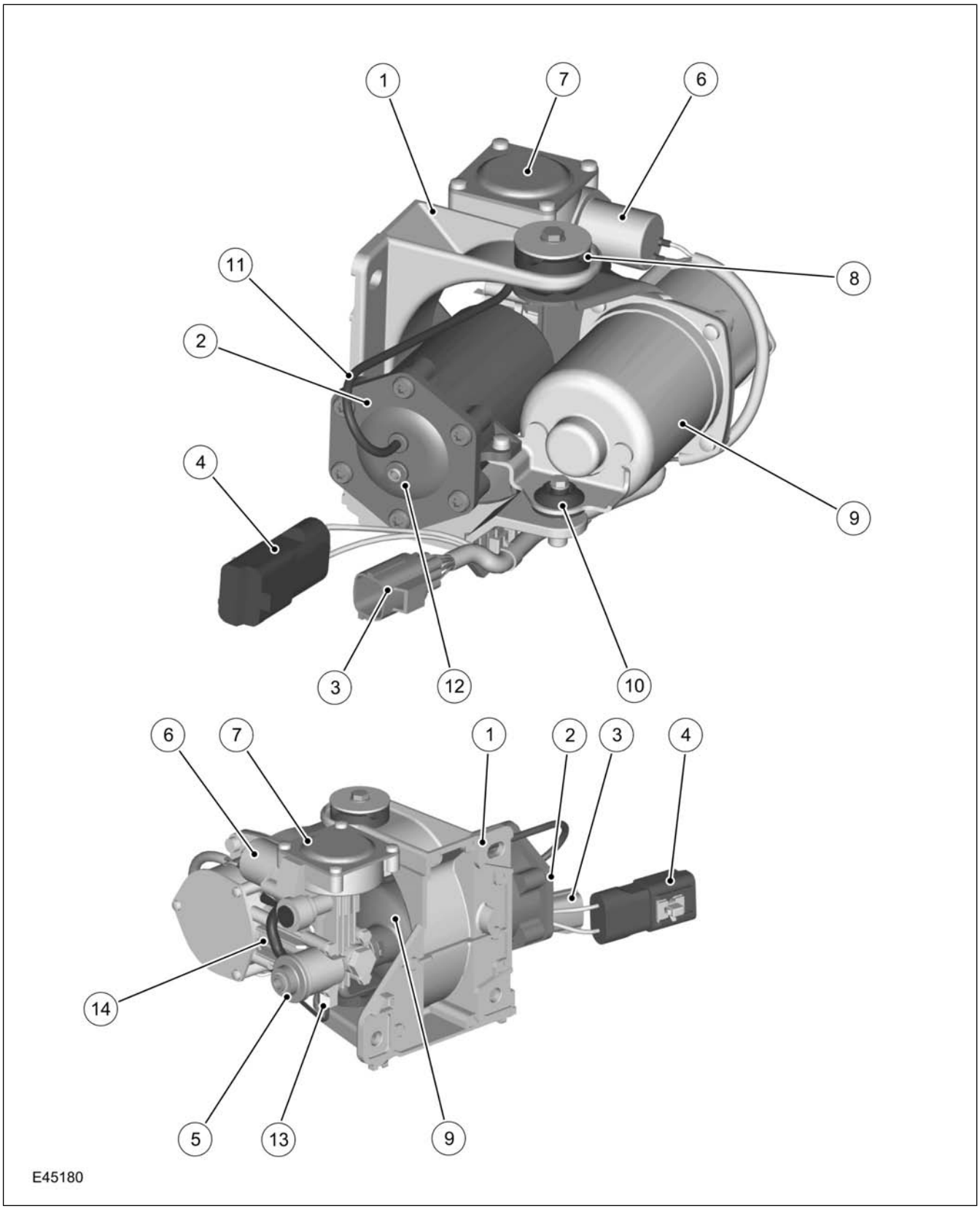
The control module provides a 5v reference voltage to the pressure sensor and monitors the return signal voltage from the sensor.

Using this sensor, the control module controls the air supply unit operation and therefore limits the nominal system operating pressure to 16.8 bar (244 lb in^2).

Maximum pressure is a nominal 23 bar (333 lb in^2), however the reservoir is tested to a maximum of 35 bar (507 lb in^2).

Air Supply Assembly

Air Supply Unit

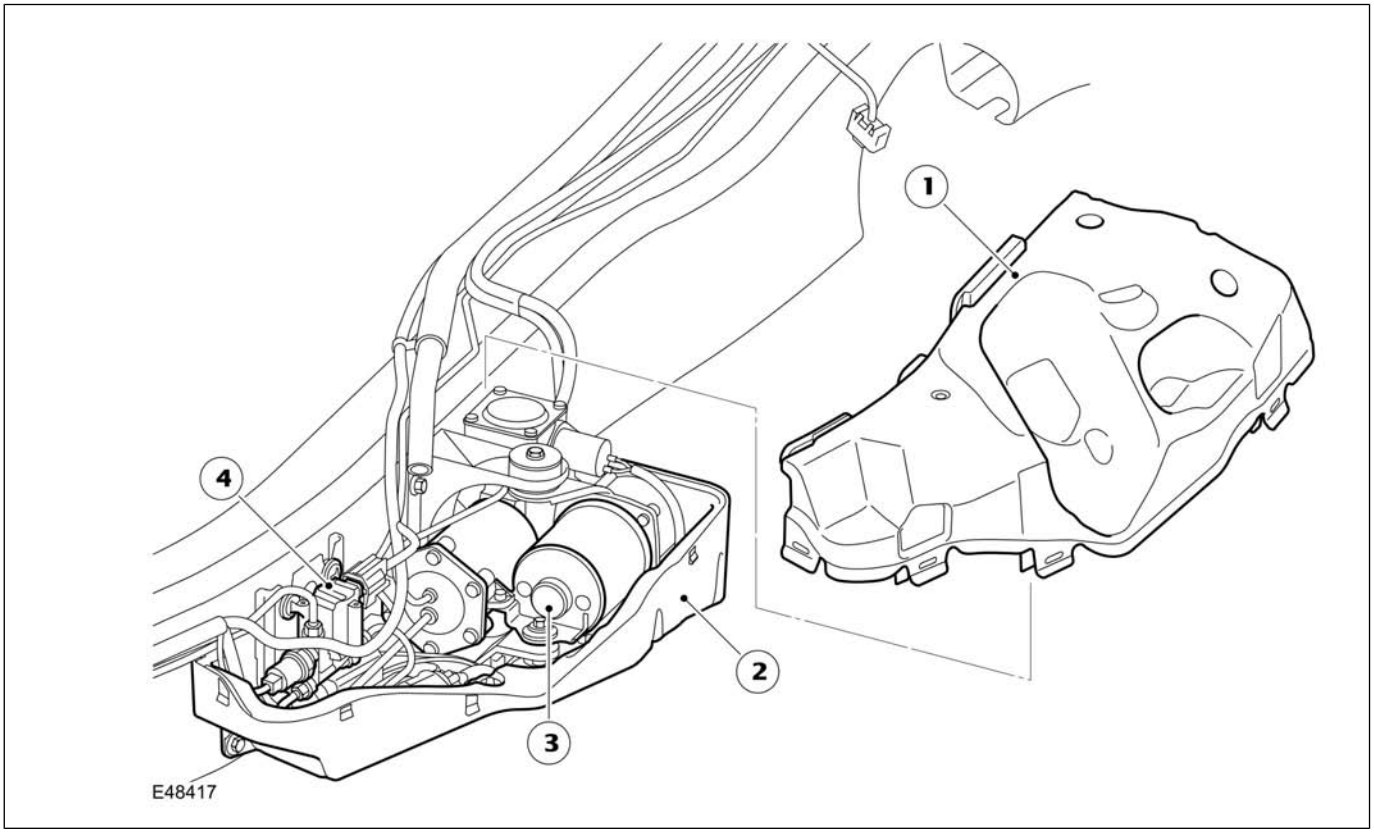


Air Supply Unit - Legend

Item	Description	Item	Description
1.	Mounting bracket	8.	Isolation mounting rubber (2 off)
2.	Air drier unit	9.	Electric motor
3.	Pilot exhaust valve solenoid and temperature sensors harness connector	10.	Isolation mounting rubber (1 off)
4.	Motor harness connector	11.	Pilot air pipe
5.	Intake port	12.	Pressure outlet to pilot exhaust valve
6.	Pilot exhaust valve	13.	Compressor cylinder head temperature sensor
7.	Exhaust valve	14.	Compressor

Acoustic Box

Acoustic Covers



Item	Description	Item	Description
1.	Upper cover	3.	Air supply unit
2.	Lower cover	4.	Reservoir valve block

Component Location

The air supply unit is located on the outside of the left hand chassis rail, forward of the upper control arm.

The unit is attached to the chassis rail and is protected by an acoustic box.

Acoustic Box

The acoustic box, which comprises of two parts; upper and lower and surrounds the air supply unit.

The box is a plastic molding which is lined with an insulating foam which controls the operating noise of the air supply unit.

The reservoir valve block is also located in the acoustic box.

Air Supply Unit

The air supply unit comprises the following major components:

- Piston compressor
- 12V electric motor
- Solenoid operated pilot valve
- Exhaust valve
- Air drier unit

The air supply unit can be serviced in the event of component failure.

Service Components

Servicing is limited to the following components:

- Air drier unit
- Pilot exhaust pipe
- Rubber mounts

Component Attachment

The air supply unit is attached to a bracket which is bolted to the chassis.

The unit is mounted to the bracket with flexible isolation mounting rubbers which assist in preventing operating noise from being transmitted to the chassis.

Air Supply Unit - Depressurization

Removal of the air supply unit does not require the whole air suspension system to be depressurized.

The front and rear valve blocks and the reservoir valve block are normally closed when de-energized, preventing air pressure in the air springs and the reservoir escaping when the unit is disconnected.

Air Supply Unit - System Inhibits

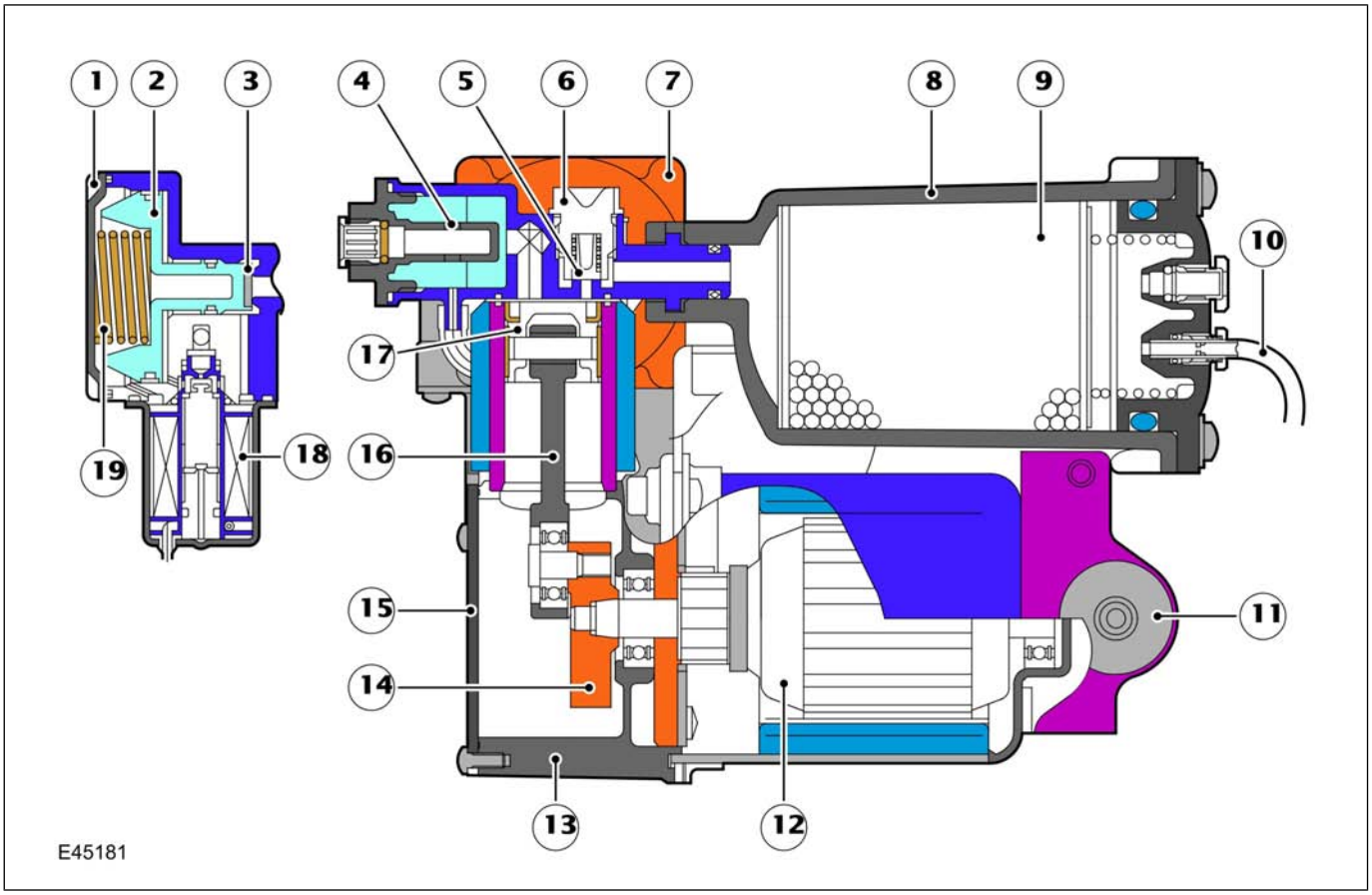
There are a number of conditions that will inhibit operation of the air supply unit.

It is vitally important that these system inhibits are not confused with a system malfunction.

A full list of air supply unit inhibits are given in the air suspension control module section in this workbook.

Air Supply Unit

Air Supply Unit - Sectioned View



Item	Description	Item	Description
1.	Exhaust valve cap	11.	Isolation rubber mount
2.	Plunger	12.	Motor assembly
3.	Valve seat	13.	Crankcase
4.	Intake silencer port	14.	Crank
5.	Delivery valve	15.	Crankcase cover
6.	Valve guide	16.	Connecting rod
7.	Cylinder head	17.	Piston
8.	Drier case	18.	Piston exhaust valve
9.	Desiccant	19.	Spring - pressure relief
10.	Pilot exhaust line		

Pilot Exhaust Valve

A solenoid operated pilot exhaust valve is connected to the air delivery gallery, downstream of the air drier.

