Introduction to Rolls-Royce and Bentley Motor Cars from VIN 30001 Major Changes

FOREWORD

This workbook is for use with the Rolls-Royce Mastertech Video Programme **'Introduction to Rolls-Royce and Bentley Motor Cars from VIN 30001, Major Changes'.**

It contains additional information describing the new features introduced on Rolls-Royce and Bentley Motor Cars from VIN 30001 and explains appropriate service procedures and use of new test boxes.

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Introduction

From a distance, a Rolls-Royce or Bentley motor car from VIN 30001 may appear virtually identical to its predecessors. In fact, the alloy wheels, new headlamp washer assemblies and new badge are the only external indications that a Silver Spur is one of a new generation of motor cars leaving Crewe.

Only the new headlamp washer assemblies identify a Post-VIN 30001 Bentley Turbo R from a Pre-VIN 30001 Bentley Turbo R.

However, even a cursory examination of the interior, facia, underbonnet and underneath the car reveals many significant changes, particularly to the electrical system.

The following new names are introduced for Rolls-Royce motor cars:

Rolls-Royce Silver Spirit II
Rolls-Royce Silver Spur II
Rolls-Royce Corniche III

There are no new names for Bentley motor cars, the following names being retained:

Bentley 8
Bentley Turbo R
Bentley Mulsanne S
Bentley Continental

Major changes have been made to the following systems:

Engine Management
K-Motronic Fuel Injection and Ignition is fitted to all motor cars.

Electrical System
Introduction of new, fuseboards, relays and switches.

Instrumentation and Controls
Introduction of new instruments and controls. Instruments and controls relocated on facia and centre console.

Suspension
Introduction of automatic ride control.

Central Door Locking
Introduction of remote locking and anti-theft alarm.

Seats
Introduction of seat heaters, adjustable lumbar support on front seats. Adjustable rear seat fitted on long wheelbase motor cars.

Passive Restraint
Introduction of driver's air bag passive restraint system on motor cars built to North American Specifications.

Publications
The following new technical manuals applicable to Rolls-Royce and Bentley Motor Cars from VIN 30001 have been published:

Workshop Manual	**TSD 5000**
Workshop Manual - Engine Management Systems	**TSD 5001**
Workshop Manual - Electrical	**TSD 5002**
Service Schedule Manual	**TSD 5003**
Workshop Tools Manual	**TSD 5004**

Test Instruments
Four new test instruments have been introduced to test the new systems introduced on motor cars from VIN 30001.

Anti-theft alarm	**RH12415**
Driver's Information panel	**RH12416**
Electric seat memory	**RH12417**
Automatic ride control system	**RH12418**

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Vehicle Identification Numbers (VIN)

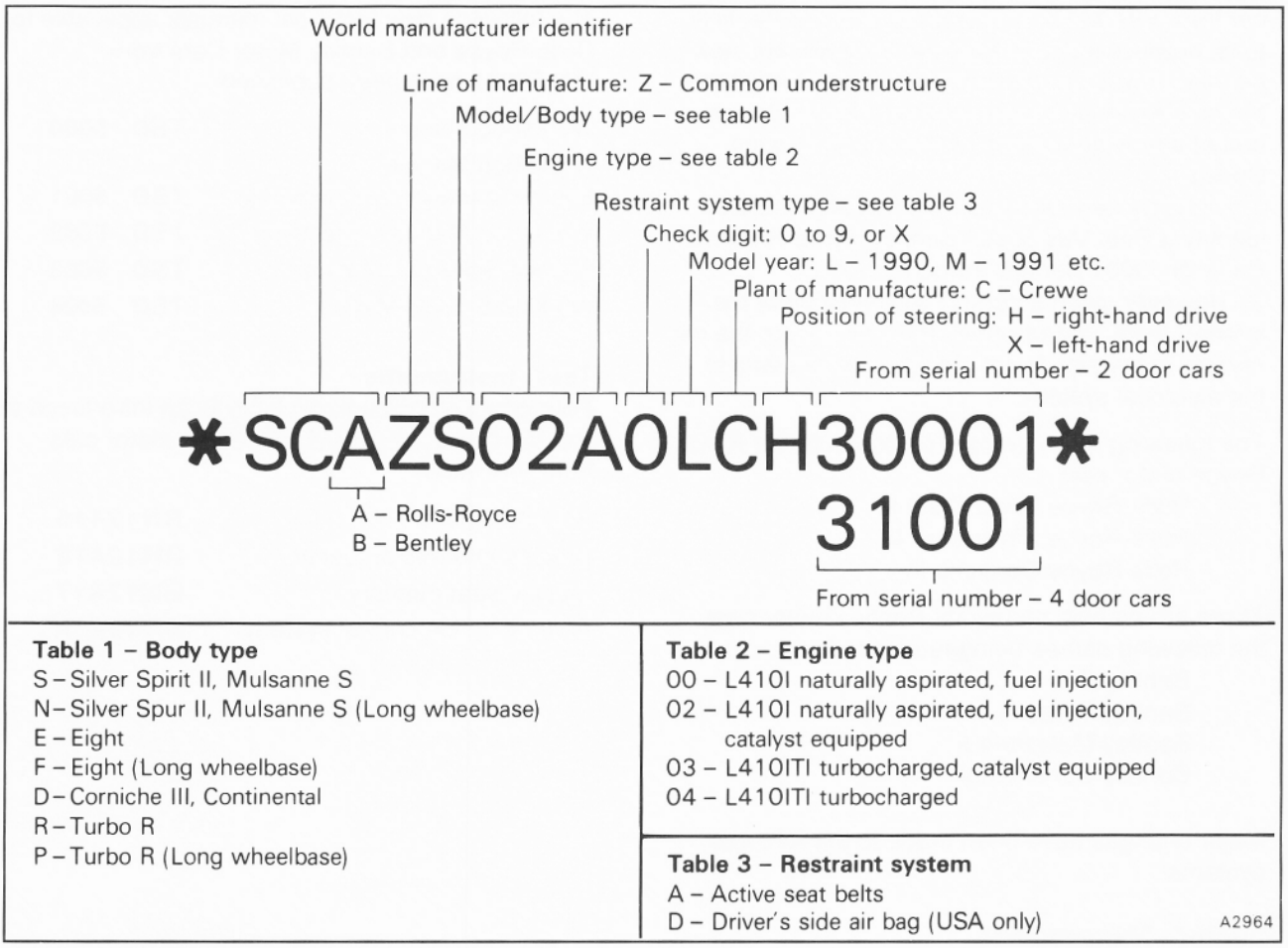

Fig.1 Vehicle identification number

Vehicle Identification Numbers from 30001

Vehicle Identification Numbers from 30001 identify Rolls-Royce and Bentley two-door motor cars built to 1990 model year specifications:

Rolls-Royce Corniche III:	UK	RHD	VIN SCAZD00AXLCH30001
Bentley Continental:	Eur 2	LHD	VIN SCBZD02A4LCX30002

Vehicle Identification Numbers from 31001

Vehicle Identification Numbers from 31001 identify Rolls-Royce and Bentley four-door motor cars built to 1990 model year specifications:

Rolls-Royce Silver Spirit II:	UK	RHD	VIN SCAZS00A7LCH31001
Rolls-Royce Silver Spur II:	Eur 2	LHD	VIN SCAZN02A7LCX31002
Bentley 8:	UK	RHD	VIN SCBZE00A6LCH31008
Bentley Mulsanne S:	Eur 1	LHD	VIN SCBZS00A5LCX31006
Bentley Turbo R:	USA	LHD	VIN SCBZR03D8LCX31004

VIN Bar Code Labels

All motor cars from VIN 30001 destined for USA have an additional record of the VIN number in the form of a machine readable bar code label which is attached to the left hand side B post.

Precautions

It is important that all personnel read, understand and observe all the precautions stated in chapter A of the Workshop Manual TSD 5000 before commencing any repairs or maintenance on cars from VIN 30001.

Important Notes:

1 Driver's Air Bag Passive Restraint System
All Rolls-Royce and Bentley motor cars built to North American Specifications are fitted with a Driver's Air Bag Passive Restraint System.

It is most important to observe the additional precautions when working on motor cars fitted with this system:

Disconnect the battery and wait for at least 30 minutes before carrying out any service procedures on the car.

2 Battery Master Switch
Some electrical circuits are connected directly to the battery through a fusebox located in the luggage compartment. These circuits are not controlled by the battery master switch.

The battery must be disconnected to electrically isolate the car. Turning the battery master switch to 'OFF' will not isolate the electrical systems connected to the luggage compartment fusebox.

Specification

For details of specifications of motor cars from VIN 30001 refer to chapter A of the Workshop Manual TSD 5000.

Data

For details of data applicable to motor cars from VIN 30001 refer to chapter A of the Workshop Manual TSD 5000.

Lubricants

For details of lubricants recommended for motor cars from VIN 30001 refer to chapter D of the Workshop Manual TSD 5000.

Storage and recommissioning

It is important that all personnel read, understand and observe all the procedures and precautions stated in chapter B of the Workshop Manual TSD 5000 before preparing for storage and recommissioning motor cars from VIN 30001.

Important Note:
All Rolls-Royce and Bentley motor cars built to North American Specifications are fitted with a Driver's Air Bag Passive Restraint System.

It is most important to observe the additional precautions when working on motor cars fitted with this system.

Shipping

It is important that all personnel read, understand and observe all the procedures and precautions stated in chapter B of the Workshop Manual TSD 5000 before shipping motor cars from VIN 30001.

Important Note:
All Rolls-Royce and Bentley motor cars built to North American Specifications are fitted with a Driver's Air Bag Passive Restraint System.

It is most important to observe the additional precautions when working on motor cars fitted with this system.

Torque tightening figures

For details of general torque tightening figures applicable to motor cars from VIN 30001 refer to chapter P of the Workshop Manual TSD 5000.

For details of torque tightening figures applicable to specific systems or components fitted to motor cars from VIN 30001 refer to the specific section of the Workshop Manuals TSD 5000, TSD 5001 or TSD 5002 dealing with the system or component.

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Summary of Changes Introduced on Rolls-Royce and Bentley Motor Cars from VIN 30001

Note:

The following summary lists the 1990 model year changes introduced on Rolls-Royce and Bentley Motor Cars from VIN 30001.

The changes are listed in the order used for the Workshop Manual, Workshop Manual - Electrical and Engine Management Systems Manual.

Information may be duplicated where relevant to more than one section.

Where these changes are described in greater detail elsewhere in this work book, reference is made to the relevant page number.

Where further explanations are not included elsewhere in this workbook, the summary has been expanded to provide useful information.

Summary of Mechanical and Body Changes

Air conditioning system

(See page 11 for further details)

1 New air conditioning system switches have been introduced.
2 New air conditioning system temperature control wheels have been introduced.
3 Air conditioning switches and temperature control wheels are located on a panel fitted in the centre console or hanging console.
4 The air conditioning system temperature control wheels now feature 'Full Heat' and 'Full Cold' manual override positions.
5 Two additional 'Bulls-Eye' vents are mounted at the outermost ends of the upper facia.
6 The facia vent control knobs have been redesigned.
7 Escutcheons are fitted to the facia vent control knobs. These retain the facia trim panel in place.
8 A new central duct and control has been introduced. It is located in the hanging console or through console.
9 A new micro-processor board is introduced.

Engine

1 K Motronic Fuel Injection and Ignition System is fitted to all motor cars from VIN 30001.
2 All cars fitted with a K-Motronic onboard diagnostics button.
3 The air pressure transducer is not fitted to naturally aspirated cars.
4 Two new air pressure transducers are fitted to turbocharged motor cars. They are located underneath the right hand front wing panel.
5 All engines fitted to motor cars from VIN 30001 are tuned for using unleaded fuel and leaded fuel, unless a catalytic converter is fitted. Unleaded fuel only must be used on motor cars fitted with catalytic converters.
6 The compression ratio for all types of engine has been standardized to 8:1.
7 All motor cars are fitted with an inertia type fuel cut-off system.
8 A new air injection pump and clutch, similar to those introduced on turbocharged, catalyst equipped motor cars from VIN 24513, is fitted to naturally aspirated motor cars equipped with catalytic converters.

Hydraulic systems

1 Hydraulic system accumulators on all cars are now mounted on the left hand side of the engine, when viewed from the rear, in a similar configuration to turbocharged motor cars from VIN 24513 to VIN 30001. Pipe-work and its routing has been adapted to suit this configuration.

Brake system

1 An electrically released foot operated parking brake release has been introduced.

Height control system

1 All four door motor cars from VIN 30001 are fitted with an automatic ride control system.

Automatic ride control

(See page 34 for further details)

1 All four door Rolls-Royce and Bentley motor cars from VIN 30001 are fitted with an electronically controlled, electrically operated automatic ride control system. This system enables the damping characteristics of the suspension dampers to be changed to provide suspension characteristics appropriate to the manner in which the car is being driven.

Steering column

(See page 49 for further details)

1 A new three-piece steering column with a sliding joint which collapses in the event of an accident is introduced.
2 A steering wheel velocity transducer which provides information to the automatic ride control system is attached to the steering column.
3 All motor cars built to North American and Canadian Specification have a driver's airbag assembly fitted to the steering wheel.
4 All motor cars built to North American and Canadian Specification, have a contact coil assembly for the air bag system fitted in the steering wheel assembly.

Summary of Mechanical and Body Changes (Continued)

Exhaust systems

1 The exhaust systems fitted to all motor cars from VIN 30001 are a similar configuration to that fitted to turbocharged cars from VIN 24513.

Exhaust gases from the 'B' bank cylinders pass through a split manifold and transfer pipe to a junction with the 'A' bank manifold.

2 All motor cars are fitted with new exhaust mountings with improved isolation of noise transmission.

3 All catalyst equipped motor cars from VIN 30001 are fitted with starter catalyst (pre-converter, warm-up catalytic converter) similar to those introduced on turbocharged, catalyst equipped cars from VIN 24513.

Wheels and Tyres

1 All Rolls-Royce motor cars from VIN 30001 are fitted with new 15 spoke 15" diameter aluminium alloy wheels and lockable stainless steel trims.

There are two styles of wheel trim, one for Silver Spirit II and one for Silver Spur II and Corniche III models.

Body

Facia trim

1 The wood trim is held in place by the escutcheons of the air conditioning system facia vent control knobs. The escutcheons have a bayonet fitting into sockets in the instrument board.

2 New wood trim designs have been introduced on Rolls-Royce motor cars.

Front seat heaters

(See page 24 for further details)

1 Both front seats of all motor cars have thermostatically controlled electrical seat heater elements fitted in the seat squabs and cushions.

2 These heaters are operated by three position switches located in the minor controls panel in the central console.

The switches have three settings:

Low (35±2 °C), Off and High (40±2 °C).

Front seats lumbar support system

(See page 24 for further details)

1 An adjustable lumbar support system is fitted to the squabs of each of the front seats.

2 The system is controlled by two three-way switches located on the outer trim of each seat below the seat cushion.

Driver's seat memory

1 The positions of both external mirrors are included in the memory function for the driver's seat.

2 A test box has been introduced to check the operation of the front seat memories.

External mirrors

1 New external mirrors contain mechanisms with feedback potentiometers to enable the ECU to establish the mirrors positions in relation to datum points memorised by the ECU during the reference position calibration procedure.

Rear seats

1 The rear seats on all four-door motor cars incorporate recessed 'pocketed' stowage points for the rear seat belt buckles.

2 The 'heel board' interior lamps are repositioned into the front of the rear seat cushion.

Adjustable rear seats

(See page 25 for further details)

1 Adjustable rear seats are now a standard fitment on Silver Spur II motor cars.

2 An opening box centre arm rest is fitted with adjustable rear seats.

3 A new rear parcel shelf is fitted with adjustable rear seats.

Sun visors

1 Vanity mirrors are fitted to both front sun visors on all four door motor cars.

2 Wooden sliding covers are fitted to the vanity mirrors in the sun visors on all motor cars.

Luggage compartment tray

The rear panel in the luggage compartment which covers the fuel tank is now hinged at its base and used as a mounting point for in-car entertainment equipment.

Drivers air bag passive restraint system

(See page 26 for further details)

1 All Rolls-Royce and Bentley motor cars built to North American Specifications are fitted with a Drivers Air bag Passive Restraint System.

Its purpose is to protect the drivers head and torso during any head on accident which occurs at a speed in excess of 15 mph.

2 An energy absorbing driver's knee bolster is incorporated in the driver's knee roll to provide extra protection.

3 The driver's seat belt incorporates a section of tear webbing.

4 The air bag system has its own separate wiring looms to ensure electrical integrity. These are tied to the main loom.

5 At the steering wheel, a contact coil assembly ensures a good electrical connection to the air bag.

Gear range selector lever

1 The mechanical gear range selector indicator has been deleted. It is replaced by an indicator incorporated in the new driver information panel.

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Summary of Engine Management System Changes

Fuel injection system
(See page 44 for further details)

1 K Motronic Fuel Injection and Ignition System is fitted to all motor cars from VIN 30001.
2 All cars are fitted with a K-Motronic diagnostic button.
3 The air pressure transducer is not fitted to naturally aspirated cars.
4 A new air pressure transducer is fitted to turbocharged motor cars. It is located underneath the right hand front wing panel.
5 All engines fitted to motor cars from VIN 30001 are tuned for using unleaded fuel and leaded fuel, unless a catalytic converter is fitted. Unleaded fuel only must be used on motor cars fitted with catalytic converters.
6 The compression ratio for all types of engine has been standardized to 8:1.
7 All motor cars are fitted with an inertia type fuel cut-off system.

Turbocharging system
1 A new air pressure transducer is fitted to turbocharged motor cars. It is located underneath the right hand front wing panel.
2 The dump valve solenoid and dump valve vacuum switch have been deleted.

Ignition system
1 The ignition warning lamp and engine oil low pressure warning lamp have been deleted.
2 The ignition switch and headlamp switch have been repositioned to a side by side configuration.

The assembly has been relocated in the lower facia panel outboard of the steering wheel in the position originally taken by the wiper switch.
3 K-Motronic Fuel Injection and Ignition System is fitted to all motor cars from VIN 30001.
4 All cars are fitted with a K-Motronic diagnostic button.
5 An air pressure transducer is not fitted to naturally aspirated motor cars.
6 A new air pressure transducer is fitted to turbocharged motor cars. It is located underneath the right hand front wing panel.
7 All engines fitted to motor cars from VIN 30001 are tuned for using unleaded fuel and leaded fuel, unless a catalytic converter is fitted. Unleaded fuel only must be used on motor cars fitted with catalytic converters.
8 The compression ratio for all types of engine has been standardized to 8:1.

Exhaust emission control system

Air injection system
1 A new air injection pump and clutch is fitted to naturally aspirated motor cars equipped with catalytic converters. This is the same as the one fitted to turbocharged motor cars equipped with catalytic converters from VIN 24513 to VIN 30001.

Catalytic converter
1 All naturally aspirated, catalyst equipped cars from VIN 30001 are fitted with starter catalyst (pre-converter, warm-up catalytic converter) similar to those introduced on turbocharged, catalyst equipped motor cars from VIN 24513 to VIN 30001.

Fuel evaporative emission control system
1 All naturally aspirated, motor cars from VIN 30001 destined for markets requiring the fitment of fuel evaporative emission control system are fitted with the fuel evaporative emission control system fitted to turbocharged engines from VIN 24513 to VIN 30001.

The system's operation is controlled by the K-Motronic engine management system ECU which operates an electrical purge valve.

Crankcase emission control system
1 All engines fitted to motor cars from VIN 30001 are fitted with the crankcase emission control system fitted to turbocharged engines from VIN 24513 to VIN 30001.

Fuel system pressure checks

The 10 Bar fuel pressure gauge RH 9612 can be fitted to the cold start injector fuel delivery port in the fuel distributor to check:

Fuel system primary system pressure when the engine is running.

Accumulator pressure when the engine is switched off.

Accumulator leak down rate.

The same gauge can be fitted to the test point in the differential pressure valve lower chamber circuit. In this position it shows the fuel pressure in the lower chambers of the differential pressure valves and enables the action of the electro-hydraulic actuator to be observed.

The earlier 6 Bar type gauge under the same part number should not be used on Turbocharged motor cars from VIN 24513 as the fuel pressure exceeds 6 Bar.

Fuel Pressure

Nominal fuel pressure is 6.3 Bar ± 0.1 Bar.

The differential pressure valve lower chamber pressure varies in accordance with engine coolant temperature, engine load and engine speed. It also varies directly in proportion to the actual system's pressure.

For example, if the system pressure is 6.2 Bar, the differential pressure valve lower chamber pressure will be correspondingly lower. If the system pressure is 6.4 Bar, the differential pressure valve lower chamber pressure will be correspondingly higher. Therefore, it is important not to use the pressure figures obtained from one car as a standard for another car.

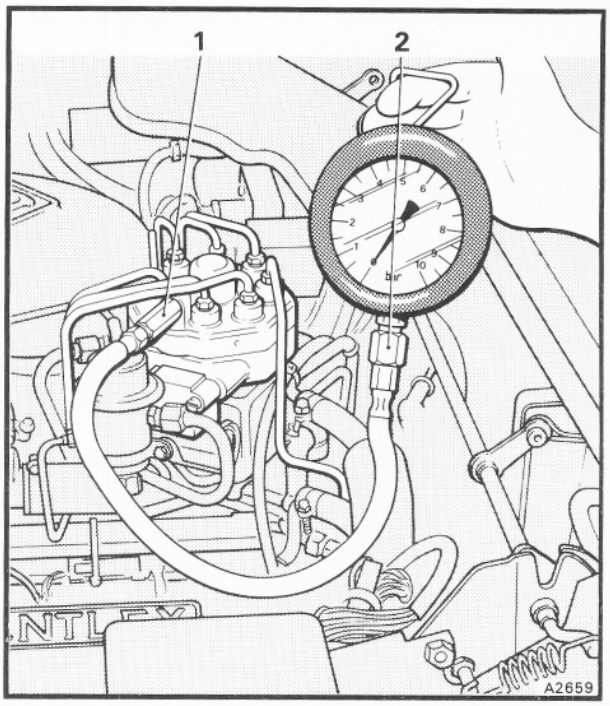


Fig.9 Pressure gauge RH 9612 connected to the cold start injector outlet.

1 Pressure gauge RH 9612
2 Special adaptor RH 9881

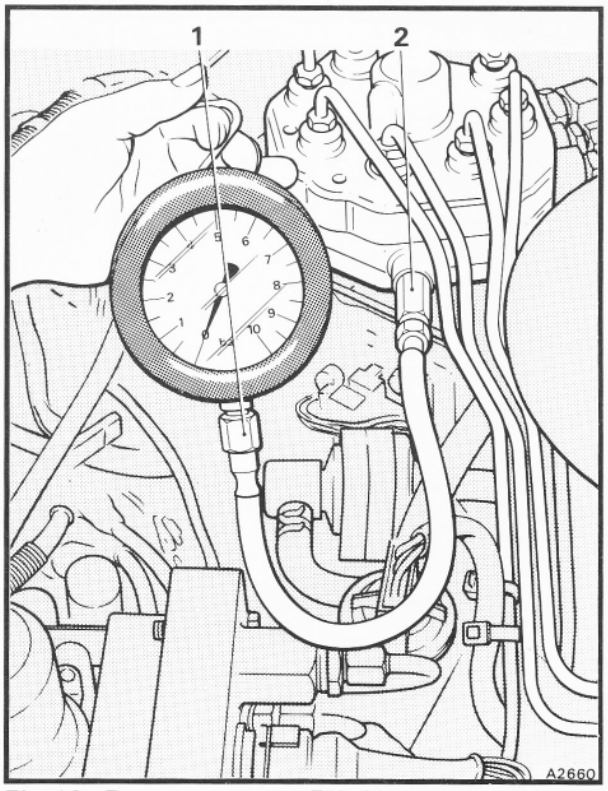


Fig.10 Pressure gauge RH 9612 connected to the differential pressure valve lower chamber test point

1 Pressure gauge RH 9612
2 Special adaptor RH 9881

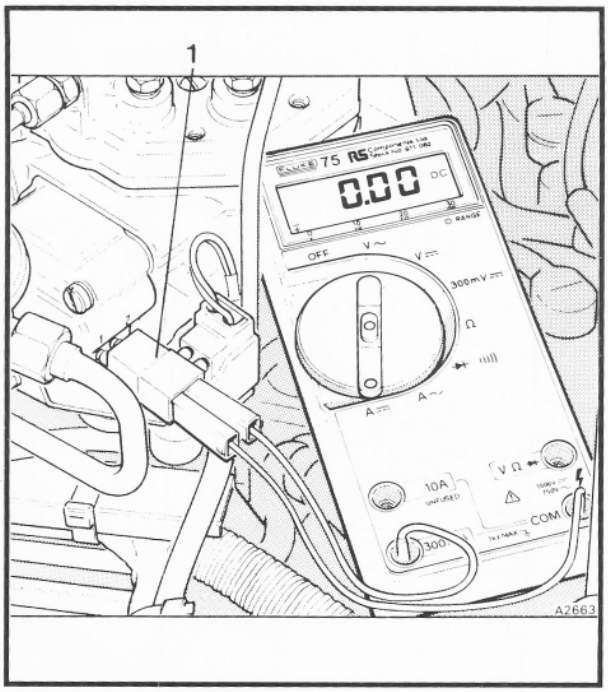


Fig.11 Digital multimeter connected as a milliammeter in series with the electro-hydraulic actuator
1 Special adaptor RH 9893

Digital Multimeter

The Electro-hydraulic Actuator

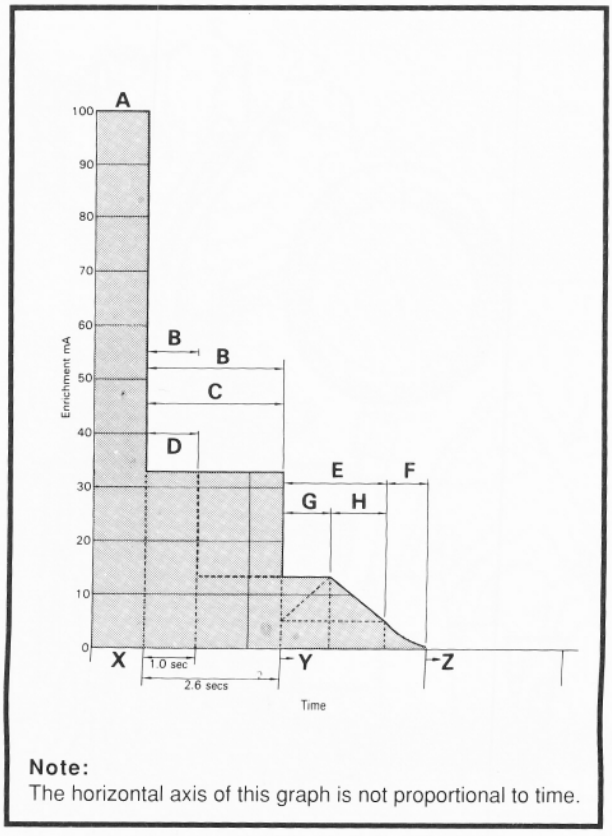
When checking the operation of the fuel injection system, a digital multimeter is used to observe the current drawn by the electro-hydraulic actuator which shows what mixture enrichment or weakening is taking place while the engine is running.

It is essential to use a digital multimeter for this check to ensure accuracy of readings and also to cater for the reverse polarity which occurs during idling on cars fitted with catalytic converters.

Key to figs 12 & 13 (See Page 11 for additional explanation)

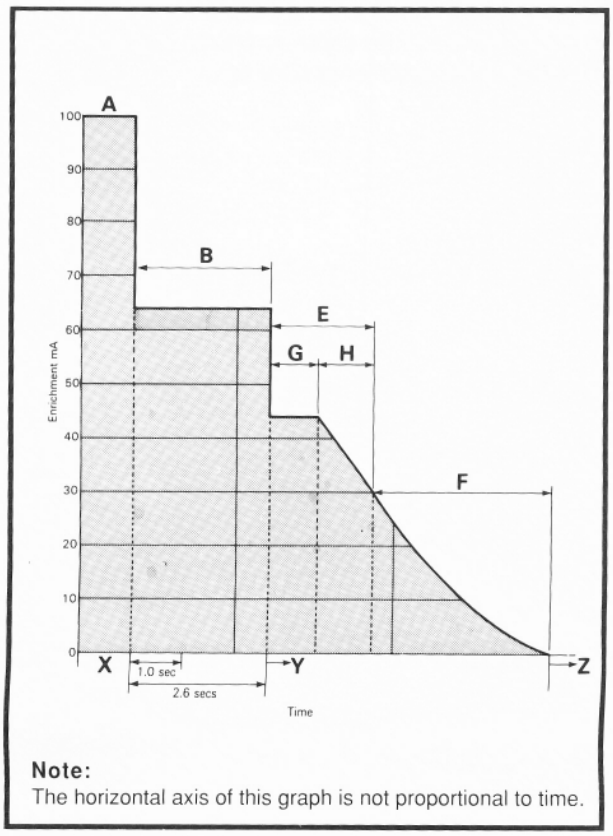
A	Stand current	E	After start enrichment
B	Start enrichment	F	Warm-up enrichment
C	Throttle plates open	G	Plateau time
D	Throttle plates closed	H	Decontrol time

X Time period dependent upon length of time ignition is switched on.
Y Enrichment functions beyond this point are solely coolant temperature dependent.
Z **'Closed -loop'** operation for cars fitted with catalytic converters.
'Open-loop' operation with basic compensation of 0 mA for cars not fitted with catalytic converters.



