Workshop Manual

Rolls-Royce & Bentley motor cars

Rolls-Royce Silver Spirit
Rolls-Royce Silver Spur
Rolls-Royce Corniche
Rolls-Royce Corniche II
Bentley Eight
Bentley Mulsanne
Bentley Mulsanne S
Bentley Turbo R
Bentley Continental

Cars built from vehicle identification number (VIN)
SCBZS0T03HCX20001
to
SCBZE00A5KCX27799
inclusive

Volume 1

TSD 4700

September 1989

Printed and Published by
Rolls-Royce Motor Cars Limited
Crewe
Cheshire
CW1 3PL
England

Introduction

This manual is written specifically for skilled service personnel and it is therefore assumed that the workshop safety and repair procedures generally accepted by the motor trade are appreciated, understood, and carried out.

Information relating to any subsequent modification will be circulated by the issue of amended or additional pages.

Each chapter incorporates an issue record sheet. Reference must be made to these sheets when determining either the current issue date for a particular page, or the number of pages contained within a chapter/section.

Throughout the manual reference is made to the right-hand and left-hand side of the car, this is determined when sitting in the driver's seat.

In order to identify the two banks of engine cylinders, it should be noted that 'A' bank of cylinders is on the right-hand side and 'B' bank on the left-hand side when viewed from the driver's seat.

Service personnel at Rolls-Royce Motor Cars Limited are always prepared to answer queries or give advice on individual servicing problems. When making an enquiry it is essential that the full vehicle identification number (VIN) is quoted.

Important
When obtaining information for a particular model always refer to the appropriate Chapter and/or Section contents page.

Printed in England

Communications

All communications should be addressed to one of the following depending upon the car's domicile.

Rolls-Royce Motor Cars Limited
Crewe Cheshire CW1 3PL England
Telephone: 0270 255155
Telex: 36121
Fax: 0270 586548

Rolls-Royce Motor Cars International SA
Au Glapin 1162 St-Prex
Switzerland
Telephone: 021 8062731
Telex: 454216
Fax: 021 8062729

Rolls-Royce Motor Cars Inc.
PO Box 476 Lyndhurst
New Jersey 07071 USA
Telephone: 201 460 9600
Telex: 427788
Fax: 201 460 9392

Rolls-Royce Motor Cars (Canada) Limited/Limitée
6634 Abrams Street
St. Laurent Quebec H4S 9Z7
Canada
Telephone: 514 335 9898
Fax: 514 335 2457

Introduction

This workshop manual has been compiled to assist Service Personnel responsible for the maintenance of Rolls-Royce and Bentley motor cars built from vehicle identification number (VIN) *SCBZS0T03HCX20001*.

Information relating to any subsequent modification will be circulated by the issue of amended or additional pages.

Each chapter incorporates an issue record sheet. Reference must be made to these sheets when determining either the current issue date for a particular page, or the number of pages contained within a chapter/section.

Throughout the manual reference is made to the right-hand and left-hand side of the car, this is determined when sitting in the driver's seat.

In order to identify the two banks of engine cylinders, it should be noted that 'A' bank of cylinders is on the right-hand side and 'B' bank on the left-hand side when viewed from the driver's seat.

Service Personnel at Rolls-Royce Motor Cars Limited are always prepared to answer queries or give advice on individual servicing problems. When making an enquiry it is essential that the full vehicle identification number (VIN) is quoted.

Important
When obtaining information for a particular model always refer to the appropriate Chapter and/or Section contents page (see samples).

Chapter contents page

Contents	Sections						
	Rolls-Royce			Bentley			
	Silver Spirit	Silver Spur	Corniche / Corniche II	Eight	Mulsanne / Mulsanne S	Turbo R	Continental
Contents and issue record sheets	G1	G1	G1	G1	G1	G1	G1
Introduction	G2	G2	G2	G2	G2	G2	G2
Special precautions (including system contamination test procedure)	G3	G3	G3	G3	G3	G3	G3
Hydraulic system pipework	G4	G4	G4	G4	G4	G4	G4
Bleeding the hydraulic systems	G5	G5	G5	G5	G5	G5	G5
Anti-lock braking system	G6	G6	G6	G6	G6	G6	G6
Hydraulic mineral oil reservoirs	G7	G7	G7	G7	G7	G7	G7

Section contents page

Contents	Pages						
	Rolls-Royce			Bentley			
	Silver Spirit	Silver Spur	Corniche / Corniche II	Eight	Mulsanne / Mulsanne S	Turbo R	Continental
Warning	G2-3	G2-3	G2-3	G2-3	G2-3	G2-3	G2-3
Hydraulic systems	G2-3	G2-3	G2-3	G2-3	G2-3	G2-3	G2-3
Facia warning lamps	G2-4	G2-4	G2-4	G2-4	G2-4	G2-4	G2-4
Mineral oil hydraulic system colour coding and component location							
Cars fitted with an anti-lock braking system							
Right-hand drive	G2-5	G2-5	G2-5	G2-5	G2-5	G2-13	G2-5
Left-hand drive	G2-7	G2-7	G2-7	G2-7	G2-7	G2-15	G2-7

Communications

All communications should be addressed to one of the following depending upon the car's domicile.

Rolls-Royce Motor Cars Limited
Crewe Cheshire CW1 3PL England
Telephone: 0270 255155
Telex: 36121
Fax: 0270 586548

Rolls-Royce Motor Cars International SA
Au Glapin CH-1162 St-Prex
Switzerland
Telephone: 021 8062731
Telex: 454216
Fax: 021 8062729

Rolls-Royce Motor Cars Inc.
P.O. Box 476 Lyndhurst
New Jersey 07071 USA
Telephone: 201 460 9600
Telex: 427788
Fax: 201 460 9392

Rolls-Royce Motor Cars (Canada) Limited/Limitée
3870 Rue Griffith Street St. Laurent
Quebec H4T 1A7 Canada
Telephone: 514 342 4332
Telex: 05 824130
Fax: 514 342 9973

Contents

Printed in England

General information

Contents

	Sections						
	Rolls-Royce			Bentley			
	Silver Spirit	Silver Spur	Corniche / Corniche II	Eight	Mulsanne / Mulsanne S	Turbo R	Continental
Contents and issue record sheet	A1	A1	A1	A1	A1	A1	A1
Identification	A2	A2	A2	A2	A2	A2	A2
Precautions	A3	A3	A3	A3	A3	A3	A3
Specification	A4	A4	A4	A4	A4	A4	A4
Data	A5	A5	A5	A5	A5	A5	A5
Body and coachwork	A6	A6	A6	A6	A6	A6	A6
Special procedures	A7	A7	A7	A7	A7	A7	A7
Raising, supporting, and transporting the car	A8	A8	A8	A8	A8	A8	A8
Abbreviations, terminology, and symbols	A9	A9	A9	A9	A9	A9	A9
Conversions	A10	A10	A10	A10	A10	A10	A10

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
1	10/89	6/87	5/88	5/88	5/88	3/87	3/87	10/89	3/87	3/87
2		5/88	5/88	5/88	5/88	3/87	10/89	10/89	3/87	
3	10/89	5/88	5/88	5/88	5/88	3/87			3/87	
4		5/88	5/88	5/88	5/88				3/87	
5			5/88	11/88					3/87	
6			5/88	5/88					6/87	
7				5/88						
8				5/88						
9				5/88						
10				11/88						
11				11/88						
12				11/88						
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Identification

The locations of the various identification numbers quoted in this section indicates their main positions. The numbers may also be found in other places depending upon the specification of the vehicle. Build sequence numbers will usually be found on the majority of main assemblies.

Vehicle identification number (VIN)
The vehicle identification number consists of seventeen digits as shown in figure A2-1.

A check digit is used to ensure the VIN is correct i.e. if the VIN is incorrect at any one digit, the check digit will show this.

Note The letters I, O, and Q are not used in a VIN, because they can be easily confused with the figures 1 and 0.

Vehicle identification plates are fitted below the upper hinge of the right or left-hand front door pillar depending upon the specification of the vehicle. The vehicle identification number is also shown between