The pilot valve, when opened, operates the main compressor exhaust valve.

This allows the air springs to be deflated when required.

When the solenoid is energized, pilot air moves the exhaust valve plunger, allowing pressurized air from the air springs and/or reservoir to pass via the reservoir control valve to the air supply unit.

The solenoid has a resistance value of 4 Ohms at a temperature of 20°C (68°F).

Exhaust Valve

The exhaust valve has three functions:

- It operates in conjunction with the pilot exhaust valve to allow air to be exhausted from the air springs and/or the reservoir as described previously
- The valve protects the system from over-pressure
- It is connected into the main pressure gallery which is subject to available system pressure in either the air springs or the reservoir

The valve is controlled by a spring which restricts the maximum operating pressure to between 319 to 391 lb in² (22 to 27 bar).

The minimum pressure in the system is also controlled by the exhaust valve to ensure that, even when deflated, the air springs contain a positive pressure of around 1.0 bar (14.5 lb in²) with respect to atmosphere.

This protects the air spring membrane by ensuring it can still 'roll' over the piston without creasing.

Electric Motor

The electric motor is a 12v dc motor with a nominal operating voltage of 13.5v.

The motor drives a crank which has an eccentric pin to which the compressor connecting rod is attached.

The motor is fitted with a temperature sensor on the brush PCB assembly.

The sensor is connected to the air suspension control module which monitors the temperature and can suspend motor operation if an overheat condition occurs.

Compressor

The compressor comprises a motor driven connecting rod and piston which operate in a cylinder with a cylinder head.

The motor rotates the crank moving the piston up and down in the cylinder bore.

The air in the cylinder is compressed with the up stroke and is passed via delivery valve, through the air drier into the system.

Air Drier

The air drier is an integral part of the air supply unit.

The air drier contains a desiccant which absorbs moisture contained in the air.

Pressurized air is passed through the air drier desiccant which removes any moisture in the compressed air before it is passed to the reservoir and/or the air suspension system.

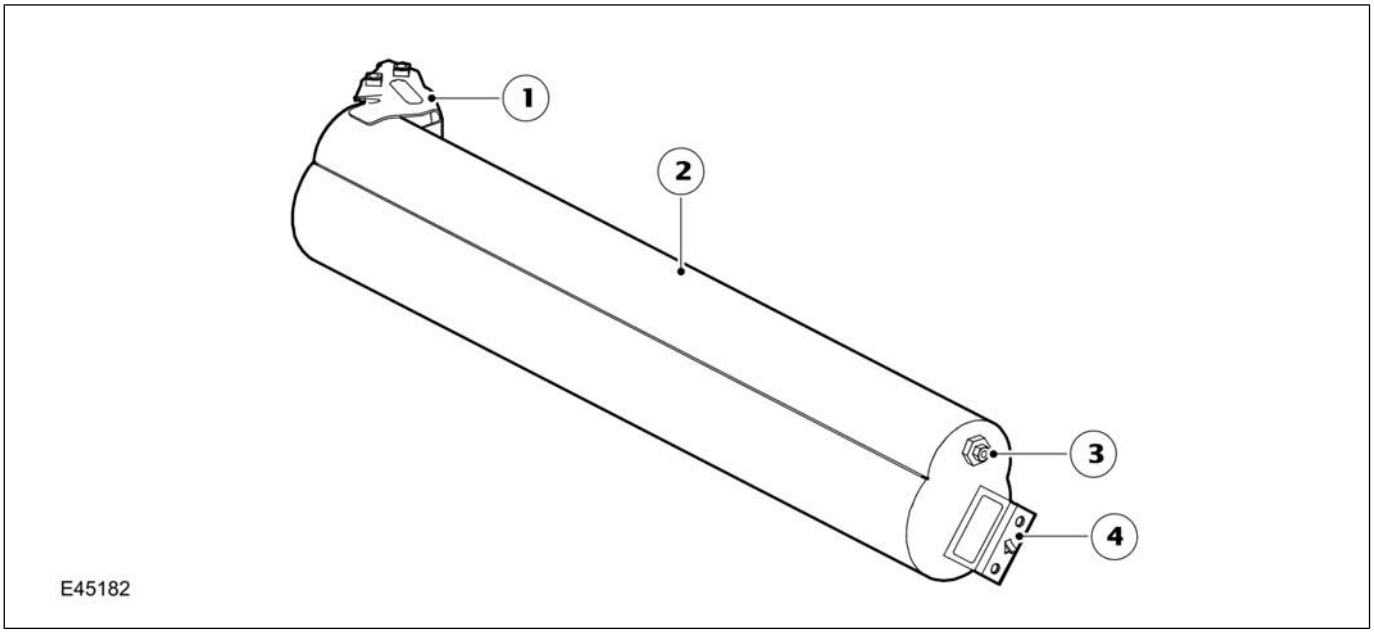
When the air is exhausted from the system, the returning air is passed back through the air drier, regenerating the air drier by removing moisture from the desiccant and expelling it to atmosphere via the exhaust outlet.

The air drier is an essential component in the system ensuring that only dry air is present in the system.

If moist air is present in the system, freezing can occur, resulting in poor system operation or component malfunction/failure.

Air Reservoir

Reservoir Assembly



Item	Description	Item	Description
1.	Front mounting bracket	3.	Air harness connection to reservoir valve block
2.	Reservoir	4.	Rear mounting bracket

The reservoir is an air storage vessel which provides fast air suspension lift times by the immediate availability of pressurized air into the system.

The reservoir is a steel fabrication and is located on the outside of the left hand chassis rail, in front of the air supply unit.

The reservoir has a bracket at each end which attach to the body mounting brackets on the chassis.

The rearward end of the reservoir has a 'Voss' air fitting which provides for the connection of the air hose between the reservoir and the reservoir valve block.

The reservoir has a capacity of 9 liters (550 in^3).

The nominal working pressure of the reservoir is 16.8 bar (243.6 lb in^2), with a maximum nominal pressure of 23 bar (333 lb in^2).

The maximum tested pressure of the reservoir is 35 bar (507 lb in^2).

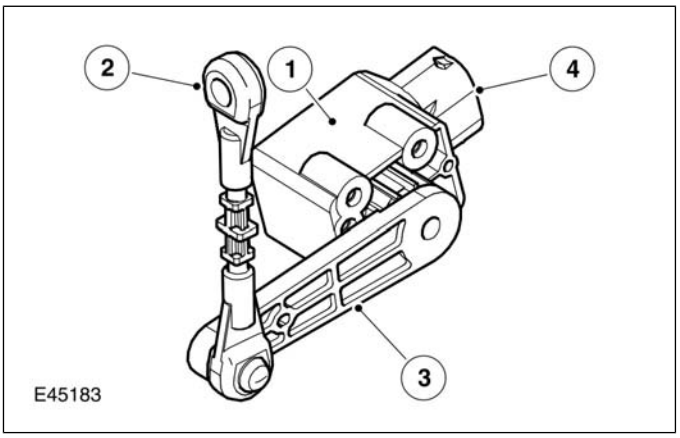
The pump will cut in when the reservoir pressure drops 1.0 bar (14.5 lb in^2) below the nominal pressure setting.

Service Reservoirs

Reservoirs are supplied to service (and track) at atmospheric pressure, i.e. not pre-charged with a gas element of any kind .

Height Sensor Assemblies

Front - Height Sensor



Item	Description
1.	Sensor body
2.	Drop link
3.	Lever arm
4.	Electrical connection

Height Sensors

A height sensor is fitted in each corner of the vehicle to monitor the ride height of the vehicle.

The sensor bodies are attached with screws to brackets on the chassis rails.

Each sensor comprises a sensor body which contains a single track rotary potentiometer, a lever arm and a drop link.

The sensor lever arm has a drop link which provides the connection between the sensor and the suspension control arm.

The drop link is a serviceable component and is a push fit to the lever arm and the suspension control arm.

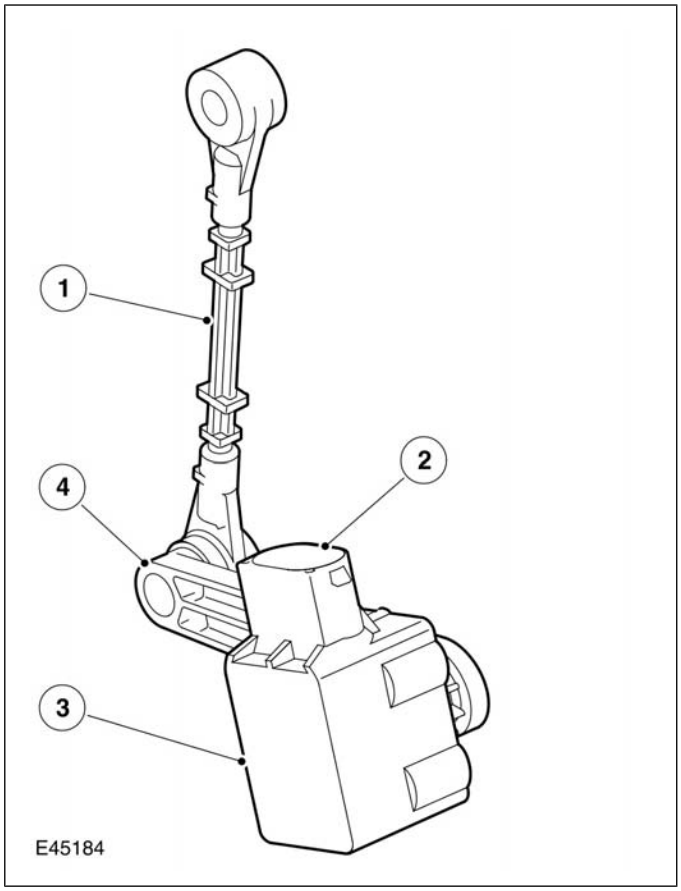
The sensors are connected via their harness connector to the air suspension control module which receives the signal output from each sensor and, using preprogrammed information, converts the signal to a height for each sensor position.

Sensor Identification

The front and rear sensors are handed and are colored coded for identification as follows:

- RH front and rear - black colored lever
- LH front and rear - white colored lever

Rear - Height Sensor



Item	Description
1.	Drop link
2.	Electrical connection
3.	Sensor body
4.	Lever arm

T4 Calibration

A calibration routine is performed using the T4 diagnostic unit.

The position of each corner of the vehicle is recorded and the result is recorded in to the ECU memory.

Once set, the calibration is not required to be performed unless one of the following occurs:

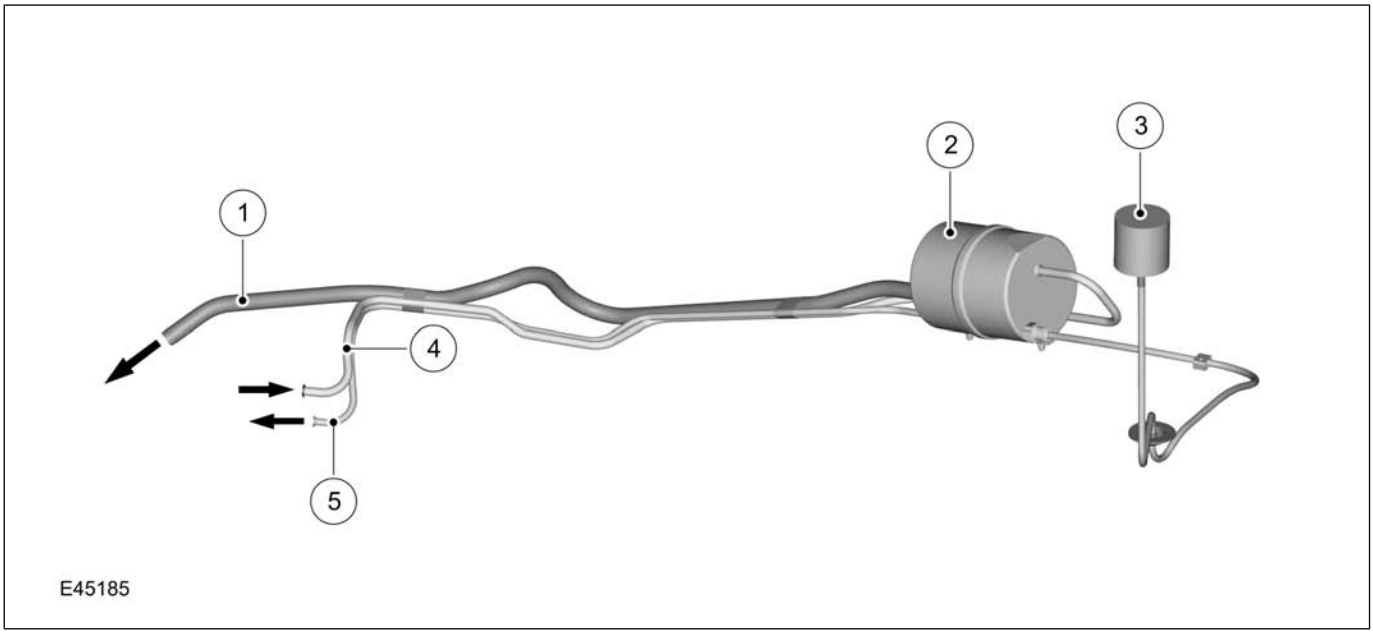
- Air suspension control module is removed or replaced
- Height sensor is removed or replaced
- Suspension arm to which the sensor is connected is removed or replaced

If the removed height sensor is subsequently refitted, the calibration procedure will have to be performed to ensure the integrity of the system.

If a replacement drop link is fitted, recalibration is not required providing the sensor body is not removed from its mounting bracket.

Air Intake Filter and Silencer

Air Intake Assembly



Item	Description	Item	Description
1.	Exhaust to atmosphere	4.	Exhaust air from air supply unit
2.	Inlet and exhaust silencer	5.	Air inlet supply to air supply unit
3.	Air inlet filter		

The air intake filter is connected via a pipe to the intake silencer chamber of the air silencer unit.