Note:
The horizontal axis of this graph is not proportional to time.

Fig.12 Typical electro-hydraulic actuator current consumption, from engine start at 20°C (68°F)



Note:
The horizontal axis of this graph is not proportional to time.

Fig.13 Typical electro-hydraulic actuator current consumption, from engine start at 0°C (32°F)

Summary of Electrical System Changes (Continued)

Front seat heaters
(See page 24 for further details)

1 Both front seats of all motor cars have thermostatically controlled electrical seat heater elements fitted in the seat squabs and cushions.

2 These heaters are operated by three position switches located in the minor controls panel in the central console.

The switches have three settings:

Low (35±2 °C), Off and High (40±2 °C).

Front seats lumbar support system
(See page 24 for further details)

1 An adjustable lumbar support system is fitted to the squabs of each of the front seats.

2 The system is controlled by two three-way switches located on the outer trim of each seat below the seat cushion.

Driver's seat memory

1 The positions of both external mirrors are included in the memory function for the driver's seat.

2 A test box has been introduced to check the operation of the front seat memories.

External mirrors

1 New external mirrors contain mechanisms with feedback potentiometers to enable the ECU to establish the mirrors positions in relation to datum points memorised by the ECU during the reference position calibration procedure.

Adjustable rear seats
(See page 25 for further details)

1 Adjustable rear seats are introduced as a standard fitment on Silver Spur II motor cars.

'Heel board' interior lamps

1 The 'heel board' interior lamps are repositioned into the front of the rear seat cushion.

Cellular telephone

New equipment has been fitted with repositioned microphone and an individual loudspeaker.

In-car entertainment

New equipment has been introduced.

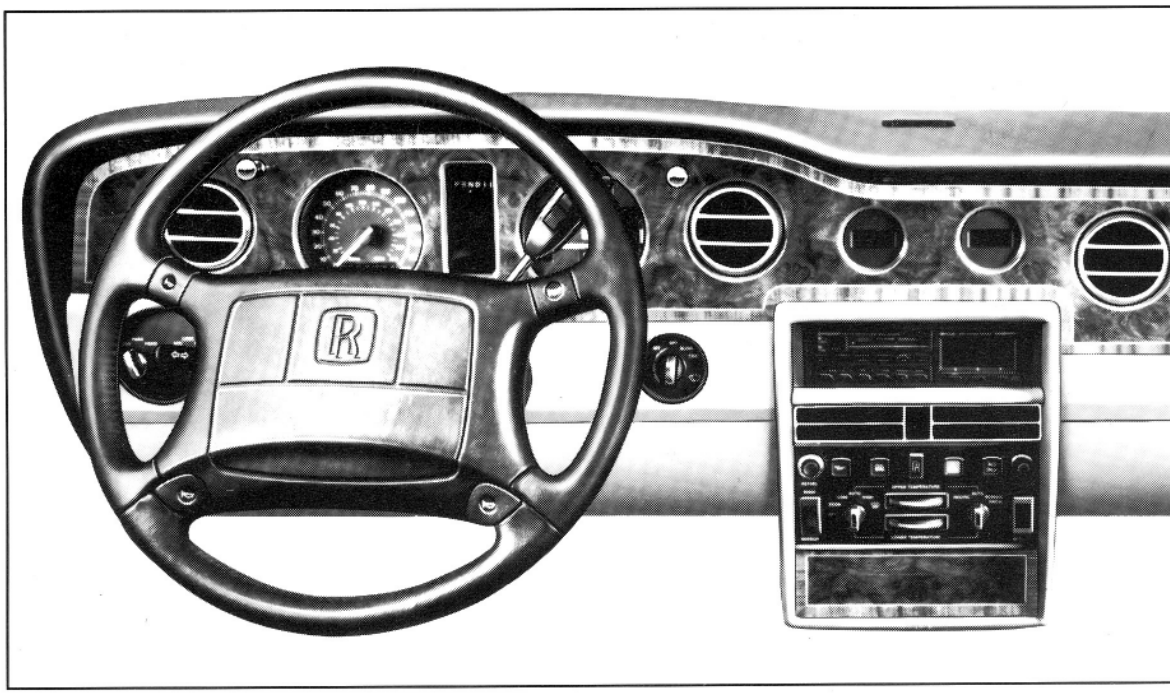


Fig. 2 Facia – Rolls-Royce built to North American specifications

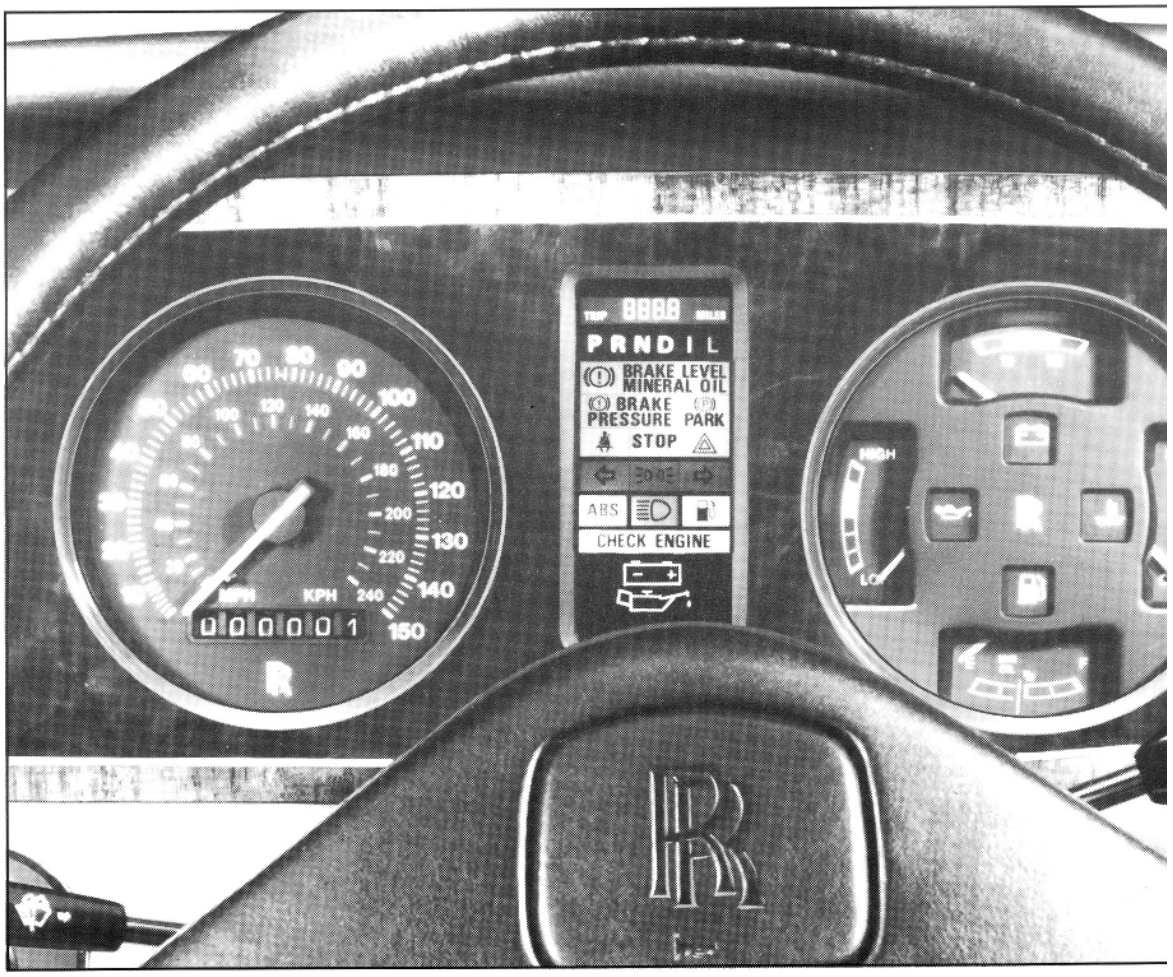


Fig. 3 Speedometer, driver's information panel and four-in-one instrument

Instruments, Switches and Controls

Instruments, switches and controls have been relocated to enable two additional ACU 'bulls-eye facia vents to be fitted. New smaller lower capacity wafer switches have been introduced. New push-push switches have been introduced for minor controls.

Modular instrumentation

Dependent on marque, the speedometer, four-in one instrument or tachometer and a new driver information panel are combined into a single new modular central instrument. The assembly features film type circuitry, plug in bulbs and its functions are controlled by an internal microprocessor.

Four-in-one instrument

This instrument has been redesigned and incorporated in a new modular instrument panel.

Drivers information panel
(See page 12 for further information)

This is a new instrument which consists of 4 elements:

A digital trip-odometer which is switchable from the facia

The gear selector indicator

A bank of warning lights

A dot matrix sequential panel which enables various warnings to be displayed.

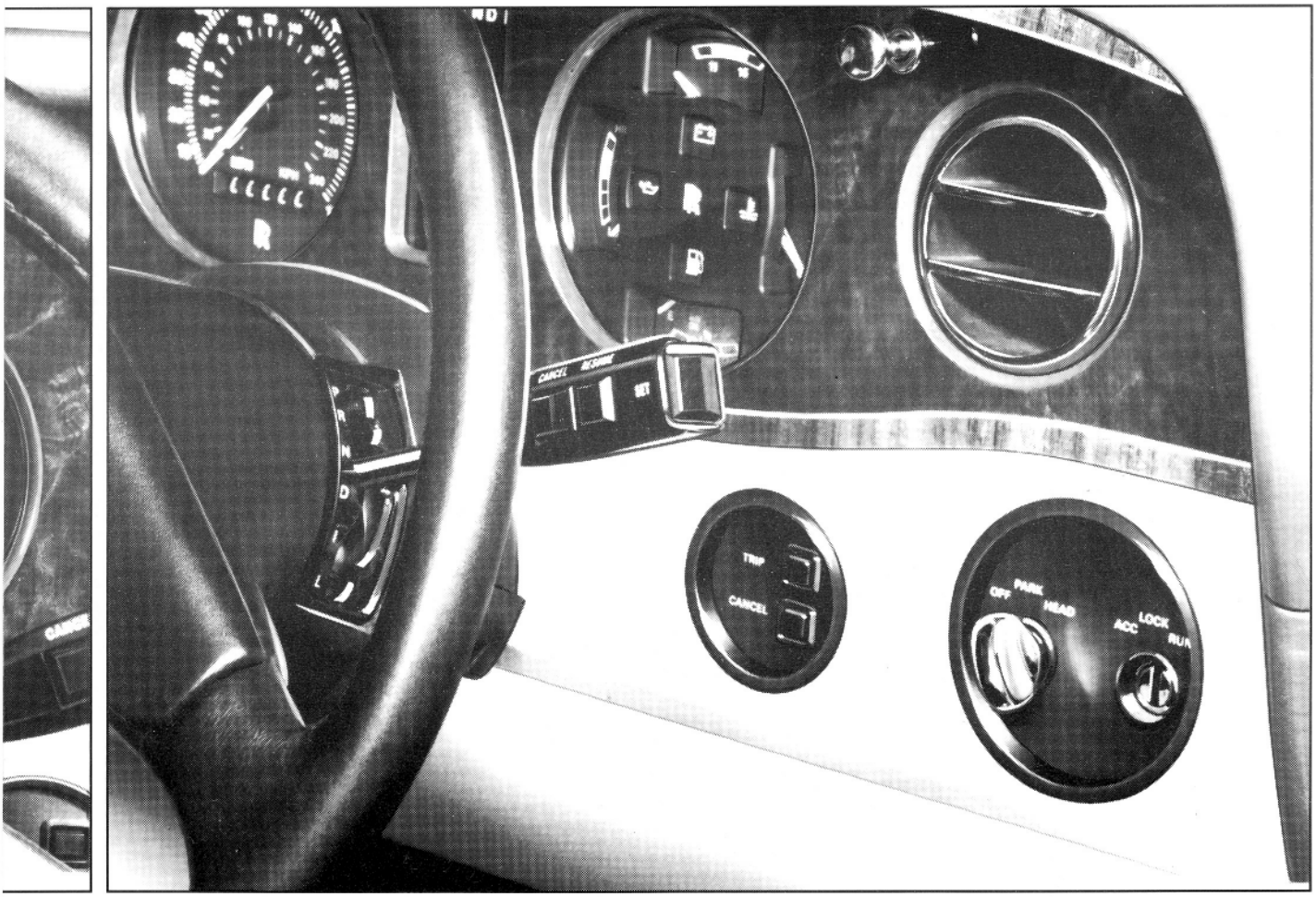
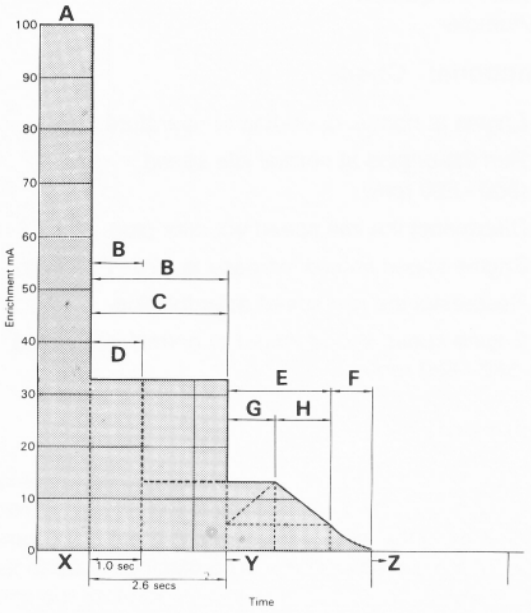
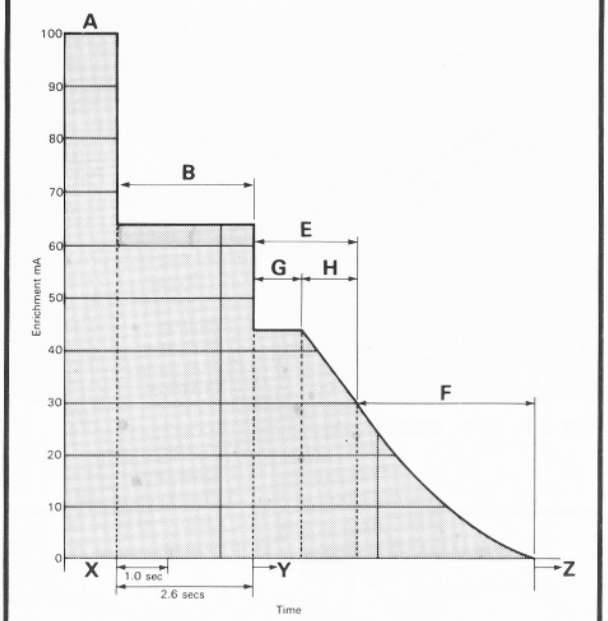


Fig. 4 Ignition switch, headlamps switch, trip and cancel switches



Note:
The horizontal axis of this graph is not proportional to time.

Fig.18 Typical electro-hydraulic actuator current consumption, from engine start at 20°C (68°F)



Note:
The horizontal axis of this graph is not proportional to time.

Fig.19 Typical electro-hydraulic actuator current consumption, from engine start at 0°C (32°F)

Key to figs 18 & 19

A	Stand current	E	After start enrichment
B	Start enrichment	F	Warm-up enrichment
C	Throttle plates open	G	Plateau time
D	Throttle plates closed	H	Decontrol time

X Time period dependent upon length of time ignition is switched on.

Y Enrichment functions beyond this point are solely coolant temperature dependent.

Z **'Closed -loop'** operation for cars fitted with catalytic converters.
'Open-loop' operation with basic compensation of 0 mA for cars not fitted with catalytic converters.

Stand current (pre-cranking)
Whenever the ignition is switched on and the engine speed is below 30 rev/min, the K-Motronic electronic control unit supplies the electro-hydraulic actuator with a constant current of 100±2 mA. This function is not temperature dependent.

Start enrichment
Start enrichment is present during cranking and continues until:

a the engine speed exceeds 430 rev/min.
b a period of 1 second is exceeded with the throttle plates closed.
c a period of 2.6 seconds is exceeded with the throttle plates open.

This function is temperature dependent.

After start enrichment
As soon as the engine speed exceeds 430 rev/min or the appropriate time period has elapsed for the start enrichment period, the K-Motronic engine management system selects the after start enrichment function. This provides smooth engine running during the initial fuel injector stabilization period. The magnitude and duration of this enrichment function is temperature dependent and can be divided into two elements:

a Plateau time when the enrichment current remains constant.
b Decontrol time when the enrichment current decays propotionally with time.

Warm-up enrichment
This final enrichment function, provides mixture enrichment from the completion of the after start enrichment phase until the engine has reached normal operating temperature. It is temperature dependent and decays as the coolant temperature increases.

A table detailing the above enrichment factors will be found in Appendix A (Page 47).

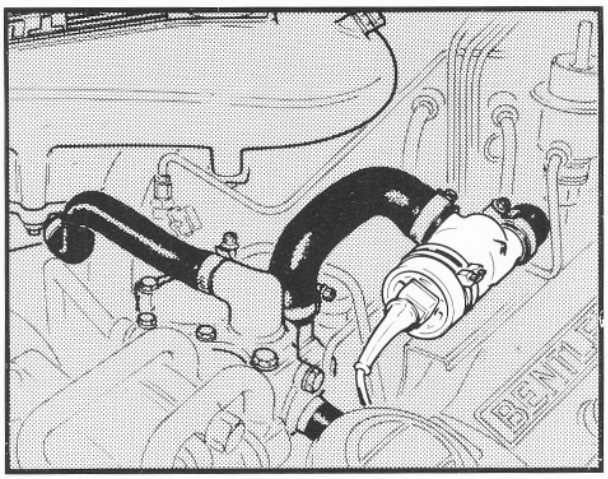


Fig.20 Idle speed actuator

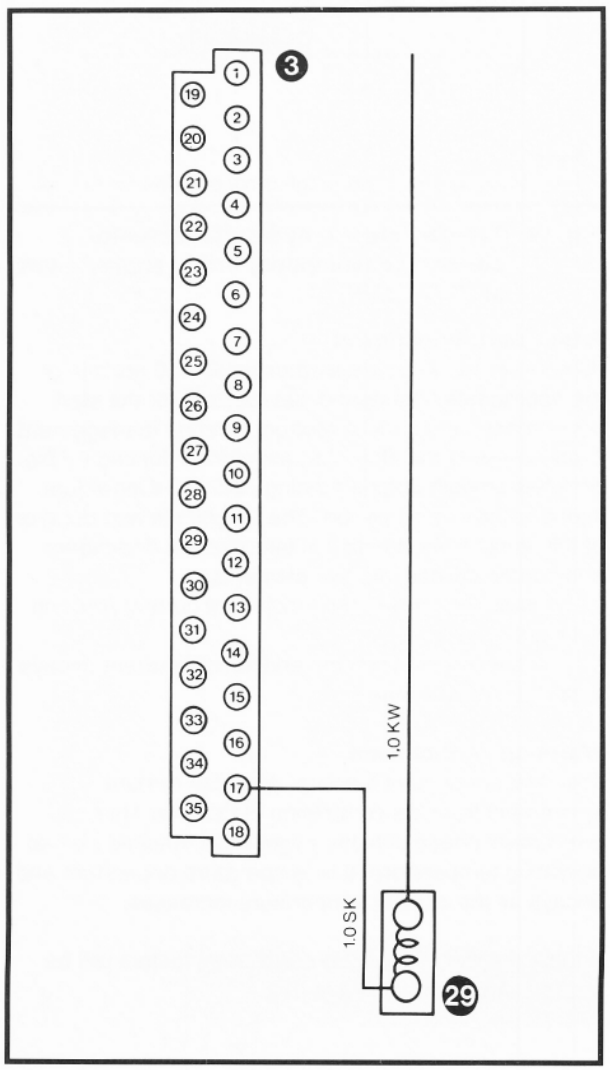


Fig.21 Idle speed actuator wiring diagram

Idle Speed Actuator

Tools Required

Tachometer

Functional Check

1 Engine at normal operating temperature.

2 Run the engine at normal idle speed (580 - 620 rpm).

3 Disconnect the idle speed actuator plug.

4 Engine speed should increase to 820 - 860 rpm.

5 Reconnect the idle speed actuator plug.

6 Engine speed should return to normal idle speed (580 - 620 rpm).

Comments

The act of disconnecting the electrical supply to the idle speed actuator effectively mimics the electronic control unit operating the idle speed actuator in the limp home mode. In this condition there is no electrical feed to turn the armature to the closed position. Therefore the spring pulls the armature back to its rest position, in which the valve is slightly open.

Incorrect Operation

If the idle speed remains at 580 - 620 rpm when you disconnect the plug, then there is either a restriction in the idle by-pass pipe or the idle speed actuator is stuck.

If the idle speed increases to 820 - 860 rpm when the plug is disconnected but fails to return to 580 - 620 rpm when you reconnect the plug, then there is a fault in the positive feed to the idle speed actuator or in the negative control wire from the K-Motronic electronic control unit.

If problems are experienced with idle speeds that are uneven or higher than the accepted norm, the throttle position switch (TPS) integrity and adjustment should be verified, as the K-Motronic ECU will only effectively control the idle speed when it is informed by the throttle position switch that the throttles are in the idle position.

Priority two messages

Priority two warnings are reserved for warnings or information concerning functions which are required whilst driving.

They include front foglamps on, rear foglamps on, low battery charge, ice warning, automatic ride control and low washer fluid.

Like the priority one messages, the second order warnings will be displayed whenever the ignition is switched on or the engine is running until the fault is cleared or the function such as the rear fog lamps is switched off.

If a number of priority two messages are present while driving, they will appear for 15 seconds when they first occur, and then cycle with a four second period on each.

Unlike the priority one warnings, the priority two warnings can be cancelled and recalled by the driver pressing the CANCEL button in the switch panel beside the ignition switch.

If the priority two messages have been cancelled and a further priority two warning develops, this will be displayed and the display will cycle with all the other priority two messages until the CANCEL button is pressed once more.

Priority one messages

The highest priority, priority one is reserved for warnings critical to the safety of the occupants or the engine.

These warnings include engine coolant, air bag, catalyst overheat, oil pressure and oil pressure and battery charge.

Priority one warnings will be displayed if a fault occurs in the appropriate system, for example low engine oil pressure and will remain illuminated whenever the ignition is switched on or the engine is running until the fault is cleared.

If more than one message is present, the messages will be cycled regularly with a period of 4 seconds for each message.

If a priority two warning occurs while a priority one message is being displayed, the priority two message will be displayed for 15 seconds. It will then self cancel and be replaced by the priority one message which will incorporate the downward arrow symbol.

If a new priority one warning occurs during this 15 second period, the appropriate new message will be displayed 4 seconds, after which the priority two message will be displayed for a new period of 15 seconds, if the input is still valid.

Pressing the CANCEL button at any time while one or more priority one messages are being displayed will cause the display to page through the priority two messages with a period of 4 seconds for each message.

Combination of messages

Where a combination of priority one and two messages exist, the priority one messages will take precedence and 'Down Arrow' display will indicate the presence of priority two messages. These can be accessed by pressing the CANCEL button.

Special messages

Other messages are displayed when the engine is switched off or when switching the ignition on, to provide warnings such as side lamps illuminated.

Audible warnings

In addition to the visual display some markets require certain warnings, the sidelights reminder, seat belt warning, key warning and overspeed warning, to be accompanied by audible warnings.

The warning tones for these functions are generated by a piezo device mounted on the panel's microprocessor.

'Driver Demonstration' facility

An easy way to familiarise yourself with a panel and its display is to select park, turn the ignition to the accessory position and then press the CANCEL button until the display changes.

This action initiates the 'Driver Demonstration' facility which is programmed into the panel control unit to assist sales-people in demonstrating this feature to owners. The panel will then page through all the warnings programmed for that particular car showing each message for approximately four seconds.

The gearchange fuse, B1 on fuseboard 1, must be fitted in its holder for this function to operate.

If the interior lamps fuse, A1 on fuseboard 2, is fitted in its holder, all the doors must be closed for this function to operate.

Dot matrix sequential panel display of K-Motronic fault (blink) codes

The driver's information has a diagnostic function which enables it to display blink codes stored by intelligent electronic control units, currently the K-Motronic engine management ECU and, when fitted, the ECU for the Air bag passive restraint system which is described on page 26.

In the case of the K-Motronic engine management system, fault codes are displayed using the CHECK ENGINE warning lamp and additional messages displayed on the dot matrix panel.

This is described in detail on page 46.

Dot matrix sequential panel display of Air bag fault (blink) codes

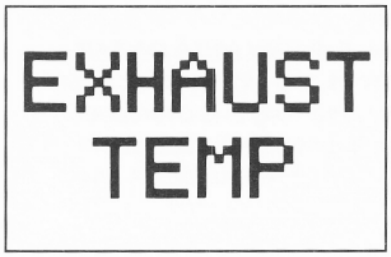
Fault codes for the air bag system when fitted are displayed using the dot matrix display only.

This is described in detail on page 32.

Driver's Information Panel – Priority 1 Dot Matrix Display Messages

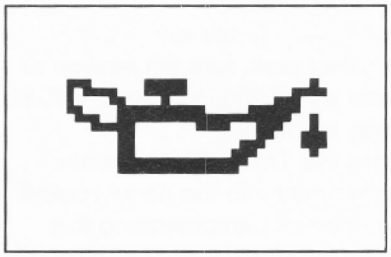
AIR BAG Legend

Colour: Red
Audible Warning: None
Markets: USA/Canada Only
Priority Level: 1
Warning: Fault in driver's air bag passive restraint system



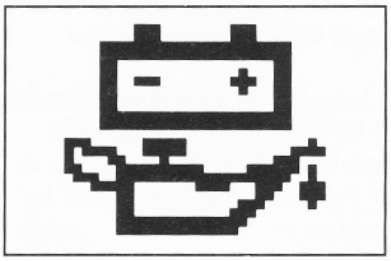
EXHAUST TEMP Legend

Colour: Red
Audible Warning: None
Markets: Japan only
Priority Level: 1
Warning: Catalytic converter overheating
Note: The CHECK ENGINE warning lamp is illuminated when this message is displayed.



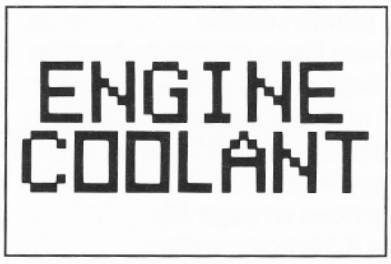
Oil Pressure Symbol

Colour: Red
Audible Warning: None
Markets: All markets
Priority Level: 1
Warning: Low oil pressure



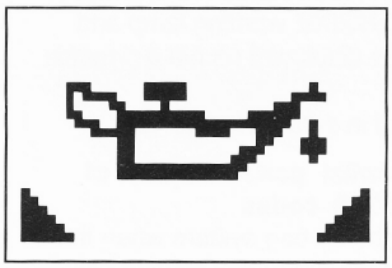
Battery and Oil Symbol

Colour: Red
Audible Warning: None
Markets: All markets
Priority Level: 1
Warning: Low battery charge and low oil pressure



ENGINE COOLANT Legend

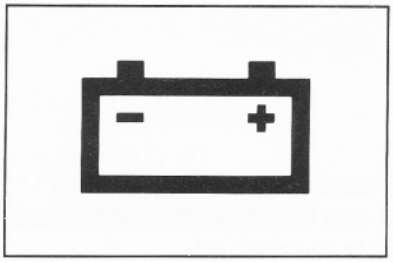
Colour: Amber
Audible Warning: None
Markets: All markets
Priority Level: 1
Warning: Low engine coolant



Down Arrow Symbol

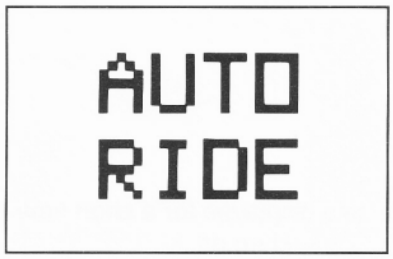
Colour: Green
Audible Warning: None
Markets: All markets
Priority Level: Special
Warning: Reminder that priority 2 messages exist which have been cancelled. This message is superimposed on the priority one message, for example the oil pressure symbol, being displayed.