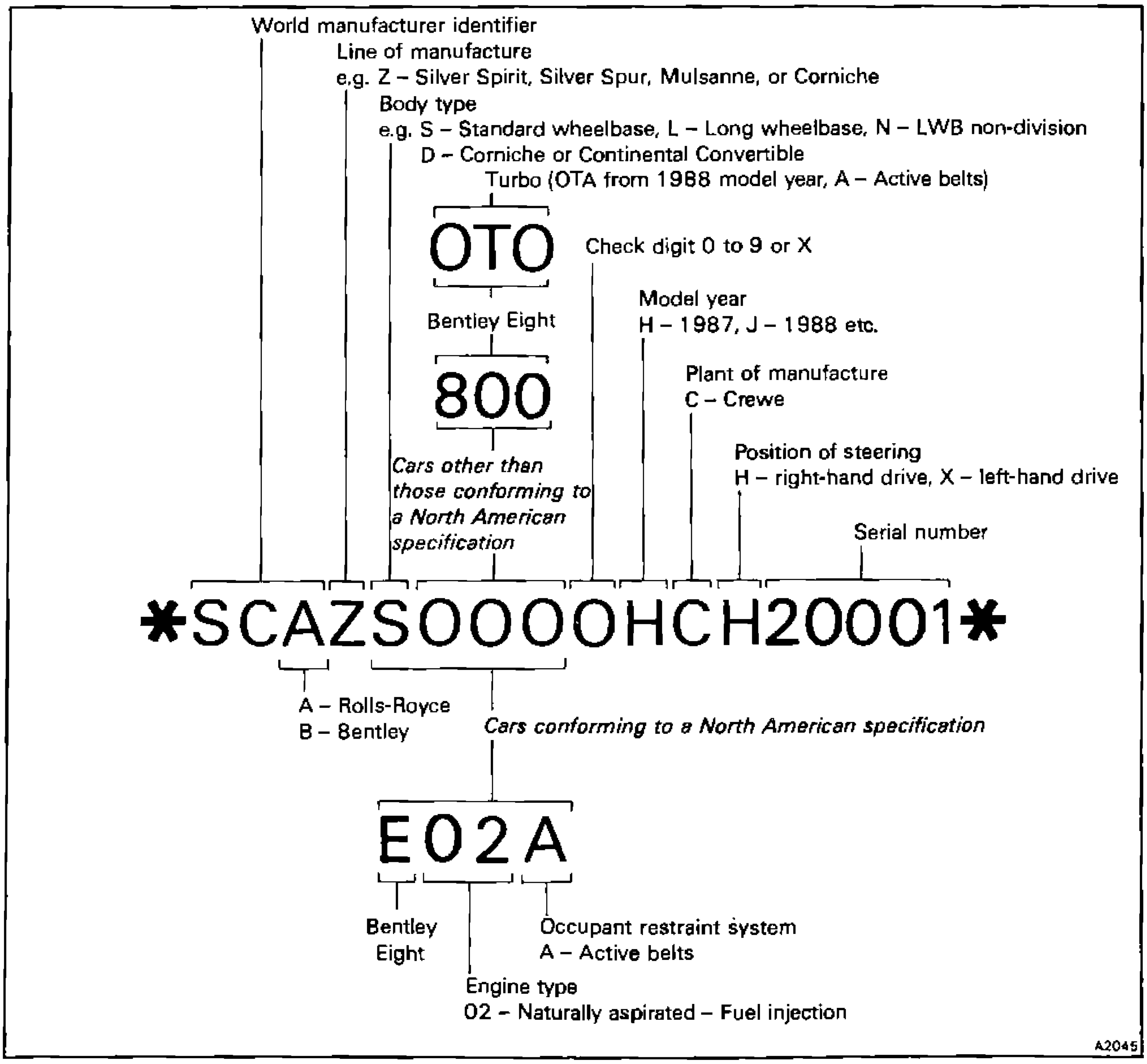


Fig. A2-1 Vehicle identification number (including 1988 model year Bentley Turbo R cars)

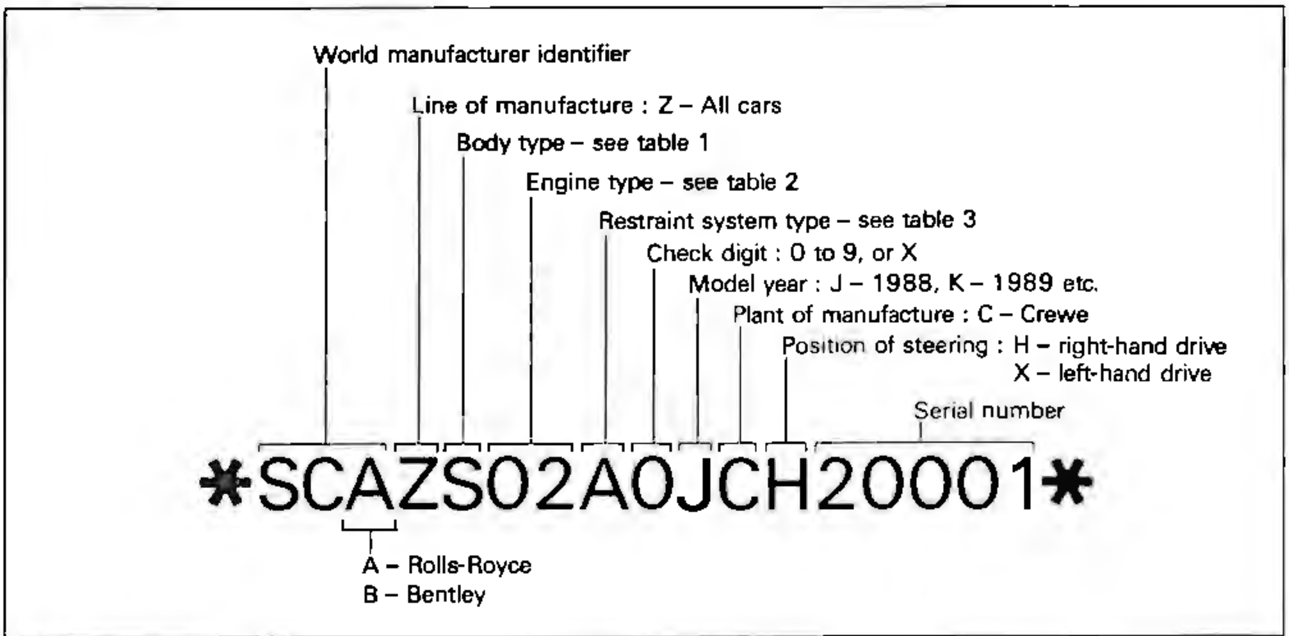


Table 1 – Body type
S – Silver Spirit, Mulsanne S
N – Silver Spur, Mulsanne S (Long wheelbase)
E – Eight
F – Eight (Long wheelbase)
D – Corniche II, Continental
X – Silver Spur Limousine

Table 2 – Engine type
00 – L410I naturally aspirated, fuel injection
02 – L410I naturally aspirated, fuel injection, catalyst equipped

Table 3 – Restraint system
A – Active seat belts
B – Passive seat belts – front

A2046

Fig. A2-2 Vehicle identification number (1988 model year and onwards, other than Bentley Turbo R cars)

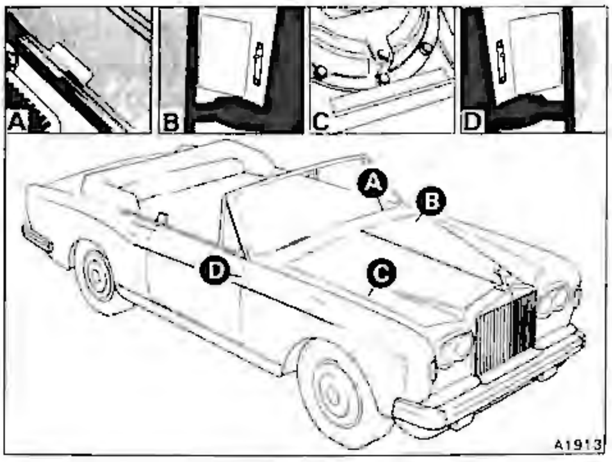


Fig. A2-3 Locations of the vehicle identification number (Corniche/Continental)
- A Left-hand lower corner of the windscreen – *Cars conforming to a North American specification*
- B Left-hand door hinge pillar – *Left-hand drive cars*
- C Right-hand valance in the engine compartment
- D Right-hand door hinge pillar – *Right-hand drive cars*

the supports of the right-hand front road spring pot, either stamped directly into the body, or on a plate attached to the wing (see figs. A2-3 and A2-4).

On cars conforming to a North American specification, an identification plate is fitted on the left-hand side of the windscreen surround, visible from outside the car.

On cars conforming to a Swedish specification, a further VIN plate is fitted beneath the carpet in the luggage compartment on the right-hand side.

When making any enquiries to Rolls-Royce Motor Cars Limited (or any appropriate member of the group) relating to the car, it is essential that the full vehicle identification number is quoted.

Engine identification number

A new system of engine identification numbering has been introduced.

In the new system, a single identification number is used in place of the individual engine build code and serial numbers used before.

The new identification number is stamped on a crankcase boss adjacent to the ignition distributor (see fig. A2-5), and is made up of the following components.

Identification

The locations of the various identification numbers quoted in this section indicates their main positions. The numbers may also be found in other places depending upon the specification of the vehicle. Build sequence numbers will usually be found on the majority of main assemblies.

Vehicle identification number (VIN)
The vehicle identification number consists of seventeen digits as shown in figure A2-1.

A check digit is used to ensure the VIN is correct i.e. if the VIN is incorrect at any one digit, the check digit will show this.

Note The letters I, O, and Q are not used in a VIN, because they can be easily confused with the figures 1 and 0.