The filter is located inside the rear left hand corner of the body, away from possible sources of dirt and moisture.

The filter contains a foam element which removes particulate matter from the inlet air before it reaches the silencer or the air supply unit.

Pipe connections are molded onto each end of the intake silencer and provide for the attachment of the air inlet pipe from the inlet air filter and the air inlet pipe to the air supply unit.

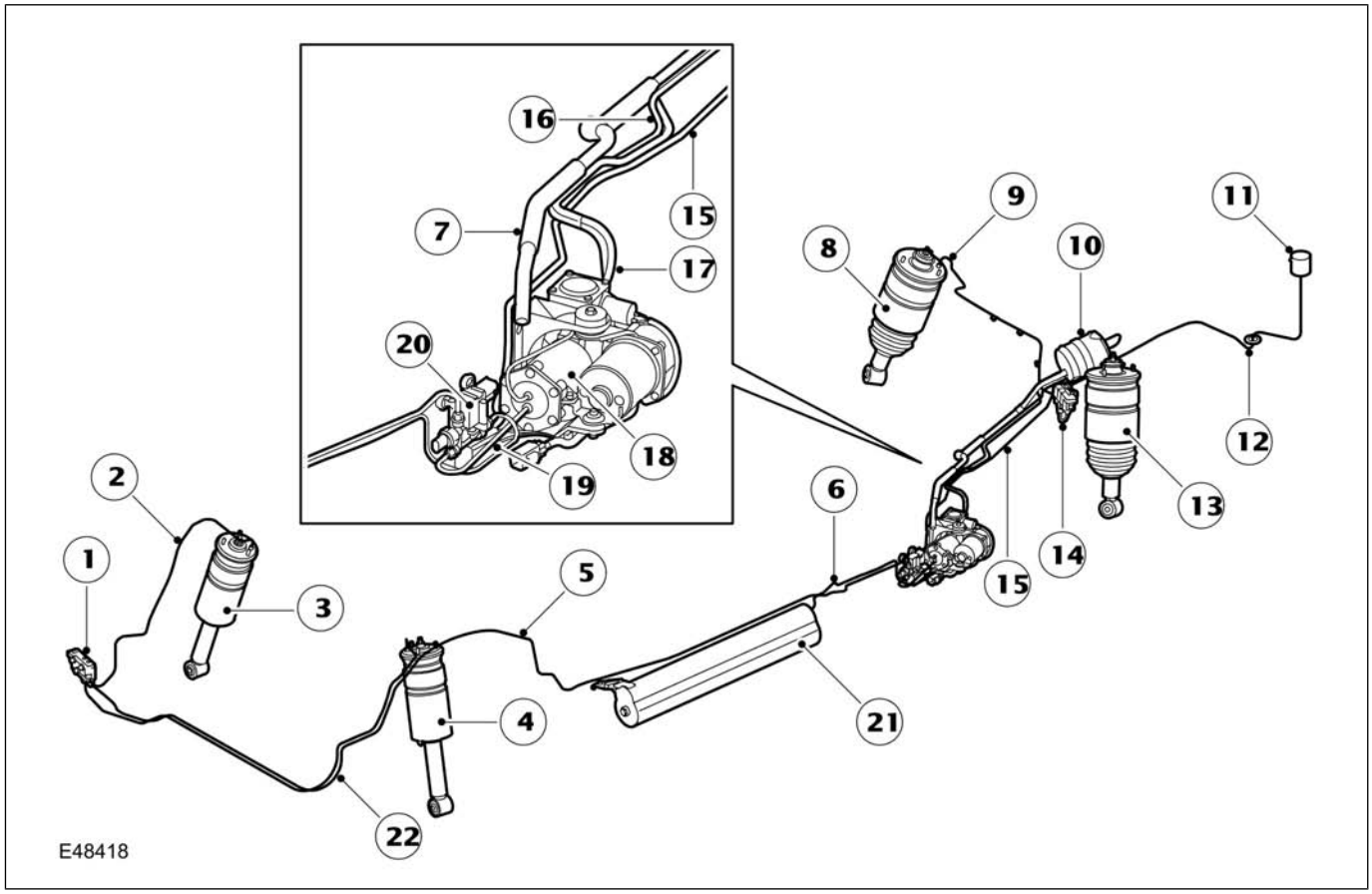
The air silencer is required to limit any noise produced from the air supply unit during inflation or deflation of the air springs.

The silencer comprises two plastic molded cans, which are bonded together with a silencing foam filling the large internal chamber which forms the exhaust silencer.

A pipe connection is molded onto each end of the silencer and provide for the attachment of the exhaust air to atmosphere pipe and the exhaust air pipe from the air supply unit.

Air Harness

Air Harness - Layout



Air Harness

Item	Description	Item	Description
1.	Front axle valve block	12.	Air harness - Main inlet
2.	Air harness - Valve block to RHF air spring	13.	LHR air spring and damper module
3.	RHF air spring and damper module	14.	Rear axle valve block
4.	LHF air spring and damper module	15.	Air harness - Reservoir supply to rear valve block
5.	Air harness - Reservoir supply to front valve block	16.	Air harness - Compressor air inlet
6.	Air harness - Reservoir valve block to reservoir	17.	Air harness - Compressor air exhaust
7.	Air harness - Exhaust air outlet	18.	Air supply unit - Desiccant
8.	RHR air spring and damper module	19.	Air harness - Air supply unit to reservoir valve block
9.	Air harness - Valve block to RHR air spring	20.	Reservoir valve block
10.	Air silencer assembly	21.	Reservoir
11.	Air inlet filter	22.	Air harness - Valve block to LHF air spring

Air Harness

Air Harness Diameters

PIPE	PIPE DIAMETER
High pressure pipe	6 mm
Compressor inlet	8 mm
Air intake filter to silencer	8 mm
Compressor exhaust	10 mm
Silencer exhaust	19 mm

The air harness consists of ten separate nylon pipes which are connected between the system components with Voss connectors.

The diameters of the individual pipes are shown in the table above for identification purposes.

If a pipe becomes damaged, an in-line connector is available for repair purposes.

The pipes are secured to the body and chassis via plastic retainer clips.

Air Harness Service

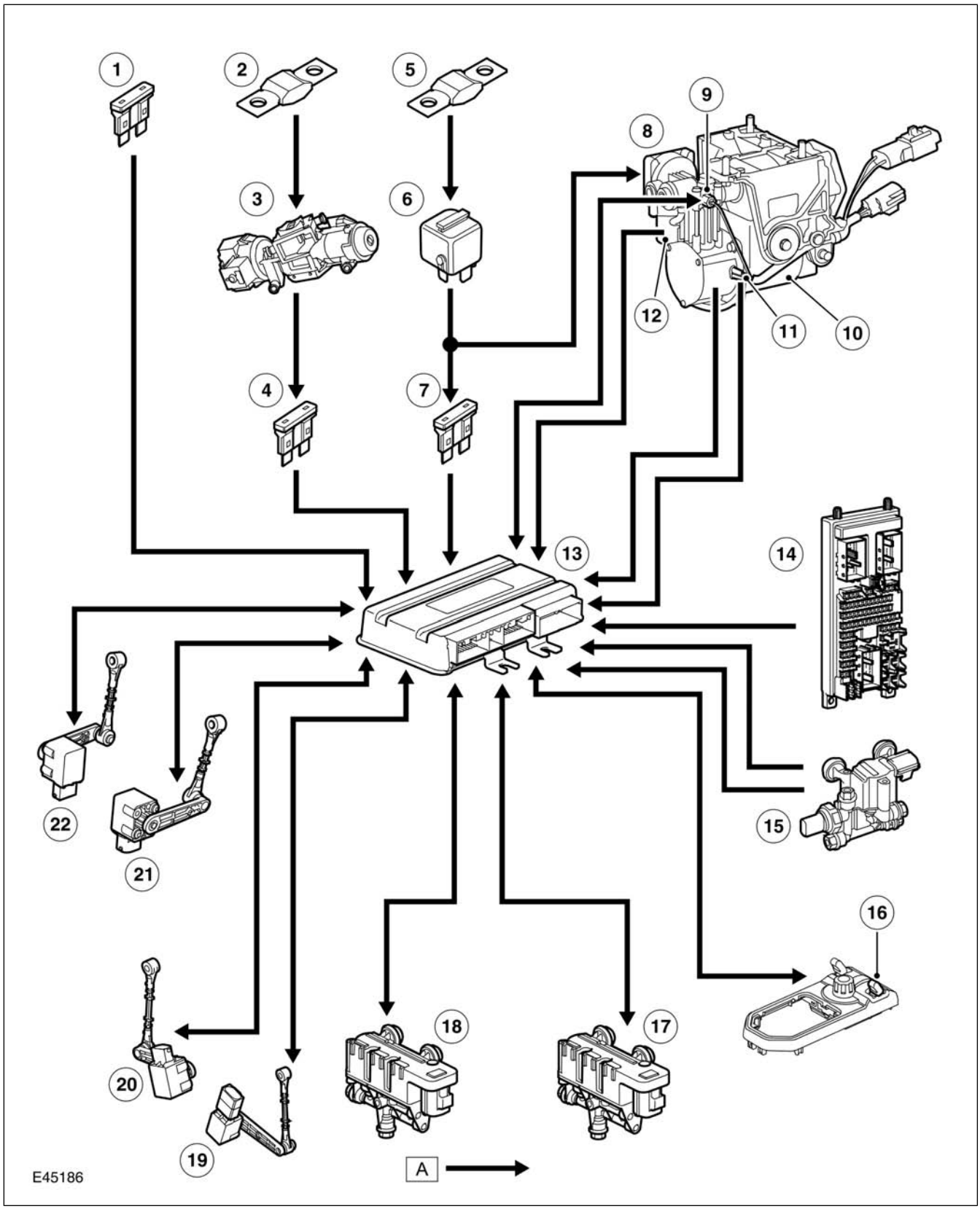
Voss connectors should be replaced when a pipe is removed and the old connector discarded.

Air harness Voss connectors can be reused if they are not disturbed from the pipe.

Installing Voss connectors to components requires careful observation so as not to cross thread components.