Driver's Information Panel – Priority 2 Dot Matrix Display Messages



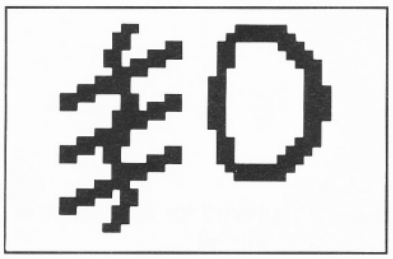
Battery Symbol

Colour: Red
Audible Warning: None
Markets: All markets
Priority Level: 2
Warning: Low battery charge
Note: This message is also displayed with the ignition key in the accessory position



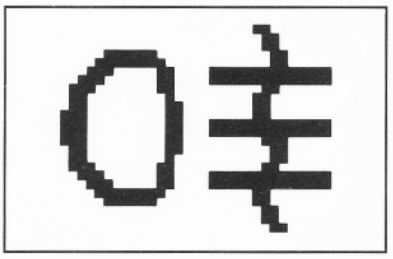
AUTO RIDE Legend

Colour: Amber
Audible Warning: None
Markets: All markets. Four-door cars only.
Priority Level: 2
Warning: Fault exists in automatic ride control system.



Front Fog lamp Symbol

Colour: Green
Audible Warning: None
Markets: Japan + Customer Option
Priority Level: 2
Warning: Front fog lamps are switched on.



Rear Fog lamp Symbol

Colour: Amber
Audible Warning: None
Markets: UK, Europe and Middle East + Customer Option
Priority Level: 2
Warning: Rear fog lamps are switched on.

ICE Legend

Colour: Amber
Audible Warning: None
Markets: All markets
Priority Level: 2
Warning: Ambient air ice warning

WASHER FLUID Legend

Colour: Amber
Audible Warning: None
Markets: All markets
Priority Level: 2
Warning: Low washer fluid level
Note: This message is also displayed with the ignition key in the off position

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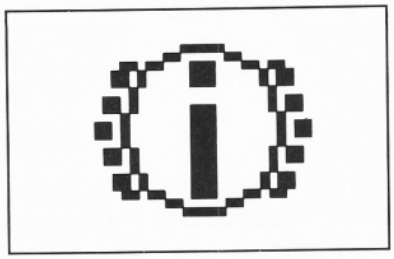
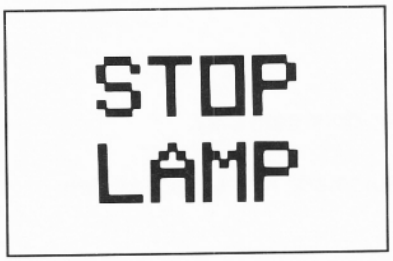
Driver's Information Panel – Priority 3 Dot Matrix Display Messages



Brake Pad Wear Symbol

Colour:	Amber
Audible Warning:	None
Markets:	All markets
Priority Level:	3
Warning:	Brake pad wear reminder
Note:	This message is also displayed for a short time when the ignition is switched off.



STOP LAMP Legend

Colour:	Red
Audible Warning:	None
Markets:	All markets.
Priority Level:	3
Warning:	Brake lamp failure
Note:	This message is also displayed for a short time when the ignition is switched off.

WASHER FLUID Legend

Colour:	Amber
Audible Warning:	None
Markets:	All markets
Priority Level:	3
Warning:	Low washer fluid level
Note:	This message is also displayed for a short time when the ignition is switched off.

Driver's Information Panel – Programming

The same display panel and control unit is used for all cars irrespective of market, model and customer option.

Individual characteristics are programmed into the unit during assembly at Crewe. When replacing a driver's information panel it will be necessary to programme the panel according to the motor car's specification.

It may also be necessary to reprogramme the panel when an additional feature, for example front fog lamps, is fitted at the customer's request after the car has been built.

To programme the panel, select the diagnostic mode by pressing theTRIP and CANCEL buttons until the dot matrix display extinguishes and the CHECK ENGINE and ABS warning lamps illuminate.

Release and press the buttons again until the control unit in the panel enters the option select mode. This is indicated by a trip-odometer display changing to show the vertical elements of the digital display and the words TRIP and either KM or MILES. The display will depend on the specification programmed into the panel's microprocessor.

Each vertical segment, and the words at either end of the display, TRIP and KM or MILES indicates a display function.

The presence of a tall " ¦ " as a vertical element indicates that the function is switched on.

The presence of a short " ˌ " indicates that the function is switched off.

The illumination of the legend KM indicates that the Trip-odometer will display readings in kilometres. Illumination of the legend MILES indicates that the Trip-odometer will display readings in miles.

During programming, the TRIP button is pressed to select a particular function. When the button is pressed for the first time, the TRIP legend will flash. Further presses of the TRIP button will cause each individual vertical element to flash indicating that the particular element can be reprogrammed.

When the relevant function requiring reprogramming has been selected using the trip button, the CANCEL button is pressed to change the display for that function.

If a selected function shows a tall " ¦ " (function switched on), pressing the CANCEL button will change the display to a short " ˌ ' (function switched off). Pressing the CANCEL button again will change the display for that element back to a tall " ı " (function switched on).

Fuel Gauge Calibration

The Low Fuel level warning is sensitive to the electrical resistance of the circuit.

During assembly this function is calibrated to minimise errors caused by the voltage drop in the cables and the change in the resistance of the meter coil between cold and normal operating conditions.

If either the driver's information panel or fuel gauge is changed in service, then it will be necessary to recalibrate the control unit.

To recalibrate the control unit, connect the test box RH 12416 and switch it on. Switch on the ignition.

Press the TRIP and CANCEL Buttons simultaneously for two consecutive periods to select the option select mode.

Then press the TRIP button for six seconds or until the calibration tone is heard. Calibration will now take place over the following five minute period during which the fuel gauge reaches a predetermined operating temperature when the processor in the cluster reads and stores a voltage corresponding to a low level.

The calibration tone will repeat at 10 second intervals while calibration is taking place.

As soon as the process is complete, the instrument panel emits a continuous tone. Switch off the test box and disconnect it.

Rolls-Royce 4-door motor cars

Model	Market		
Silver Spirit II/Silver Spur II	USA	TRIP	Miles
Silver Spirit II/Silver Spur II	UK	TRIP	Miles
Silver Spirit II/Silver Spur II	EUROPE 1	TRIP	Km
Silver Spirit II/Silver Spur II	EUROPE 2	TRIP	Km
Silver Spirit II/Silver Spur II	MIDDLE EAST	TRIP	Km
Silver Spirit II/Silver Spur II	JAPAN 1	TRIP	Km
Silver Spirit II/Silver Spur II	JAPAN 2	TRIP	Km
Silver Spirit II/Silver Spur II	AUSTRALIA	TRIP	Km
Silver Spirit II/Silver Spur II	CANADA	TRIP	Km

Bentley 4-door motor cars

Mulsanne S/8/Turbo R	USA	TRIP	Miles
Mulsanne S/8/Turbo R	UK	TRIP	Miles
Mulsanne S/8/Turbo R	EUROPE 1	TRIP	Km
Mulsanne S/8/Turbo R	EUROPE 2	TRIP	Km
Mulsanne S/8/Turbo R	MIDDLE EAST	TRIP	Km
Mulsanne S/8/Turbo R	JAPAN 1	TRIP	Km
Mulsanne S/8/Turbo R	JAPAN 2	TRIP	Km
Mulsanne S/8/Turbo R	AUSTRALIA	TRIP	Km
Mulsanne S/8/Turbo R	CANADA	TRIP	Km

Fig. 10 Driver's Information Panel – Model/Market Selection Chart

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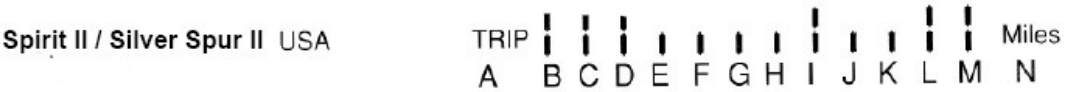
Rolls-Royce and Bentley Two Door Cars

Model	Market		
Corniche III / Continental	USA	TRIP	Miles
Corniche III / Continental	UK	TRIP	Miles
Corniche III / Continental	EUROPE 1	TRIP	Km
Corniche III / Continental	EUROPE 2	TRIP	Km
Corniche III / Continental	MIDDLE EAST	TRIP	Km
Corniche III / Continental	JAPAN 1	TRIP	Km
Corniche III / Continental	JAPAN 2	TRIP	Km
Corniche III / Continental	CANADA	TRIP	Km

Fig. 10 Driver's Information Panel - Mode/Market Chart - Select Option Code on Trip/Odometer Display



= Feature 'selected' = Feature 'not selected'

Feature	Notes
Odometer and/or Trip Meter Selection	TRIP 'selected' for all motor cars
Airbag	Feature 'selected' on USA motor cars only
Key Warning	Feature 'selected' on USA/Canada motor cars only
Digital Outside Air Temperature Gauge Display °F or °C	°F when feature 'selected', °C when feature 'not selected'
Catalyst Overheat Warning	Feature 'selected' on Japan motor cars only
Overspeed Warning	Feature 'selected' on Middle East motor cars only
Front Fog Lamps	
Rear Fog Lamps	
Automatic Ride Control	Feature 'selected' on all 4-Door motor cars only
Not Used	Features 'not selected' on all motor cars
Rolls-Royce/Bentley Digital Output Control For Digital Instrumentation	Rolls-Royce with digital clock and outside air temperature gauge when feature 'selected', Bentley with analogue clock and outside air temperature gauge when feature 'not selected', All Corniche III cars are fitted with analogue clock and outside air temperature gauge and, therefore, are programmed as Bentley – feature 'not selected'
Not Used	Feature 'selected' on all motor cars
Odometer/Trip Meter Display Km or MILES	MILES 'selected' on UK/USA motor cars only

Fuseboards

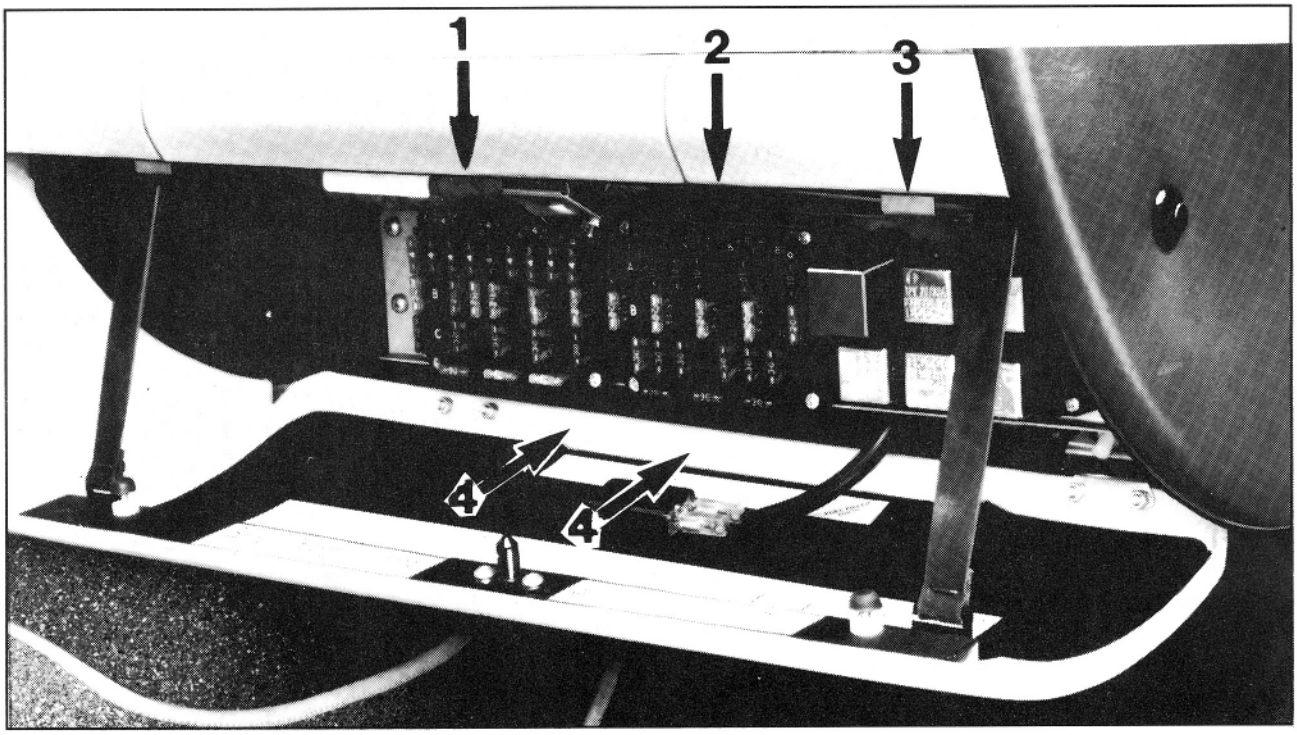


Fig. 11 Fuseboards

1 Fuseboard No 1
2 Fuseboard No 2
3 Relays
4 Lucas Relays

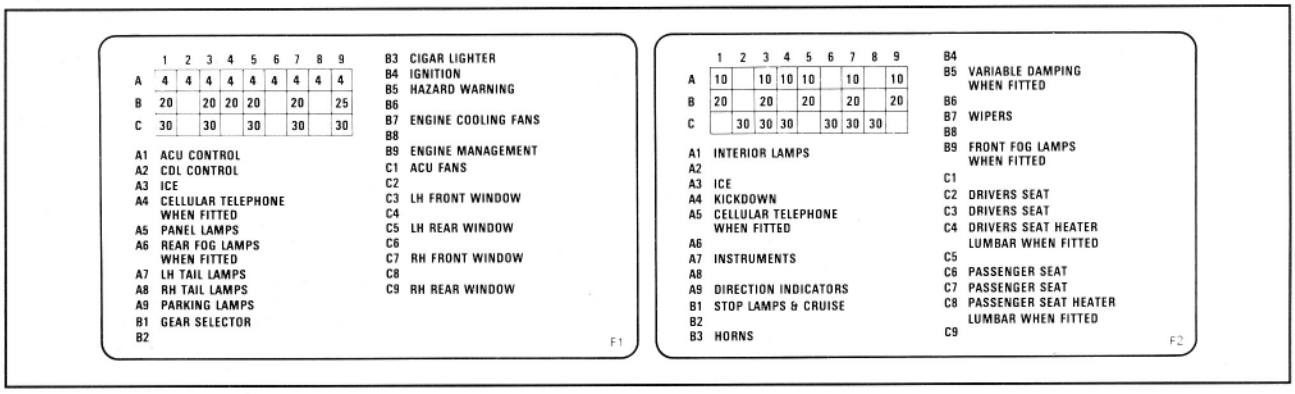


Fig. 12 Fuse identification panel

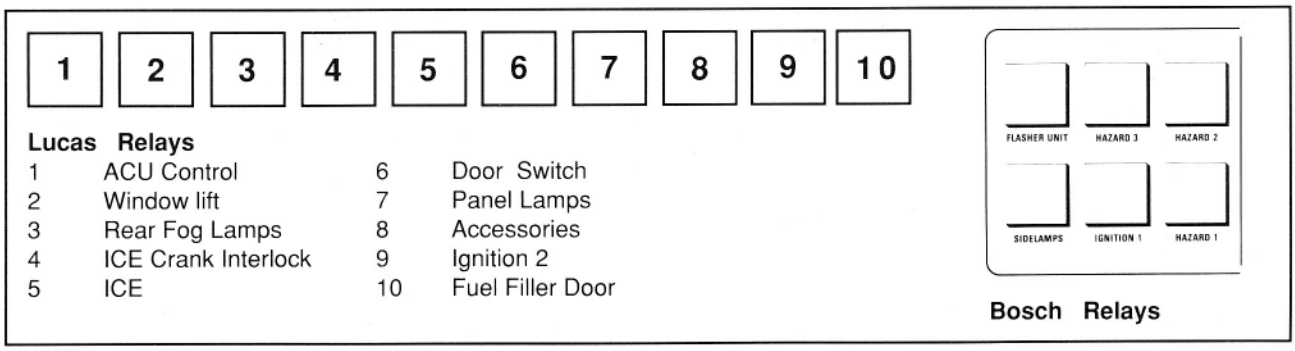


Fig. 13 Fuseboard relay identification

Fuse Identification

Fuseboard

A new fuseboard consisting of two panels replaces the earlier three panel fuseboard fitted to cars prior to VIN 30001.

Generally, the fuses are grouped in lines of the same rating.

Fuseboard 1

On Fuseboard number one, all the fuses on the top row are rated at 4 amps (pink). All the fuses on the second row are 20 amps (yellow) and all the fuses on the bottom row are 30 amps (green).

On cars fitted with twin fuel pumps, the engine management fuse, B9 on fuseboard 1, has a 25 Amp (blue) fuse in place of the 20 Amp (yellow) normally fitted where cars have single fuel pumps.

Fuseboard 2

On Fuseboard number two, all the fuses on the top line are rated at 10 amps (red). All the fuses on the second row are 20 amps (yellow) and all the fuses on the bottom row are 30 amps (green).

Gearchange fuse

The gearchange fuse which should be removed during service after the selector has been placed in the park position to isolate the transmission is now located at B1 on fuseboard 1.

It should be noted that the removal of this fuse will inhibit the display of fault codes and the 'Driver Demonstration' sequence on the dot matrix panel (see page 13).

Interior lamps fuse

The interior lamps fuse is at position A1 on fuseboard 2.

If this fuse is removed to prevent battery drain during service, it is important that the driver's window lift fuse, C3 or C7 on fuseboard 1, dependent on specification, is removed as well.

Removal of this fuse will inhibit the 'Key' and 'Lights on' warnings on the dot matrix panel (see page 17).

Lucas Relays

Ignition controlled circuits are switched using new relays to reduce:

current loadings on switch contacts.
cable lengths in power circuits.
bulk, weight and cost.

These new Lucas relays are located below the fuseboard.

Luggage Compartment Fusebox

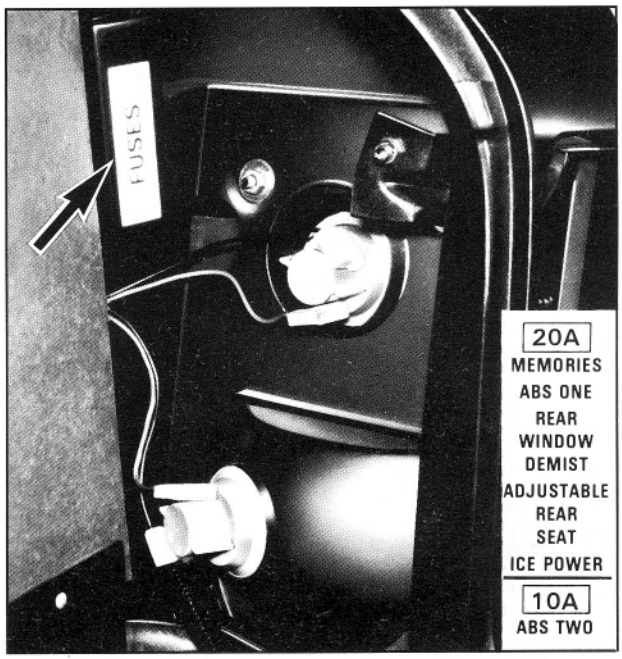


Fig. 14 Luggage compartment fuse box and identification panel

Luggage compartment fusebox

A separate fusebox is fitted in the luggage compartment.

It is located just behind the right hand rear lamp cluster and is fed directly by two cables connected to the battery positive terminal clamp bolt.

The fuse box provides supplies to the following circuits:

Fuse 1	Cranking interlock relay
Fuse 2	ABS system - Modulator relay
Fuse 3	Rear window demister relay
Fuse 4	Adjustable rear seats (when fitted)
Fuse 5	In-car entertainment
Fuse 6	ABS system - Overvoltage relay

Note:

The battery supply to these circuits is not controlled by the battery master switch. If the battery master switch is turned to off but the battery is still fully connected, the circuits fed by the luggage compartment fuse box will still be live.

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Windscreen Wiper – Washwipe Control

Normal windscreen wiper operation for all motor cars from VIN 30001 is identical to earlier models.

A new washwipe ECU, part no. UD 72110, which is common to all models and all markets is introduced.

The new ECU provides all the features of its predecessor plus one additional feature.

If the washwipe switch is momentarily pressed for any period less than 1 second, the wipers will operate at normal speed until the switch is again pressed momentarily.

When the washwipe switch is pressed for longer than 1 second, the normal washwipe operation of earlier cars is provided.

Provided that normal wiper speed only is required, control can, therefore, be achieved using the washwipe switch only with the wiper switch remaining in the 'OFF' position.

If the wipers are being used in this way and the wiper switch is then switched on, for example to 'fast' speed, they cannot be stopped by pressing the washwipe switch alone. The wiper switch must first be turned to the 'OFF' position and then the washwipe switch momentarily pressed to stop the wiper operation.

One Shot Window Lift System

The 'one-shot' window lift is a feature fitted to the driver's door of all motor cars from VIN 30001 destined for all markets.

The system will only operate when the engine is running. This applies to all markets.

When the driver's window lift switch is pressed either 'up' or 'down' for longer than 0.4 seconds and then released, the window will continue to move to the limit of its travel in that direction.

From the time the window lift switch is released, power is supplied to the window lift motor for 8 seconds. Therefore, the motor is stalled for the remainder of the 8 seconds after the window has reached its travel limit.

The window can be stopped at any point by momentarily pressing the switch in the opposite direction.

The system is controlled by an ECU mounted in a cavity in the driver's door behind the large radio speaker.

The ECU, part no. UD 72266 is common to all cars irrespective of destination. A parameter code socket enables different characteristics to be selected to meet the legal requirements of different markets.

On cars destined for USA, Canada and Australia, the Black/White and Black/Brown cables are linked together.

On cars destined for countries other than USA, Canada and Australia, the Black/Blue and Black/Brown cables are linked together.

Apart from the introduction of the 'one shot' system, the operation of the windows is the same as on 1989 model year cars.

The table on page 23 provides a full explanation of the window lift operating sequence.

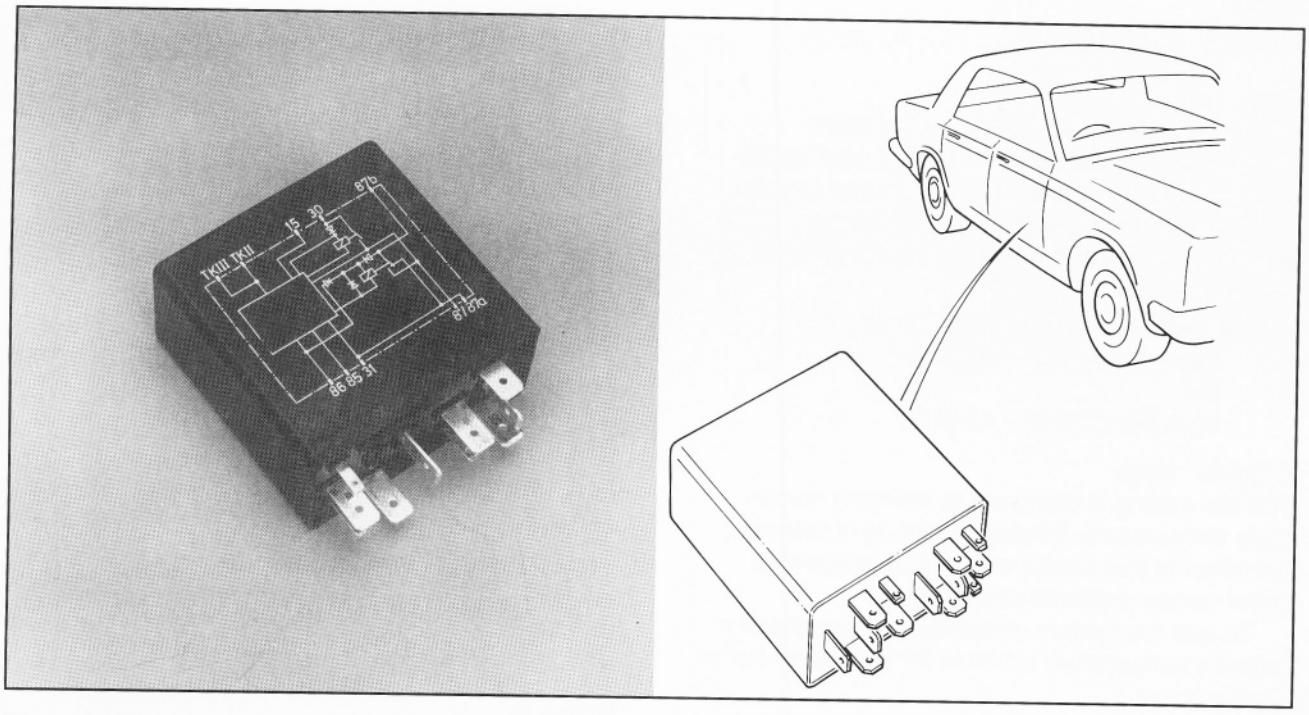

Fig. 15 'One shot' window control unit and location.

Sequence of Events for Window Operation

Event No.	Sequence of Events	USA,Can, Aust		UK, ME, Jap		Eur	
		Passenger's Window Power	Driver's Window Power	Passenger's Window Power	Driver's Window Power	Passenger's Window Power	Driver's Window Power
1	Driver's Door opened	No	No	Yes	Manual	Yes	Manual
2	Car entered and door shut	No	No	Yes	Manual	No	No
3	Ignition on	Yes	Manual	Yes	Manual	Yes	Manual
4	Engine running	Yes	One shot	Yes	One shot	Yes	One shot
5	Ignition off	Yes	Manual	Yes	Manual	Yes	Manual
6	Driver's Door opened	No	No	Yes	Manual	Yes	Manual
7	Driver's Door closed	No	No	Yes	Manual	No	No
8	Back to Event 1	No	No	Yes	Manual	No	No

Note:
All windows operational when driver's door open regardless of ignition switch position.

Front Seats

Seat heaters

Both front seats of all cars are fitted with thermostatically controlled electrical seat heater elements fitted in the seat cushions and squabs.

These heaters are operated by three position switches located in the minor controls panel in the central console.

The switches have three settings:

Low [Position 1] – 35±2 °C
Off
High [Position 2] – 40±2 °C

Service Note

The low setting is designed to maintain normal body temperature. When this setting is selected, the effect of this heater may not be noticeable under certain ambient conditions.

To test the system effectively, ensure that the ambient temperature is below 25°C or carry out an electrical test.

Front seats lumbar support system

An adjustable lumbar support system is fitted to the squabs of each of the front seats.

The system comprises a two part bladder which is inflated by an electric pump and deflated by the action of solenoid valves in a valve block. The pump and solenoid assembly for each seat is located in a sleeve situated behind the seat squab.

The system is controlled by two three-way switches located on the outer trim of each seat below the seat cushion. The lower switch controls the bladder that supports the lower part of the seat occupant's back and the upper switch controls the bladder which supports the middle region of the occupant's back.

Driver's seat memory

The positions of both external mirrors are included in the memory function for the driver's seat. The seat electronic control units are not interchangeable with units fitted to motor cars prior to VIN 30001.

Front Seats test box

A test box, RH 12417, has been introduced to check the operation of the front seat memories.

External mirrors

New external mirrors contain mechanisms with feedback potentiometers to enable the ECU to establish the mirrors positions in relation to datum points memorised by the ECU during the reference position calibration procedure. The calibration procedure is the same as for motor cars prior to VIN 30001.