Vehicle identification plates are fitted below the upper hinge of the right or left-hand front door pillar depending upon the specification of the vehicle. The vehicle identification number is also shown between

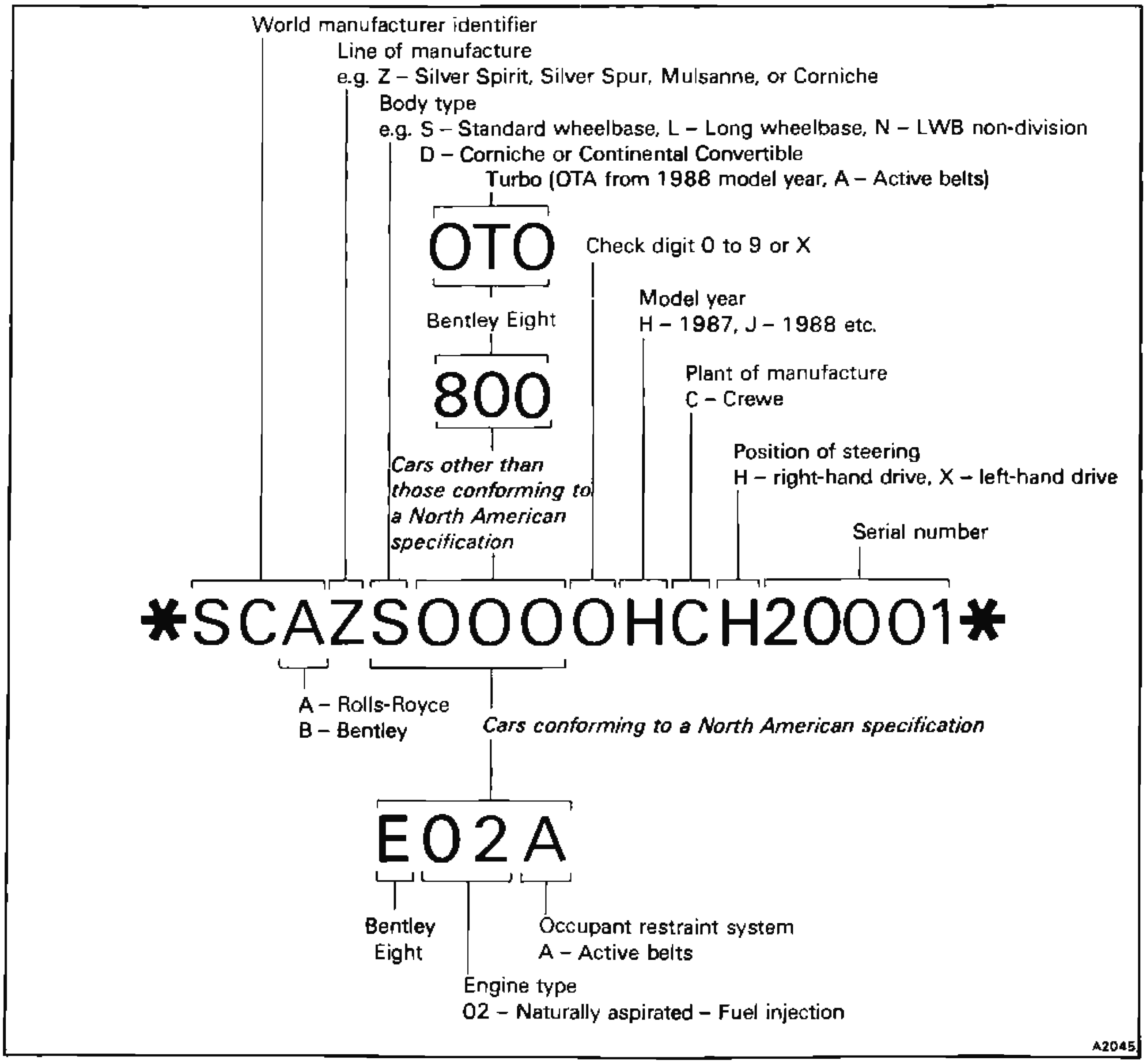


Fig. A2-1 Vehicle identification number (including 1988 model year Bentley Turbo R cars)

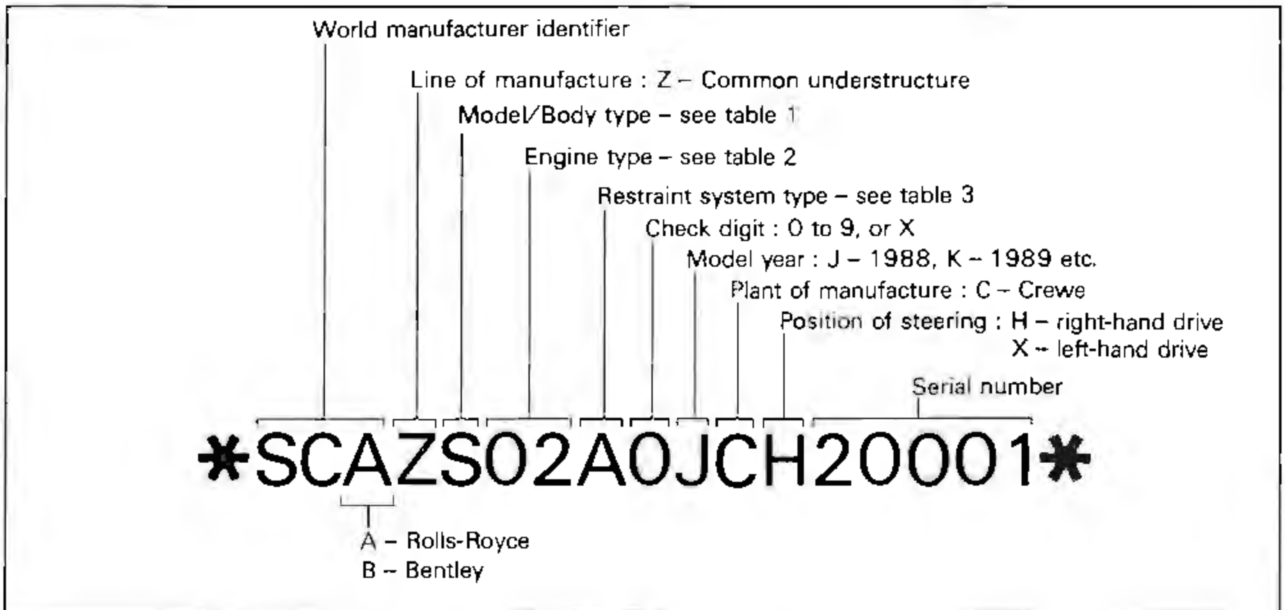


Table 1 – Body type	Table 2 – Engine type
S – Silver Spirit, Mulsanne S	00 – L410I naturally aspirated, fuel injection
N – Silver Spur, Mulsanne S (Long wheelbase)	02 – L410I naturally aspirated, fuel injection, catalyst equipped
E – Eight	03 – L410ITI turbocharged, catalyst equipped
F – Eight (Long wheelbase)	04 – L410ITI turbocharged
D – Corniche II, Continental	

Table 1 – Body type (continued)	Table 3 – Restraint system
X – Silver Spur Limousine	A – Active seat belts
R – Turbo R – From 1989 model year	B – Passive seat belts – front
P – Turbo R (Long wheelbase) – From 1989 model year	

A2452

Fig. A2-2 Vehicle identification number (1988/1989 model year, excluding 1988 model year Bentley Turbo R)

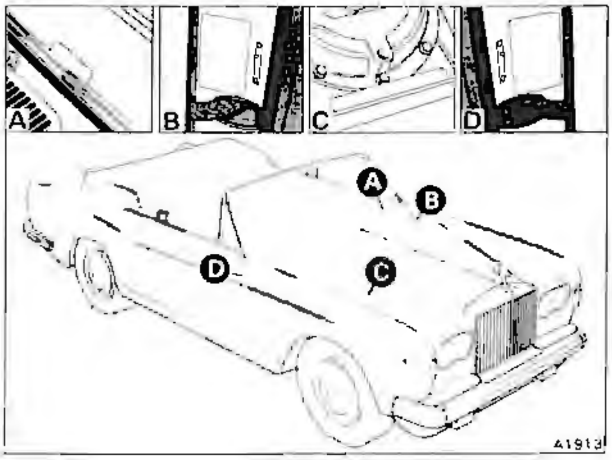


Fig. A2-3 Locations of the vehicle identification number (Corniche/Continental)

A Left-hand lower corner of the windscreen – *Cars conforming to a North American specification*

B Left-hand door hinge pillar – *Left-hand drive cars*

C Right-hand valance in the engine compartment

D Right-hand door hinge pillar – *Right-hand drive cars*

the supports of the right-hand front road spring pot, either stamped directly into the body, or on a plate attached to the wing (see figs. A2-3 and A2-4).

On 1989 model year four door cars, the vehicle identification number is stamped directly into the body, forward of the right-hand front road spring pot (see fig. A2-4, inset F).

On cars conforming to a North American specification, an identification plate is fitted on the left-hand side of the windscreen surround, visible from outside the car.

On cars conforming to a Swedish specification, a further VIN plate is fitted beneath the carpet in the luggage compartment on the right-hand side.

When making any enquiries to Rolls-Royce Motor Cars Limited (or any appropriate member of the group) relating to the car, it is essential that the full vehicle identification number is quoted.

Engine identification number

The engine identification number is stamped on a crankcase boss adjacent to the ignition distributor (see fig. A2-5), and is made up of the following components.