System Control Schematic

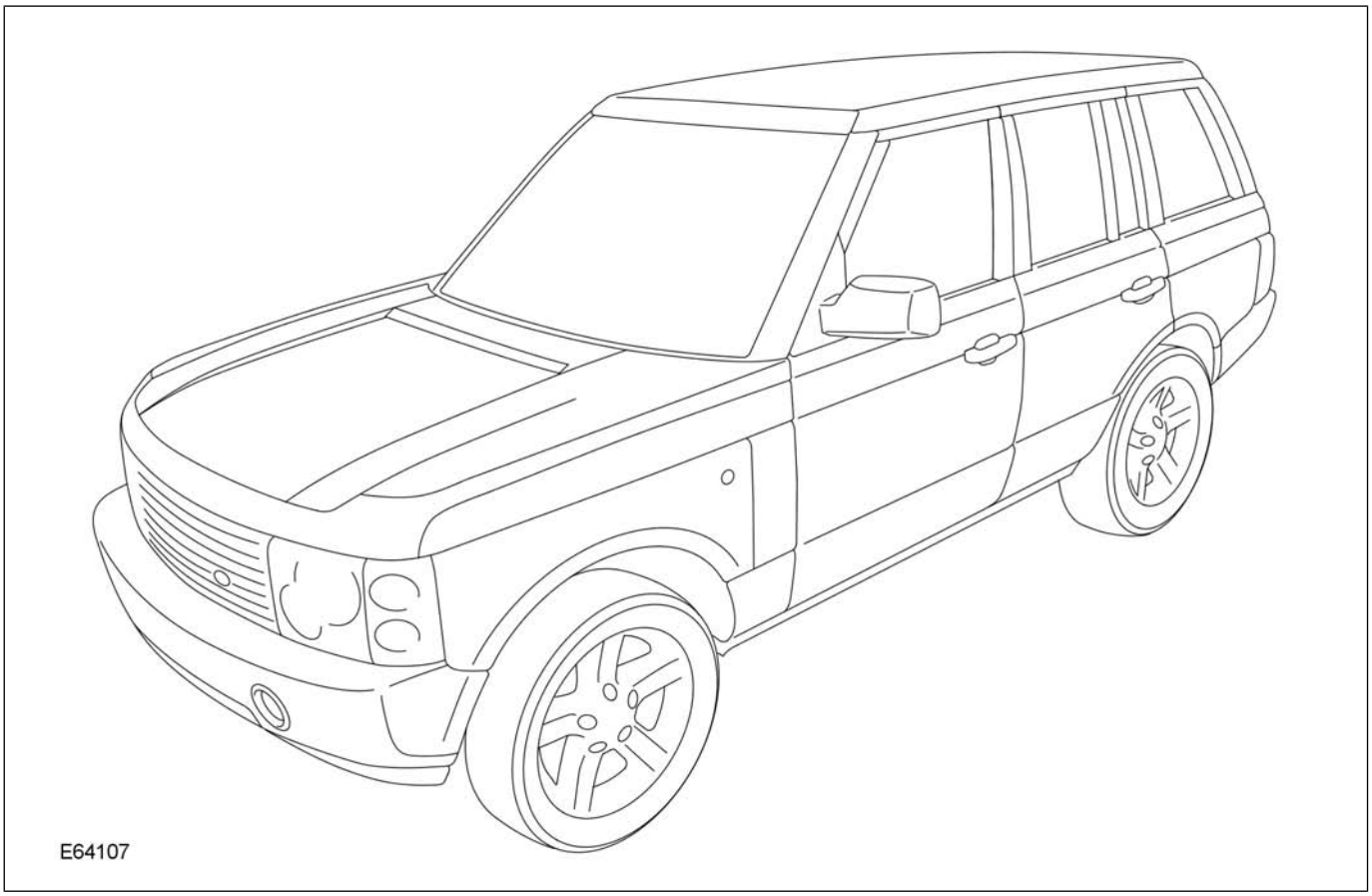
Control Schematic



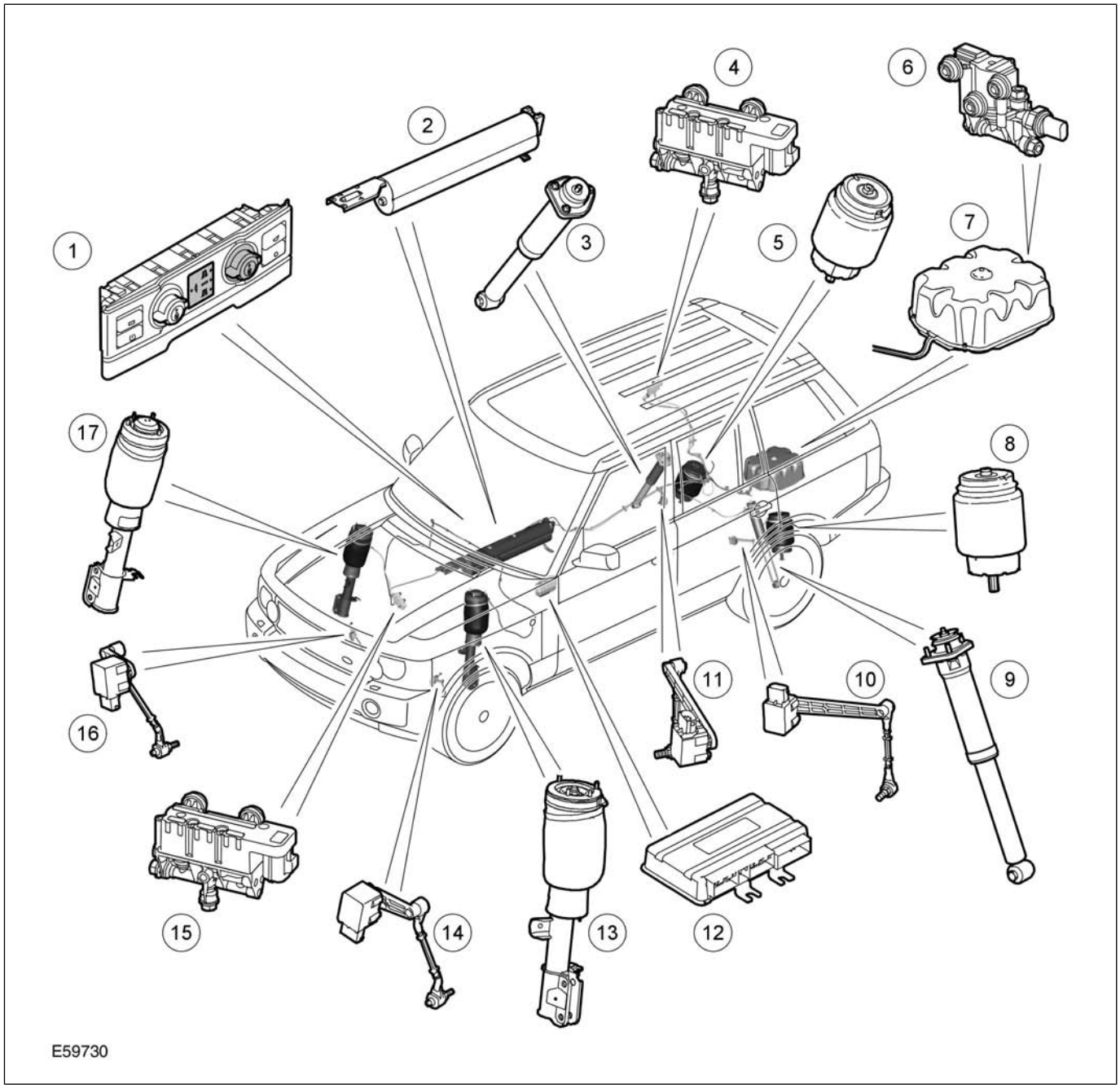
Control Schematic

Item	Description	Item	Description
1.	Fuse 26E (20 amp)	12.	Exhaust valve solenoid
2.	Fusible link 11E (30 amp)	13.	Air suspension control module
3.	Ignition switch	14.	Central Junction Box (CJB)
4.	Fuse 35P (5 amp)	15.	Reservoir control valve
5.	Fusible link 10E (60 amp)	16.	Air suspension control switch
6.	Air supply unit relay	17.	Front valve block
7.	Fuse 3E (5 amp)	18.	Rear valve block
8.	Air supply unit	19.	RHR height sensor
9.	Compressor temperature sensor	20.	LHR height sensor
10.	Motor	21.	RHF height sensor
11.	Motor temperature sensor	22.	LHF height sensor

2006MY Range Rover (LM)



Component Review



Component Description

Item	Description
1.	Air suspension control switch
2.	Reservoir
3.	RHR damper
4.	Rear valve block
5.	RHR air spring
6.	Reservoir valve block
7.	Compressor assembly
8.	LHR air spring
9.	LHR damper
10.	LHR height sensor
11.	RHR height sensor
12.	Air suspension control module
13.	LHF strut assembly
14.	LHF height sensor
15.	Front valve block
16.	RHF height sensor
17.	RHF strut assembly

System Components

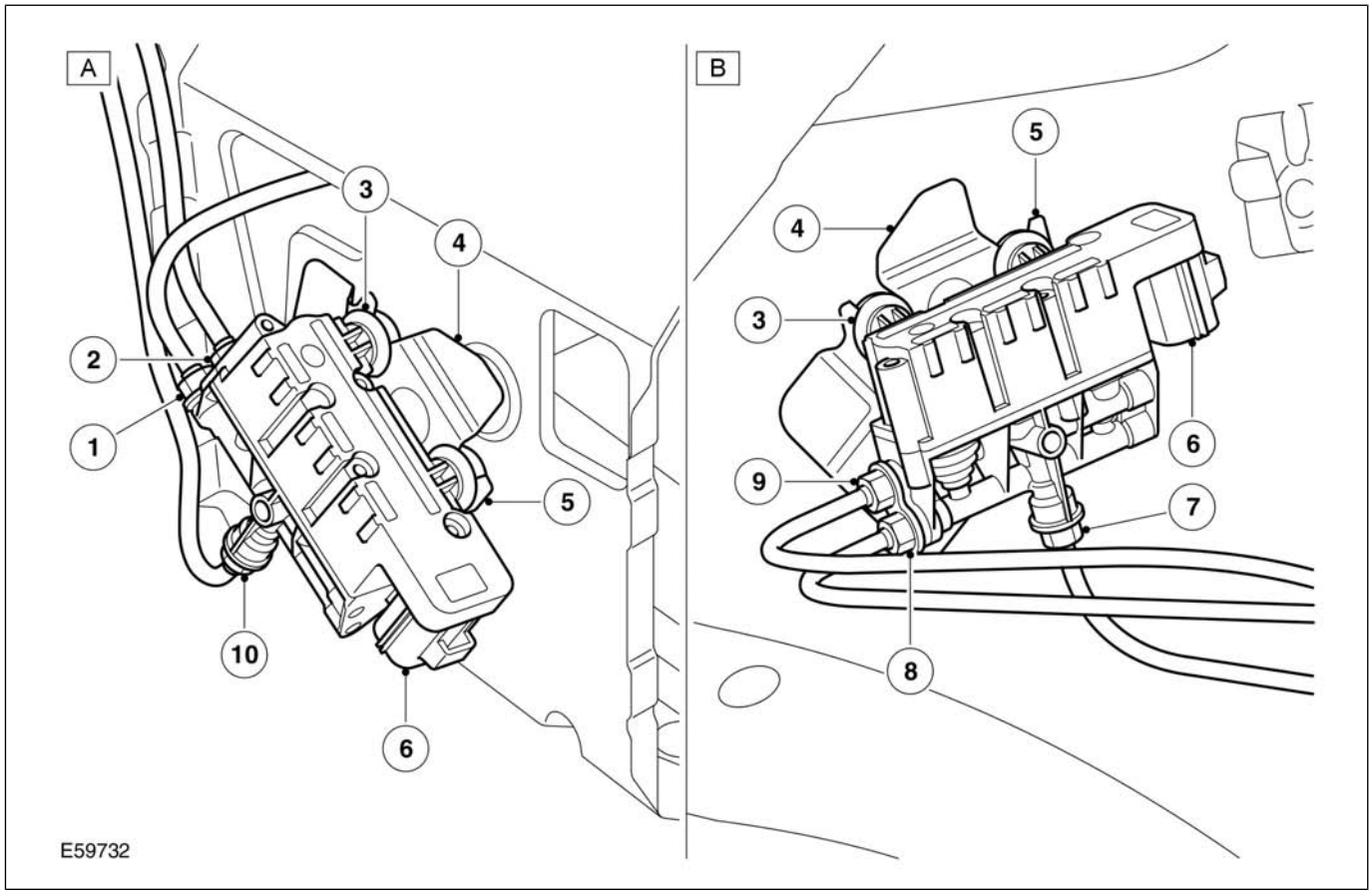
The air suspension comprises the following:

- Two front struts incorporating air springs
- Two rear air springs
- Front and rear valve blocks
- Reservoir valve block incorporating a pressure sensor
- An air reservoir
- Four height sensors
- Air supply unit
- Air suspension control module
- Air supply pipes
- Air suspension control switch.

The air suspension system is controlled by the air suspension control module which is located adjacent to the central junction box (CJB), behind the instrument panel.

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

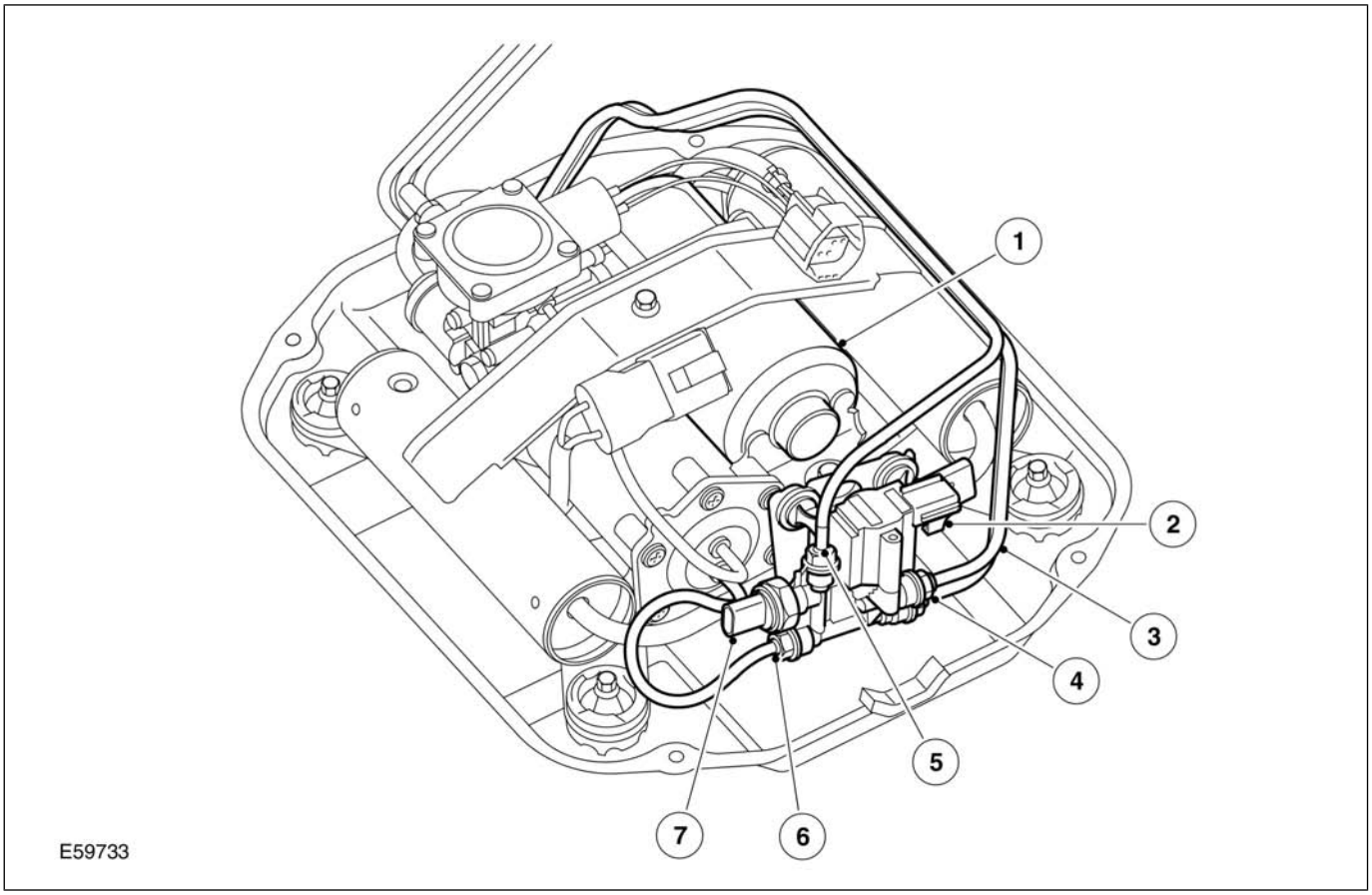
Front and rear Valve Blocks



Item	Description
A.	Front valve block
B.	Rear valve block
1.	Air inlet /outlet to reservoir valve block (Yellow pipe)
2.	RHF air spring harness connection (Blue pipe)
3.	Isolation rubber mounts
4.	Mounting bracket
5.	Location slots
6.	Electrical connector
7.	RHR air spring harness connection (Yellow pipe)
8.	Air inlet /outlet to reservoir valve block (Yellow pipe)
9.	LHR air spring harness connection (Black pipe)
10.	LHF air spring harness connection (Black pipe)

Valve Blocks

Reservoir Valve Block



Item	Description
1.	Air supply unit
2.	Electrical connector
3.	Air harness connection to reservoir (Black pipe)
4.	Air inlet /outlet to rear valve (Blue pipe)
5.	Air inlet /outlet to front valve block (Blue pipe with white tape)
6.	Air harness connection to air supply unit (Black pipe)
7.	Pressure sensor

Front and rear Valve Blocks

The front and rear valve blocks are similar in their design and construction and control the air supply and distribution to the front or rear pairs of air spring damper modules respectively.

The difference between the two assemblies is the connections from the valve block to the left and right hand air spring damper modules and the valve size.

It is important that the correct valve block is fitted to the correct axle.

Fitting the incorrect valve block will not stop the air suspension system from functioning but will result in slow raise and lower times and uneven raising and lowering between the front and rear axles and may result in misleading DTC'S being set.