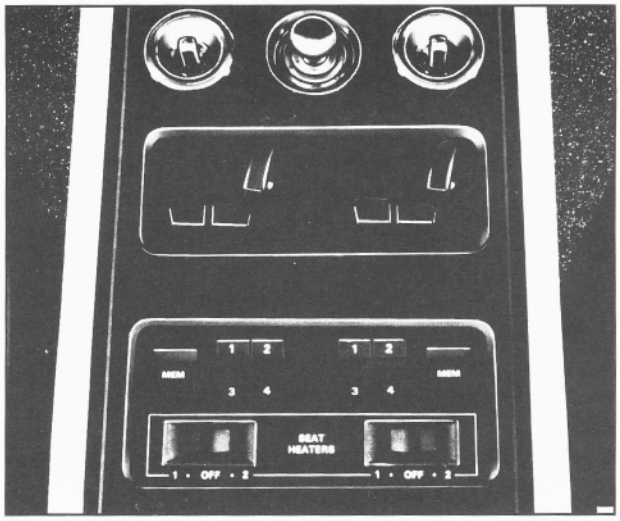

Fig. 16 Front seat heater switches

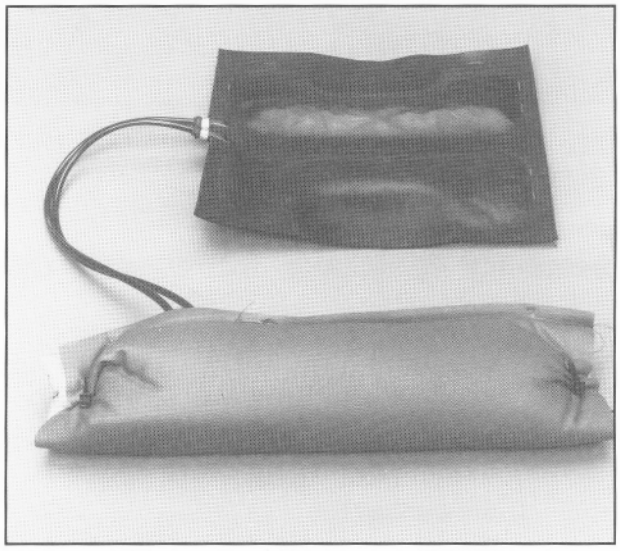

Fig. 17 Front seat lumbar support components

Fig. 18 Front seat lumbar support switches

Rear Seats

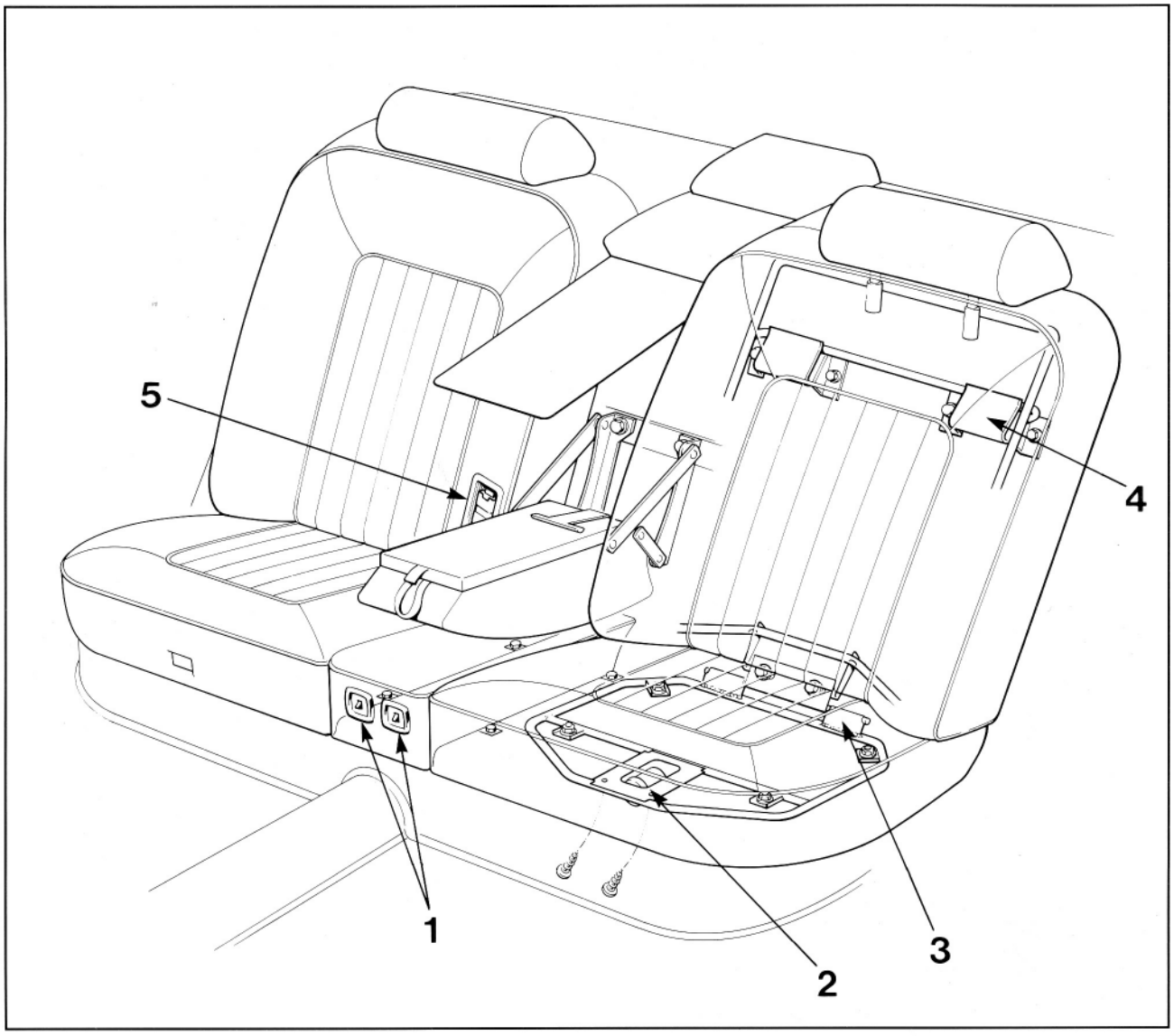

Fig. 19 Adjustable rear seats

1 Seat switches
2 Left-hand seat motor
3 Hinge
4 Attachment point to rear bulkhead
5 Pocketed seat buckle

Pocketed seat buckles

The rear seats on all four-door motor cars incorporate recessed 'pocketed' stowage points for the rear seat belt buckles.

Adjustable rear seats

Adjustable rear seats are now a standard fitment on Silver Spur models and are available as a customer option on other long wheel base four door cars.

Each rear seat consists of an articulated seat frame which is hinged at the junction of the seat and squab.

The seat frame is mounted on a pair of slides and is moved backwards and forwards by an electric motor and drive mechanism. The top of the squab frame is attached to the rear bulkhead. As the seat moves forwards the squab reclines.

The seat position is controlled by a three-way switch located on the front trim of the division between the two seats.

An opening box centre arm rest is fitted with adjustable rear seats.

Driver's Air Bag Passive Restraint System

Fig. 20 Driver's airbag passive restraint system

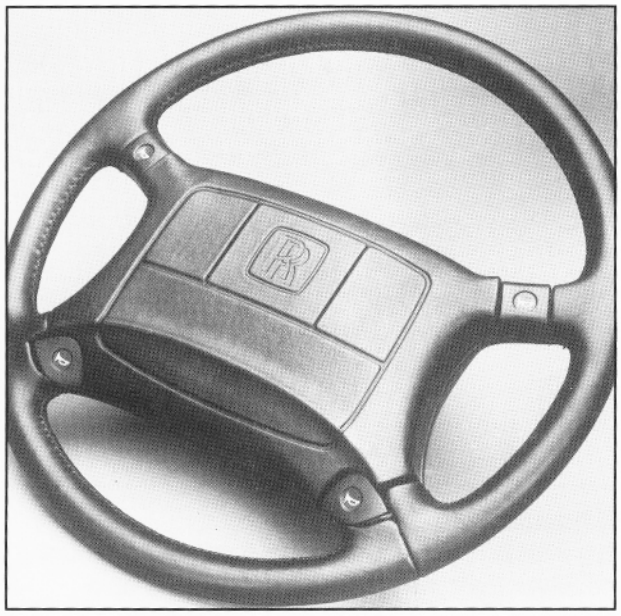

Fig. 21 Steering wheel with airbag

Introduction

All Rolls-Royce and Bentley motor cars built to North American Specifications are fitted with a Driver's Air Bag Passive Restraint System.

Its purpose is to protect the driver's head and torso during any severe head on accident which occurs at a speed in excess of 15 mph (24 km/h).

The system consists of a voltage supply system, deceleration sensors and an air bag assembly.

If the car is involved in a severe frontal impact when the speed is greater than 15 mph (24 km/h), the air bag inflates and cushions the upper torso and head from the steering wheel.

The air bag will not be deployed at lower speeds or deceleration, when the collision zones of the car and conventional seat belts effectively restrain the cars occupants. The air bag will not operate in side or rear collisions or if the car rolls over.

The air bag system incorporates a microprocessor based self-diagnostic function which checks the system for faults and malfunctions. If a fault occurs in the system, the microprocessor causes a warning message to be displayed on the drivers information panel. At the same time, it records the fault in the form of a fault code which it stores in a memory which can be interrogated by service personnel.

Service note

If the air bag electrical system is broken into, a fault code may be generated causing illumination of the air bag warning legend on the dot matrix display of the driver's information panel.

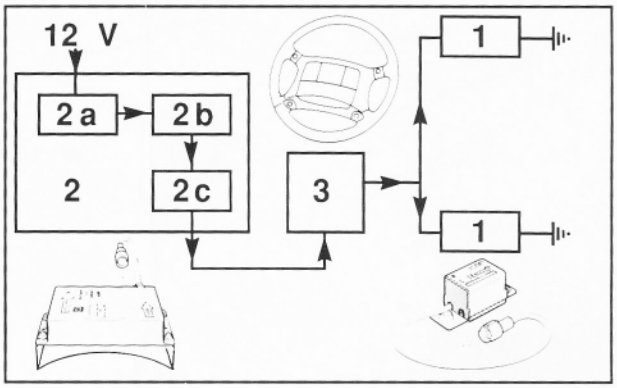

Fig. 22 Driver's airbag passive restraint system – schematic

1 Front sensors (2)
2 Control unit
2a Transformer
2b Capacitor
2c Safety sensor
3 Airbag

Operation

Whenever the ignition is switched on, the transformer in the control unit charges a capacitor to 35 volts. This voltage is supplied to the input side of the safety sensor.

If the car is involved in a collision, the safety sensor will close as soon as its deceleration exceeds 4g, delivering the capacitor voltage through a gas generator in the airbag assembly to the input side of both the front sensors. Immediately the deceleration of one of the front sensors exceeds 16g, it will close. The capacitor discharges causing the gas generator to inflate the airbag.

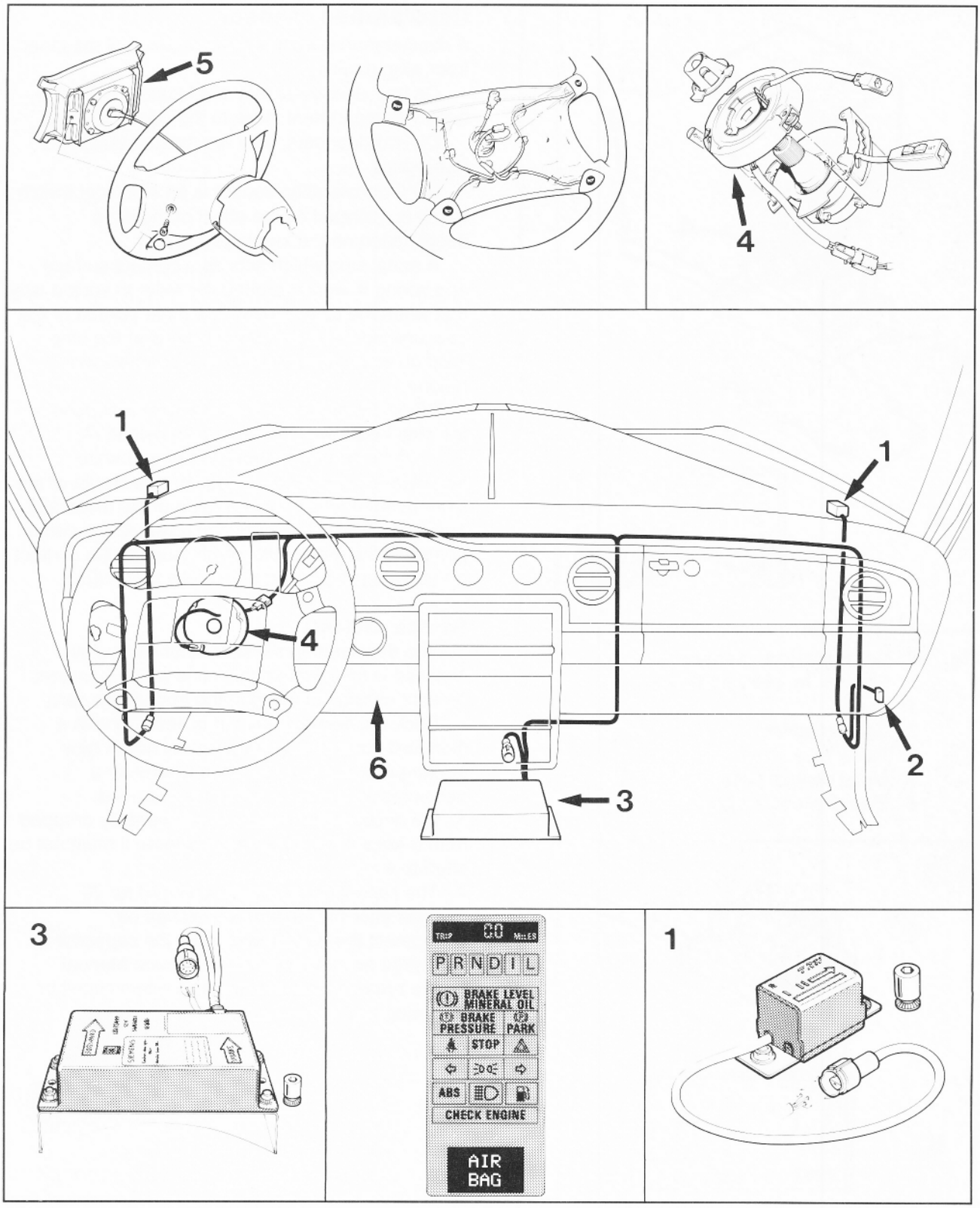

Fig. 23 Driver's airbag passive restraint system

1 Front sensors (2)
2 Test point
3 Control unit including 1 safety sensor
4 Contact coil
5 Airbag
6 Driver's knee bolster

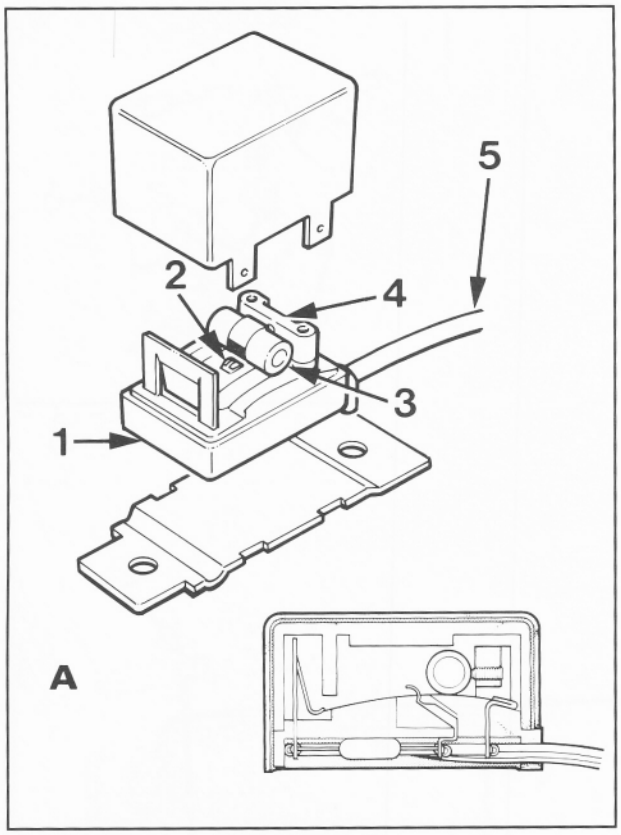

Fig. 24 Deceleration sensor Shown in rest position

1 Body
2 Contact spring
3 Roller
4 Metal contact strip
5 Electrical connections

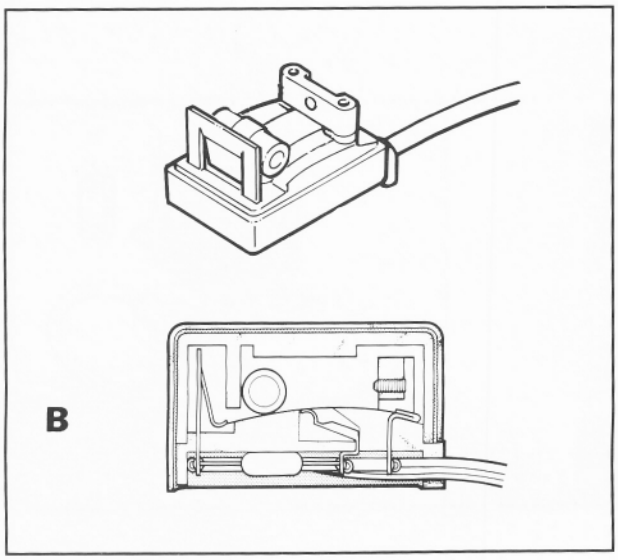

Fig. 25 Deceleration sensor Shown in closed position

Deceleration sensor

A deceleration sensor is fitted on each of the inner front wing panels.

On four-door cars, they are located inside the engine compartment close to the front bulkhead.

On two-door cars, they are located under the front wings.

Each deceleration sensor is an electrical switch which is operated by the effect of the car's deceleration on the inertia of a roller.

A metal strip which acts as a contact surface and spring is wound around the roller in such a way that when the roller moves, the inner portion of the strip unwinds and the outer portions of the strip wind up in a manner similar to a chameleon's tongue.

When the sensor is in its dormant rest position the strip holds the roller in a rest position (A).

If the sensor is subjected to a forward deceleration greater than 16g (B), the inertia of the roller overcomes the spring force of the metal strip. The roller moves forwards and unwinds the centre portion of the metal strip which touches the contact (2) in the base completing the electrical circuit.

Service Notes

1 The deceleration sensors must always be installed in their correct positions with the arrows on their casings pointing to the front of the car.

2 Each deceleration sensor is secured with a standard nut and one tamperproof nut. A new tamperproof nut must be fitted whenever a deceleration sensor is refitted or replaced.

3 If a deceleration sensor is accidentally dropped from a height of 0,5 metres (1.5 feet), it must not be fitted to a car.

4 The capacitor will remain charged for 20 minutes after the ignition is switched off. Disconnect the battery and allow the capacitor to discharge as instructed in the Service Manual before breaking into the air bag system circuit or removing any components.

Electronic control unit

The electronic control unit contains four components:

- a transformer
- a capacitor
- a safety sensor
- a microprocessor

Microprocessor

The microprocessor performs a self diagnostic function only. It does not control the operation of the air bag system.

It continually monitors the operation and integrity of the system, recording any faults which occur in a memory function, either permanent or intermittent. When a fault occurs in the system, the microprocessor causes the dot matrix display of the driver's information panel to display the message AIR BAG.

Each time the ignition switch is turned to on, the air bag microprocessor carries out a complete electrical check of the air bag system's circuits and components. If a fault is present in the system, the microprocessor causes the dot matrix display of the driver's information panel to display the message AIR BAG.

The microprocessor can be interrogated to access any fault codes stored in its memory.

Safety sensor

The safety sensor is similar in construction to the deceleration sensors. It operates when the deceleration at the control unit exceeds 4g.

Transformer

The transformer increases the battery voltage supply to the air bag system's operational voltage of 35 Volts and delivers this voltage to the capacitor.

Capacitor

Whenever the ignition is switched on, the capacitor unit becomes charged with the 35 volts supplied by the transformer and delivers power to the safety sensor.

The use of a capacitor ensures that the air bag system will operate during an accident even if the electrical circuit between the control unit and the battery is broken in the accident.

Circuitry within the control unit allows the capacitor to discharge slowly over a period of 20 minutes after the ignition is switched off.

Service Notes

1 The control unit must always be installed in its correct position with the arrows on the casing pointing to the front of the car.

2 The control unit is secured with three standard nuts and one tamperproof nut. A new tamperproof nut must be fitted whenever the control unit is refitted or replaced.

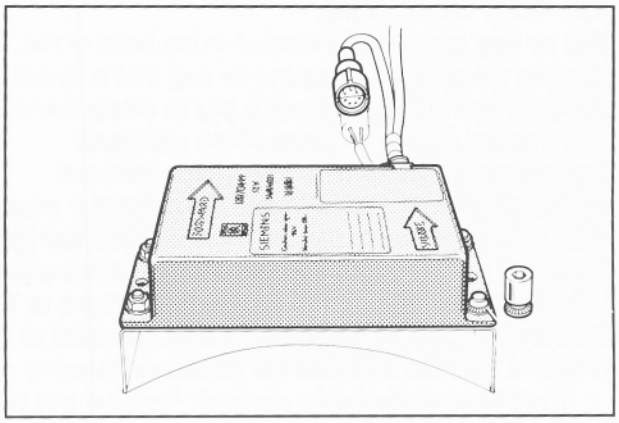

Fig. 26 Air bag electronic control unit

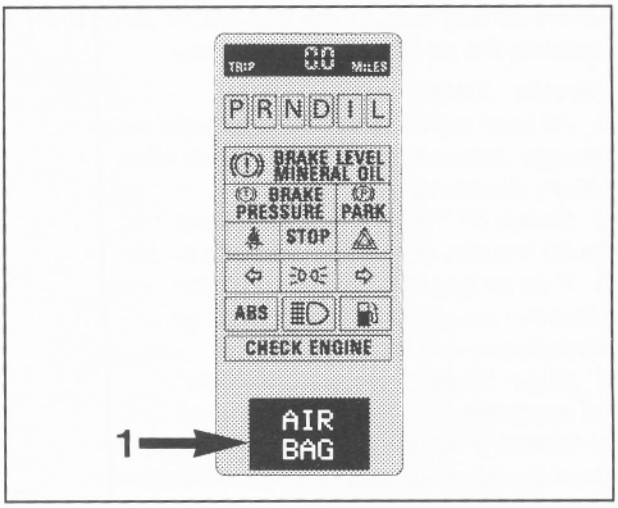

Fig. 27 Drivers information panel
1 Dot matrix display showing AIR BAG legend

3 When refitting or replacing a control unit, do not make any electrical connections until the control unit has been securely fitted to its bracket so that it is earthed.

4 If a control unit is accidentally dropped from a height of 0,5 metres (1.5 feet), it must not be fitted to a car.

5 The capacitor will remain charged for 20 minutes after the ignition is switched off. Disconnect the battery and allow the capacitor to discharge as instructed in the Service Manual before breaking into the air bag system circuit or removing any components.

6 If the air bag control unit is disconnected, the battery supply to the fuel pump relay will also be disconnected.

7 If during fault diagnosis, a known good condition electronic control unit is 'slaved' into the system to check the system's operation, make sure that the control unit is properly earthed and is maintained in a horizontal position throughout the test.

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Air bag assembly

The air bag assembly is located in the boss of the steering wheel. It contains the air bag and a pyrotechnic device which rapidly generates gas to inflate the air bag.

When an accident occurs which will cause deployment of the air bag, the voltage from the discharging capacitor detonates the detonator or squib. This ignites the pyrotechnic charge which in turn ignites the fuel. The fuel burns quickly, and generates a large volume of gas, inflating the air bag to a volume of 70 litres within 20 to 30 milliseconds from the point of impact to form a cushion between the driver and steering wheel.

The filters remove solid particles from the gas before it inflates the air bag.

The steering wheel pad has predefined fracture lines. As the air bag inflates, the pad cracks along these lines enabling the air bag to deploy rapidly.

Service Notes

1 All local legislation and procedures governing the storage, removal and refitment of air bags must be strictly observed.
2 Switch off the ignition, disconnect the battery and wait for 20 minutes before removing an air bag assembly.
3 If an air bag is to be removed from a car, it must be placed in an approved designated secure area immediately it is removed.
4 When fitting an air bag assembly, it must be kept in an approved designated secure area until the actual time of fitment. If for any reason the air bag cannot be fitted it must be returned to the approved designated secure area until it can be fitted.
5 Air bags must not be left unsupervised in the workshop, when removed from their car or place of storage.
6 Air bags not fitted to cars must always be placed with the trim part facing upwards.
7 Air bags must always be stored in approved containers.
8 Do not affix badges or stickers, etc. to the steering wheel hub or air bag assembly.
9 Do not expose any air bag assembly to temperatures exceeding 90°C (194°F).
10 Do not allow any air bag assembly to come into contact with water.
11 Do not attempt to repair any part of an air bag assembly or its trim cover.
12 If an air bag is accidentally dropped from a height of 0,5 metres (1.5 feet), it must not be fitted to a car.
13 If an air bag is diagnosed faulty or is removed because of trim cover damage, it must be returned to Rolls-Royce Motor Cars Limited in accordance with current instructions.
14 If a motor car fitted with an air bag system is to be scrapped, the air bag must be removed before the motor car is scrapped and it must be returned to Rolls-Royce Motor Cars Limited in accordance with current instructions.

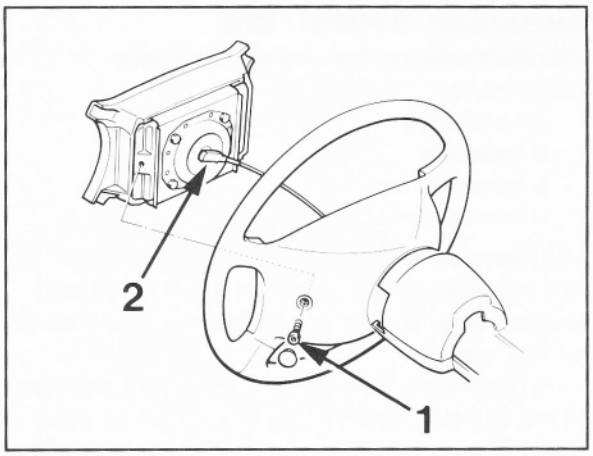

Fig. 28 Air bag assembly
1 Securing bolt
2 Electrical connection

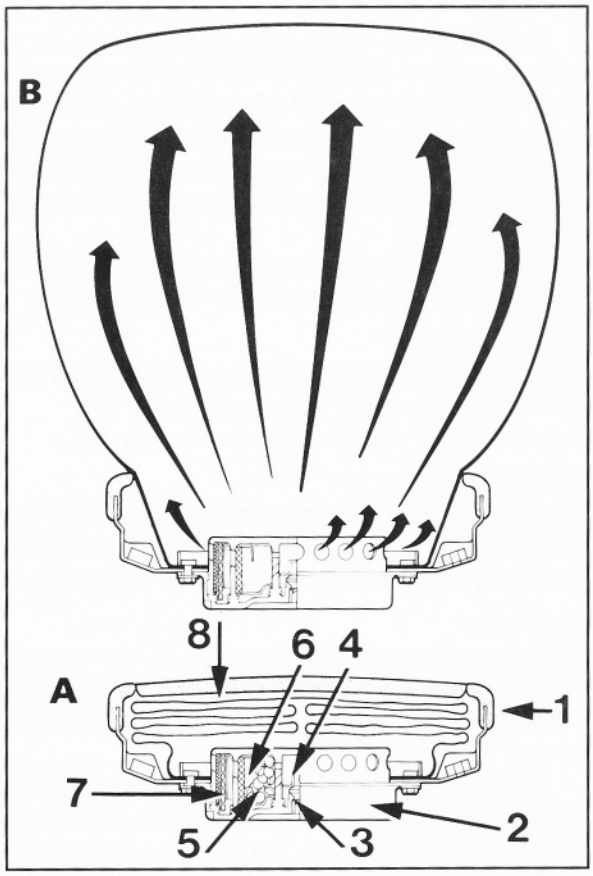

Fig. 29 Air bag assembly
1 Air bag assembly
2 Gas generator
3 Detonator (squib)
4 Pyrotechnic charge
5 Fuel
6 Combustion chamber
7 Filter
8 Air bag
A Normal Position
B Deployed Position

Contact coil assembly

The contact coil assembly provides a secure electrical connection to the air bag assembly and enables the steering wheel to be turned, without the use of slip rings.

It comprises a two-part housing, one part of which is attached to a fixed part of the steering column, the other to the steering wheel.

The housing contains a coiled electrical conductor which winds and unwinds as the steering wheel is turned from lock to lock.

The coil allows for a total of 9 complete turns of the steering wheel, lock to lock, that is 4.5 turns from the centre point to complete lock.

If the steering wheel is turned further than the 4.5 turns, the coiled electrical conductor will break. This will result in the failure of the air bag system.

Service Notes

1 If the steering column is disconnected, do not spin the steering wheel as this action will break the conductor in the contact coil assembly.

2 It is important that the contact coil assembly is fitted correctly when replaced, that is the mid position of the contact coil assembly must coincide with the wheels straight ahead position on the steering wheel.

Refitting a contact coil assembly

1. Centralize the steering wheel, ensuring that the wheels are in the straight ahead position.

2. Carefully rotate the centre section of the contact coil assembly in either a clockwise or counter-clockwise direction until it will not turn any further. **Do not force** the assembly.

3. Carefully rotate the centre section of the contact coil assembly four and a half turns in the opposite direction.

4. Align the marks on the contact coil assembly. This marks the centre position.

5. Refit the contact coil assembly over the splines on the steering column and secure with the three screws.

If a new contact coil assembly is being fitted it will be supplied with a red plastic locking device holding the assembly in its central position.

Remove the locking device before fitting the assembly.