1. A five digit build sequence number which commences at 60000.

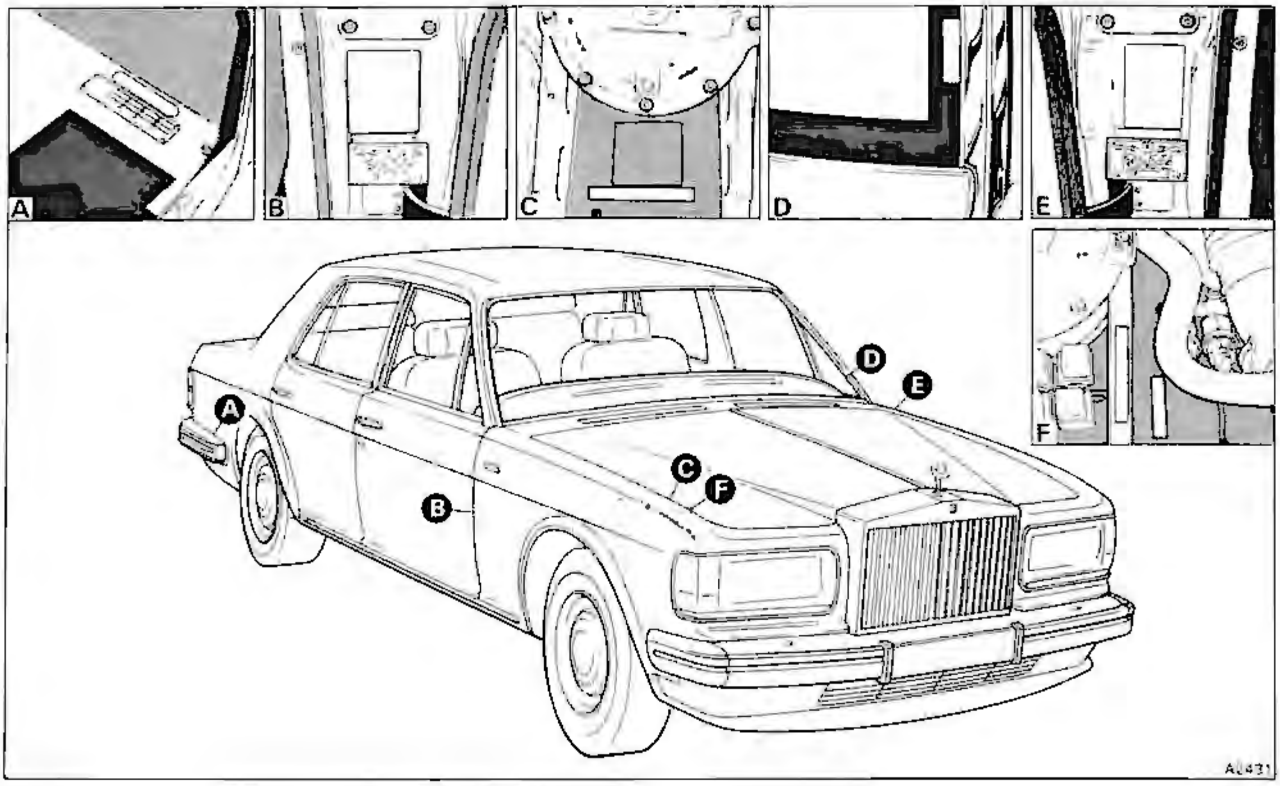


Fig. A2-4 Locations of the vehicle identification number (Four door cars)

A Right-hand side of the luggage compartment – *Cars conforming to a Swedish specification*

B Right-hand front door hinge pillar – *Cars other than those conforming to a Middle East or North American specification*

C Right-hand valance in the engine compartment – *Cars prior to 1989 model year*

D Left-hand side of the windscreen surround – *Cars conforming to a North American specification*

E Left-hand front door hinge pillar – *Cars conforming to a Middle East or North American specification*

F Right-hand valance in the engine compartment – *1989 model year cars*

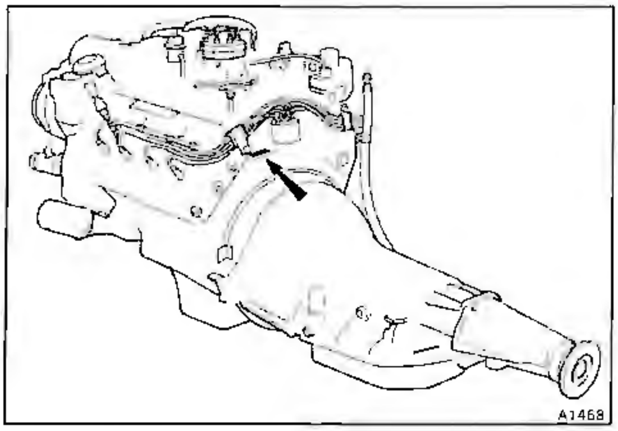


Fig. A2-5 Engine identification number

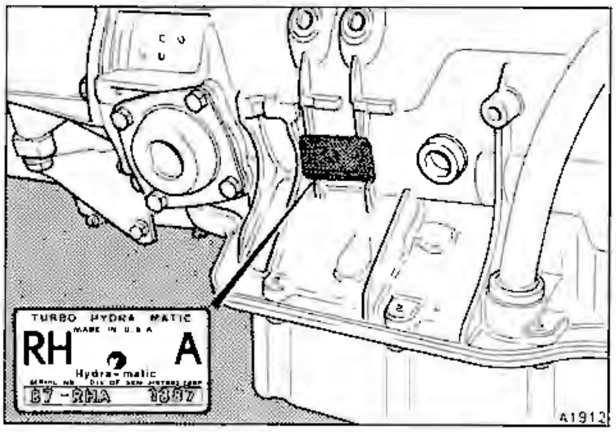


Fig. A2-6 Transmission serial number

2. A 5 or 6 character engine type code which denotes whether the engine is naturally aspirated or turbocharged (L410I or L410IT).

3. A single digit compression ratio identification, either 8 (8:1 compression ratio), or 9 (9:1 compression ratio).

Example

60001 L410IT/8 = Turbocharged with 8:1 compression ratio.

In addition, 1989 model year turbocharged cars have the letter I as the final digit.

Example

60001 L410IT/I = Turbocharged with intercooler.

This is now the only number stamped on the engine and should be used for all identification purposes.

Transmission serial number
The transmission serial number is located on a metal plate attached to the right-hand side of the transmission casing as shown in figure A2-6.

Body serial number
The body serial number is stamped on a metal plate which is attached to the front support bracket adjacent to the right-hand front road spring pot (see fig. A2-4, inset C).

Precautions

The information contained within this section highlights important notes, warnings, and precautions listed in the appropriate Chapter of the manual. This section should be used as a quick reference guide to any features considered essential for the safety of either the operator or the vehicle.

The list is not exhaustive.

In the interests of health and hygiene, items normally used in service workshops such as anti-freeze, hydraulic system mineral oil, lubricants, engine oil, adhesives, cleaning agents, etc., should all be treated with extreme caution. As these items can be of a toxic nature they must not be swallowed and contact with the skin must be kept to an absolute minimum. Manufacturers' instructions should be followed carefully.

Workshop safety

Whenever any work is being carried out on the vehicle with the engine running, always ensure that the gear range selector lever is in the park position, the parking brake is applied, and fuse A6 is removed from fuse panel F2 on the main fuseboard.

Towing the vehicle

Before towing the vehicle note the following.

Do not tow the vehicle to start the engine.

Do not tow the vehicle if any mechanical damage to the transmission is suspected.

Do not tow the vehicle with a low fluid level in the torque converter transmission.

If it is necessary to tow the vehicle for even a short distance a solid tow bar must be used. A speed of 56 km/h (35 mile/h) and a maximum distance of 80 kilometres (50 miles) must not be exceeded.

For towing distances in excess of 80 kilometres (50 miles) either disconnect the propeller shaft or transport the vehicle.

Always tow the vehicle with the torque converter transmission in neutral.

Metric components

A number of the nuts, bolts, and setscrews used in the manufacture of these cars are dimensioned to the metric system. It is important therefore, that when new parts become necessary the correct replacements are obtained and fitted.

Chapter B – Special processes

Storage

When the car is stored, always ensure that the battery master switch is turned to the OFF position.

If any electrical connections or disconnections are required, always disconnect the battery.

Recommissioning

Always ensure that the battery is removed from the car before charging.

Chapter C – Air conditioning

Danger – Exhaust gases

Due to the danger from inhaling exhaust gases the engine should not be operated for long periods in a confined space e.g. private garage. Sitting in the car with the air conditioning system operating does not eliminate this danger.

First aid – Refrigerant burns

If the skin is injured by refrigerant it should be bathed with clean cold water and medical attention sought immediately. Do not apply any localized heat, hot dressings, etc.

An eye injured by refrigerant must be immediately washed with clean cold water. The eye must not be rubbed as this will aggravate the injury.

A doctor should be consulted as soon as possible after administering emergency treatment.

Chapter E – Engine

Engine oils

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation, and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities should be provided.

Health protection precautions

Avoid prolonged and repeated contact with oils, particularly used engine oils.

Wear protectiva clothing, including impervious gloves where practicable.

Do not put oily rags in pockets.

Avoid contaminating clothes, particularly underpants, with oil.

Overalls must be cleaned regularly. Discard unwashable clothing and oil impregnated footwear.

First Aid treatment should be obtained immediately for open cuts and wounds.

Use barrier creams, applying before each work period, to help the removal of oil from the skin.

Wash with soap and water to ensure all oil is removed (skin cleansers and nail brushes will help). Preparations containing lanolin replace the natural skin oils which have been removed.

Do not use petrol, kerosine, diesel fuel, gas oil, thinners, or solvents for washing skin.

If skin disorders develop, obtain medical advice.

Where practicable, degrease components prior to handling.

Where there is a risk of eye contact, eye protection should be worn, for example, chemical goggles or face shields; in addition an eye wash facility should be provided.

Environmental protection precautions

It is illegal to pour used oil onto the ground, down sewers or drains, or into water courses.

The burning of used engine oil in small space heaters or boilers is not recommended unless emission control equipment is fitted; in cases of doubt check with the Local Authority.

Dispose of used oil through authorized waste disposal contractors to licensed waste disposal sites, or to the waste oil reclamation trade. If in doubt, contact the Local Authority for advice on disposal facilities.