The front valve block:

This is attached to a bracket at the rear of the right hand front wheel arch, behind the wheel arch liner.

The valve block has three attachment lugs which are fitted with isolation rubber mounts.

Each rubber mount locates in a 'V' shaped slot in the bracket.

The rear valve block:

This is attached to a bracket at the top of the right hand rear wheel arch, behind the wheel arch liner and adjacent to the fuel filler pipe.

The valve block has three attachment lugs which are fitted with isolation rubber mounts which locate in the bracket in three slotted holes.

The isolation rubber mounts locate in the 'V' shaped slots and are pulled downwards into positive location in the slots.

The front and rear valve blocks:

These both have three air pipe connections which use 'Voss' type air fittings.

One connection is an air pressure inlet/outlet from the reservoir valve block.

The remaining two connections provide the pressure connections to the left and right hand air springs.

Each valve block contains three solenoid operated valves; two corner valves and one cross-link valve.

Each of the valve solenoids is individually controlled by the air suspension control module.

Reservoir Valve Block

The four way reservoir valve block is located in the air supply unit sealed housing.

The valve block is attached to a bracket at the rear of the air supply unit on three attachment lugs which are fitted with isolation rubber mounts.

The isolation rubber mounts locate in the 'V' shaped slots in the bracket and are pulled downwards into positive location in the slots.

The valve block controls the storage and distribution of air from the air supply unit and the reservoir and contains an integral system pressure sensor.

The valve block has four air pipe connections which use 'Voss' type air fittings.

The connections provide for air supply from the air supply unit, air supply to and from the reservoir and air supply to and from the front and rear valve blocks.

The connections from the air supply unit and the front and rear control valves are all connected via a common gallery within the valve and therefore are all subject to the same air pressures.

The valve block contains a solenoid operated valve which is controlled by the air suspension control module. The solenoid valve controls the pressure supply to and from the reservoir.

When energized, the solenoid moves the valve spool allowing air to pass to or from the reservoir.

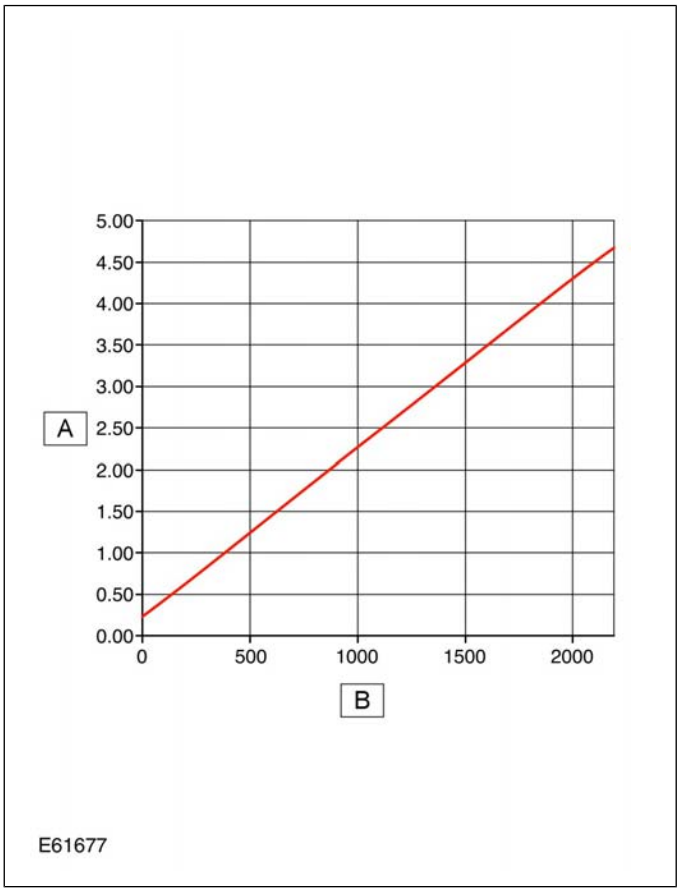
The valve block also contains a pressure sensor which can be used to measure the system air pressure in the air springs and the reservoir.

The pressure sensor is connected via a harness connector to the air suspension control module.

The control module provides a 5V reference voltage to the pressure sensor and monitors the return signal voltage from the sensor.

Using this sensor, the control module controls the air supply unit operation and therefore limits the nominal system operating pressure to 17.5 bar (254 lbf/in).

The following graph shows nominal pressure values against sensor output voltage.



Item	Description
A.	Output voltage (V)
B.	Pressure (kPa)

Removal of the reservoir valve block will require full depressurization of the air suspension system.

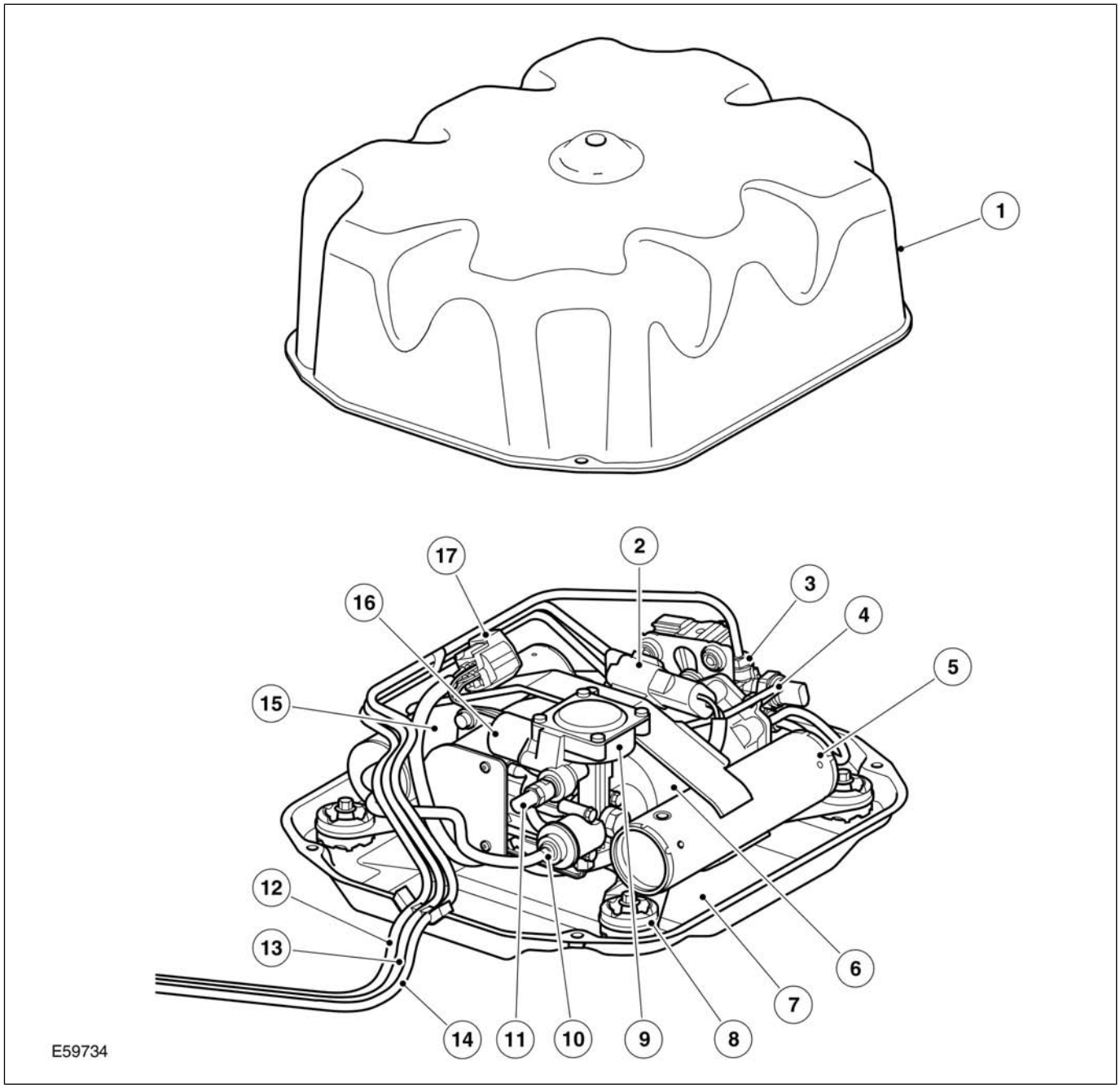
The valve block is a non-serviceable item and should not be disassembled other than for replacement of the pressure sensor.

Valve Block Solenoid Specifications

Description	Value
Coil resistance at 20°C (68°F)	2.05 Ohms ± 10%

NOTE: Resistance values will vary with coil temperature. Resistance of test leads must be measured before any readings are taken. Resistance value of the test leads must be subtracted from final solenoid resistance value.

Air Supply Unit



Item	Description
1.	Cover
2.	Motor electrical connector
3.	Reservoir valve block
4.	Pilot air pipe
5.	Secondary silencer

Item	Description
6.	Air drier
7.	Base plate
8.	Rubber mounts
9.	Exhaust valve
10.	Intake pipe
11.	Exhaust silencer
12.	Air harness to front valve block
13.	Air harness to reservoir
14.	Air harness to rear valve block
15.	Secondary silencer
16.	Pilot exhaust valve
17.	Solenoid and sensors electrical connection

The air supply unit fitted from 2006MY is an improved unit providing quieter operation.

Two silencer units are incorporated into the unit assembly to reduce operating noise.

The air supply unit is located in a housing which is mounted in the spare wheel well and secured with four bolts into threaded inserts to the vehicle floorpan.

The unit is isolated from the vehicle body via four rubber isolation mounts.

The reservoir valve block is also located within the housing on a separate bracket at the rear of the unit.

The unit is connected to the system via a single air pipe to the reservoir valve block.

Three air pipes from the reservoir valve block pass through an aperture in the unit housing and through a grommet in the wheel well. It is important to ensure that this grommet is not disturbed and correctly installed.

Incorrect fitment will allow water to enter the wheel well leading to possible damage to and failure of the air supply unit.

The unit comprises a piston compressor, a 12V electric motor, a solenoid operated exhaust pilot valve, a pressure relief valve, an air drier unit and two silencers.

The electric motor, compressor, air drier and pressure limiting and exhaust valve are mounted on a frame which in turn is mounted on flexible rubber mountings to reduce operating noise.

The unit is mounted on a pressed base plate which is located on the floor of the wheel well.

The unit is protected by a pressed cover which is lined with an insulating foam further limiting the operating noise.

The air supply unit can be serviced in the event of component failure, but is limited to the following components; air drier, pilot exhaust pipe and the rubber mounts.

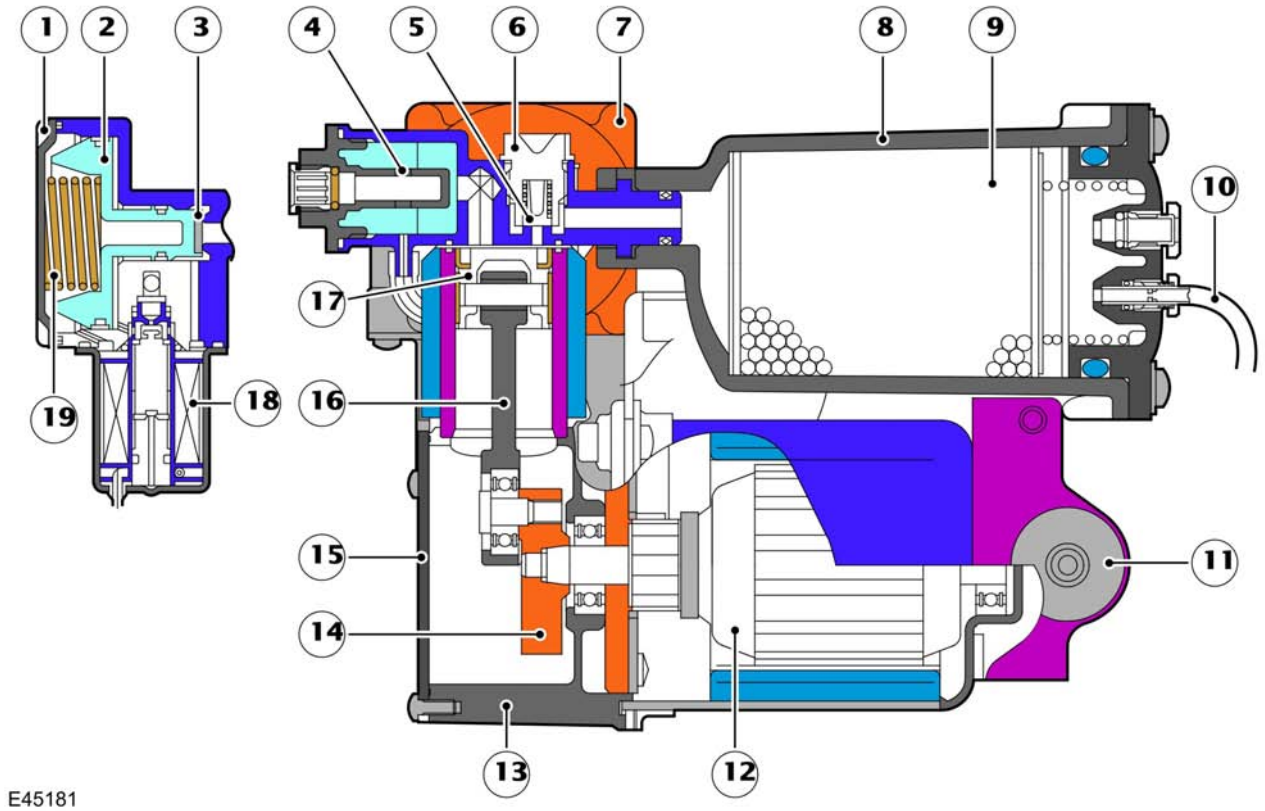
Removal of the air supply unit does not require the whole air suspension system to be depressurized.

The front and rear valve blocks and the reservoir valve block are normally closed when de-energized, preventing air pressure in the air springs and the reservoir escaping when the unit is disconnected.

There are a number of conditions that will inhibit operation of the air supply unit.

It is vitally important that these system inhibits are not confused with a system malfunction.

A full list of air supply unit inhibits are given in the air suspension control module section in this chapter.