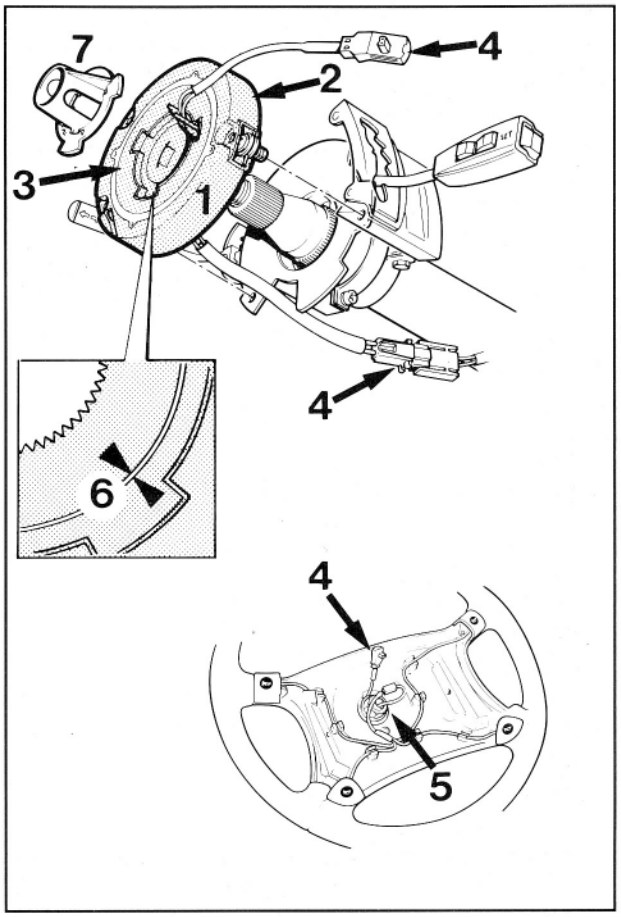

Fig. 30 Contact coil assembly

1 Contact coil assembly
2 Fixed part
3 Movable part
4 Air bag electrical connections
5 Horn electrical connections
6 Alignment marks
7 Alignment locking device

Driver's seat belt stalk

On motor cars fitted with the air bag passive restraint system, the driver's seat belt stalk incorporates a section of 'tear-edge' webbing, where the seat belt is doubled back on itself and stitched together. If the motor car is involved in an accident in which the air bag system would become operational, the stitches in the 'tear-edge' webbing break to provide a progressive lengthening of the seat belt.

Seat belt stalks with 'tear-edge' webbing are only be fitted to the driver's seat of motor cars with the air bag passive restraint system.

Service Note

If replacing the seat belt stalks on a motor car fitted with the air bag passive restraint system, make sure that the stalk with the 'tear-edge' webbing is fitted to the driver's side.

Air Bag Fault (Blink) Codes

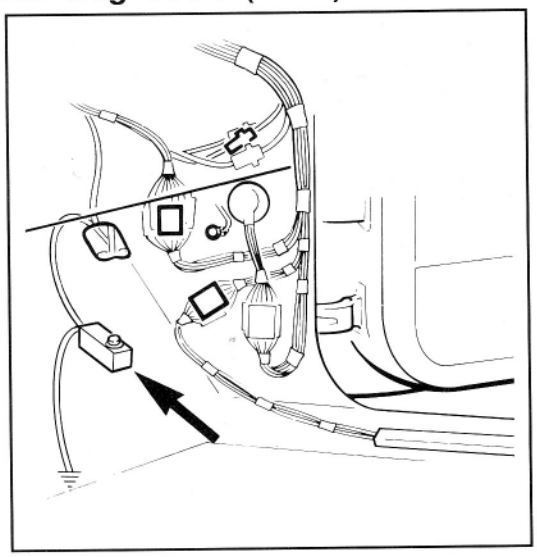

Fig. 31 Switch connected to the air bag diagnostic socket

IMPORTANT

READ THE COMPLETE SECTION ON PAGES 32:1 AND 32:2 ABOUT FAULT CODES BEFORE ATTEMPTING TO EXTRACT FAULT CODES FROM THE AIR BAG CONTROL UNIT.

To read the air bag fault code:

1 Using a suitable switch, make a switched ground (earth) lead as shown in fig. 33.

2 Locate the air bag diagnostic socket behind the footwell carpet trim immediately in front of the right hand side 'A'-post.

The plug is a flat three-way type and is protected by a short piece of black plastic sleeve. The cable colours are blue, green and slate/yellow.

3 Connect one wire of the switch to the green cable in the socket and the other to a good ground (earth).

4 Close the switch to ground the green cable. While the switch is closed, switch the ignition on.

5 Precisely three seconds after switching the ignition on, open the switch connected between the air bag diagnostic socket and ground. This instructs the control unit to issue signals about the fault codes stored in its memory to the dot matrix display in the driver's information panel.

6 The dot matrix display will flash alternately the legend AIR BAG and the combined battery and oil can symbol to display a fault (blink) code. If this fails to happen, you have probably mistimed operation 5. Switch off the ignition and repeat operations 4 and 5.

7 Record the number of groups of flashes and the number of flashes in each group of flashes corresponding to the fault code.

8 After each complete code has been read, close the switch connected to the air bag diagnostic socket for approximately three seconds to display the next code until the code 3–0–0–0 is displayed. This code indicates that all the fault codes stored in the memory have been displayed and no more faults are stored.

The ignition switch must stay on throughout the procedure.

9 If the code displayed is 3–5–0–0, then no faults are stored in the control unit's memory at that time.

Fault code description

Each fault (blink) code consists of a start signal and a four digit code number.

The start signal consists of a two and a half second flash of the AIR BAG legend followed by a two and a half second flash of the combined battery and oil can symbol.

Each digit of the fault code is then displayed by the AIR BAG legend and the combined battery and oil can symbol flashing alternately at half second intervals, counted on the flashes of the AIR BAG legend. Each flash of the AIR BAG legend is accompanied by an audible beep.

A two and a half second flash of the combined battery and oil can symbol marks the space between each digit of the fault code.

The first digit of the fault code will be a 3 which indicates that the code is for the air bag system.

The second digit of the fault code will be one of the following five numbers;

0 – this can only be part of code 3–0–0–0, which indicates that no more faults are present in the system.

1 – this indicates that a fault is currently present in the system.

2 – this indicates that a fault has been recorded but it is not currently present in the system.

3 – this indicates the length of time that the most recent fault has been memorised for.

5 – this can only be part of code 3–5–0–0 which indicates that no faults are present in the system.

The third and fourth digits can be any number from zero to nine.

If the second digit of the fault code is a 1 or 2, the third and fourth digits of the code denote the fault code number.

If the second digit of the fault code is a 3, the third and fourth digits of the code denote the time in hours that the fault code has been present.

Interpreting The Air Bag Fault Code Display

Each fault code will be displayed as follows:

1 The AIR BAG legend is displayed for 2.5 seconds. Then the combined battery and oil can symbol is displayed for 2.5 seconds.
This is the 'start' signal.

2 The AIR BAG legend and the combined battery and oil can symbol flash alternately to display a number, counted on the flashes of the AIR BAG legend.
This is the first digit of the fault code.
It should always be a 'three' which identifies the air bag system.

3 The combined battery and oil can symbol is displayed for 2.5 seconds.
This is a pause between the first code digit and the second code digit.

4 The AIR BAG legend and the combined battery and oil can symbol flash alternately to display a number, counted on the flashes of the AIR BAG legend.
This is the second digit of the fault code.
It should be one of the following five numbers; 0, 1, 2, 3 or 5.

5 The combined battery and oil can symbol is displayed for 2.5 seconds.
This is a pause between the second code digit and the third code digit.

6 The AIR BAG legend and the combined battery and oil can symbol flash alternately to display a number, counted on the flashes of the AIR BAG legend.
This is the third digit of the fault code.
It will be a digit from 0 to 9.

7 The combined battery and oil can symbol is displayed for 2.5 seconds.
This is a pause between the third code digit and the fourth code digit.

8 The AIR BAG legend and the combined battery and oil can symbol flash alternately to display a number, counted on the flashes of the AIR BAG legend.
This is the fourth digit of the fault code.
It will be a digit from 0 to 9.

9 The combined battery and oil can symbol is displayed for 2.5 seconds.
This indicates the end of the fault code.

10 The fault code will be repeated, starting with a start signal (AIR BAG legend displayed for 2.5 seconds followed by the combined battery and oil can symbol displayed for 2.5 seconds), until the switch connected to the air bag diagnostic socket is closed to display the next fault code.

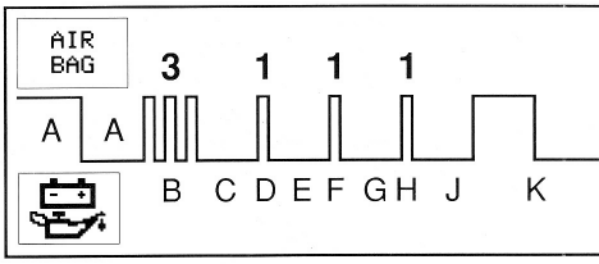

Fig. 32 Fault code 3–1–1–1
The code is made up as follows:
3 Air bag system identification number.
1 A fault is present in the system.
1 }
1 } The fault code number is 11.

Example: Fault code 3–1–1–1
The fault code 3–1–1–1 will be displayed in the following way (see Fig. 32):

A AIR BAG for 2.5 seconds.
Combined battery and oil can symbol for 2.5 seconds (**Start Signal**).

B AIR BAG for half a second.
Battery and oil can symbol for half a second.
AIR BAG for half a second.
Battery and oil can symbol for half a second.
AIR BAG for half a second (**1st digit – 3**).

C Battery and oil can symbol for 2.5 seconds (**Pause between digits 1 & 2**).

D AIR BAG for half a second (**2nd digit – 1**).

E Battery and oil can symbol for 2.5 seconds (**Pause between digits 2 & 3**)

F AIR BAG for half a second (**3rd digit – 1**).

G Battery and oil can symbol for 2.5 seconds (**Pause between digits 3 & 4**).

H AIR BAG for half a second (**4th digit – 1**).

J Battery and oil can symbol for 2.5 seconds (**End Signal**).

K AIR BAG for 2.5 seconds.
Combined battery and oil can symbol for 2.5 seconds (**Start Signal**).
The code will then repeat.

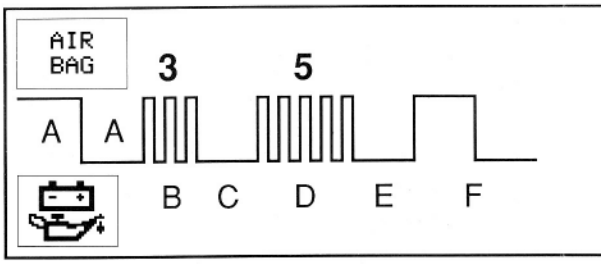

Fig. 33 Fault code 3–5–0–0
The code is made up as follows:
3 Air bag system identification number.
5 }
0 } No faults recorded in the memory
0 } have been displayed.

Presence of a zero (0) in a fault code

The presence of a zero (0) in a fault code is indicated by no display of the AIRBAG legend (no flash).

The presence of one or more zeros can only be determined from the fact that 4 digits must always be signalled between each two and a half second flash of the AIR BAG legend which indicates the start of each fault code. If only three digits are counted, then there must be a zero in the code. If only two digits are counted then there must be two zeros in the code.

To illustrate this consider code 3–5–0–0 (see Fig. 33).

A AIR BAG for 2.5 seconds.
Combined battery and oil can symbol for 2.5 seconds (**Start Signal**).

B AIR BAG for half a second.
Battery and oil can symbol for half a second.
AIR BAG for half a second
Battery and oil can symbol for half a second.
AIR BAG for half a second (**1st digit – 3**).

C Battery and oil can symbol for 2.5 seconds (**Pause between digits 1 & 2**).

D AIR BAG for half a second.
Battery and oil can symbol for half a second.
AIR BAG for half a second.
Battery and oil can symbol for half a second.
AIR BAG for half a second.
Battery and oil can symbol for half a second.
AIR BAG for half a second.
Battery and oil can symbol for half a second.
AIR BAG for half a second (**2nd digit – 5**).

E Battery and oil can symbol for 2.5 seconds (**End Signal**).

F AIR BAG for 2.5 seconds.
Combined battery and oil can symbol for 2.5 seconds (**Start Signal**).

It can be seen that between the two start signals, A & F, only two digits, 3 and 5, of the four digit code were displayed. Therefore, the remaining two codes must be zeros. Fig. 34 shows the code 3–0–0–0. Here only the first digit of the four digit code is displayed between the two start signals. Therefore, the remaining three digits of the code must be zeros.

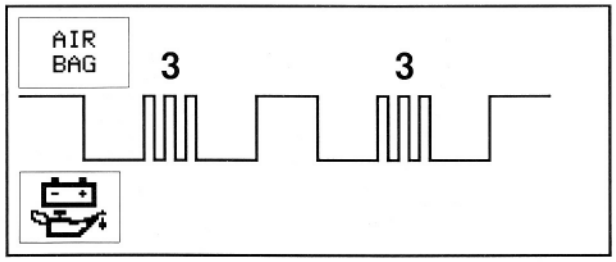

Fig. 34 Fault code 3–0–0–0

The code is made up as follows:
3 Air bag system identification number.
0, 0, 0 } All faults recorded in the memory have been displayed.

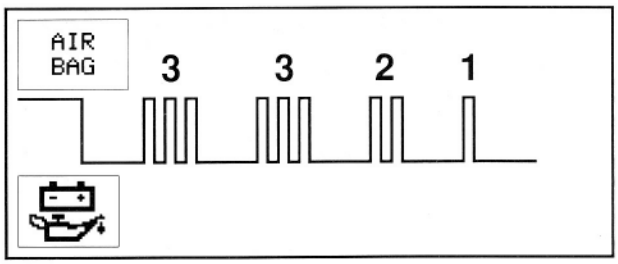

Fig. 35 Fault code 3–3–2–1

The code is made up as follows:
3 Air bag system identification number.
3 The time a fault has been present in the system.
2, 1 } The fault has been present in the system for 21 hours.

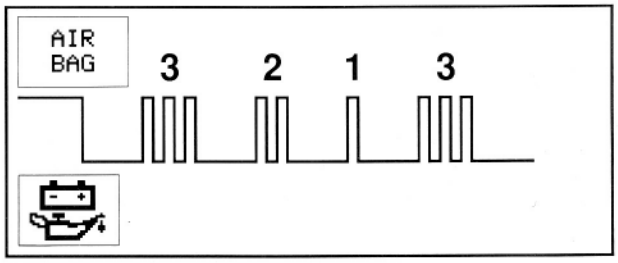

Fig. 36 Fault code 3–2–1–3

The code is made up as follows:
3 Air bag system identification number.
2 A fault has been recorded which is not currently present in the system.
1, 3 } The fault code number is 13.

Erasing fault codes from the air bag electronic control unit

When all the stored fault codes have been retrieved from the control unit and the appropriate repairs have been completed, the memory can be erased.

To do this:

1 Switch the ignition off.

2 Close the switch connected between the air bag diagnostic socket and ground.

3 Switch the ignition on.

4 After a period exceeding 10 seconds from switching the ignition on, open the switch connected between the air bag diagnostic socket and ground.

5 Switch the ignition off and then on again.

6 The legend AIR BAG should not be displayed.

7 Switch the ignition off again and disconnect the switch from the air bag diagnostic plug.

If the legend AIR BAG is still displayed after erasing the memory, one or more faults are still present in the system and the diagnosis procedure should be repeated.

Fault Code Number	Fault Description	Fault Rectificatio
11	LH deceleration sensor closed once.	Replace LH deceler
12	LH deceleration sensor closed more than five times.	Replace LH deceler
13	RH deceleration sensor closed once.	Replace RH deceler
14	RH deceleration sensor closed more than five times.	Replace RH deceler
15	LH deceleration sensor continuous contact more than 2 seconds.	Replace LH deceler
16	RH deceleration sensor continuous contact more than 2 seconds.	Replace RH deceler
17	LH deceleration sensor leakage to positive.	1. Ensure that the a
18	RH deceleration sensor leakage to positive.	2. If fault remains, c
19	LH deceleration sensor leakage to earth.	Ohmmeter ac
20	RH deceleration sensor leakage to earth.	Ohmmeter ac
21	LH deceleration sensor short-circuit to positive.	If correct Ohmmeter
22	RH deceleration sensor short-circuit to positive.	If correct Ohmmeter
25	RH deceleration sensor earth resistance too great.	
26	LH deceleration sensor earth resistance too great.	
27	LH deceleration sensor lead open-circuit.	1. Ensure that the a
28	RH deceleration sensor lead open-circuit.	2. If fault remains, c
		Ohmmeter acros
		Ohmmeter acros
		If correct Ohmme
		If Ohmmeter rea
29	LH deceleration sensor connecting cable resistance too great.	1. Check the appro
30	RH deceleration sensor connecting cable resistance too great.	Ohmmeter acros
		Ohmmeter acros
		If correct Ohmme
		If Ohmmeter rea
33	Capacitor capacitance (4700 μF) too low.	Replace electronic c
35	Capacitor capacitance (4700 μF) too great.	Replace electronic c
37	Gas generator detonator (squib) leakage to positive.	1. Replace contact
40	Gas generator detonator (squib) short-circuit to positive.	2. If fault remains, r
43	Gas generator detonator (squib) leakage to earth.	3. If fault remains, r
46	Gas generator detonator (squib) short-circuit to earth.	
49	Gas generator detonator (squib) open-circuit.	1. Ensure that plug
		2. If plug connectio
		3. If fault remains, r
		4. If fault remains, r
52	Gas generator detonator (squib) resistance too low.	1. Replace air bag
		2. If fault remains, r
55	Gas generator detonator (squib) resistance too great.	1. Ensure that plug
		2. If plug connectio
		3. If fault remains, r
		4. If fault remains, r
58	AIR BAG warning short-circuit to positive or earth.	1. Check electronic
59	AIR BAG warning open-circuit.	2. Check driver's in
60	Electronic control unit faulty.	Replace electronic c
61	Firing sequence confirmation.	These fault codes a
62	Firing circuit confirmation.	Replace all air bag s
65	Gas generator detonator (squib) current has flowed.	

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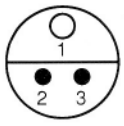
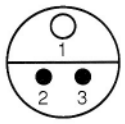
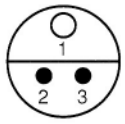
n Procedure
ation sensor. ation sensor. ration sensor. ration sensor. ation sensor. ration sensor.
appropriate sensor mountings are secure and that a good earth exists at the sensor mounting bracket. check the appropriate sensor plug with an ohmmeter: ross terminals 1 and 2 Correct value 10 kOhm. ross terminals 2 and 3 Correct value 0 Ohm. readings are obtained, replace the electronic control unit. readings are not obtained, replace the appropriate deceleration sensor. 
appropriate sensor plug connection is tight and secure. check the appropriate sensor plug with an ohmmeter: s terminals 1 and 2 Correct value 10 kOhm. s terminals 2 and 3 Correct value 0 Ohm. eter readings are obtained, replace the electronic control unit. ding across terminals 1 and 2 is 0 Ohms, replace the appropriate deceleration sensor. 
priate sensor plug with an ohmmeter: s terminals 1 and 2 Correct value 10 kOhm. s terminals 2 and 3 Correct value 0 Ohm. eter readings are obtained, replace the electronic control unit. ding across terminals 1 and 2 is outside specification, replace the appropriate deceleration sensor. 
control unit. control unit.
coil assembly. eplace air bag module. eplace electronic control unit.
connections between contact coil and air bag are tight and secure. ns are satisfactory, replace contact coil. eplace air bag module. eplace electronic control unit.
module. eplace electronic control unit.
connections between contact coil and air bag are clean, tight and secure. ns are satisfactory, replace contact coil. eplace air bag module. eplace electronic control unit.
control unit loom for damage and replace if necessary. formation and warning panel loom for damage and replace if necessary.
control unit.
re displayed following air bag deployment. system components.

Automatic Ride Control

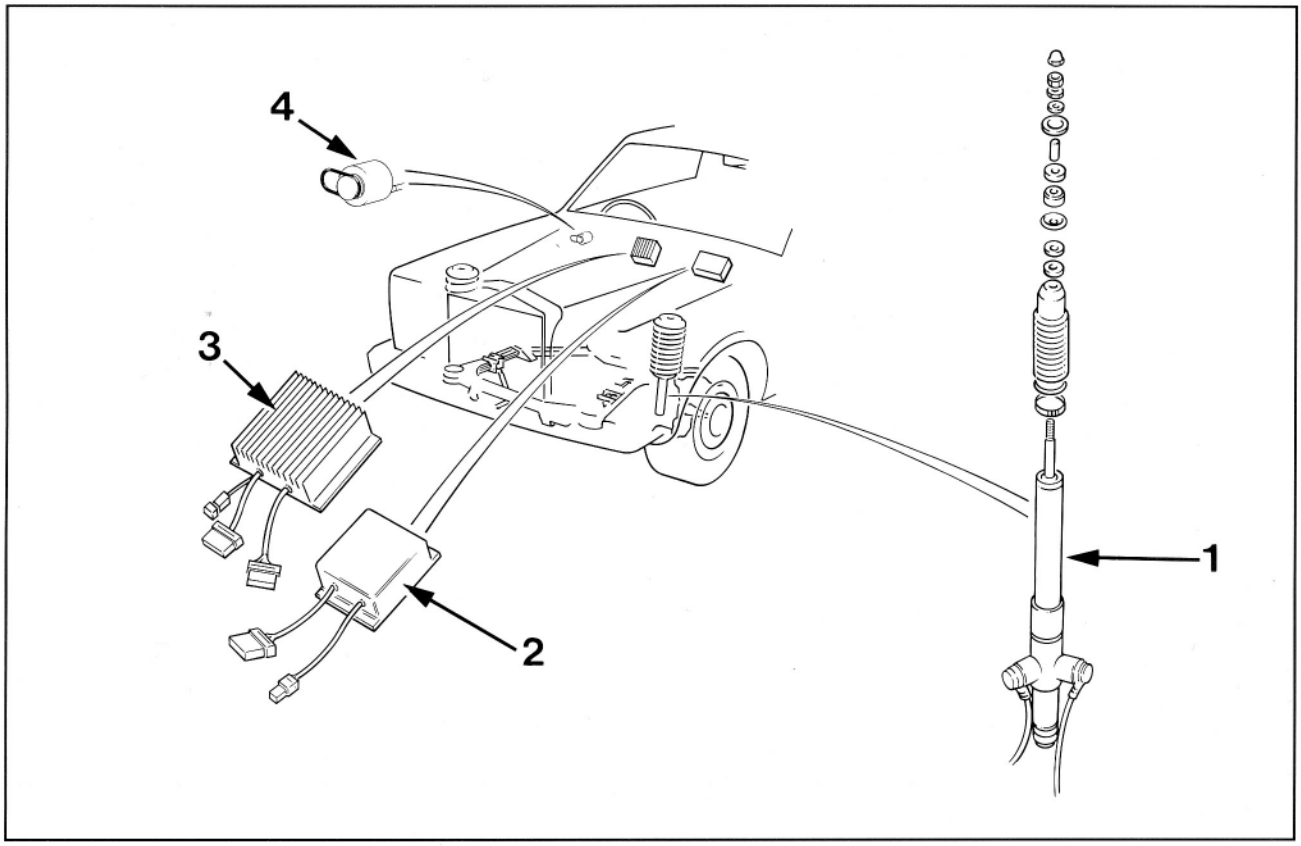


Fig. 37 Automatic ride control components
1 Front damper
2 Control ECU
3 Power ECU
4 Steering wheel velocity transducer

Introduction

All four door Rolls-Royce and Bentley motor cars from VIN 30001 are fitted with an electronically controlled, electrically operated automatic ride control system. Two door cars are not fitted with automatic ride control. This system enables the damping characteristics of the front dampers and rear struts to be changed to provide suspension characteristics appropriate to the manner in which the car is being driven.

The automatic ride control system consists of the following components:

A control electronic control unit (ECU)
A power electronic control unit (ECU)
Two front dampers
Two rear struts with variable valve assemblies and gas springs.
Steering wheel velocity transducer
Speedometer (road speed input signal)
Throttle position switch (engine idling input signal)
Brake light switch (brakes applied input signal).

The automatic ride control system operates by changing the damping rates of the front dampers and rear struts. The damping rate is controlled by electrically operated solenoid valves.

Three settings are available:

Comfort (Soft)
Normal
Firm

The appropriate setting is selected automatically by the automatic ride control ECU which monitors road speed, braking, acceleration and cornering forces, body vertical acceleration and the rate at which the steering wheel is turned.

The control ECU passes signals to the power ECU, which, in turn controls the power supply to the damper solenoid valves.

In operation all the dampers and struts should change mode simultaneously.

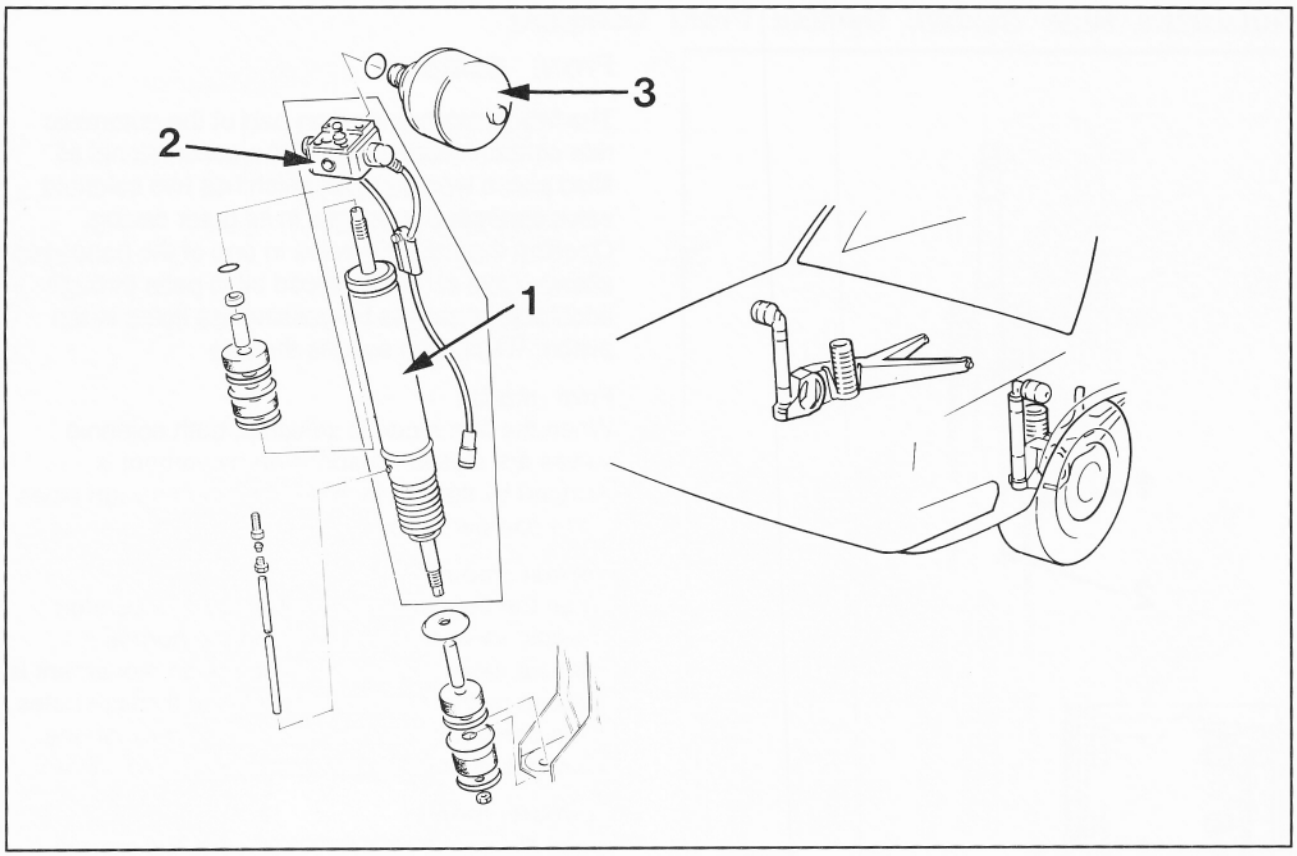


Fig. 38 Automatic ride control components

1 Rear damper
2 Variable valve assembly
3 Gas spring

If a fault occurs in the system, the system will fail-safe in the firm mode and the ECU will cause the legend 'AUTO RIDE' to be displayed on the dot matrix panel in the drivers information panel.

The control ECU will log and store all faults related to the automatic ride control system in the form of 3 digit fault codes.

If a fault is stored in the control ECU but is no longer present in the system, the dot matrix panel will display the 'AUTO RIDE' legend for ten seconds after starting the engine, after which the warning will self cancel.

Front dampers

The front dampers fitted to cars with automatic ride control incorporate two solenoid valves. The operation of the front dampers is described on page 36.

Rear struts/Variable valve assemblies

On cars fitted with automatic ride control, the rear gas spring adapters which connect each rear strut to its gas spring have been replaced with variable valve assemblies. These assemblies contain electrically controlled solenoid valves.The operation of the rear struts and variable valve assemblies is described on page 38.

Steering wheel velocity transducer

The steering wheel velocity transducer is mounted on the upper section of the steering column and is driven by a small rubber belt.

Control ECU

The automatic ride control ECU is mounted under the fuseboard. It controls the operation of the automatic ride control system.

The control ECU contains three accelerometers which measure forward, vertical and sideways acceleration of the car.

It receives a road speed signal from the instrument module.