Chapter F – Propeller shaft

Propeller shaft – To remove

The crossmember centre section must not be allowed to hang on the parking brake cables.

Chapter G – Hydraulics

WARNING

Use only hydraulic system mineral oil (LHM) to replenish the braking and levelling systems.

Do not use brake fluids (Castrol RR363, Universal, or any other type). The use of any type of brake fluid, even in very small amounts, will cause component failure necessitating extensive rectification to the braking and levelling systems of the car.

Always ensure before fitting any seals, hoses, pipes, etc., that they are suitable for a mineral oil system. For details of correct component identification reference should be made to Chapter G.

Always ensure that two sealed containers of **hydraulic system mineral oil (LHM)** are fitted in the luggage compartment.

Always ensure that no foreign matter enters the systems when work is being carried out.

It is of the utmost importance that Service Personnel should fully appreciate that the hydraulic systems operate at high pressures.

The systems are designed to operate safely under normal working conditions, but, when work is performed on the systems, certain precautions must be observed to ensure adequate safety to personnel and equipment.

Cleanliness

To ensure correct functioning of the hydraulic systems it is imperative that meticulous care is taken to ensure complete cleanliness at all times.

Operation of the brakes (engine not running)

The service brakes (i.e. footbrake) consists of two independent all power systems. The power for these systems in the form of hydraulic pressure is provided by two engine driven hydraulic pumps. When the engine stops, a limited reserve of pressure remains stored in the hydraulic accumulators. Due to brake operation, natural internal leakage, and height control system operation this energy will be slowly depleted. Although a number of brake applications will be available immediately after the engine stops, it is recommended that the service brakes are not utilized when the engine is not running.

Finally, always remember that if the car is being manoeuvred without the engine running, the footbrake will not stop the car if the pressure in the hydraulic systems is exhausted.

Precautions before working on the car

Before any work, except bleeding and specified tests, is carried out on the car hydraulics, the systems must be depressurized (refer to Section A7 or Chapter G).

With the exception of bleed screws, components must never be disturbed when the systems are in a pressurized state.

Hydraulic system mineral oil

The hydraulic braking and height control systems of the car are filled with hydraulic system mineral oil which is green in colour. Always refer to Chapter D – Lubricants, for the correct type of approved hydraulic system mineral oil to use in the system.

Warning Hydraulic system mineral oil is not miscible with conventional brake fluids (i.e. RR363 or Universal types).

Under no circumstances should any fluid other than the genuine hydraulic system mineral oil be used.

Contamination of the hydraulic systems with a conventional vegetable or synthetic type brake fluid will cause the seals and hoses to deteriorate which could result in eventual brake faults.

To avoid contamination, all mineral oil containers and components should be stored in a clearly defined area away from that used for conventional brake fluid.

Before topping-up the system, if contamination is at all suspect, check the contents of the mineral oil reservoirs using the contamination kit RH 2841, available from Rolls-Royce Motor Cars Limited at Crewe.

Component identification

All components which are susceptible to damage from brake fluid are colour coded **Green** and have a **GMF** prefix part number e.g. **GMF 1062.**

Other components which are not susceptible to brake fluid damage (i.e. metal pipes and connectors) are not colour coded and do not have a **GMF** prefix part number. It must be stressed however that these parts must not become contaminated with brake fluid, as this fluid could circulate to other components in the hydraulic systems.

Hydraulic accumulator and gas spring spheres

The accumulator and gas spring spheres are charged on one side of their diaphragms with nitrogen gas prior to despatch from the factory.

Each sphere is marked with a band of white paint or a yellow stick-on label when charged. The charge pressure in 'bars' (1 bar = 14.50 lbf/in^2) is stamped on the non-return valve cap at the lower end of the sphere. It is recommended that spheres are stored and issued from stock in date sequence.

Storage and transportation

To avoid contamination, it is of the utmost importance that brake fluid and hydraulic system mineral oil containers and components are kept completely separate. Conventional brake fluids have a detrimental effect on rubber seals and hoses used in a mineral oil system.

Chapter H – Sub-frames and suspension

Urethane foam filled components

The suspension crossmember and final drive crossmember are filled with urethane foam. When using cutting or welding equipment on the crossmembers suitable precautions should be taken not to inhale the toxic gases given off when the temperature exceeds 200°C (392°F).

Shock dampers

Each shock damper contains nitrogen gas under pressure. On no account should the damper be subjected to undue force of any description. Do not clamp the damper in a vice.

If the spring support has seized onto the damper, renew the shock damper and spring support.

To render a shock damper safe for disposal, drill a small hole 25 mm (1.0 in) from the closed end of the outer tube. The escaping gas should not be allowed to come into contact with eyes or skin whilst under pressure.

Immediately the hole has been drilled, stand clear and allow the nitrogen gas to disperse to atmosphere.

Front road springs

Use of the road spring retaining tool RH 8809 should be restricted to a maximum of 200 applications.

Inspection of the long bolt threads must be made at frequent intervals. The person lifting the compressed assembly out of the car must keep their head and body clear of the tool.

Caster and Camber angles

The caster and camber angles must always be checked at the same time, as adjustment of one affects the other.

'Jacking up' the car

Care must be taken not to leave the car jacked up for long periods without support to the trailing arms, otherwise damage may result to the trailing arm mounting points.

When using a hydraulic jack to raise the car ensure that a hardwood block is placed between the jack and the underneath of the car.

The engine front pulley should not be used to support the engine.

Rear suspension

Warning

Before any work is carried out on the rear suspension frame tubes, etc., reference must be made to the appropriate section in the Workshop Manual.

Chapter K – Fuel system (Refer to TSD 4737)

Fuel – To drain

The fuel is highly flammable, and extreme care must be exercised whenever the system is opened (i.e. pipes or unions disconnected) or when the fuel is drained. The following basic rules should apply.

1. Disconnect the battery.
2. Place 'No Smoking' signs in the vicinity of the vehicle.
3. Ensure that adequate fire fighting equipment is available in the vicinity of the vehicle.
4. Depressurize the fuel system.
5. Protective clothing including safety goggles, gloves, and aprons should be worn at all times by the operator.
6. If fuel is to be removed from the tank, it should be siphoned into a suitable covered container.

Do not run the engine to completely drain the system as damage to the fuel pump could occur. Damage to the catalytic converter (if fitted) in the exhaust system could also occur if the engine is allowed to run until the fuel system is completely empty.

Health risk

Fuel may contain up to 5% of Benzene as an anti-knock additive. Benzene is extremely injurious to health (being carcinogenic) **and therefore all contact should be kept to an absolute minimum, particularly inhalation.**

Fuel has a sufficiently high vapour pressure to allow a hazardous build-up of vapour in poorly ventilated areas. The vapours are irritant to the eyes and lungs, if high concentrations are inhaled it may cause nausea, headache, and depression. Liquid fuel is an irritant to the eyes and skin and may cause dermatitis with prolonged or repeated contact.

If there is contact with fuel the following emergency treatment is advised.

Ingestion (swallowing)

Do not induce vomiting. Give the patient milk to drink (if none is available water can be given). The main hazard after swallowing fuel is that some of the liquid may get into the lungs. Send the patient to hospital immediately.

Eyes

Wash with a good supply of clean water for at least 10 minutes.

Skin contact

Immediately drench the affected parts of the skin with water. Remove contaminated clothing and then wash all contaminated skin with soap and water.

Inhalation (breathing in vapour)

Move the patient into the fresh air. Keep the patient warm and at rest. If there is loss of consciousness give artificial respiration. Send the patient to hospital.

Cleanliness

It is extremely important to ensure maximum cleanliness whenever work is carried out on the system.

The main points are.

1. To prevent the ingress of dirt, always clean the area around a connection before dismantling a joint.

2. Having disconnected a joint (either fuel or air) always blank off any open connections as soon as possible.
3. Any components that require cleaning should be washed in clean fuel and dried, using compressed air.
4. If it is necessary to use a cloth when working on the system, ensure that it is lint-free.

Fuel injection system
During manufacture, the components of the fuel injection system are precisely adjusted in order to comply with the relevant emission control regulations. Therefore, alterations to any of the settings should not normally be necessary.

Before carrying out any tests, ensure that the battery is in a fully charged condition.

The control piston, if removed, should be handled with care as it is machined to very fine tolerances.

Fuel pressure
The fuel injection system contains fuel that may be under high pressure [approximately 5,2 bar (75 lbf/in^2)]. Therefore, to reduce the risk of possible injury and fire, always ensure that the system is depressurized.

Turbocharging system
The turbocharger assembly should never be dismentled. If the turbocharger is faulty, a service exchange unit should be fitted.

Prior to the turbocharger being fitted to the engine, it should be primed with engine oil through the oil feed pipe.

Never run the engine with the oil feed pipe to the turbocharger disconnected.

Whenever any components are removed from the turbocharging system, they should be handled with care to avoid damaging the machined faces.

An application of Neverseez or similar anti-seize lubricant should be applied to any exhaust bolts whenever they are removed to aid dismantling at a future date.

The wastegate assembly when removed from the car should be tested with air pressure only and care should be taken to avoid blanking off the spring cover vent hole whilst doing so, as this can cause damage to the diaphragm.

Do not run the engine with the air cleaner disconnected. The only possible exception being in the workshop, where care should be taken to avoid dirt and foreign matter entering the system.

A knock sensor is fitted between cylinders two and three on both 'A' bank and 'B' bank. Therefore, when any work is being carried out in these areas, special care must be taken.