Item	Description
1.	Exhaust valve cap
2.	Plunger
3.	Valve seat
4.	Intake silencer port
5.	Delivery valve
6.	Valve guide
7.	Cylinder head
8.	Drier case

Item	Description
9.	Desiccant
10.	Pilot air pipe
11.	Isolation rubber mounts
12.	Motor assembly
13.	Crankcase
14.	Crank
15.	Crankcase cover
16.	Connecting rod
17.	Piston
18.	Pilot exhaust valve
19.	Spring - slave valve (pressure relief)

Electric Motor

The electric motor is a 12V dc motor with a nominal operating voltage of 13.5V.

The motor drives a crank which has an eccentric pin to which the compressor connecting rod is attached.

The motor is fitted with a temperature sensor on the brush Printed Circuit Board (PCB) assembly.

The sensor is connected to the air suspension control module which monitors the motor temperature and can suspend motor operation if the operating thresholds are exceeded.

The following table shows the control module operating parameters for the differing air supply unit functions and the allowed motor operating temperatures.

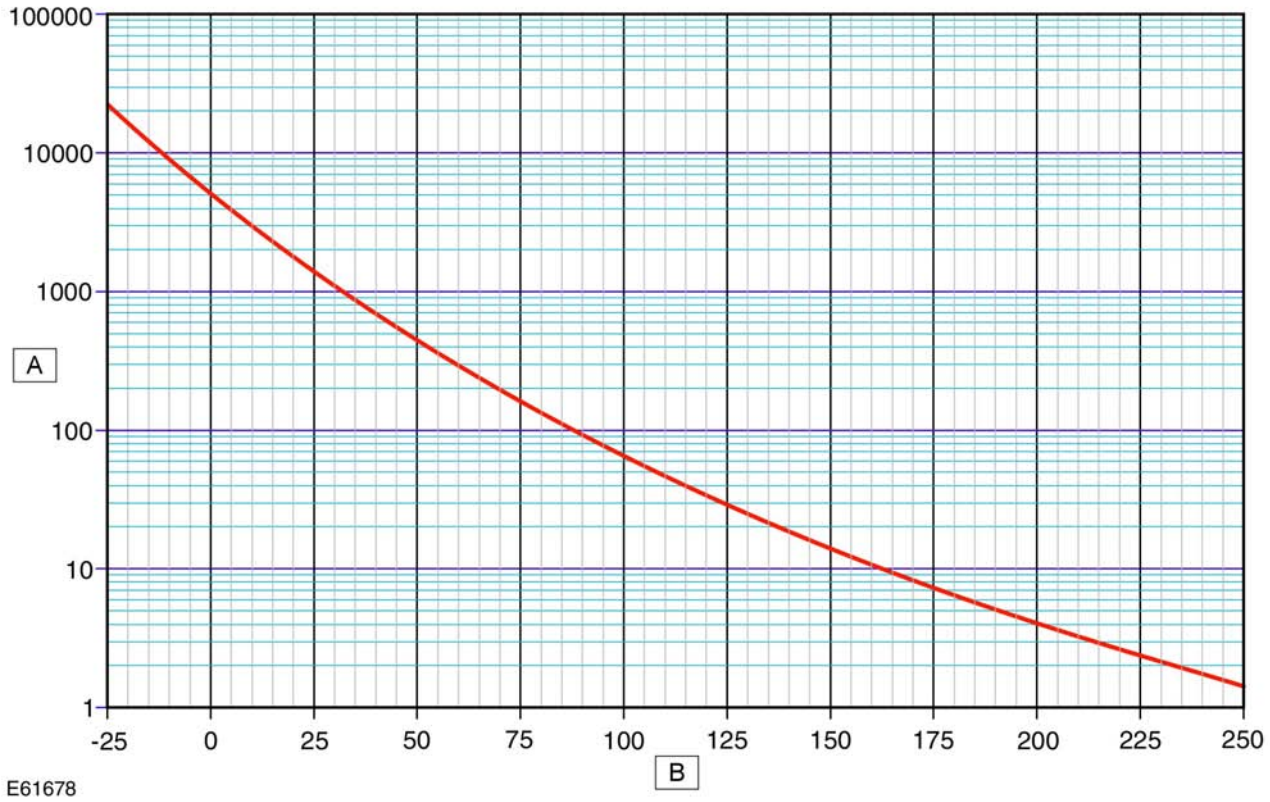
Motor Operating Temperatures

	Leveling	Reservoir Filling
OFF	140°C (284°F)	130°C (266°C)
ON	120°C (248°F)	110°C (230°F)

The following graph shows motor temperature sensor resistance values against given temperatures.

NOTE: This graph is also applicable for the compressor cylinder head temperature sensor.

Brush Temperature and Resistance

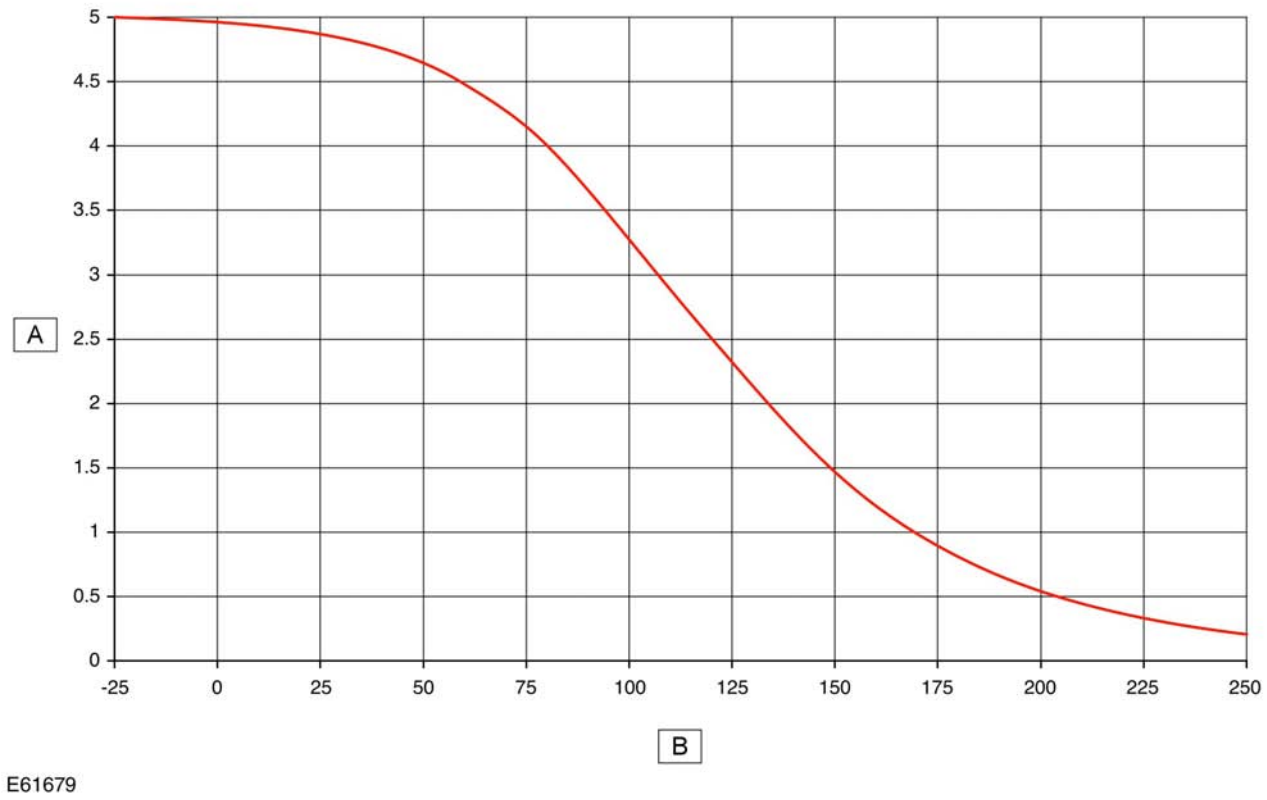


Item	Description
A.	Resistance (kOhms)
B.	Temperature (°C)

The following graph shows air suspension control module output voltages against motor temperature sensor temperatures.

NOTE: This graph is also applicable for the compressor cylinder head temperature sensor.

Compressor Temperature and Sensor Voltage



Item	Description
A.	Control module input voltage (V)
B.	Temperature sensor (°C)

Compressor

The compressor is used to supply air pressure to the air suspension reservoir.

The air suspension control module monitors the pressure within the reservoir and, when the engine is running, maintains a pressure of 17.5 bar (254 lbf/in).

The compressor comprises a motor driven connecting rod and piston which operate in a cylinder with a separate cylinder head.

The motor rotates the crank moving the piston up and down in the cylinder bore.

The air in the cylinder is compressed with the up stroke and is passed via the delivery valve through the air drier and the silencers into the system.

The cylinder head is fitted with a temperature sensor.

The sensor is connected to the air suspension control module which monitors the cylinder temperature and can suspend motor and compressor operation if an overheat condition occurs.

The following table shows the control module operating parameters for the differing air supply unit functions and the allowed compressor cylinder head operating temperatures.

Compressor Cylinder Head Operating Temperatures

	Leveling	Reservoir Filling
OFF	150°C (302°F)	140°C (284°C)
ON	130°C (266°F)	120°C (248°F)

Refer to the motor temperature sensor graph for compressor cylinder head temperature sensor resistance values and the air suspension control module output voltage / temperature sensor graph.

Air Drier

Attached to the compressor is the air drier which contains a desiccant for removing moisture from the compressed air.

Pressurized air is passed through the air drier which removes any moisture in the compressed air before it is passed into the reservoir and/or the system.

When the air springs are deflated, the exhaust air also passes through the air drier, removing the moisture from the unit and regenerating the desiccant.

The air drier is an essential component in the system ensuring that only dry air is present in the system.

If moist air is present, freezing can occur resulting in poor system operation or component malfunction or failure.

Pilot Exhaust Valve

Attached to the end of the air drier unit is a solenoid operated exhaust pilot valve.

This valve is opened when the air springs are to be deflated.

The pilot exhaust valve is connected to the air delivery gallery, downstream of the air drier.

The pilot valve, when opened, operates the compressor exhaust valve allowing the air springs to be deflated.

When the solenoid is energized, pilot air moves the exhaust valve plunger, allowing pressurized air from the air springs and/or the reservoir to pass through the air drier to atmosphere.

Exhaust Valve

The exhaust valve operates when the pilot exhaust valve is opened, allowing air returning from the air springs and/or the reservoir to be exhausted quickly.

The pilot exhaust valve also provides the system pressure relief function which protects the air springs from over inflation.

The valve is pneumatically operated, responding to air pressure applied to it to overcome pressure from its internal spring.

The valve is connected into the main pressure gallery which is always subject to the system pressure available in either the air springs or the reservoir.

The valve is controlled by a spring which restricts the maximum operating pressure to between 22 to 27 bar (319 to 391 lbf/in).

The minimum pressure in the system is also controlled by the exhaust valve to ensure that, even when deflated, the air springs contain a positive pressure with respect to atmosphere.

This protects the air spring by ensuring it can still 'roll' over the piston without creasing.

Air Supply Unit Specifications

Description	Value
Working pressure	14.5 bar
Maximum pressure (stabilized)	22.0 to 27.0 bar
Operating voltage	10 to 16.5 Volts (13.5 Volts nominal)

Description	Value
Running current consumption	20-50 Amps depending on load
Maximum start-up current	120 Amps
Pilot Exhaust Valve - Solenoid valve resistance at 20°C (68°F)	4 Ohms ± 10%

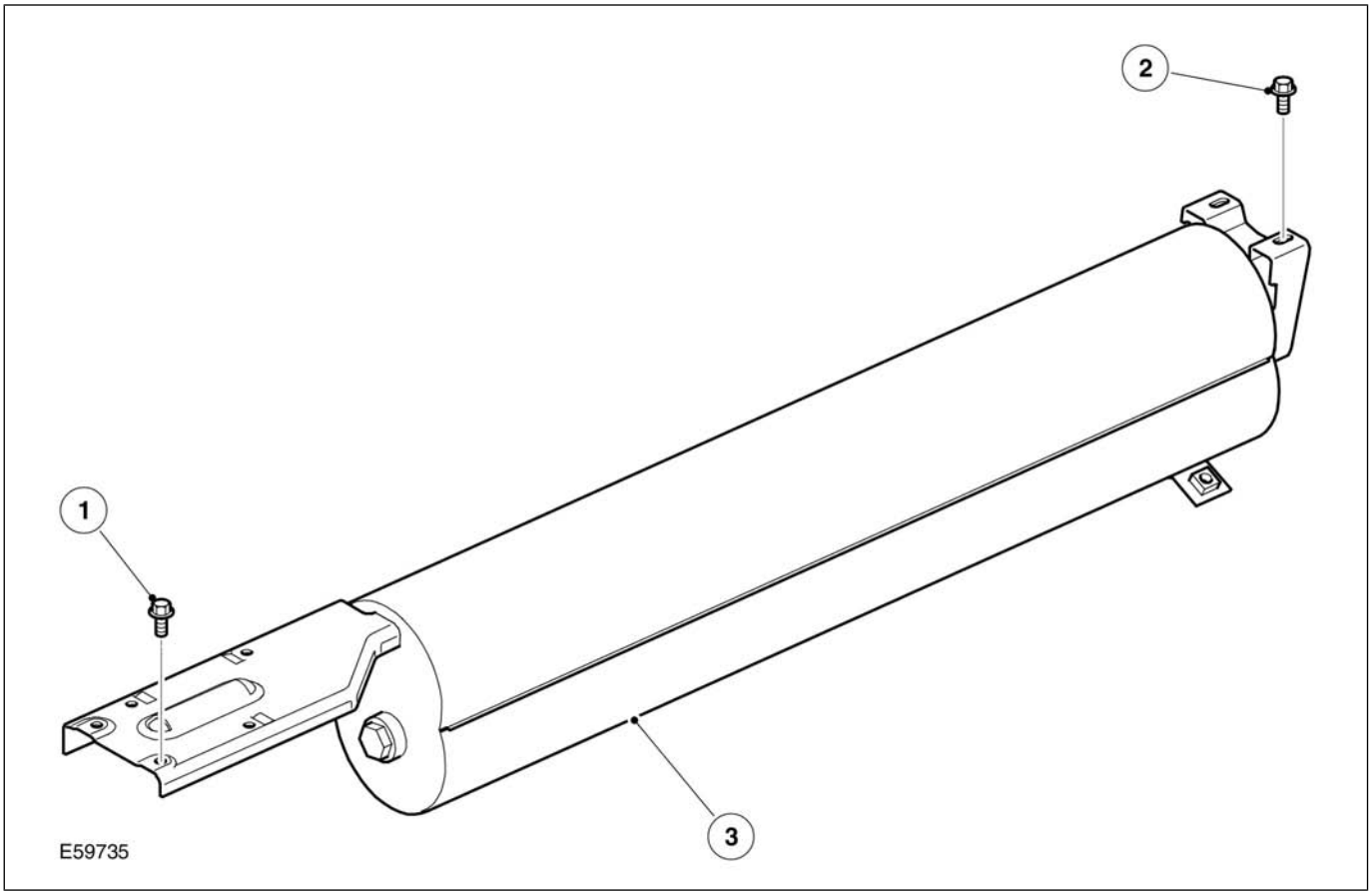
NOTE: Resistance values will vary with coil temperature. Resistance of test leads must be measured before any readings are taken. Resistance value of the test leads must be subtracted from final solenoid resistance value.