It receives a steering rate signal from a steering wheel velocity transducer.

The control ECU also receives signals from the brake light switch and the throttle position switch.

Power ECU

The automatic ride control power ECU is mounted under the fuseboard and is recognisable by its finned casing. Its function in the system is very similar to that of a relay in an ordinary electrical circuit, in that it converts the signals received from the control ECU into electrical outputs which it delivers to the solenoid valves in the front dampers and variable valve assemblies simultaneously.

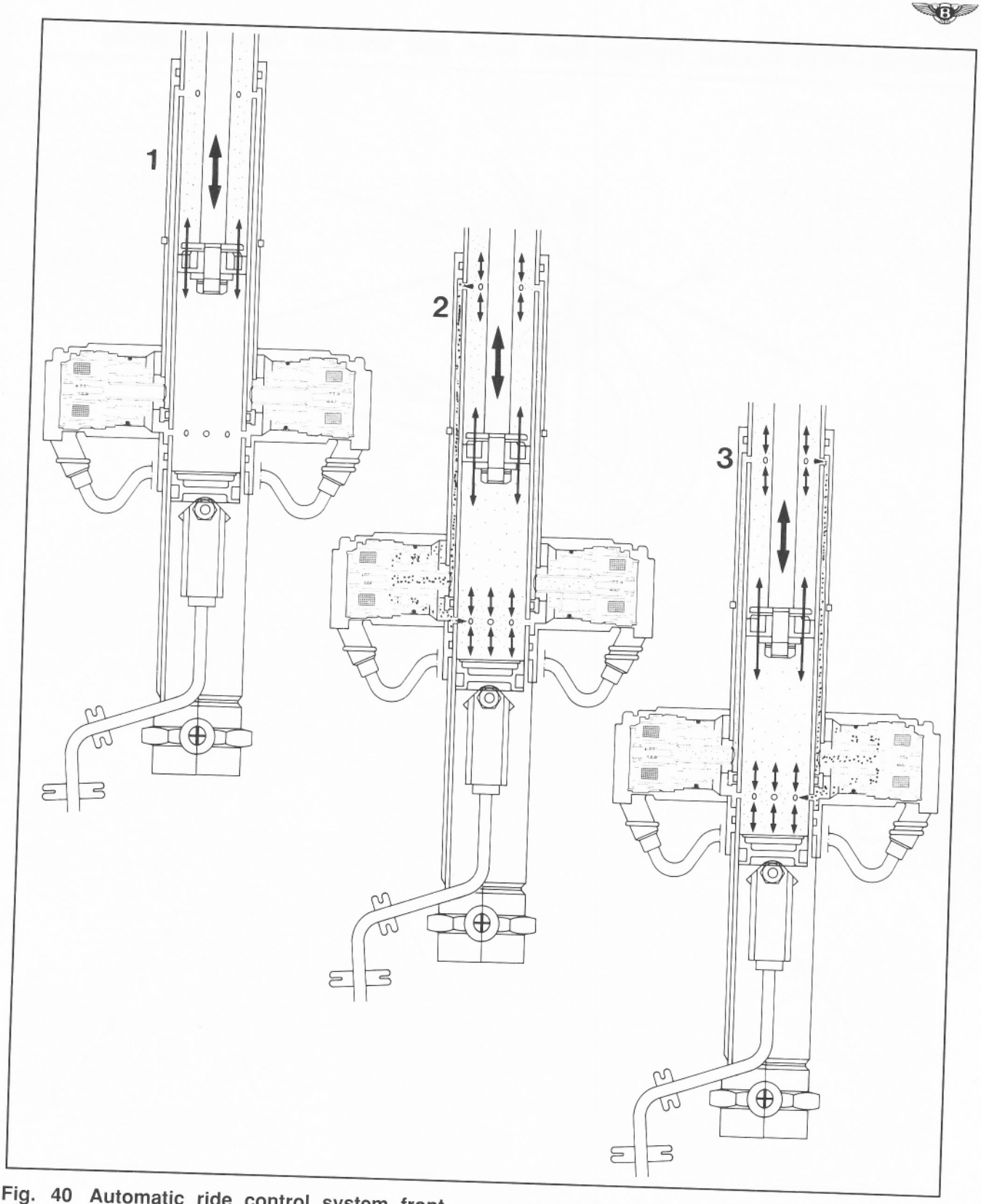


Fig. 40 Automatic ride control system front damper

1 Firm mode
2 Normal mode selected
3 Comfort mode selected

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Rear struts and variable valve assemblies

The rear struts fitted as part of the automatic ride control system are very similar to the conventional oil filled piston type strut fitted to motor cars with earlier mineral oil hydraulic systems.

The two solenoid valves and the passages they control are contained in the variable valve assembly which replaces the adaptor between the strut and gas spring. Opening the solenoid valve in either one of the passages allows displaced oil to pass through additional passages softening the ride, in a similar manner to the front dampers.

Firm mode

When the firm mode is selected, both solenoid valves are closed. Suspension movement is damped by the displacement of fluid through holes in the damper piston and displacement of the gas spring.

Normal mode

When the normal mode is selected, the comfort solenoid valve stays closed and the normal solenoid valve is opened. Suspension movement is damped by the displacement of fluid through holes in the damper piston, oil passing through the passages opened by the normal solenoid valve and displacement of the gas spring.

Comfort mode

When the comfort mode is selected, the normal solenoid valve is closed and the comfort solenoid valve is opened. Suspension movement is damped by the displacement of fluid through holes in the damper piston, oil passing through the passages opened by the comfort solenoid valve and displacement of the gas spring. These passages permit an easier flow of oil than the 'normal' oil channels.

Service notes:

1 The strut and variable valve assembly are matched pairs. Therefore, if either a strut or variable valve assembly is faulty, both parts must be replaced with a new matched pair.

2 The low pressure return pipes taking mineral oil from the struts are attached to the struts using bayonet type adaptors.

To release the pipe, press the adaptor into the strut and then gently pull the pipe out of the adaptor.

To refit the pipe, push the pipe into the adaptor until it is secure.

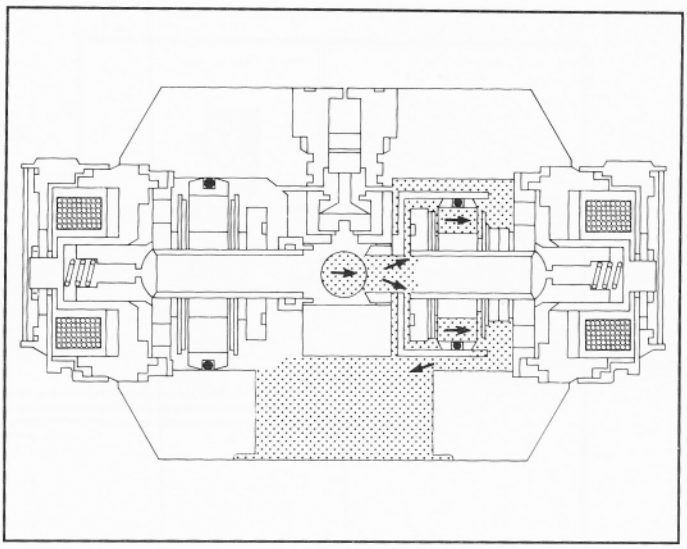


Fig. 42 Variable valve assembly – Firm mode

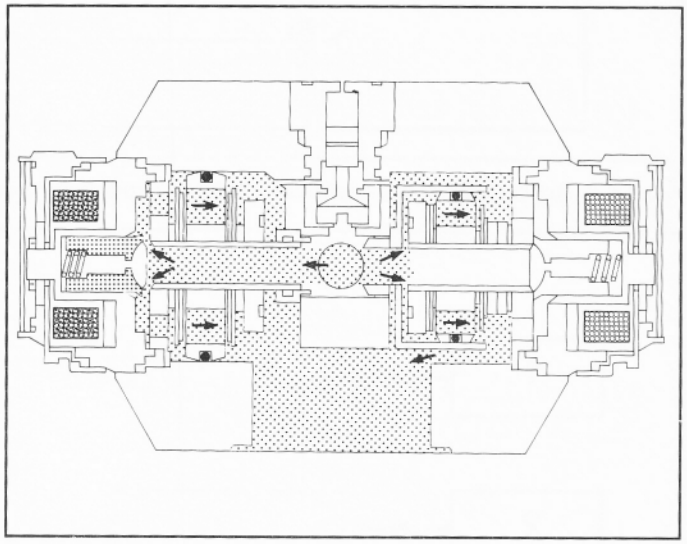


Fig. 43 Variable valve assembly – Normal mode

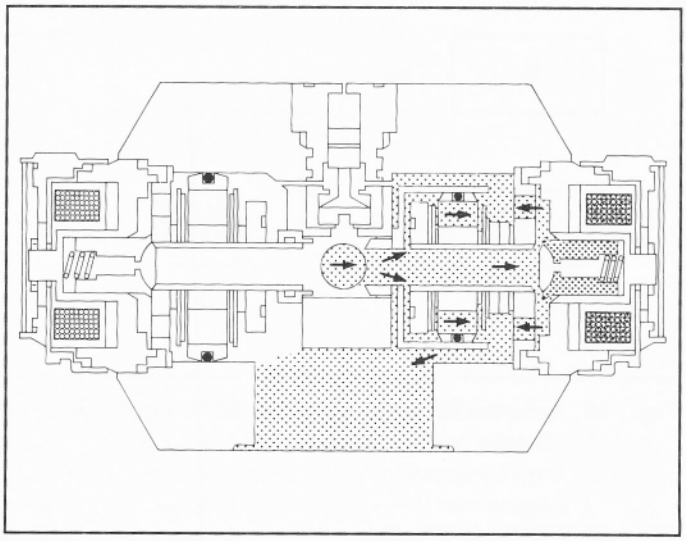


Fig. 44 Variable valve assembly – Comfort mode

Electrical System Operation

Figs. 45 and 46 show the wiring diagram and schematic for the electrical connections, inputs and outputs to and from the two automatic ride control electronic control units.

With the exception of the steering wheel transducer, the control ECU receives its signals from outside sources via the power ECU.

Switching of the solenoids is achieved in two stages. Initially, a high current is supplied to each of the selected solenoids, normal or comfort, to move the solenoid valve.

A very short time after the switching current has been supplied, the current is reduced to a value sufficient to hold the solenoid valve in position.

This action ensures rapid switching, lower power consumption and minimises heat generation.

Automatic Ride Control Test Procedure

Test box

Test box, RH 12418 allows the system to be checked both statically and during the road test. It allows each damper mode to be selected manually and the system's normal operation to be monitored by means of indicator lights.

The test box is also used to interrogate the control ECU for stored blink (fault) codes.

Static damper check

1 Remove the rubber plug from the diagnostic port of the control ECU and connect the test box RH 12418.
2 Switch the test box to the 'AUTOMATIC' position.
3 Observe the usual safety precautions, and start the engine. Allow the system to self check for 10 seconds and ensure that 'AUTO RIDE" is not displayed on the driver's information panel dot matrix display.
4 Switch the system to 'COMFORT' (Amber light). Bounce the front of the car noting any difference in damper resistance between left and right hand sides.
5 Switch the system to 'NORMAL' (Green light). Bounce the front of the car noting any difference in damper resistance between left and right hand sides. Check that the damping increases in relation to the COMFORT setting.
6 Switch the system to 'FIRM' (Red light). Bounce the front of the car noting any difference in damper resistance between left and right hand sides. Check that the damping increases in relation to the NORMAL setting.
7 Repeat operations 4, 5 & 6 at the rear of the car.
8 Access the control ECU blink code system for any stored faults and rectify as necessary.
9 Clear the ECU memory.
10 Remove the test box.

Road test

1 Connect the test box to the control ECU.
2 Select 'AUTOMATIC'.
3 Start the engine and ensure that the system selects 'FIRM'. The red light should illuminate. Allow the system to self-check for 10 seconds.
4 Check the Speed Signal.
A Drive off slowly and ensure that the system changes to 'COMFORT' (Amber light) when the speed exceeds 3 mph (5 kph).
B Bring the car to a halt and check that the system reverts to 'FIRM' after 2 seconds.
5 Check the Steering Transducer.
A Drive the car at 20 mph (32 kph) on a smooth straight road.
B Check that the system is in 'COMFORT'.
C Give the steering wheel a sharp 'tweak' to the right or left.
D Check that the system changes immediately to 'FIRM' then back to 'COMFORT' via 'NORMAL'.
6 Check the Brake Signal.
A Drive the car at 20 mph (32 kph) on a smooth straight road.
B Check that the system is in 'COMFORT'.
C Brake gently.
D Check that the system changes from 'COMFORT' to 'NORMAL' and in a short space of time back to 'COMFORT'.
7 Check the Brake Signal.
A Drive the car at 30 mph (48 kph) on a smooth straight road.
B Check that the system is in 'COMFORT'.
C Brake hard.
D Check that the system changes from 'COMFORT' to 'FIRM'.
8 Accelerate hard from rest.
Check that the system remains in 'FIRM' during initial acceleration and then reverts to 'NORMAL' or 'COMFORT' as acceleration reduces.
The 'FIRM' period may be brief depending on the car's specification.
Bentley models will stay in 'FIRM' or a harder mode more readily than Rolls-Royce motor cars.
9 Check the speed lock-out.
Bentley models should lock-out of 'COMFORT' mode into either 'NORMAL' or 'FIRM' dependent on driving conditions above 40 mph (64 kph).
Rolls-Royce models should lock-out of 'COMFORT' mode into either 'NORMAL' or 'FIRM' dependent on driving conditions above 70 mph (112 kph).
All models should lock-in to 'FIRM' above 100 mph (160 kph).
10 On completion of testing check that no faults have been logged in the ECU's memory.
11 Remove the test box.

Automatic Ride Control Fault Code List

Fault Code	Fault	Corrective Action
111 112 113 114 121 122 123 124	High current in 'COMFORT' coil RHF High current in 'COMFORT' coil LHR High current in 'COMFORT' coil RHR High current in 'COMFORT' coil LHF High current in 'NORMAL' coil RHF High current in 'NORMAL' coil LHR High current in 'NORMAL' coil RHR High current in 'NORMAL' coil LHF	Check wiring for short circuits. If all is satisfactory, replace appropriate damper or strut and variable valve assembly.
211 212 213 214 221 222 223 224	Low current in 'COMFORT' coil RHF Low current in 'COMFORT' coil LHR Low current in 'COMFORT' coil RHR Low current in 'COMFORT' coil LHF Low current in 'NORMAL' coil RHF Low current in 'NORMAL' coil LHR Low current in 'NORMAL' coil RHR Low current in 'NORMAL' coil LHF	Check wiring for open circuits. If all is satisfactory, replace appropriate damper or strut and variable valve assembly.
311 312 313 314	LATACC out of range VACC out of range FACC out of range EXTACC out of range	Check that the control ECU is correctly mounted. If all is satisfactory, change the ECU.
321	No steering pulses	Check steering transducer drive belt. See also 323.
322	No speed pulses	Check speedometer is working. Check wiring to speedometer. Check wiring to ABS ECU. Check that the control ECU is correctly mounted.
323 324	Phase A Failure Phase B Failure	Check wiring to steering transducer. If all is satisfactory, change the control ECU.
331	Power ECU over temperature	Check that fins on Power ECU are not obstructed. If all is satisfactory, change the power ECU.
332	Temperature sensor failure	Change the control ECU.
333	No brake signal	Check brake light switch and wiring.
334	EPROM CHECKSUM failure	Change the control ECU.

K-Motronic Fault (Blink) Codes

The K-Motronic engine management system electronic control unit incorporates a separate program which continually checks the inputs from specific sensors and components critical to the emission control system.

If a signal from one of the sensors is outside the specified limits programmed into the electronic control unit or if the electronic control unit recognizes that a malfunction has occurred in one of the prescribed systems, the electronic control unit stores a record of the fault in the form of a four digit fault code in a Random Access Memory (RAM) used specifically for this purpose.

The fault code is designed to define the fault to service personnel, thereby assisting fault diagnosis.

All cars are fitted with a diagnostic button enabling the electronic control unit to be interrogated.

On cars fitted with catalytic converters, the system recognizes a total of 11 such faults. If any one of 7 of these faults occurs, the control unit alerts the driver by illuminating the CHECK ENGINE warning lamp.

On cars not fitted with catalytic converters, the system recognizes a total of 6 such faults. If any one of 4 of these faults occurs, the control unit alerts the driver by illuminating the CHECK ENGINE warning lamp.

Procedure for interrogating the K-Motronic Engine Management ECU

The procedure for interrogating the K-Motronic Engine Management ECU for stored fault codes is as follows:

1 Check that the gear selector fuse B1 (20 Amps) in fuseboard 1 is fitted.

Note: The driver's information panel will not display fault codes if this fuse is not in place.

2 Select Park and apply the handbrake.

3 Switch the ignition to on.

The dot matrix display will show the oil can and battery symbol or air bag legend and oil can and battery symbol alternating.

From this point there are two alternative ways of proceeding:

4 Press the Trip and Cancel buttons simultaneous until the CHECK ENGINE and ABS warning lamps illuminate. The dot matrix display will extinguish at the same time.

This instructs the display to go into the diagnost mode where it will then scan any connected ECUs for blink code signals.

5 Immediately press the K-Motronic diagnostic button for 4 seconds and then release it.

This action instructs the K-Motronic ECU to sen blink code signals to the instrument panel.

Note:

Operations 4 and 5 must be completed within 10 seconds from the point of pressing the trip and cancel buttons. If the 10 second period is exceede the dot matrix display may revert to normal operation.

Alternative procedure for Operations 4 and

4 Simultaneously press the trip and cancel buttor on the trip panel and the diagnostic button.

5 As soon as the CHECK ENGINE and ABS warning lamps illuminate, release the trip and canc buttons.

6 Two seconds after releasing the trip and cance buttons, release the diagnostic button.

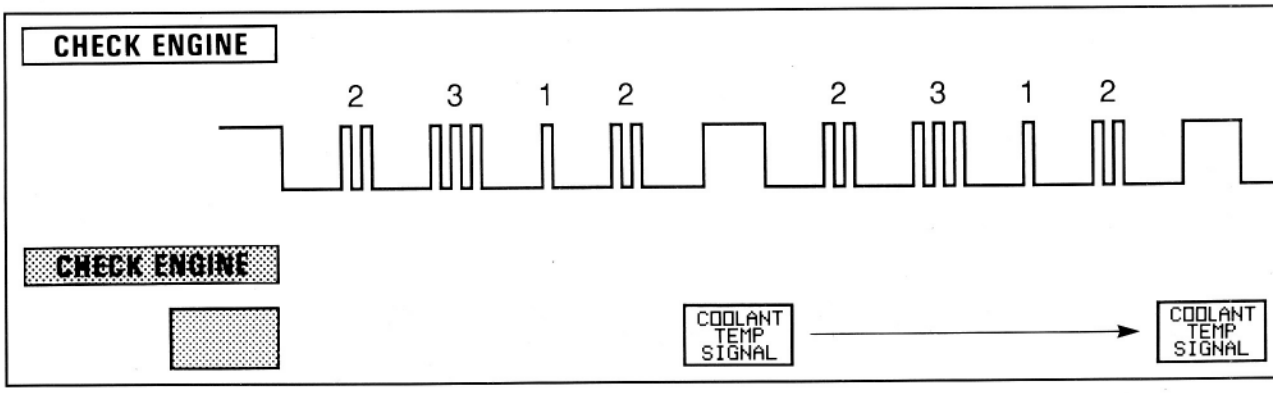


Fig. 50 Fault code 2–3–1–2 repeated twice followed by the code 1–1–1–1 repeated twice.

The fault code will be displayed in the following way:

The dot matrix display will remain extinguished. The CHECK ENGINE warning lamp will illuminate for 2.5 seconds and then extinguish for 2.5 seconds. This is a 'Start Signal'

The CHECK ENGINE warning lamp will then illuminate and extinguish, or blink, in 0.5 second intervals to display a digit from one to four.

It will then extinguish for 2.5 seconds before illuminating and extinguishing, or blinking, in 0.5 second intervals to display a second digit from one to four.

The CHECK ENGINE warning lamp illumination sequence is repeated to display a third and fourth digit.

The lamp will then illuminate for 2.5 seconds and then extinguish for 2.5 seconds.

At the same time the dot matrix panel will display a legend corresponding to the fault code.

The fault codes and their corresponding dot matrix panel legends are listed in the fault code summary on Page 47.

The CHECK ENGINE warning lamp will repeat the same fault code number and the dot matrix panel will continue to display the legend. This will continue until the ignition is switched off or the next fault code is chosen.

6 Press the diagnostic button only (There is no need to press the trip and cancel buttons) again for approximately four seconds to display the next fault code.

As soon as the diagnostic button is released again, the CHECK ENGINE warning lamp will flash the start signal followed by the next fault code signal.

At the same time the dot matrix panel will display the legend from the previous fault code.

As soon as the CHECK ENGINE warning lamp has displayed the next fault code the start signal is repeated.

At the same time, the dot matrix panel will display the legend corresponding to the new fault code.

7 Repeat the procedure until the code 1–1–1–1 is obtained. This signifies that all the fault codes stored in the memory have been displayed.

Note: The dot matrix panel will display the legend for the last complete fault code displayed by the CHECK ENGINE warning lamp.

The faults which are stored in the ECU's memory are not necessarily stored in the order that they occur as they are stored in a predetermined order as per the list on page 47.

Fig.50 shows the lamp's illumination for the code 2–3–1–2 repeated twice followed by the code 1–1–1–1 repeated twice. This illustration demonstrates the action of the dot matrix display.

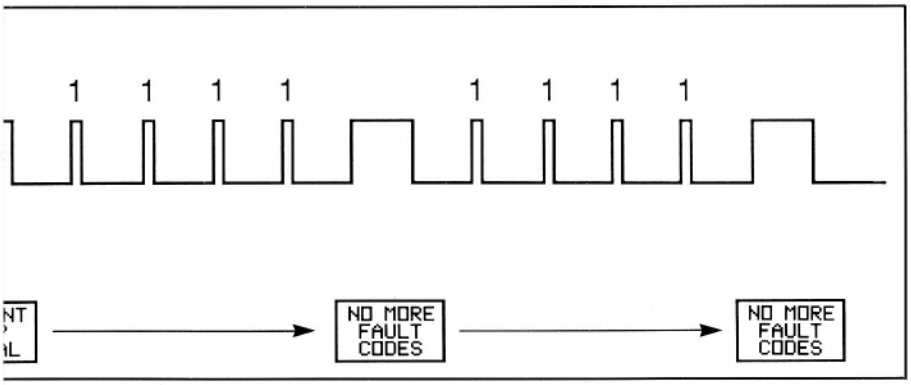
If the Display panel does not detect a blink code input within ten seconds of the trip and cancel buttons being pressed, it will automatically leave the diagnostic mode and resume its normal function. The panel can be instructed to quit the diagnostic mode by switching the ignition off or moving the gear selector from park.

Erasing the fault codes

To erase any fault codes from the control unit memory, remove the engine management fuse, fuse B9 on Fuseboard 1.

Service Note:

If the procedure for initiating the display of the fault codes is not carried out correctly, it is possible for the CHECK ENGINE warning lamp to flash fault codes while the dot matrix display remains illuminated. These are not necessarily correct fault (blink) codes and must be disregarded.



cancel buttons. If the 10 second period is exceeded the dot matrix display may revert to normal operation.

Alternative procedure for Operations 4 and 5

4 Simultaneously press the trip and cancel buttons on the trip panel and the diagnostic button.

5 As soon as the CHECK ENGINE and ABS warning lamps illuminate, release the trip and cancel buttons.

6 Two seconds after releasing the trip and cancel buttons, release the diagnostic button.

code.

As soon as the diagnostic button is released again, the CHECK ENGINE warning lamp will flash the start signal followed by the next fault code signal.

At the same time the dot matrix panel will display the legend from the previous fault code.

As soon as the CHECK ENGINE warning lamp has displayed the next fault code the start signal is repeated.

At the same time, the dot matrix panel will display the legend corresponding to the new fault code.

codes while the d
illuminated. These
(blink) codes and

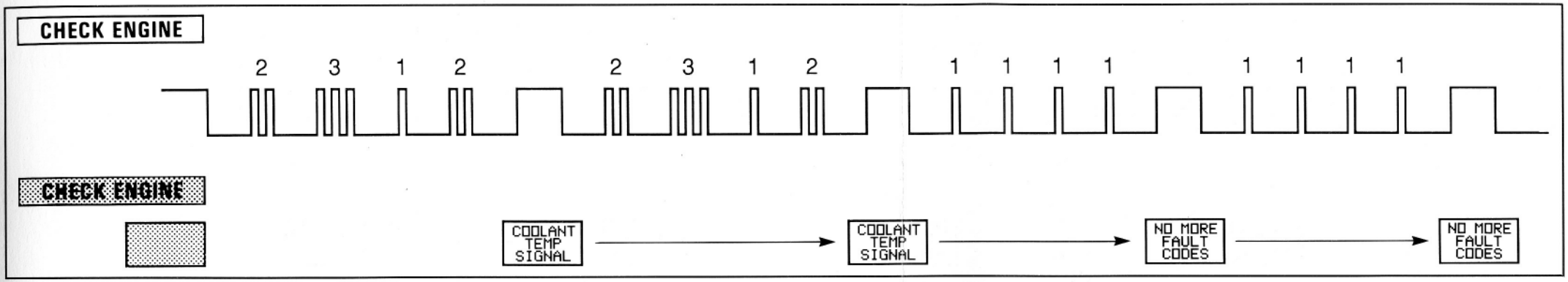


Fig. 50 Fault code 2–3–1–2 repeated twice followed by the code 1–1–1–1 repeated twice.

Blink Code	Dot Matrix Legend	CHECK ENGINE Warning Lamp	Fault Description	System M
4 - 4 - 3 - 1	IDLE SPEED CONTROL	Extinguished All Cars	Idle speed actuator connecting plug open or short circuit.	Resistance limits.
2 - 1 - 1 - 3	ENGINE SPEED SENSOR	Illuminated All Cars	Engine speed sensor and/or connection to the K-Motronic electronic control unit defective. Air sensor plate mechanism or fuel distributor plunger stuck.	Ignition swi greater thar (determined voltage outp
2 - 1 - 2 - 3	FULL LOAD SWITCH	Illuminated All Cars	Full load switch fault (closed) or yellow/purple wire earthed.	Full load sw wire for mo air flow for
2 - 1 - 2 - 1	IDLE MODE SWITCH	Extinguished All Cars	Idle switch fault (closed) or blue/purple wire earthed.	Idle switch wire for mo air flow for
2 - 2 - 3 - 2	AIR FLOW SIGNAL	Illuminated All Cars	Incorrect air flow signal.	Volumetric upper and than 2000
2 - 3 - 1 - 2	COOLANT TEMP SIGNAL	Illuminated All Cars	Coolant temperature sensor output outside operating range.	Resistance (+367°F) ar
4 - 3 - 1 - 2	SPARK TIMING SENSOR	Illuminated All Cars	Engine reference sensor and/or its connection to the K-Motronic electronic control unit defective.	Synchronis
2 - 3 - 4 - 4	MIXTURE CONTROL RICH	Extinguished Catalyst Only	Basic idle mixture strength adjustment on mixture control unit set to its rich limit.	Adaptive La electro-hyd more than
2 - 3 - 4 - 3	MIXTURE CONTROL LEAN	Extinguished Catalyst Only	Basic idle mixture strength adjustment on mixture control unit set to its lean limit.	Adaptive La electro-hyd by more tha
2 - 3 - 4 - 1	LAMBDA OUTSIDE LIMITS	Illuminated Catalyst Only	Lambda control outside limits.	The electro less than - for more th
2 - 3 - 4 - 2	LAMBDA SENSOR FAILURE	Illuminated Catalyst Only	Lambda sensor and/or connection failure.	Lack of pla electronic c
4 - 4 - 4 - 4	NO FAULTS STORED	Extinguished	No faults in memory.	
1 - 1 - 1 - 1	NO MORE FAULT CODES	Extinguished	No more faults in memory.	