Do not use an exhaust extraction system on the vehicle. Failure to observe this caution may result in a temporary leak from the turbocharger oil seal arrangement.

Chapter L – Cooling system

Cooling system – To flush
Under no circumstances use a strong alkaline compound or detergent to clean the cooling system. Such compounds have a detrimental chemical action on aluminium alloys.

Thermostat – To test
Important If the water is heated too quickly, or if the circulation is poor, a false reading may result.

The thermostat has its opening temperature stamped on the base of the unit, e.g. 88°C (190°F).

When fully open, the valve should have travelled a minimum of 9,50 mm (0.375 in).

Chapter M – Electrical system
(Refer to TSD 4701 and TSD 4848)

Before commencing work on a particular circuit the following precautions **must** always be observed.
1. Whenever possible the gear range selector lever should be placed in the park position, the gearchange isolating fuse (fuse A6) removed from fuseboard F2, and the ignition key removed from the switchbox.

In addition, turn the battery master switch (if fitted) to the OFF position and disconnect the battery.
2. When reactivating a seat memory ensure that contact with the seat or seat mechanism is avoided. Immediately the seat is reactivated it will automatically move to a pre-set adjustment position.
3. **Never** disconnect the battery when the engine is running.
4. When working on the windscreen wiper system with the wiper mechanism cover removed, **always** disconnect the battery.
5. **Always** ensure correct polarity when making cable connections.
6. **Never** use a test lamp on circuits that contain electronic components.
7. When working on or in the vicinity of the air conditioning micro-processor, anti-static precautions, in particular, the wearing of an anti-static wristband connected to a good earth, must be observed.

Battery
It is imperative that the battery is disconnected before commencing work on the electrical system or components, or if any electric arc welding is to be used on the car.

Battery – To charge
The gases given off during charging are highly flammable.

Always remove the battery from the car before charging.

Chapter N – Steering system
Damage can be caused to the steering column and power assisted steering rack boots if the steering is operated without the engine running, i.e. distortion to the column, broken column mounts, and cut rack boots.

Rack and pinion unit
Do not strike this unit with a hammer as extreme damage could result.

Belt tension
A slipping belt will squeal and produce judder at the steering wheel nearing full lock. Belt dressing must not be applied to prevent slip.

Steering pump – Priming and filling
When filling an empty system with the engine running, it is essential that at no time the fluid level in the pump reservoir be allowed to drop sufficiently for air to be drawn into the system. If this occurs, irreparable damage will result.

Chapter R – Wheels and Tyres

Tyre – To fit
Dunlop tyre bead lubricant TBL1, TBL2, or Tip Top 593063 is recommended for use when fitting tyres. It is most important that soap or other similar agents are not used.

Tyre service
Periodically the balance of each wheel should be checked and corrected if necessary. In the interest of increased tyre life, the wheels may be changed back and forth on any one side. **Do not** change the wheels from one side of the car to the other.

To ensure the designed handling characteristics of the car are achieved, it is important to maintain the differential in tyre pressures between the front and rear wheels. For full information refer to Chapter R.

Under no circumstances should any tyres be fitted which have been branded 'Regraded Quality', 'Remould Quality' or 'Seconds', or those which have had the speed rating removed or altered.

Care of tyres
Clean any oil or grease from the tyres using a soap solution and water, then rinse off with clean water. Always remove any oil spillage from the tyres immediately as certain oils, in particular hydraulic system mineral oil, have a harmful effect on the tyre rubber if not cleaned off immediately.

Chapter S – Body

Before using adhesives, paints, primers, thinners, solvents, etc., refer to Section S3 – Safety procedures.

Urethane foam filled cavities
The lower 'A' post and 'D' post (from waist downwards) are filled with urethane foam. When using cutting or welding equipment on these areas suitable precautions should be taken not to inhale the toxic gases given off when the temperature exceeds 200°C (392°F).

Chapter T – Transmission

Torque converter transmission – To remove
When removing the transmission from the car always use the retaining clamp RH7952 (J-21366), otherwise the converter may fall as the transmission is withdrawn.

TSD 4737 Engine Management Systems

Exhaust emission control system
The exhaust emission control system is designed to reduce the carbon monoxide, hydrocarbon, and oxides of nitrogen content in the exhaust gases.

The system does not eliminate the danger caused by inhaling exhaust gases in a confined area.

Before commencing work on the exhaust emission control system, care should be taken to ensure that the relevant components are not hot.

Unleaded fuel
Use the correct grade of unleaded fuel only. The use of leaded fuel will result in a substantial reduction in the performance of the catalyst. Under no circumstances add fuel system cleaning agents for induction into the engine, as the materials may have a detrimental effect on the catalytic converter.

Do not allow the vehicle to run out of fuel. If the vehicle does run out of fuel at high speed, possible damage to the catalyst could result.

General precautions

Cleaning agents and solvents
Throughout this Workshop Manual various cleaning agents and solvents are recommended. The following precautions should be observed in their storage and use.

Reference should also be made to the Safety procedures section contained in Chapter S when carrying out work on the items covered in Chapter S.

1. Cleaning agents and solvents should only be used in well ventilated areas.
2. Ensure that cleaning agents and solvents are kept in clean containers. Also ensure that the lids fit securely and are replaced immediately after use.
   Do not store or carry solvents in open containers.
3. Clearly label all containers.
4. The issue of all solvents should be closely controlled. Containers should be kept in locked storerooms with a responsible person in possession of the key.
5. In the event of a major spillage, the area should be evacuated and then thoroughly ventilated.
6. Do not dispose of any solvents into open drains.
7. Avoid skin contact as far as possible. If contact is likely, wear PVC gloves and an appropriate barrier cream, such as Rozalex No. 9.
8. Always protect the eyes with goggles if there is any danger of the solvents coming into contact with the eyes.
9. Use solvents sparingly, cleaning only small areas at a time. After use, cloths should be deposited into a closed metal container.
10. Care should be taken when working in an inspection pit to avoid being overcome with the vapours from some solvents i.e. Genklene. These vapours are heavier than air, and therefore collect at low levels.
11. Do not smoke in the vicinity of any solvents.
12. Do not allow solvents near any naked flames, hot surfaces, or welding arcs.

Genklene
Genklene is the I.C.I. trade name for 1:1:1-trichloroethane. It possesses anaesthetic properties and the inhalation of high concentrations of vapour will cause drowsiness, headache, and giddiness.

Vapours exposed to high temperatures degrade and produce toxic gases (e.g. Phosgene).

Important Anyone suffering from over exposure to Genklene vapour should be moved into the fresh air and medical attention sought immediately. **Do not** walk the patient.

Methylated spirit/Petroleum ether

The main hazard of methylated spirit or petroleum ether is fire, its low flash point making it easily ignited by heat or flame.

Avoid prolonged or frequent contact with the skin as it removes the natural oils, which can lead to dermatitis.

Paraffin

Prolonged or frequent skin contact with paraffin can cause defatting of the skin, which can lead to dermatitis. Therefore, it should not be used for cleaning the hands. Protective clothing should be worn to prevent contact with the skin, either directly or through contaminated clothing.

Paraffin is flammable, therefore, the creation of spray, mist, or vapours, not only increases the fire risk, but also introduces a health hazard. The inhalation of high concentrations, may cause dizziness, headache, and nausea. The vapour is also irritating to the eyes and mucous membranes.

Fuel (Petrol)

Fuel is a narcotic and inhalation of heavy concentrations of vapour should be avoided.

Repeated or prolonged contact with the skin can cause skin disorders. It should not be used for cleaning the skin as it removes the natural oils.

Fuel may contain up to 5% of Benzene as an anti-knock additive. Benzene is extremely injurious to health (being carcinogenic) therefore, all contact should be kept to an absolute minimum, particularly inhalation.

Suitable protection should always be used e.g. gloves, aprons, and goggles.

Fuel has a sufficiently high vapour pressure to cause a hazardous build-up of vapour in poorly ventilated areas.

The vapours are irritant to the eyes and lungs and if high concentrations are inhaled it may cause nausea, headache, and depression.

White spirit

The major hazard of white spirit is skin irritation, therefore, it should not be used for removing grease, grime, paint, etc., from the skin. Skin contact should be avoided and gloves, aprons, etc., should be worn. If there is any risk of splashes entering the eyes, goggles should be used.

White spirit should only be used in well ventilated ereas and unnecessary breathing of the vapours should be avoided.

Treatment in the event of poisoning

In the event of acute poisoning occurring as a result of exposure to methylated spirit, paraffin, petrol, or white spirit, the patient should be removed from the hazard, into the fresh air, and medical attention obtained immediately.

Handling and disposal of components containing asbestos

These notes are provided for the guidance of Service Personnel handling components containing asbestos.

1. There is no application on current Rolls-Royce or Bentley cars involving the use of free asbestos fibres. All components containing asbestos are produced with the asbestos bonded into a matrix.

Asbestos is used in the following components.

a. Heat shields.
b. Parking brake pads.
c. Engine gaskets.
d. Gearbox brake bands.

In non-current cars asbestos is also used in service brake pads and linings and, where applicable, in the brake servo linings.

2. The form of asbestos used in these applications is chrysotile asbestos.

3. When disposing of parts identified as containing asbestos, the following procedure is advised.

a. Hard waste, i.e. parts where the asbestos is bonded by a matrix, may be handled and disposed of without special precautions [ref. United Kingdom Control of Pollution (Special Waste) Act 1980].

b. Dust containing asbestos, should be removed by vacuum cleaning. In the United Kingdom the vacuum cleaner must be approved to BSI 5415 Amendment 4, Section 2.2 1976 – Vacuum Cleaner Wet and/or Dry. The bags containing the dust should be disposed of by a method approved by your Local Authority.