There are a number of conditions that will inhibit operation of the air suspension compressor.

It is vitally important that these inhibits are not confused with a system malfunction.

A full list of compressor inhibits is contained in the Principles of Operation section.

Reservoir



Item	Description
1.	Reservoir mounting screw - front
2.	Reservoir mounting screw - rear
3.	Reservoir

The reservoir is an air storage vessel which provides fast air suspension lift times by the immediate availability of pressurized air into the system.

The reservoir is located under the RH sill of the vehicle and is fabricated from steel and secured with four bolts to the underside of the vehicle.

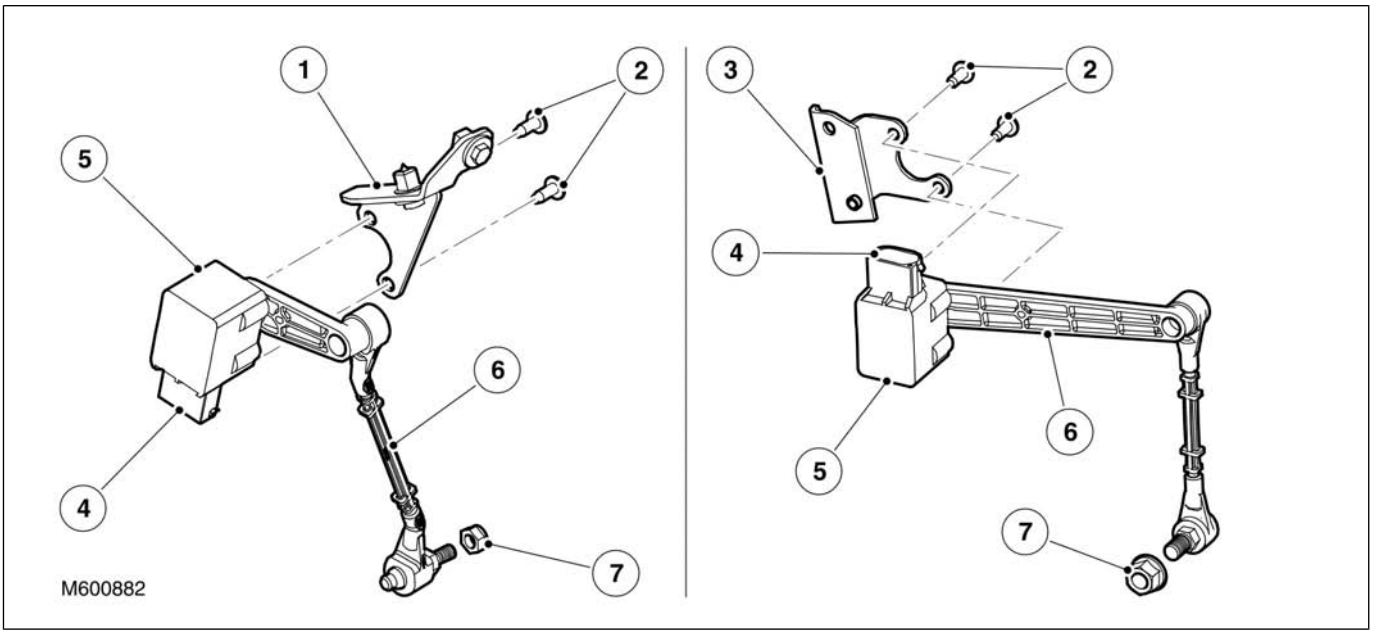
The reservoir supplies pressurized air to the four air springs, via the valve blocks, to enable the air suspension system to carry out ride height changes.

The rearward end of the reservoir has a 'Voss' air fitting which provides for the connection of the air hose between the reservoir and the reservoir valve block.

The reservoir has a capacity of 10.2 liters (622 in).

The nominal working pressure of the reservoir is 14.4 to 15.5 bar (209 to 224 lbf/in), with a maximum pressure of 22 bar (319 lbf/in).

Height Sensors



Item	Description
1.	Front sensor bracket
2.	Fixings
3.	Rear sensor bracket
4.	Electrical connector

Item	Description
5.	Sensor
6.	Lever arm and drop link
7.	Securing nut

A height sensor is fitted in each corner of the vehicle to monitor the ride height of the vehicle.

The sensors are mounted on the front and rear subframes, with a mechanical link to the suspension lower arms.

There are four different types of sensor fitted.

The front and rear sensors are handed and are colored coded for identification as follows:

- Right hand front and rear - black colored lever
- Left hand front and rear - white colored lever

If a height sensor is removed from its mounting position for servicing or replacement , T4 must be used to re-calibrate the system.

Calibration will also be required if the suspension arm to which the sensor is connected is removed or replaced or if a replacement drop link is fitted.

A calibration routine is performed using T4 to read the position of each corner of the vehicle and record the settings in the control module memory.

Once set, the calibration is not required to be performed unless the air suspension control module is removed or replaced, a height sensor is removed or replaced or a suspension arm to which the sensor is connected is removed or replaced.

If the removed height sensor is subsequently refitted, the calibration procedure will have to be performed to ensure the integrity of the system.

The height sensors are attached to brackets on the subframes and are connected to the lower arms by links.

The links allow articulation of the arm to allow for suspension travel.

Each sensor is connected by a six pin multiplug.

The front and rear sensor drop links are serviceable items.

Each sensor comprises a sensor body which contains a single track rotary potentiometer, a lever arm and a drop link.

The sensor is supplied with a reference voltage from the air suspension control module which measures the returned voltage to determine the sensor arm position.

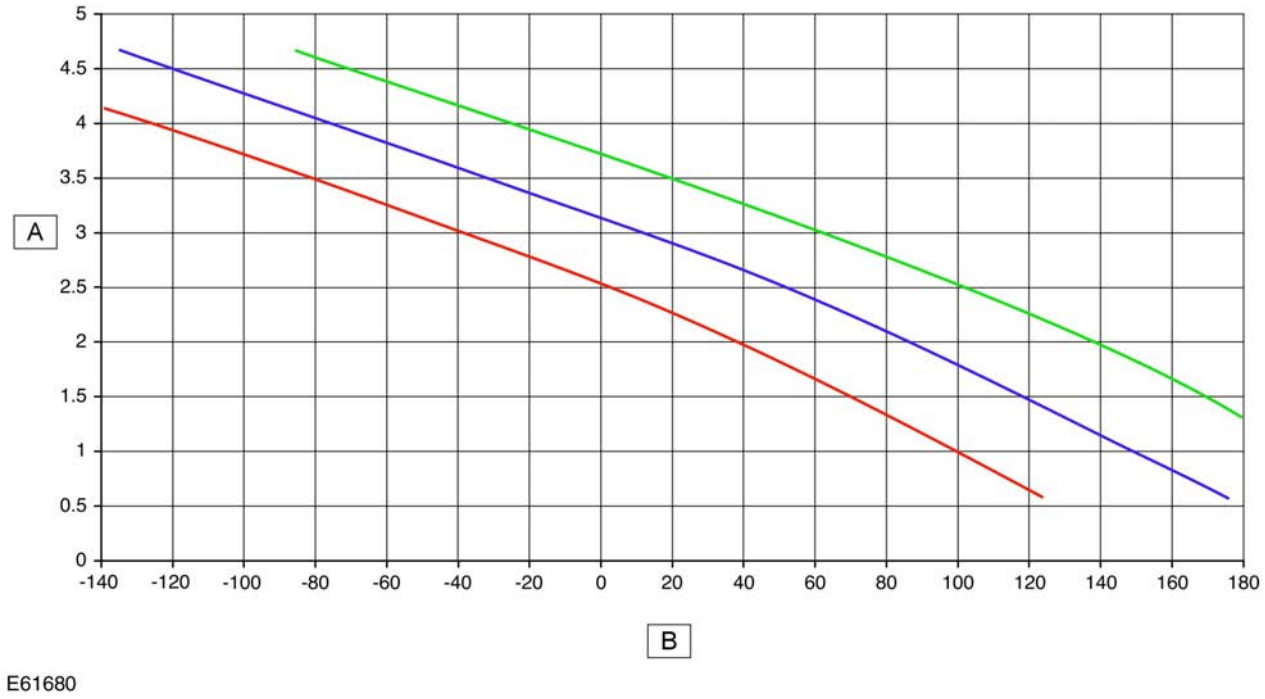
Front Height Sensor

On the front height sensors the voltage decreases as the vehicle height increases. On the rear sensors the voltage increases as the vehicle height increases.

The sensors can be checked by applying 5V across the positive and negative terminals and measuring output signal which should be a nominal 57mV ± 3% per degree of sensor arm movement.

The following graph shows the vehicle height displacement from normal against output voltage for the front height sensors.

The center line represents the "nominal" condition but depending on tolerances, the actual line may lie anywhere between the upper and lower lines.

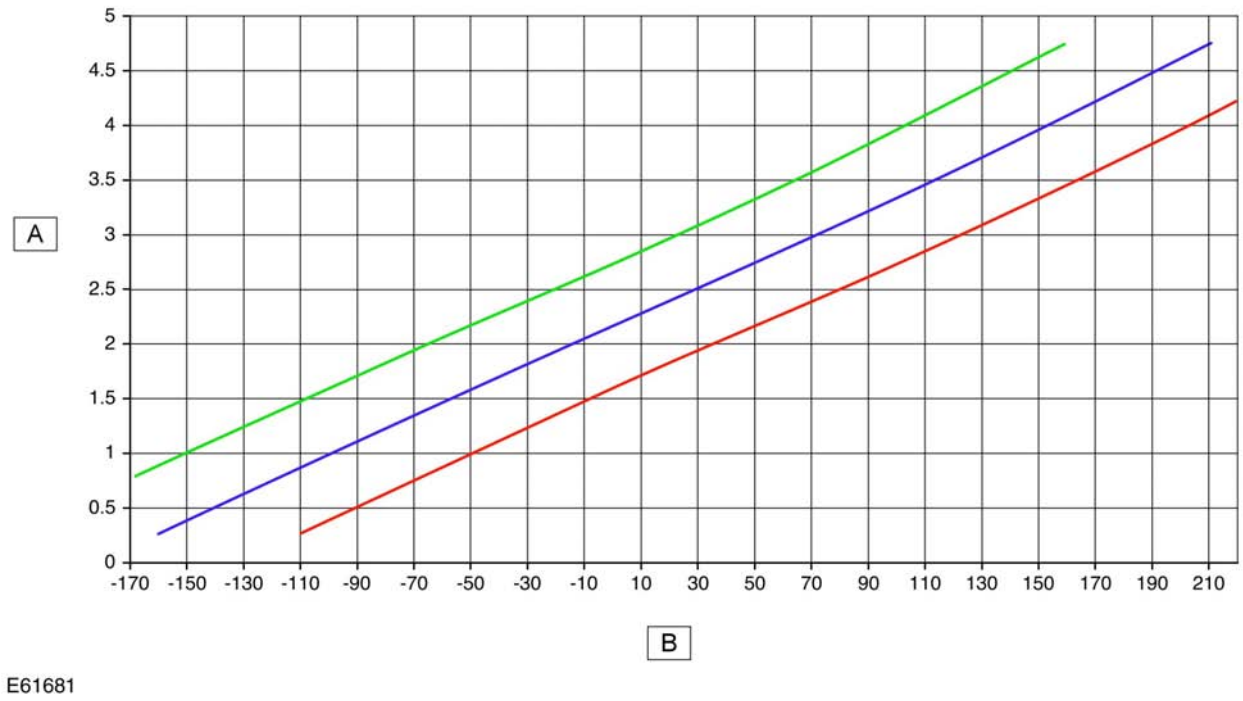


Item	Description
A.	Volts (V)
B.	Displacement from normal height (mm)

Rear Height Sensor

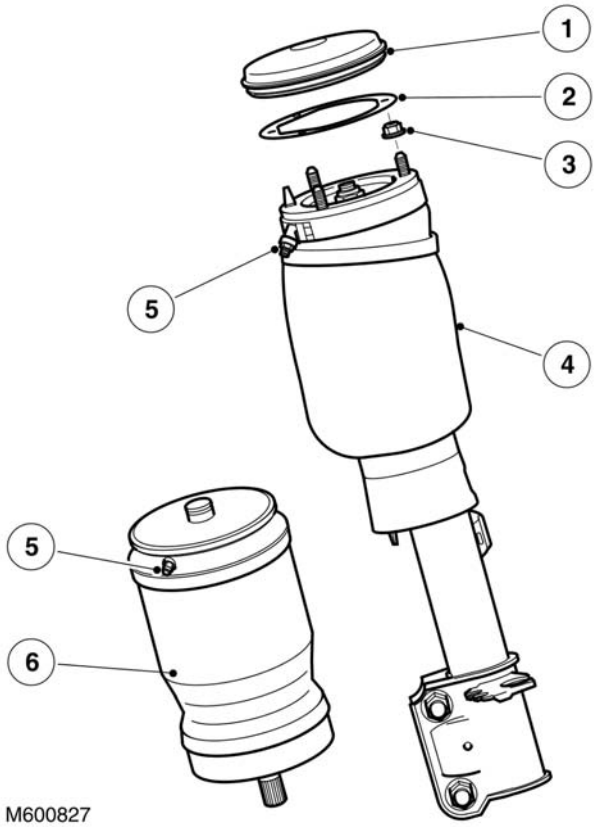
The following graph shows the vehicle height displacement from normal against output voltage for the rear height sensors.