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ethod of Recognition	'Limp Home' Facility
values beyond upper and lower	Engine idle speed may drift 580 ± 20rpm when warm. Cold starting and cold idle may be poor (the throttle may have to be pressed to keep the engine running). Otherwise normal engine running.
tched on, volumetric air flow rate 1 5 m^3/hr but no engine speed signal. d by air flow sensor potentiometer out) but no engine speed signal.	If the engine speed signal is not being generated or is not reaching the ECU, the engine will not run. If the fault is in the air flow sensor potentiometer, the engine may run, the quality depends on the severity of the fault.
vitch closed or earth fault on signal re than 0.3 seconds. ECU only sees part load (greater than 166m^3/hr).	Ignition and fuelling switched to part load map while fault persists.
closed or earth fault on signal re than 0.3 seconds. ECU only sees part load (greater than 166m^3/hr).	Ignition and fuelling switched to part load map while fault persists.
air flow rate outside predetermined ower threshold limits. Flow greater m^3/hr. Flow less than 9 m^3/hr.	Ignition and fuelling switched to full load map.
is outside preset upper +186°C nd lower -46°C (-51°F) limits.	The K-Motronic electronic control unit provides EHA with a compensation signal equivalent to +80°C (176°F) coolant temperature for all operational modes other than start.A +20°C (68°F) equivalent signal is used for starting. When starting from cold, there is no acceleration enrichment and spit-back may occur.
ation is lost.	Dependent on K-Motronic electronic control unit data prior to engine reference sensor failure. Normally engine will run well.
ambda pre-control decreases raulic actuator current -5mA.	The K Motronic engine management system electronic control unit will continue to compensate until the threshold limit of -14 mA is exceeded.
ambda pre-control increases raulic actuator current an 10mA.	The K Motronic engine management system electronic control unit will continue to compensate until the threshold limit of +21 mA is exceeded.
-hydraulic actuator current is 14mA or greater than +21mA an 2 minutes.	Once the threshold limits are exceeded, further compensation/correction is not available and the K-Motronic electronic control unit effectively resorts to open loop mode.
usible signal to K Motronic control unit.	The K Motronic electronic control unit switches to open loop engine operation. Current (mA) supply to EHA will be dependent on highest average value when in closed loop mode.

Engine Run Timer ECU (UD 71731)

The Engine Run Timer ECU is fitted to all 90MY motor cars from VIN 30001 for all markets.
Its primary function is to inhibit the operation of the foot operated parking brake release for 2 seconds after the engine has been started. This 2 seconds is timed from the release of the ignition key.
The engine is allowed to run for 2 seconds, which gives the hydraulic system time to generate sufficient pressure to hold the car on the foot brake before release in the event that a driving gear is selected immediately after the engine has been started.

This ECU also supplies a feed to other ECUs after the engine has been running 2 seconds. This eliminates voltage dip that would normally be present when starting the engine, which some of the ECUs find confusing.

The other ECU's and components fed by the engine run timer ECU are:

1 Air conditioning
2 Variable ride damping
3 One-shot window lift
4 Oxygen sensor heater

The Engine Run Timer ECU is located underneath the driver's knee roll between the steering column and speed control ECU.

It is black in colour and measures 92 X 38 X 31 mm.

Single Catalyst ECU UD 71551

This unit is only fitted on motor cars destined for Japan. It is a legal requirement in this country.

Its function is to monitor the temperature of the warm-up, starter or pre-catalyst via a thermocouple. In the event of excessive temperature (more than 900°C) the ECU will signal the Driver Information Panel.

This in turn will display the legend 'EXHAUST TEMP' on the dot matrix display and cause the CHECK ENGINE light to be illuminated as long as the overheating condition persists.

It is important that the thermocouple wires are not cut and re-terminated as this action will affect the input signal to the ECU and, therefore, the overall accuracy of the system.

The electronic control unit is only suitable for motor cars from VIN 30001 and is not retrofitable. Its calibration and connections are quite different from its predecessor.

It is located behind the fuseboard on the left hand side and is clipped to the panel lamp dimmer unit.

The ECU is dark grey in colour and measures 100 X 50 X 25 mm.

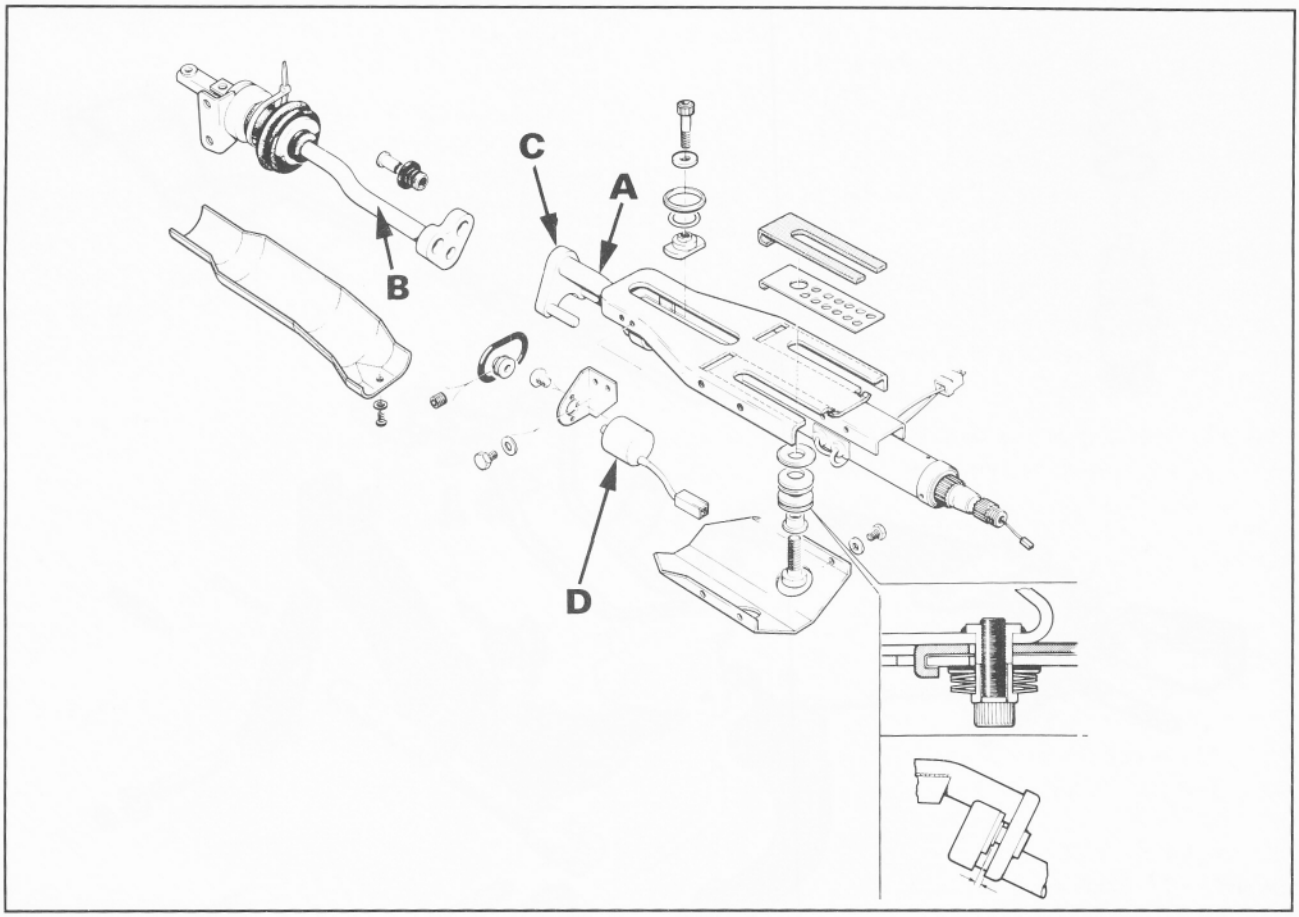

Fig. 51 Steering column

A Upper column
B Middle column
C Sliding joint
D Steering wheel velocity transducer

A new three-piece steering column is introduced. The upper two parts of the column form a sliding joint which collapses in the event of an accident to minimise injuries to the driver.

The lower column, which isolates subframe movement is the same as for 1989 model year motor cars. The upper column now has a joint in the middle to allow relative movement between the shortened upper section and the intermediate section, in the event of a crash.

The scuttle reinforcement comprises a cross tube and brackets, one of which is used to support the column mounting bracket. The column mounting bracket has a slotted interface parallel with the axis of the column to maintain its alignment.

The upper column is clamped to the interface with conical disc springs at two points with a shear sandwich interposed at each point.

Each shear sandwich comprises a slotted steel strip with one anti-friction face, clamping an aluminium shear strip which absorbs the energy of the collision.

The lower end of the column is located with a nut which slides in a slot and clamps a rubber 'O'-ring to prevent free movement.

The upper and intermediate shafts of the column are connected with a sliding coupling. This comprises a pair of half moon plates, one on each shaft. One of the plates has a pair of drive pegs, the other has a pair of corresponding holes.

The upper shaft has a dog-leg which enables it to slide clear of the intermediate in the event of a crash.

After the upper column has collapsed about an inch (25mm) relative to the intermediate column, the joint disconnects and the two parts of the column move independently of each other to minimise injuries to the driver.

After a crash resulting in relative movement between the upper and intermediate columns of more than an inch, there is no way of steering the wrecked car by the steering wheel.

A steering wheel velocity transducer which provides information to the Variable Ride Damping system is attached to the steering column behind the facia.

Foot Operated Parking Brake Release

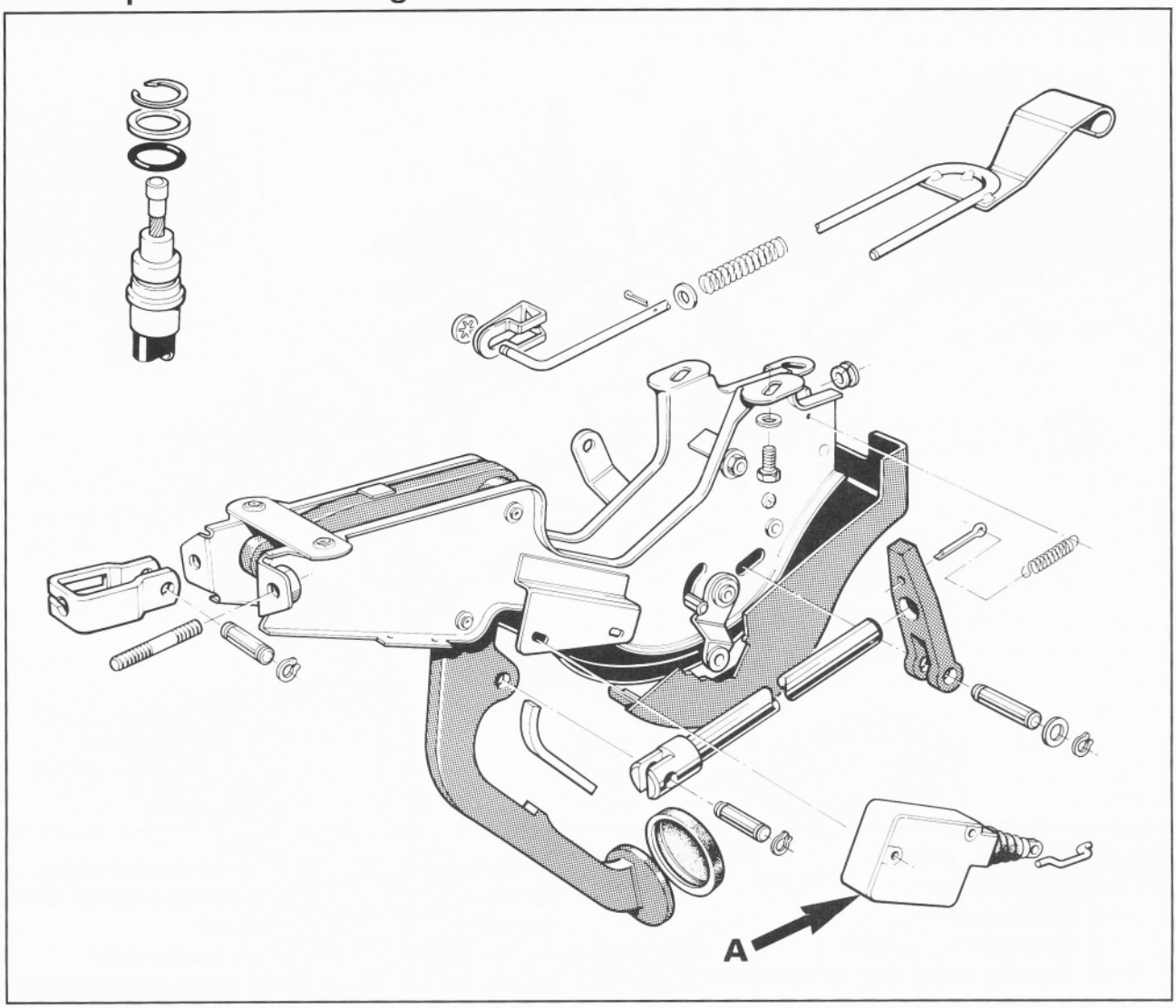

Fig. 52 Foot operated parking brake release
A Actuator

The foot operated parking brake release now incorporates an electrically driven motor release mechanism which automatically releases the parking brake when the gear selector is moved into either reverse or any forward gear when the engine has been running for more than 2 seconds.

It is possible to apply the parking brake while reverse or a forward gear is selected but it will not lock in the 'On' position. It will only lock 'On' when the gear selector is in the park or neutral position.

A warning lamp with the legend PARK and the parking brake symbol will be illuminated whenever the parking brake is applied.

The system incorporates interlocks to prevent the actuator operating when the ignition is switched off or the engine is stationary.

Manual operation is retained in case an electrical fault occurs in the system.

Take care not to leave your foot near the pedal when selecting a gear.

Service Note:
If the actuator is not allowed to fully release, the foot operated parking brake switch (see fig. 53) will stay closed. The actuator will continue to operate (a slight gear noise will be heard)whenever the gear selector is moved although the actuator is in the off position.

Circuit operation

The FOPB (foot operated parking brake) release motor is controlled by the gearchange actuator via 2 switches and 3 relays.

Whenever the FOPB is applied, the FOPB switch (2) is closed and connects the FOPB motor (1) to the FOPB relay (3) common terminal 30 using a Black/Brown wire. Terminal 87 of this relay is connected via a Brown/Yellow wire to the Park switch (4) in the gearchange actuator.

This switch (4) is closed whenever Reverse, Drive, Intermediate or Low gears are selected. A Brown/Red wire from the common terminal of the Park switch (4) is connected to terminal 87a of the FOPB inhibit relay (5) in the gearchange actuator. Terminal 30 of this relay is connected to fuse B1 in fuseboard 1 via a Brown/Black wire.
Whenever the gearchange actuator is in motion, the FOPB inhibit relay (5) is energised which in turn inhibits the feed to the FOPB motor. Once the motor has come to rest, a positive supply is allowed to flow via the Park switch (4), providing it is in R D I or L through the FOPB relay (3), but only when the relay is energised.
In order to energise this relay, it must receive a positive from the engine run timer (9) and a negative from the gearchange inhibit relay (6). The gearchange inhibit relay will not energize unless it receives a positive feed to terminal 86 and a negative from the ignition switch to terminal 85.

The FOPB relay (3) will now pass a feed to the FOPB motor providing the FOPB switch (2) is closed, i.e. the parking brake is in the applied position.

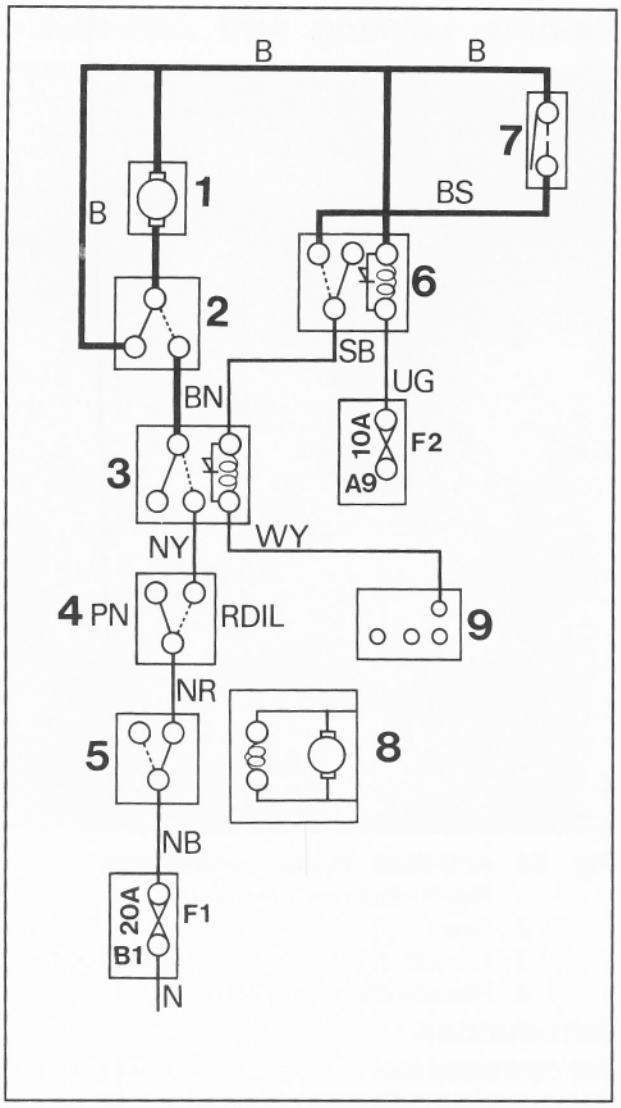

Fig. 53 Foot operated parking brake release wiring diagram

Legend for Fig. 53 foot operated parking brake release wiring diagram

No	Item	Function
1	FOPB Motor	Releases the parking brake mechanism.
2	FOPB Switch	Isolates the feed from the FOPB motor once the parking brake mechanism has been released.
3	FOPB Relay	Prevents operation of the FOPB motor until it receives a positive from the engine run timer.
4	Park Switch	Prevents operation of the FOPB motor unless R, D, I or L is selected.
5	FOPB Inhibit relay	Prevents operation of the FOPB motor while the gearchange actuator is operating.
6	Gearchange Inhibit Relay	Ensures that the ignition switch is mechanically turned before the FOPB motor can be energised (Anti-thief).
7	Ignition Switch	Controls the negative supply for the ignition controlled circuits.
8	Gearchange actuator	Moves the actuator in both directions to operate gearbox manual valve.
9	Engine Run Timer	Ensures that the ignition key has been released from the start position for 2 seconds before feeding the FOPB relay winding.

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Remote Locking and Anti-theft Alarm

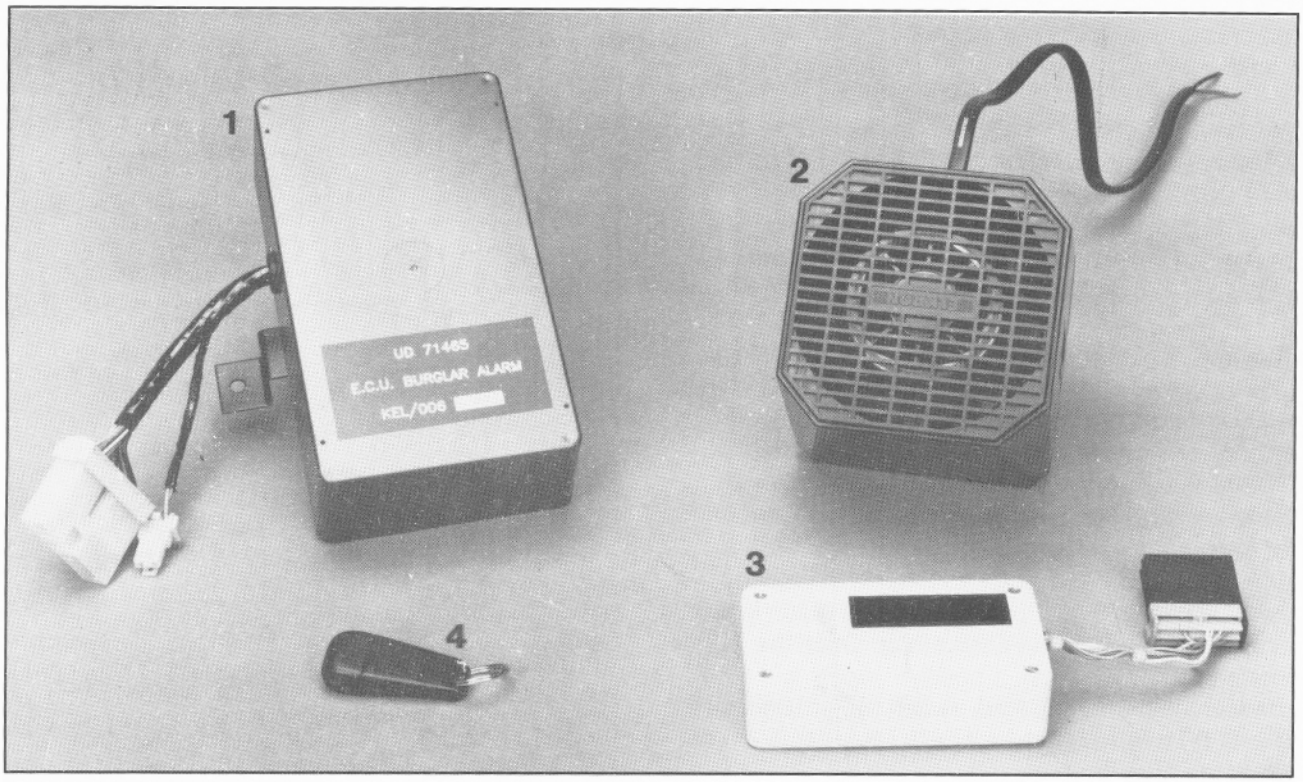

Fig. 54 Anti-theft alarm components
1 Alarm electronic control unit
2 Siren
3 Remote control electronic control unit
4 Remote control key fob

Introduction

The centralized door locking (CDL) system fitted to motor cars from VIN 30001 is identical to its predecessors in that all doors and the boot can be locked and unlocked by both the door keys and the front door sill buttons. Mechanically and electrically there is no change.

All motor cars from VIN 30001, including two door models for all markets are fitted with the wiring looms necessary to provide a remote locking and anti-theft alarm facility which will operate in conjunction with the normal CDL system.

As the remote locking and burglar alarm system is operated by radio, current legislation means that only cars destined for the UK and USA markets (not Canada) are fitted with the additional equipment to make the system operational.

Each individual system uses one of 13,000 different unique operating code combinations.

A remote control in the from of a key fob is used for arming and disarming the system. The system is controlled by two electronic control units, one for system operation, the other a receiver for the remote key fob transmitter. The operating range of the system has been restricted to a few metres/feet and will vary from car to car.

The system uses the car's interior lighting system as a trigger. Vehicle movement or air disturbance in the car will not trigger the system.

The remote locking and burglar alarm system comprises the following components:

Component **Part No.**
Location

Alarm ECU **UD 71465**
Centre of the car, under the top roll

Remote control ECU UD 71466
In the luggage compartment behind the right hand side panel

Siren **UD 70904**
Under the right hand front wing behind the undersheet.

Override switch
Glove box.

2 remote control key fobs
Attached to the car's key rings.

Alarm ECU

The alarm ECU controls the operation of the alarm system. It sounds the alarm and inhibits the starter motor operation if an event occurs which the control unit recognises as an unauthorised opening of any of the car doors, boot or bonnet.

Remote control ECU

The remote control electronic control unit acts as a radio receiver. It receives instructions from the driver in the form of radio signals transmitted by the remote control key fob and relays the instructions to the alarm ECU.

Each remote control ECU is individually coded to recognise only one of 13000 possible codes available for the system.

Remote control key fob

The remote control key fob is a self contained radio transmitter operating on 418 MHz. When operated, it transmits a code which the remote control electronic control unit recognises.

The unit is in the form of a key ring fob. It is powered by a sealed lithium battery. Battery life is estimated at five/six years with ten operations a day.

It is not possible to replace a failed battery. Therefore, the complete remote control unit must be replaced. Each individual remote control unit is coded to match the remote control electronic control unit mounted in the boot.

When a car is supplied new from the factory, a record of the remote control unit code is filed with the car's VIN number in the factory's records system. Records are also kept which relate the code to the serial number of each remote control ECU.

Replacement key fob control units

Replacement key fob control units must be individually coded to match the car's ECU. This can only be carried out at the factory.

When ordering a replacement unit, it is recommended that the serial number marked on the cover of the remote control ECU as well as the VIN be stated in case the remote control ECU is not the original one having been previously replaced.

Arming the system

The system can only be armed with the remote control units. Ensure that the override switch in the glove box is in the 'Alarm' position. Close all doors, bonnet and boot.

Pressing the remote control will now arm the burglar alarm system and also lock all the doors and the boot.

When the alarm is set, the boot lock is isolated from the CDL system. Unlocking the doors will not unlock the boot.

Isolating the system

If the override switch is in the 'Isolate' position, the remote control will only activate the CDL system. The alarm will not be set.

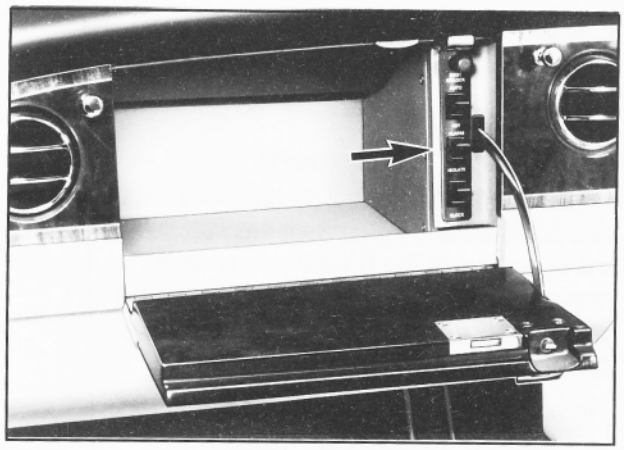

Fig. 55 Anti-theft alarm isolation switch

Activating the system

When the alarm is set/armed, it will be activated by the opening of any door, the boot or bonnet, even if a key is used.

When triggered, the system will inhibit the starter motor until the system is disarmed using a remote control unit. At the same time, the siren will sound for 30 seconds, after which it will be silent. Each subsequent entry will cause the siren to sound until the system is disarmed using a remote control key fob.

Disarming the system

The system can only be disarmed with a remote control key fob. This will unlock all the doors at the same time but not the boot.

Once the alarm has been disarmed, the system can be permanently de-activated by moving the override switch in the glove box to the 'ISOLATE' position. The remote control unit will only operate the CDL system and not the alarm. Alternatively the car's doors can be locked or unlocked in the conventional way using the door key or sill buttons.

Test Box

A test box, RH 12415, has been introduced to check the operation of the anti-theft system.

Basic Functional Checks and Setting Procedures – K-Motronic Engine Management Systems

Tools and Equipment

In addition to the normal technician's tools, some special tools and equipment are required to check the operation of the K-Motronic engine management system and associated emission control systems during scheduled service operations or when diagnosing faults.

These should include the following:

An Engine Diagnostic Tester
or
A Tachometer and Engine Timing Stroboscopic Light
This is required to check the basic engine parameters such as engine speed and ignition timing. The oscilloscope fitted to modern diagnostic testers is useful for checking the output signals of various sensors fitted to current electronic control systems.

An Infra-red CO Meter
This is essential for accurate checking of the engine's exhaust gas CO content when checking and setting the idle mixture strength.

A Digital Multimeter
This should be a good quality meter capable of accurately reading all three electrical parameters, Volts, Amps, Ohms. It should have a minimum impedance of 10MOhms. It is necessary for various functional checks and for fault diagnosis.

An Extension Harness or Adaptor (RH 9893)
This is used to connect the multimeter in series with the electro-hydraulic actuator during some of the functional checks.

A Mixture Adjusting Tool (RH 9608)
This is necessary for adjustment of the idle mixture strength as the adjustment involves turning a screw which is located in the air flow meter assembly.

A Suitable Air Meter Blanking Tool
This is used during adjustment of the idle mixture strength. It is used to blank the access hole to the adjustment screw and prevent unmetered air entering the inlet manifold when checking the CO content after making an adjustment. If the hole is not blocked off during the check, the additional un-metered air would give a false lean CO reading.

An Insertion Tool for Fitting the Tamperproof Plug
This is used to replace the tamperproof plug after making an adjustment to the idle mixture strength. This is only necessary for use on catalyst equipped cars

A Mityvac Vacuum Pressure Pump
This vacuum pump/air pressure pump is ideal for applying vacuum or pressure to components such as the air pressure transducers during basic checks.

A Combination Vacuum Pressure Gauge
An accurate vacuum pressure gauge is used for checking the vacuum or pressure applied to components during basic checks.

A Fuel Pressure Gauge and Adaptor (RH 9612 [0 - 10 Bar] and RH 9881)
This is required for checking the fuel system pressures in the fuel injection system.

A Flowmeter
(0 - 100 litres/min)/(0 - 220 ft^3/min)
This is required for checking the flow through the purge line of the evaporative loss control system fitted to cars destined for emission conscious markets.

A Manometer
(0 - 20 ins H_2O)/(0 - 500 mm H_2O)
This is required for checking the crankcase depression.

A Bridge link for the Throttle Position Switch
This is required for bridging the throttle position switch connector to simulate specific engine running conditions.

Exhaust Extraction

When a car engine is running, the gases issued from the exhaust tail pipe contain gases such as Carbon Monoxide which are extremely harmful to human beings.

If it is necessary to run the engine in a workshop, then it is most important to make sure that the exhaust gases are directed to a suitable point outside the workshop.

This can be achieved by connecting a suitable pipe or pipes to the car's exhaust tailpipes.

Some workshops are fitted with vacuum operated exhaust extraction devices which suck the exhaust out of the tailpipe and pump it to atmosphere at a suitable point.