When cleaning or servicing vacuum cleaners it is necessary to wear an air fed, or approved disposable, mask. Use of a wet cloth for cleaning is advised, which should after use, be disposed of in a similar manner to the asbestos dust.

c. It is not recommended to cut, abrade, or machine parts containing asbestos. In the event of it being necessary, dust formation is reduced by wetting of the work piece, hand tools, or low speed tools where possible. Use of local extraction and approved masks is recommended. The extracted material may need to be treated as asbestos dust.

4. Further information regarding the handling of asbestos can be obtained in the United Kingdom from local Health and Safety Offices.

Specification

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Audio equipment *Cars other than those conforming to an Australian, Japanese, North American, or South African specification prior to 1989 model year*	Combined radio/ cassette unit Bosch 'Bremen', 'Toronto', or 'New York', depending upon the car's specification	as 1	as 1	Combined radio/ cassette unit Bosch 'Vancouver'	as 1
1989 model year	Combined radio/ cassette unit. Bosch 'Bamberg'	as 1	as 1	Combined radio/ cassette unit Bosch 'Bremen'	as 1
Japanese cars prior to 1988 model year	Combined radio/ cassette unit. Pioneer 8800	as 1	–	Combined radio/ cassette unit Pioneer KEH 8800/ZRR	–
1988 model year	Pioneer KEH 8020	as 1	–	as 1	–
1989 model year	Pioneer KEH 8050/J	as 1	as 1	as 1	–
North American cars prior to 1989 model year	Combined radio/ cassette unit. Delco 2000 ETR VF	as 1	–	as 1	as 1
1989 model year	Pioneer KEH 8050 /UC	as 1	as 1	as 1	Pioneer KEX M700/UC
Australian cars	Combined radio/ cassette unit. Clarion 9000 E	as 1	as 1 *from 1989 model year*	as 1	–
South African cars	Combined radio/ cassette unit. Pioneer 8800 SA	as 1	as 1	as 1	as 1
Automatic air conditioning system	Supplies hot or cold air to independently ducted upper and lower systems. Air temperature sensors, air temperature selectors, electronic actuators, and a micro-processor board form the basic system. With the exception of when switched to the Economy mode (where the refrigeration compressor is disengaged), all air is refrigerated Refrigeration is provided from a compressor, through a condenser, to an evaporator matrix. Twin auxiliary engine cooling fans are fitted to aid refrigeration. The fans are switched from either engine coolant temperature or from refrigerant pressure.				
Braking system	Castrol hydraulic system mineral oil Refer to Chapter D – Lubricants	as 1	as 1	as 1	as 1
1987 model year cars other than those conforming to an Australian, Japanese, or North American specification. In addition, all cars from 1988 model year	The system incorporates anti-lock braking features (ABS)	as 1	as 1	as 1	as 1 *from 1988 model year*
	Maximum operating pressure (pump cut-out pressure) 180,0 bar (2610 lbf/in^2). Pump cut-in pressure 140,0 bar (2030 lbf/in^2)	as 1 as 1	as 1 as 1	as 1 as 1	as 1 as 1

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Caliper type					
Front	Four M16 calipers	as 1	as 1	as 1	as 1
Rear	Two T11/11 calipers	as 1	as 1	as 1	as 1
Brake pads					
Service (power)	Ferodo 3416F FF	as 1	as 1	as 1	as 1
Parking brake	Mintex M68/IGG	as 1	as 1	as 1	as 1
Pad area					
Service brake – Front	260 cm^2 (40.30 in^2)				
Rear	238 cm^2 (36 90 in^2)				
Parking brake	41,03 cm^2 (6.360 in^2)	as 1	as 1	as 1	as 1
Swept area					
Front	1503 cm^2 (233 in^2)				
Rear	1596 cm^2 (247 in^2)	as 1	as 1	as 1	as 1
Disc diameter Nominal	279,40 mm (11 00 in)				
Actual – Front	281 mm (11.060 in)				
Actual – Rear	277 mm (10.90 in)	as 1	as 1	as 1	as 1
Disc width					
Front (ventilated)	31,80 mm (1.250 in)				
Rear	12,70 mm (0.50 in)	as 1	as 1	as 1	as 1

Capacities	Metric	Imperial	US	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Braking and levelling hydraulic systems	5 litres	8.8 pt	10.50 pt	as 1 and 2	as 1 and 2	as 1 and 2
Cooling system	18 litres	31.7 pt	38.0 pt	as 1 and 2	as 1 and 2	as 1 and 2
Engine oil						
Sump	8,4 litres	14.7 pt	17.7 pt			
Filter	1,0 litre	1.75 pt	2 1 pt			
Cooler	0,5 litre	0.9 pt	1.0 pt			
Refill capacity	9,4 litres	16.5 pt	19.8 pt			
Total capacity	9.9 litres	17.4 pt	20.8 pt	as 1 and 2	as 1 and 2	as 1 and 2
Note When changing the oil filter the loss from the oil cooler is negligible						
Final drive unit	2,30 litres	4 pt	4.80 pt			
Fuel tank	108 litres	23.75 gal	28.50 gal			
Steering system	0,87 litre	1.53 pt	1.84 pt	as 1 and 2	as 1 and 2	as 1 and 2
Torque converter transmission (dry)	10,60 litres	18 70 pt	22 50 pt			
When changing fluid in sump only	2,80 litres	5 pt	6 pt			
When changing fluid in sump and renewing intake strainer	4,50 litres	8 pt	9 60 pt	as 1 and 2	as 1 and 2	as 1 and 2
Windscreen washer reservoir	5 litres	8.80 pt	10 50 pt	as 1 and 2	as 1 and 2	as 1 and 2
Headlamp power wash reservoir	6,50 litres	11 50 pt	13.70 pt	as 1 and 2	as 1 and 2	–
Windscreen/headlamp power wash reservoir – 1989 model year	10 litres	17.60 pt	21.0 pt	as 1 and 2	as 1 and 2	–
Power operated hood	–	–		–	–	0.43 litre 0 75 pt 0.9 pt

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Dimensions **Wheelbase**	3061 mm (120.50 in)	3162 mm (124 50 in)	as 1 LWB as 2	as 1	as 1
Track Front	Silver Spirit 1537 mm (60 50 in) Mulsanne/S 1549 mm (61.0 in)	1537 mm (60.50 in)	Bentley Turbo R 1549 mm (61 0 in) Bentley Turbo RL 1549 mm (61.0 in)	Steel wheels 1537 mm (60.50 in) Aluminium wheels 1549 mm (61.0 in)	Corniche/II 1537 mm (60.50 in) Continental 1549 mm (61.0 in)
Rear	Silver Spirit 1537 mm (60.50 in) Mulsanne/S 1549 mm (61.0 in)	1537 mm (60.50 in)	Bentley Turbo R 1549 mm (61.0 in) Bentley Turbo RL 1549 mm (61.0 in)	Steel wheels 1537 mm (60.50 in) Aluminium wheels 1549 mm (61.0 in)	Corniche/II 1537 mm (60 50 in) Continental 1549 mm (61.0 in)
Overall length *Cars other than those conforming to a North American specification*	5268 mm (207.42 in)	5370 mm (211.42 in)	5268 mm (207.42 in) **LWB** 5370 mm (211.42 in)	5268 mm (207.42 in)	5196 mm (204.60 in)
Cars conforming to a North American specification	5277 mm (207.75 in)	5379 mm (211.75 in)	5277 mm (207.75 in)	5277 mm (207.75 in)	5270 mm (207.50 in)
Overall width Excluding door mirrors	1887 mm (74.29 in)	as 1	as 1	as 1	1836 mm (72.33 in)
Including door mirrors	2008 mm (79.05 in)	as 1	as 1	as 1	1956 mm (77.05 in)
Overall height	1485 mm (58 46 in)	as 1	*Prior to 1989 model year* 1480 mm (58.27 in) *1989 model year* – as 1	as 1	1518 mm (59.75 in)
Ground clearance	165,1 mm (6.50 in)	as 1	*Prior to 1989 model year* 160,1 mm (6.30 in) *1989 model year* – as 1	as 1	152,4 mm (6.0 in)
Electrical system **Alternator**	Delco CS 144 (108 amperes)	as 1	as 1	as 1	as 1
Battery (Negative earth) *Cars other than those conforming to a North American specification*	Chloride 069 Low maintenance type (12 volts)	as 1	as 1	as 1	as 1
Cars conforming to a North American specification	Delco Freedom Maintenance free type (12 volts)	as 1	as 1 *from 1989 model year*	as 1	as 1
Ignition timing *Cars other than those incorporating a catalytic converter*	30° btdc± 1° at 2000 rev/min, with the hose to the vacuum advance capsule disconnected at the reducer connection and the exposed hose to the throttle body blanked off	as 1	*Prior to 1989 model year* Not adjustable. Idle check 7° btdc± 1° at 580 rev/min. Check settings 30° btdc ± 3° at 1500 rev/min, set with the hose from the induction mani-fold to the EZ 58F electronic control unit disconnected and the exposed induction manifold tapping blanked off 20° btdc± 1° at 2000 rev/min 21° btdc± 1° at 3000 rev/min.	as 1	as 1