The center line represents the "nominal" condition but depending on tolerances, the actual line may lie anywhere between the upper and lower lines.



Item	Description
A.	Volts (V)
B.	Displacement from normal height (mm)

Air Springs



Item	Description
1.	Cover
2.	Seal plate
3.	Securing nut
4.	Front air spring
5.	Air pipe connection
6.	Rear air spring

The air springs on the front and rear suspension are similar in construction.

The air springs are manufactured from a flexible rubber and each air spring forms an air tight cavity which provides the required spring rate for each corner of the vehicle.

As the air spring is compressed, the rubber material compresses and rolls down the side of the vertical housing (piston) below the spring.

An air connection port is located on the top of each spring and allows air to be added or removed from each spring.

The port is connected via a Voss connector and a plastic tube to the valve block on the reservoir.

Replacement of an individual air spring does not require a full depressurization of the air suspension system.

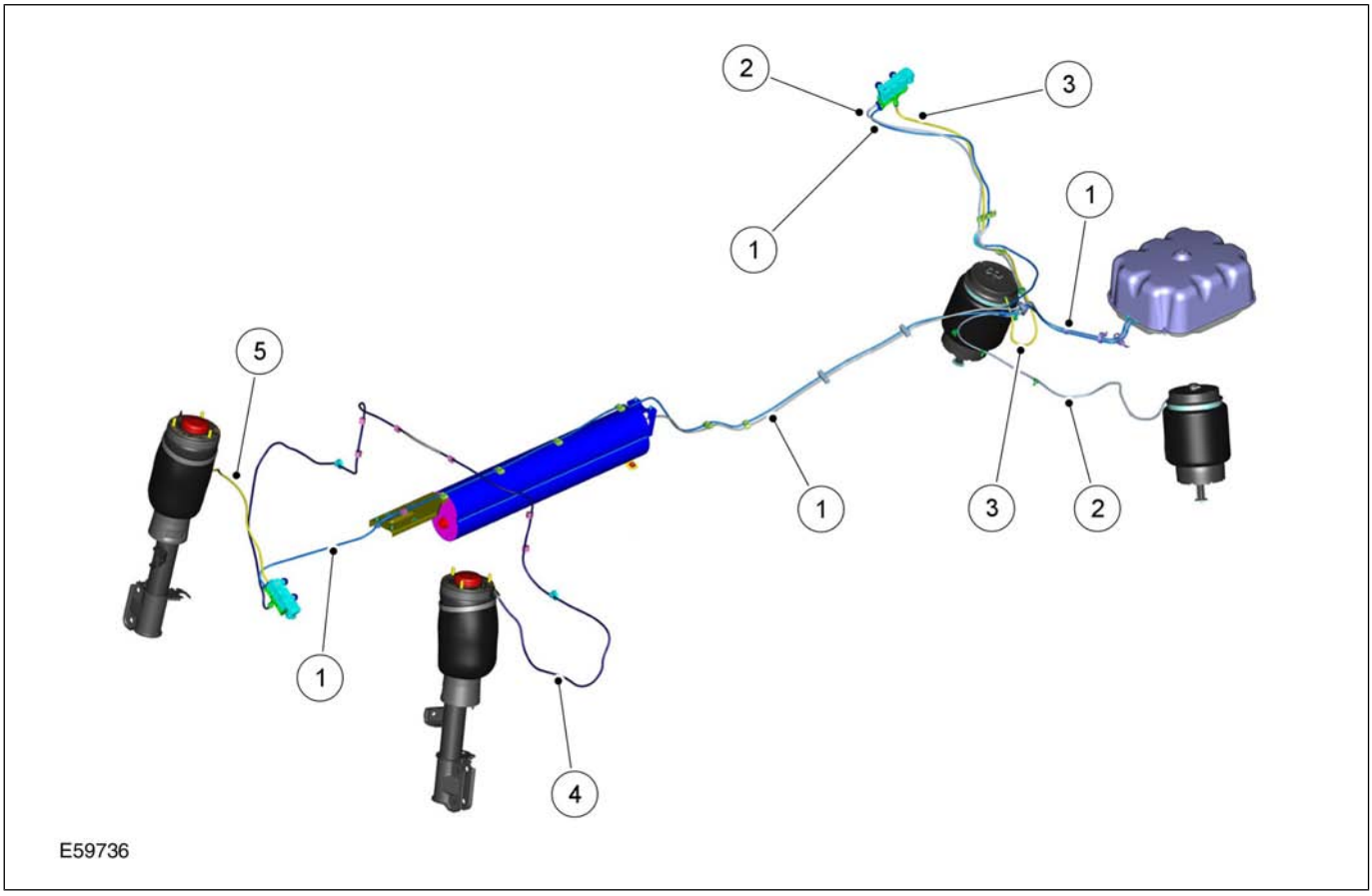
Only the corner concerned need be depressurized.

This is achieved using a routine in T4.

When servicing of an air spring or a full system depressurization is required, the weight of the vehicle must be supported before the system is depressurized.

On reassembly, the air spring must be fully pressurized before the weight of the vehicle is applied to it.

Air Harness



Item	Description
1.	Main harness
2.	Rear valve block to LHR air spring
3.	Rear valve block to RHR air spring
4.	Front valve block to LHF air spring
5.	Front valve block to RHF air spring

The system is interconnected via 6 mm diameter blue, yellow and black colored nylon pipes.

The yellow pipes denote the right hand side and the black pipes denote the left hand side.

Blue colored pipes are used to show the pipes which connect the front and rear valve blocks to the reservoir valve.

The air harness comprises a main harness which is located along the full length of the vehicle and connects the reservoir valve block to the front and rear valve blocks and the reservoir and four separate harnesses which are used to connect each valve block to the air springs.

The pipes are attached to the subframes and vehicle body with clips.

To ensure that the correct routing is maintained, the pipes have timing marks which align with various clip positions.

The timing marks are in the form of a white band around the pipe, indicating the clip position.

If the correct routing is not achieved, unnecessary tension at the pipe joints will occur resulting in possible early failure.

If a pipe becomes damaged, an in-line connector is available for repair purposes.

The pipes are secured to the body and the chassis with a number of plastic clips.

Leak Detection

Leak detection can be carried out using a Land Rover approved leak detection spray.

Leak detection spray part number: STC 1090 (GOTEC LDS).

If the vehicle appears to be leaking, perform a leak check on all aspects of the system, i.e.; air spring hose fittings and the associated connections on the valve blocks, air springs and reservoir.

Failure to correctly diagnose leakage will result in unnecessary exchange of serviceable components and recurrence of original problem.

Air Suspension 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 has the following modes of operation:

- Calibration
- Normal
- Periodic Wake-Up.

When a new air suspension control module is fitted, the air suspension system will not function until the air suspension software is loaded and the system calibrated with T4.

Module Calibration

A calibration routine is performed using T4 to access the position of each corner of the vehicle and record the settings in the control module memory.

Once set, the calibration is not required to be performed unless any of the following occurs:

The air suspension control module is removed or replaced.

A height sensor or bracket is removed, replaced or disturbed.

The suspension arm to which the sensor is connected is removed or replaced.

If the removed height sensor is subsequently refitted, the calibration procedure will have to be performed to ensure the integrity of the system.

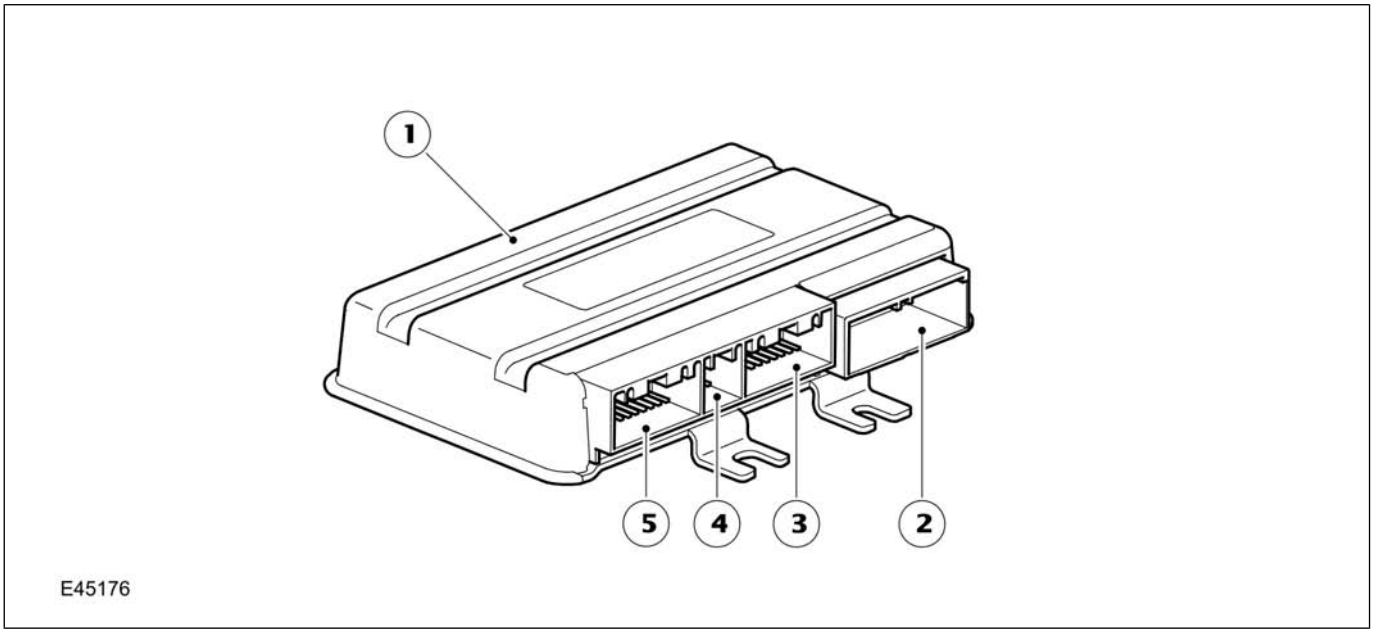
If the air supply unit, the reservoir, a valve block, a damper module or the air harness is removed or replaced, the system will not require recalibration.

Wake-Up Mode

When the vehicle is parked, the air suspension control module 'wakes up' two hours after the ignition was last switched off and then once every six hours thereafter.

The vehicle height is checked and if the vehicle is not level within a pre-set tolerance, small downwards height adjustments may be made automatically.

Air Suspension Control Module Harness Connectors



Item	Description
1.	Air suspension control module
2.	Connector C2321
3.	Connector C2030
4.	Connector C2320
5.	Connector C0867

Connector C2030

Pin No.	Description	Input/Output
1	Rear control valve - Cross link valve - Positive (+)	Output
2	Not used	-
3	Not used	-
4	Not used	-
5	Air supply unit - Motor temperature sensor signal	Input
6	Not used	-
7	Air supply unit - Motor temperature sensor - Ground	Input
8	Not used	-
9	Switch pack display - Height change LED	Output
10	Switch pack display - On-road mode LED	Output
11	Rear control valve - Cross link valve - Negative (-)	Input
12 to 14	Not used	-
15	Gateway wake-up signal	Output
16	Not used	-
17	Switch pack display - Crawl mode LED	Output
18	Switch pack display - Access mode LED	Output
19	Driver door module access switch	Input
20	Switch pack - Raise switch signal	Input

Connector C2320

Pin No.	Description	Input/Output
1	Air supply unit voltage signal input from air supply unit relay	Input
2	Reservoir control valve - Pressure sensor - 5 Volt supply	Output
3	Reservoir control valve - Pressure sensor - Signal	Input
4	Reservoir control valve - Pressure sensor - Ground	Input

Pin No.	Description	Input/Output
5	Air supply unit - Exhaust valve - Negative (-)	Input
6	Air supply unit - Exhaust valve - Positive (+)	Output
7 and 8	Not used	-

Connector C2321

Pin No.	Description	Input/Output
1	12V Permanent battery supply	Input
2	Compressor temperature sensor - Signal	Input
3	Front LH height sensor - 5 Volt supply	Output
4	Front LH height sensor - Signal	Input
5	Front LH height sensor - Ground	Input
6	Air supply unit relay coil - Positive	Output
7	Air supply unit relay coil - Ground	Input
8	Reservoir control valve coil - Positive (+)	Output
9	Front control valve - RH corner valve - Negative (-)	Input
10	Front control valve - RH corner valve - Positive (+)	Output
11	Front control valve - LH corner valve - Negative (-)	Input
12	Front control valve - LH corner valve - Positive (+)	Output
13	Switch pack - Hold switch signal	Input
14	Front RH height sensor - 5V supply	Output
15	Front RH height sensor - Signal	Input
16	Front RH height sensor - Ground	Input
17	Compressor temperature sensor - Ground	Input
18 to 20	Not used	-
21	Reservoir control valve coil - Negative (-)	Input
22	Front control valve - cross link valve - Positive (+)	Output
23	Front control valve - cross link valve - Negative (-)	Input
24	Permanent ground supply	Input

Connector C0867

Pin No.	Description	Input/Output
1	Rear control valve - LH corner valve positive (+)	Output
2	Rear control valve - LH corner valve negative (-)	Input
3	Not used	-
4	Switch pack - Lower switch signal	Input
5	Rear LH height sensor - 5 Volt supply	Output
6	Rear LH height sensor - Signal	Input
7	Rear LH height sensor - Ground	Input
8	Rear RH height sensor - 5 Volt supply	Output
9	Rear RH height sensor - Signal	Input
10	Rear RH height sensor - Ground	Input
11	Rear control valve - RH corner valve positive (+)	Output
12	Rear control valve - RH corner valve negative (-)	Input
13	Air suspension control - GEM signal (wake-up)	Input
14	Switch pack display - LED negative	Input
15	Switch pack display - off-road mode LED	Output
16	CAN IN positive (+) - High	Input
17 and 18	Not used	-
19	CAN IN negative (-) - Low	Input
20	12 Volt ignition switch supply	Input