These vacuum operated exhaust extraction devices must not be used on turbocharged cars. If they are, the vacuum may draw the oil past the oil seal in the turbine. If this occurs, it may cause permanent damage to the turbocharger and ultimately to the engine.

Carbon Monoxide

A car's exhaust emits three main noxious gases, Carbon Monoxide (CO), Oxides of Nitrogen (NOX) and unburnt Hydrocarbons (HC).

Of these, Carbon Monoxide is poisonous to man when inhaled. It is colourless, odourless and tasteless.

If Carbon Monoxide is inhaled into the lungs during the respiration process, it combines with the haemoglobin in the blood preventing oxygen entering the blood. If inhaled in sufficiently large quantities, it effectively suffocates the person by preventing the blood absorbing sufficient oxygen to meet the body's requirements.

In low concentrations, it causes headaches and slows down the body's mental and physical activity.

In high concentrations, it can cause unconsciousness and death.

As soon as the body is returned to fresh air, it will purge itself of the Carbon Monoxide in the lungs.

Emergency treatment

If a case of Carbon Monoxide poisoning is suspected,

1 Move the patient into fresh air immediately.

2 If the patient has stopped breathing administer artificial respiration.

3 Call for an ambulance.

4 Keep the patient at rest and warm. If necessary, cover the patient to maintain warmth. Be prepared to administer artificial respiration if the patient loses consciousness.

5 Send the patient to hospital. Make sure he/she is accompanied by a proficient first aid person if an ambulance is not used.

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Fuel

In a workshop environment, car fuel can be an extremely hazardous product. It is most important, therefore, that all the correct precautions are strictly observed.

Fire Hazard

Fuel is highly inflammable. It evaporates very quickly and in an enclosed space, the vapour can quickly build up into an explosive mixture. Fuel vapour is heavier than air and, therefore, will displace air and accumulate in the lowest unventilated places in the workshops.

Therefore, extreme care must be taken when carrying out any service operation on the fuel system to avoid fires, particularly if the system is being opened.

When selecting a work-station for working on fuel systems, choose a well ventilated position where any fuel vapour can be ventilated to the atmosphere easily. Make sure that this area is not close to an inspection pit; places where sparks are generated, such as grinding machines, welding equipment, etc.; and storage places for other inflammable items, such as paint, inflammable cleaning fluids, etc..

Before Commencing work:

1 Place 'No Smoking' signs in the vicinity of the car being worked on, making sure that they are easily visible to other staff yet do not themselves constitute a workshop hazard.

2 Place suitable fire extinguishers in the vicinity of the car being worked on. These should be of the Carbon Dioxide type. Do not use 'Water' types. Make sure that the fire extinguishers are fully charged and ready for instantaneous use.

3 Place suitable containers filled with sand or a similarly absorbent non-combustible substance in the vicinity of the car being worked on ready to contain any large spillages of fuel.

4 Advise all your colleagues about the work you are about to do and instruct them what to do in the event of a fire breaking out.

5 Ensure that your colleagues observe the 'No Smoking' signs, that they will not operate any welding or grinding apparatus or carry out any other operation which may cause a fire.

6 Ensure that your colleagues are aware of the locations of the fire extinguishers and how to use them.

7 Disconnect the battery of the car on which you are working.

8 Make sure the engine of the car you are working on is cold.

Handling Fuel

Observe the following precautions when handling fuel:

1 When draining fuel from the fuel tank, ensure that it is siphoned or drained into a suitable container which can be closed.

2 Make sure that any containers in which fuel is stored are correctly labeled with a legible warning label, even if the fuel is to be stored for a short time.

3 Store any containers filled with fuel in an approved safe area.

4 Before braking into the fuel system, disconnect the battery.

5 Before braking into the fuel system, carefully depressurise the system in the approved manner.

Health Risk

Fuel used in motor cars may contain up to 5% of benzene as an anti-knock additive. Benzene is carcinogenic (causes cancer) and, therefore, is extremely injurious to health. It is most important, therefore to take all necessary precautions to avoid contact with fuel, particularly inhalation.

Fuel Vapour

Fuel vaporizes very easily and can accumulate in poorly ventilated areas to provide an extremely hazardous environment.

Fuel vapour will irritate the eyes and lungs. If inhaled in high concentrations, fuel vapour may cause nausea, headache and depression.

Ensure that all service operations involving fuel systems are carried out in a well ventilated area, well away from other areas, such as inspection pits, where fuel vapour may accumulate and become a hazard to other members of the workforce.

Fuel Liquid

When working with fuel systems, it is easy for the hands to come into contact with fuel.

Fuel liquid will irritate the skin and eyes and may cause dermatitis after prolonged or repeated contact.

Do not use fuel to remove dirt or grease from your hands.

Except where specifically directed in service instructions, do not use fuel as a component cleaning fluid. It may be necessary to wash certain fuel system components in clean fuel to prevent contamination of the fuel system.

When carrying out service operations involving fuel systems, wear suitable protective clothing, including safety goggles, gloves and aprons, to minimize contact with fuel. When working underneath a car, take particular care to avoid fuel running down the gloves and onto your overalls.

Depressurizing the Fuel System

All fuel injection systems fitted to Rolls-Royce and Bentley Motor Cars contain fuel at high pressure up to 6.4 Bar (93 lbf/in^2). A small leak of fuel at this pressure will result in fuel spraying over a very large area creating a hazard. When carrying out service operations on these fuel systems always assume that the system contains fuel at pressure and take the necessary precautions.

Therefore, before commencing any work which involves disconnecting any component from a fuel system, you must depressurize the fuel system.

This can be done in one of two ways:

A Depressurizing at the fuel filter

Note: This process takes a relatively long time and involves relieving the pressure by releasing the inlet pipe to the fuel filter and allowing fuel in the pressurized part of the fuel system to leak out in a controlled manner. Before commencing this procedure have a good supply of suitably lint free cloth at hand to absorb the fuel as it emerges.

Procedure

1 Make sure all safety precautions are taken.

2 Scrupulously clean the inlet connection to the fuel filter.

3 Place a suitable container filled with sand or a similarly absorbent non-combustible substance underneath the fuel filter to catch any dripping fuel.

4 Wrap a piece of absorbent lint free cloth around the fuel filter inlet joint.

5 Take suitable precautions to prevent fuel leaking onto your body and spraying into your face.

6 Carefully 'crack' the pipe nut on the fuel filter inlet pipe and allow the fuel to leak out slowly. Use suitable absorbent material to collect the fuel as it emerges.

7 As the pressure drops, carefully loosen the nut further so that the fuel discharges in a controlled manner until all the pressure has been released.

8 Tighten the nut again as soon as the system is fully depressurized.

9 Dispose of the materials used to absorb the fuel in an approved place in accordance with local Health and Safety Regulations.

Note: Even though the system has been fully depressurized, it is possible that, if a fault exists in the system, then specific parts of the system may remain pressurized until such time as they are disconnected. Therefore, it is essential to take extreme care when making any disconnections. Place absorbent material around any nut you are about to release to collect any fuel that may be discharged. Carefully loosen the nut in such a way that any fuel discharges in a controlled manner.

B Natural leak down

This procedure involves allowing the car to stand with the fuel pumps switched off for a period of time sufficient for the system pressure to leak down naturally. On Turbocharged cars, this may take in excess of 36 hours.

Note: It is impossible to be sure that the system pressure has leaked down completely. Before disconnecting any part of the fuel system, carry out the depressurizing procedure as described in 'A Depressurizing at the fuel filter' to ensure that no pressure exists in the fuel system.

Emergency Treatment

The following emergency treatment is advised if contact with fuel occurs:

Ingestion (swallowing)

The main hazard after swallowing fuel is that some of the liquid may pass into the lungs. The patient will almost certainly have inhaled an unacceptable amount of fuel vapour.

Do not induce vomiting.

Give the patient milk to drink (water can be given if milk is not available).

Send the patient to hospital immediately. Make sure he/she is accompanied by a proficient first aid person if an ambulance is not used.

Be prepared to administer artificial respiration if the patient loses consciousness.

Inhalation

Move the patient into fresh air immediately.

Keep the patient at rest and warm. If necessary, cover the patient to maintain warmth.

Send the patient to hospital. Make sure he/she is accompanied by a proficient first aid person if an ambulance is not used.

Be prepared to administer artificial respiration if the patient looses consciousness.

Eye Contact

Immediately, wash the eyes with a good supply of clean water for a minimum of 10 minutes.

While this is taking place, contact a doctor and obtain further advice.

Skin Contact

Immediately drench the affected parts of the skin with water.

If necessary, remove any contaminated clothing.

Wash all contaminated skin with soap and water.

If necessary, consult a doctor at the earliest opportunity.

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Preliminary Checks

Service Note:
Observe all safety precautions throughout the check sequence.

1 Disconnect the battery before depressurising the fuel system or opening any fuel lines.

2 Ensure that the fuel system is fully depressurised before undoing any connections.

3 Ensure that exhaust gas is removed safely.

4 Ensure that the parking brake is applied, the gear selector is in Park and that the gear change isolation fuse B1 on Fuseboard 1 is removed.

5 If you are looking for an engine related fault, do not assume that it is engine management related. Check that there are no induction manifold air leaks. Make sure that the engine is running on all eight cylinders before proceeding.

6 Turn the ignition key from the Off to the Run position. The fuel pumps should be heard to run for 0.5 seconds.

7 Start the engine. The CHECK ENGINE warning lamp should extinguish. If it remains illuminated, check for fault codes stored in the K-Motronic ECU.

8 The air flow sensor potentiometer checks and the air injection system checks should be made while the engine is cold.

Air Flow Sensor Potentiometer

Tools Required

A good quality digital multimeter.
An extension harness or adaptor for connecting the multimeter in series with the electro-hydraulic actuator.

Functional Check

To carry out this check, it is important that the engine is cold. The engine should be left standing for several hours before the check.

1 Connect a milliammeter in series with the electro-hydraulic actuator.

2 Turn the ignition key from LOCK to RUN.

The milliammeter should read 98-102 milliAmps.

3 Start the engine.

The milliammeter reading should begin to fall.

4 Before the milliammeter reading reaches 0 milliAmps, watch the milliammeter and blip the throttles.

The milliammeter reading should rise and fall as the throttles are blipped. The increase in the reading should be in line with the intensity of the throttle blip.

5 Allow the engine to idle until the coolant temperature reaches +80°C (normal operating temperature).

6 Whilst watching the milliammeter, blip the throttles.

The milliammeter reading should not rise and fall as the throttles are blipped. A small rise and fall may be noticeable and is acceptable.

7 Remove the milliammeter and return the car to standard.

Service Note:

The acceleration enrichment current on cars fitted with catalytic converters is significantly less than on cars not fitted with catalytic converters.

Air Injection System

Service Note:
The air injection system is best checked when the engine is cold (Coolant temperature below 33°C [91°F]).

Tools Required

A tachometer.

Functional Check - Engine Cold (Coolant temperature below 33°C (91°F))

1 Turn the ignition on.

The air injection pump clutch should be heard to engage.

2 Start the engine.

3 Accelerate the engine above 3000 rpm.

The air injection pump should disengage as the engine speed reaches 2950 - 3050 rpm.

4 Reduce the engine speed slowly.

The air injection pump should re-engage as the speed falls to 1400 - 1500 rpm again.

5 Allow the engine to run at idle.

The air injection pump should disengage when the coolant temperature exceeds 33°C (91°F).

Functional Check - Engine Hot (Coolant temperature above 33°C (91°F))

1 Locate the 33°C (91°F) Otter switch. Disconnect and bridge its plug.

2 Start the engine.

3 Accelerate the engine above 3000 rpm.

The air injection pump should disengage as the engine speed reaches 2950 - 3050 rpm.

4 Reduce the engine speed slowly.

The air injection pump should re-engage as the speed falls to 1400 - 1500 rpm again.

5 Return the car to standard.

Throttle Position Switch

Tools Required

A good quality digital multimeter.

Functional Check

1 Disconnect the throttle position switch plug and socket.

Idle Micro-switch Functional Check

2 Connect an Ohmmeter across the Black/Pink and Blue/Purple male connectors at the back of the plug.

3 Measure the resistance as the throttle pedal is pressed from the idle position to the full load position.

At idle, the meter should show 0.0 - 0.5 Ohms.

At part load, the meter should show an open circuit.

At full load, the meter should show an open circuit.

Full Throttle Switch Functional Check

4 Connect the Ohmmeter across the Black/Pink and Yellow/Purple male connectors at the back of the plug.

5 Measure the resistance as the throttle pedal is pressed from the idle position to the full load position.

At idle, the meter should show an open circuit.

At part load, the meter should show an open circuit.

At full load, the meter should show 0.0 - 0.5 Ohms.

6 Return the car to standard.

Service Note:
This procedure checks the function of the throttle position switch as it responds to movement of the accelerator pedal.

It is most important to use the accelerator pedal for this test and not the throttle linkage to ensure that the throttle position switch is being operated through its full range by the pedal.

Printed in England

Fuel Injection and Ignition Maps

Tools Required

An engine diagnostic tester.
A good quality digital multimeter.
An extension harness or adaptor for connecting the multimeter in series with the electro-hydraulic actuator.
A tachometer.
A stroboscope.

Idle Map Check

1 Connect a milliammeter in series with the electro-hydraulic actuator.

2 Connect a suitable tachometer.

3 Connect a stroboscope.

4 Switch the ignition from LOCK to RUN.

The milliammeter should show a reading between 98 and 102 milliAmps as the electronic control unit issues the stand current.

5 Start the engine and allow it to reach normal operating temperature.

6 Check the ignition timing.

Part Load Map Check **

This is provided for information purposes only.

7 Disconnect the throttle position switch.

8 Increase the engine speed to 2000 rpm.

9 Check the ignition timing.

10 Remove the test equipment and return the car to standard.

Service Note: Part load map **

The ignition timing at part load is determined by engine speed and load. Due to the simulated conditions when checking in the workshop, the load signal may, depending on the prevailing conditions of the day, indicate an extremely light load, which in turn will cause the ignition to advance in line with load.

The ignition timing may tend to drift upwards to the next site. If the ignition timing is advancing, this is normally sufficient to indicate that all is well.

Turbocharged motor cars fitted with catalytic converters

Idle map

Idle Speed: 560 - 600 rpm
Ignition Timing: 7° - 9° BTDC

Part load map **

Engine Speed: 1950 - 2050 rpm
Ignition Timing: 26° - 28° BTDC
(Part load site 26° - 34°)

Milliammeter reading:

The milliammeter reading should move regularly from about -3 to +3 milliAmps. This reading is influenced by the idle mixture setting.

Turbocharged motor cars not fitted with catalytic converters

Idle map

Idle Speed: 560 - 600 rpm
Ignition Timing: 5° - 7° BTDC

Part load map **

Engine Speed: 1950 - 2050 rpm
Ignition Timing: 13° - 15° BTDC
(Part load site 14° - 42°)

Milliammeter reading

The milliammeter reading should be stable between –1.0 and +1.0 milliAmps.

Non-turbocharged motor cars fitted with catalytic converters

Idle map

Idle Speed: 560 - 600 rpm
Ignition Timing: 7° - 9° BTDC

Part load map **

Engine Speed: 1950 - 2050 rpm
Ignition Timing: 28° - 30° BTDC
(Part load site 28° - 34°)

Milliammeter reading

The milliammeter reading should move regularly from about -3 to +3 milliAmps. This reading is influenced by the idle mixture setting.

Non-turbocharged motor cars not fitted with catalytic converters

Idle map

Idle Speed: 560 - 600 rpm
Ignition Timing: 7° - 9° BTDC

Part load map **

Engine Speed: 1950 - 2050 rpm
Ignition Timing: 13° - 15° BTDC
(Part load site 14° - 42°)

Milliammeter reading

The milliammeter reading should be stable between –0.05 and +0.5 milliAmps.

Idle Speed Actuator

Tools Required
Tachometer

Functional Check

1 Ensure the engine is at normal operating temperature.

2 Connect a tachometer.

3 Run the engine at normal idle speed (560 - 600 rpm).

4 Disconnect the idle speed actuator plug.

The engine speed will tend to fall.

5 Stop the engine.

6 Switch the ignition on and ensure that there is a supply voltage (12 – 14 Volts) at the Pink/White wire in the plug.

7 Reconnect the idle speed actuator plug.

8 Switch the ACU on and run the engine.

The engine speed should be stable at normal idle speed (560 - 600 rpm) while the compressor clutch cycles in and out.

If the engine speed drops below 500 rpm when the compressor clutch cuts in, the idle speed actuator is not functioning correctly.

If the idle speed actuator or its associated circuit and control is faulty, ensure that the ignition timing is rechecked and the CO is reset after the fault has been rectified.

9 Remove the test equipment and return the car to standard.

Service Note:
If the engine speed drops below 400 rpm, the CHECK ENGINE warning light will illuminate. It will extinguish if the speed increases. If this happens, the idle speed actuator will not control the engine speed until the ignition is switched off and the engine is re-started.

Dump Valve

Tools Required
A Mityvac vacuum pressure pump.
A combination vacuum pressure gauge.

Functional Check

1 Disconnect the inlet manifold vacuum line from the dump valve. It is the smaller of the two pipes going to the dump valve.

2 Connect a Mityvac vacuum pump to the dump valve.

3 Gradually operate the Mityvac to apply a vacuum 20 ins (500 mm) to the dump valve.

4 The dump valve should retain this vacuum for at least 15 seconds.

5 Release the vacuum by disconnecting the Mityvac vacuum tube from the dump valve. The dump valve should be heard closing rapidly (audible ring).

6 Remove the test equipment and return the car to standard.

Incorrect Operation

Failure to hold the vacuum indicates that the dump valve diaphragm is split or holed.

Failure to obtain an audible ring indicates that the dump valve piston is siezed or stuck.

Idle Mixture Check

Tools Required
An infra-red CO meter
A tachometer.

Cars fitted with catalytic converters

1 Switch the air conditioning system off.

2 Make sure that the transmission is in Park (P) and that the gearchange fuse B1 is removed from fuse panel F1 on the main fuseboard.

3 Make sure that the engine is at normal operating temperature.

4 Make sure that the ambient temperature is between +15°C and +30°C (59°F - 86°F).

5 Make sure that the oil filler cap is closed.

6 Make sure the dipstick is fully home.

7 Disconnect the electro-hydraulic actuator.

8 Disconnect the purge hose from the induction manifold and blank the tapping in the induction manifold.

9 Connect the sample probe of a fully warmed-up CO meter to the tapping at the inlet to the warm-up catalytic converter (pre-converter).

10 Allow engine to idle at 560 - 600 rpm.

11 CO concentration should be 0.8% - 1.0%.

12 Remove the test equipment and return the car to standard.

Cars not fitted with catalytic converters destined for Middle East and Taiwan

1 Switch the air conditioning system off.

2 Make sure that the transmission is in Park (P) and that the gearchange fuse B1 is removed from fuse panel F1 on the main fuseboard.

3 Make sure that the engine is at normal operating temperature.

4 Make sure that the ambient temperature is between +15°C and +30°C (59°F - 86°F).

5 Make sure that the oil filler cap is closed.

6 Make sure the dipstick is fully home.

7 Leave the electro-hydraulic actuator connected.

8 Disconnect the purge hose from the induction manifold and blank the tapping in the induction manifold.

9 Insert the sample probe of a fully warmed-up CO meter, as far as practically possible, into the exhaust tail pipe.

10 Allow engine to idle at 560 - 600 rpm.

11 CO concentration should be 0.8% - 1.0%.

12 Remove the test equipment and return the car to standard.

Cars not fitted with catalytic converters or evaporative loss purge control systems

1 Switch the air conditioning system off.

2 Make sure that the transmission is in Park (P) and that the gearchange fuse B1 is removed from fuse panel F1 on the main fuseboard.

3 Make sure that the engine is at normal operating temperature.

4 Make sure that the ambient temperature is between +15°C and +30°C (59°F - 86°F).

5 Make sure that the oil filler cap is closed.

6 Make sure the dipstick is fully home.

7 Leave the electro-hydraulic actuator connected.

8 Insert the sample probe of a fully warmed-up CO meter, as far as practically possible, into the exhaust tail pipe.

9 Allow engine to idle at 560 - 600 rpm.

10 CO concentration should be 0.8% - 1.0%.

11 Remove the test equipment and return the car to standard.

Idle Mixture Adjustment

Tools Required

An infra-red CO meter.
Tachometer.
A mixture adjusting tool.
An air meter blanking tool.
An insertion tool for the tamperproof plug fitted to the mixture adjusting screw (catalyst equipped cars only).

A If the CO concentration is less than 0.8%

1 Check the idle mixture strength as described on page 62.

2 Remove idle mixture adjustment access plug and screw (if fitted).

3 Locate the mixture adjusting tool in the mixture adjustment screw.

4 Taking extreme care not to press down, turn the mixture adjusting tool clockwise by a very small amount.

5 Remove the mixture adjusting tool.

6 Insert the air meter blanking tool.

7 Briefly open the primary throttles to accelerate the engine to purge the induction.

8 Check that the engine speed returns to the idle speed (560 - 600 rpm).

9 Check the CO reading.

10 Repeat operations 2 - 8 until the CO reading is correct.

11 Replace the idle mixture adjustment access screw (if fitted) and plug.

12 Replace the EHA plug and the purge line if removed for check.

13 Remove the test equipment and return the car to standard.

B If the CO concentration is more than 1.0%

Note: The final CO setting must be approached from a lower limit.

1 Check the idle mixture strength as described on page 62.

2 Remove idle mixture adjustment access plug and screw (if fitted).

3 Locate the mixture adjusting tool in the mixture adjustment screw.

4 Taking extreme care not to press down, turn the mixture adjusting tool counter-clockwise a small amount.

5 Remove the mixture adjusting tool.

6 Insert the air meter blanking tool.

7 Briefly open the primary throttles to accelerate the engine to purge the induction.

8 Check that the engine speed returns to the idle speed (560 - 600 rpm).

9 Check the CO reading.

10 Repeat operations 2 - 8 until the CO reading is less than 0.8%.

11 Steadily increase the CO reading until the correct value - **SEE 'A If the CO concentration is less than 0.8%'.**

12 Replace the idle mixture adjustment access screw (if fitted) and plug.

13 Replace the EHA plug and the purge line if removed for check.

14 Remove the test equipment and return the car to standard.

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Evaporative Loss Control System

Tools Required

Flowmeter (0 - 100 litres/min)/(0 - 220 ft³/min).
Tachometer.

Canister Purge Control Check.

Cars fitted with catalytic converters destined for Europe, North America, Japan and Australia

1 Run the car until it is at an operating temperature above 33°C (91°F).

2 Disconnect the purge hose from the canister at its connection in the inlet manifold.

3 Connect the purge hose from the canister to the inlet of the flow meter. The inlet is at the bottom of the flowmeter.

4 Connect a hose from the outlet of the flowmeter to the purge connection in the inlet manifold. The outlet is at the top of the flowmeter.

5 Observe and time the action of the flowmeter from the point of starting the engine and allowing it to idle.

A time interval of 90 seconds should elapse from the instant when the engine is switched on until purging commences.

Purging should then occur for 150 seconds.

Purging should then cease for the next 105 seconds.

Purging should then occur for the next 150 seconds, after which the system should alternate between 105 seconds no purge and 150 seconds active purging.

6 Increase the engine speed to between 1950 and 2050 rpm while purging is taking place.

Purge flow rate should be between 25 and 50 litres/min (53 and 106 ft³/min).

Cars not fitted with catalytic converters destined for Middle East and Taiwan

1 Disconnect the purge hose from the canister at its connection in the inlet manifold.

2 Connect the purge hose from the canister to the inlet of the flow meter. The inlet is at the bottom of the flowmeter.

3 Connect a hose from the outlet of the flowmeter to the purge connection in the inlet manifold. The outlet is at the top of the flowmeter.

4 Start the engine and allow it to run until the coolant temperature is above 33°C (91°F).

5 Increase the engine speed to between 1950 and 2050 rpm while purging is taking place.

Purge flow rate should be between 25 and 50 litres/min (53 and 106 ft³/min).

Comments

This functional check makes sure that:

the purge control valve is responding to the commands issued by the electronic control unit.

there are no leaks or blockages in the purge system hoses.

the 33°C (91°F) temperature switch is operating correctly.

the purge line control solenoid is operating correctly.

UNLIKE CARS FITTED WITH CATALYTIC CONVERTERS, THE PURGE SYSTEM FITTED TO CARS DESTINED FOR THE MIDDLE EAST AND TAIWAN DOES NOT OPERATE WHEN THE ENGINE IS IDLING.

Incorrect operation

If the purge flow rate recorded at an engine speed between 1950 and 2050 rpm is less than 25 litres/min (53 ft³/min), check for the following:

1 A leakage in any of the purge lines from the charcoal canister.

2 A blockage in any of the purge lines from the charcoal canister.

3 Incorrect operation of the purge system solenoid valve.

4 Faulty 33°C (91°F) switch or circuit.

Air Pressure Transducers

Two air pressure transducers are fitted to turbocharged motor cars only.

One provides a boost pressure signal to the K-Motronic electronic control unit.

One provides a boost pressure feedback signal to the boost control electronic control unit.

The air pressure transducers are identical and are mounted together under the right hand front wing.

Air pressure transducers are not fitted to naturally aspirated motor cars.

Boost Control Air Pressure Transducer

Tools Required

A Mityvac vacuum pressure pump.
A combination vacuum pressure gauge.

Functional Check

1 Disconnect the APT pressure feed pipe from the steel feed pipe located by the speed control actuator.

2 Blank off the steel pipe.

3 Connect a Mityvac pressure pump and pressure gauge to the APT pressure feed pipe.

4 Switch the ignition to RUN.

5 Steadily apply pressure up to a maximum of 500 mB (7 lbf/in^2) to the air pressure transducer. At the same time listen to the boost control solenoid.

6 Remove the test equipment and return the car to standard.

Correct Operation

Cars fitted with catalytic converters

At a pressure of approximately 240 mB (3.6 lbf/in^2), the boost control solenoid should begin to click.

Cars not fitted with catalytic converters

At a pressure of approximately 175 mB (2.6 lbf/in^2), the boost control solenoid should begin to click.

All cars

As the pressure is increased further, the frequency of the clicking should increase.

Service Note:

A good quick functional check is to disconnect the 6-way plug on the right-hand valance adjacent to the K-Motronic ECU. The boost control solenoid should click on and off.

This indicates that the signal from the APT is reaching the boost control ECU and that the boost control ECU output signal to the boost control solenoid is good.

K Motronic Air Pressure Transducer

Tools Required

A good quality digital multimeter.
An extension harness or adaptor for connecting the multimeter in series with the electro-hydraulic actuator.
A Mityvac vacuum pressure pump.
A combination vacuum pressure gauge.

Functional Check

1 Disconnect the APT pressure feed pipe from the steel feed pipe located by the speed control actuator.

2 Blank off the steel pipe.

3 Connect a Mityvac pressure pump and pressure gauge to the APT pressure feed pipe.

4 Connect a milliammeter in series with the electro-hydraulic actuator.

4a If the car is fitted with catalytic converters, disconnect the Lambda (oxygen) sensor at its plug and socket connection adjacent to the K-Motronic electronic control unit.

5 Start and run the engine at normal operating temperature.

6 Steadily apply an increasing pressure of not more than 500 mB (7 lbf/in^2) to the K-Motronic fuel injection air pressure transducer and observe the response of the milliammeter.

7 Remove the test equipment and return the car to standard.

Correct Operation

The milliammeter reading should increase by 2 mA for each 100 mB (1.5 lbf/in^2) increase of pressure.

Service Note:

The Lambda (Oxygen) sensor is disconnected on catalyst equipped cars to prevent the Lambda closed loop system compensating for the pressure changes applied to the air pressure transducer.

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Crankcase Depression Check

Motor cars fitted with turbochargers.

Tools Required
A Manometer (0 - 20 ins H_2O)/(0 - 1000 mm H_2O).

Function Check

1 Run engine to normal operating temperature then switch off.

2 Remove the engine oil dipstick.

3 Connect a suitable manometer to the dipstick tube.

4 Start and run the engine at idle.

Correct Operation
The crankcase depression should be 4 - 6 inches (100 - 150 mm) of water.

Service Note:
If the crankcase depression is more than 6 inches (150 mm.) of water, it is possible that a groan will be heard from the induction system during cranking and when the engine is switched off. To decrease the crankcase depression, remove the top of the breather and shorten the spring located above the diaphragm, one coil at a time.

Do not reduce the depression to less than 4 inches (100 mm.) of water, otherwise the turbocharger may be damaged.

Crankcase Depression Check

Motor cars not fitted with turbochargers.

Tools Required
A Manometer (0 - 20 ins H_2O)/(0 - 1000 mm H_2O).

Function Check

1 Run engine to normal operating temperature then switch off.

2 Remove the engine oil dipstick.

3 Connect a suitable manometer to the dipstick tube.

4 Start and run the engine at idle.

Correct Operation
The manometer reading should be seen to flick towards depression indicating a slight depression.

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