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Ignition timing (continued)			*1989 model year* Not adjustable. Idle check 6°btdc± 1° at 580 ± 20 rev/min. Check setting 27°btdc± 1° at 1500± 50 rev/min.		
Cars conforming to a Middle East specification	25°btdc± 1° at 2000 rev/min	as 1	*Prior to 1989 model year* Not adjustable Idle check 7°btdc± 1° at 580 rev/min. *1989 model year* 6°btdc± 1° at 580± 20 rev/min.	as 1	as 1
Cars incorporating a catalytic converter	20°btdc± 1° at 1400 rev/min	as 1	*1989 model year* Not adjustable. Idle check 8°btdc± 1° at 580 ± 20 rev/min. Check setting 23°btdc± 1° at 1500± 50 rev/min.	as 1	as 1
Ignition coil	Lucas 32 C5	as 1	Twin Bosch	as 1	as 1
Ignition distributor	Lucas 35 DLM8 constant energy electronic	as 1	*Prior to 1989 model year* Twin rotor 8 cylinder distribution for use with Bosch EZ 58F digital ignition system *1989 model year* Twin rotor 8 cylinder distribution for use with Bosch K-Motronic digital system	as 1	as 1
Rotation	Anti-clockwise, viewed from the top	as 1	as 1	as 1	as 1
Advance mechanism	Automatic centrifugal advance	as 1	Electronically controlled	as 1	as 1
Firing order	A1, A3, B3, A2, B2, B1, A4, B4. 'A' bank is on the right when viewed from the driver's seat	as 1	as 1	as 1	as 1
Drive	Through camshaft skew gears	as 1	as 1	as 1	as 1
Sparking plugs	NGK BPR 5 EV	as 1	as 1	as 1	as 1
1989 model year cars incorporating a catalytic converter	NGK BPR 4 EVX	as 1	as 1 – All cars	as 1	as 1
Gap setting	1 mm (0.040 in)	as 1	as 1	as 1	as 1

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Starter motor	Nippondenso 1.4 kW	as 1	as 1	as 1	as 1
Windscreen wipers	Two 457 mm (18 in) wiper blades operated by a two-speed 28W permanent magnet motor	as 1	as 1	as 1	16W motor, otherwise as 1. 29W motor from mid-1988
Headlamp power wash *Cars other than those conforming to a Japanese or USA specification*	Two jets mounted in bumper; one central to each headlamp unit	as 1	as 1	as 1	–
Cars conforming to a Japanese or USA specification	Four jets; one mounted above each headlamp unit	as 1	–	as 1	–
	1989 model year Mulsanne S Two twin jet modules; one central to each pair of headlamps	–	*1989 model year* Turbo R as 1	*1989 model year* Eight as 1	–
Engine Type	Over square 90° Vee formation	as 1	as 1	as 1	as 1
Number of cylinders	Eight, in two banks of four	as 1	as 1	as 1	as 1
Bore	104, 14 mm (4.10 in)	as 1	as 1	as 1	as 1
Stroke	99,06 mm (3.90 in)	as 1	as 1	as 1	as 1
Total capacity	6,75 litres (411.90 in^3)	as 1	as 1	as 1	as 1
Compression ratio	8:1 or 9:1 according to the car's specification	as 1	8:1	as 1	as 1
Engine and transmission mounting points	Flexibly mounted on rubber at three points; one at the front, two at the rear	as 1	as 1	as 1	as 1
Camshaft Material	Alloy cast iron	as 1	as 1	as 1	as 1
Bearings	Surface machined in crankcase	as 1	as 1	as 1	as 1
Thrust taken	On front end	as 1	as 1	as 1	as 1
Drive	Through helical gears	as 1	as 1	as 1	as 1
Connecting rods	'H' section forgings, balanced before fitting to engine	as 1	as 1	as 1	as 1

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Connecting rods (continued) Material	Chrome molybdenum steel	as 1	as 1	as 1	as 1
Big-end bearings	Split steel backed shells lined with 20% tin-aluminium	as 1	as 1	as 1	as 1
Small-end bushes	Pressed into connecting rod small-end bosses	as 1	as 1	as 1	as 1
Material	Lead-bronze, steel backed	as 1	as 1	as 1	as 1
Crankshaft	Dynamically balanced two plane crankshaft with four crankpins and integral balance weights	as 1	as 1	as 1	as 1
Material	Chrome molybdenum steel. Nitride hardened	as 1	as 1	as 1	as 1
Damping	Bonded rubber vibration damper	as 1	as 1	as 1	as 1
Direction of rotation	Clockwise (when viewed from front of engine)	as 1	as 1	as 1	as 1
Cylinder block Type	Monobloc casting	as 1	as 1	as 1	as 1
1989 model year	Ribbed and cross-bolted	as 1	as 1	as 1	as 1
Material	Cast aluminium alloy	as 1	as 1	as 1	as 1
Cylinder heads	Two detachable heads, each having four separate inlet and exhaust ports	as 1	as 1	as 1	as 1
Material	Aluminium alloy, with phosphor bronze exhaust valve guides, cast iron inlet guides, and valve seat inserts of austenitic alloy	as 1	as 1	as 1	as 1
Cylinder liners Type	Detachable wet liners	as 1	as 1	as 1	as 1
Material	Cast iron	as 1	as 1	as 1	as 1
Main bearings	Split steel backed shells lined with 20% tin-aluminium	as 1	as 1	as 1	as 1

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Pistons	Aeconoguide pistons. The crown of the pistons differ to give a compression ratio of either 8:1 or 9:1 dependent upon the car's specification	as 1	as 1 (8 1)	as 1	as 1
Material	Aluminium alloy with steel struts	as 1	as 1	as 1	as 1
Number of rings	Two compression and one 'H' flex oil control ring	as 1	as 1	as 1	as 1
Valve gear Inlet valves	Overhead push rod operated	as 1	as 1	as 1	as 1
Material	Alloy steel	as 1	Austenitic steel with stellite tip	as 1	as 1
Cars from approximately mid-March 1988	Austenitic steel with stellite tip	as 1	as 1	as 1	as 1
Exhaust valves	Overhead push rod operated	as 1	as 1	as 1	as 1
Material	Austenitic steel with stellite tip and valve seat	as 1	as 1	as 1	as 1
Tappets	Self-adjusting hydraulic tappets The base of the tappets have a spherical radius	as 1	as 1	as 1	as 1
Material	Alloy cast iron	as 1	as 1	as 1	as 1
Push rods	Rods are hollow and have spherical ends	as 1	as 1	as 1	as 1
Lubrication system Type	Wet sump	as 1	as 1	as 1	as 1
Relief valve setting	2,74 bar (40 lbf/in^2)	as 1	as 1	as 1	as 1
Oil pump	Helical gear type with fine mesh strainer	as 1	as 1	as 1	as 1
Oil filter	Sealed disposable type; full flow with filter by-pass relief valve	as 1	as 1	as 1	as 1
Oil cooler	Mounted forward of radiator	as 1	as 1	as 1	Mounted forward of right-hand front wheel
Cooling system Type	Pressurized system	as 1	as 1	as 1	as 1
Pump type	Centrifugal	as 1	as 1	as 1	as 1
Pump drive	Twin 'V' belts	as 1	as 1	as 1	as 1

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Cooling system (continued) Radiator matrix type	Aluminium tube and fin construction, with plastic top and bottom tanks	as 1	as 1	as 1	as 1
Thermostat opening temp	85°C to 89°C (185°F to 192°F)	as 1	as 1	as 1	as 1
System pressure	1.03 bar (15 lbf/in^2)	as 1	as 1	as 1	as 1
Engine fan	Viscous drive coupling with a seven blade 508 mm (20 in) dia. plastic fan located at the rear of the radiator	as 1	as 1	as 1	Viscous drive coupling with a seven blade 483 mm (19 in) dia. metal fan located at the rear of the radiator
Auxiliary fans	Twin electrically operated four blade 250 mm (9.813 in) dia. plastic fans located forward of the radiator	as 1	as 1	as 1	as 1
Turbocharging system	–	–	Engine fitted with a Garrett AiResearch T04B exhaust driven turbocharger. Boost pressure limited by a 'wastegate' in the exhaust system *1989 model year* Behr intercooler; lowers compressed air temperature	–	–
Exhaust system Type	Twin pipe system down right-hand side of car	as 1	Single downtake pipe leading to a twin pipe system	as 1	as 1
Silencers *Cars other than those incorporating a catalytic converter*	Two	Two	Three	Two	Two
Cars incorporating a catalytic converter prior to 1989 model year	One (plus a catalytic converter)	as 1	–	as 1	as 1
1989 model year cars incorporating a catalytic converter	One (plus a catalytic converter)	as 1	One (plus one warm-up and twin main catalytic converters)	as 1	as 1

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Fuel system **Fuel recirculation system**	Excess fuel not required by the engine returned to the fuel tank via a non-return valve	as 1	as 1	as 1	as 1
Fuel filters Main fuel filter	Disposable canister	as 1	as 1	as 1	as 1
In-tank filter	Strainer on inlet to pre-pump	as 1	as 1	as 1	as 1
Fuel tank	Located behind the trim panel at the forward end of the luggage compartment	as 1	as 1	as 1	as 1
Fuel grade *Cars other than those incorporating a catalytic converter*	97 octane (minimum) 4 star where BS 4040 is applicable	as 1	*Prior to 1989 model year* as 1 *1989 model year* as 1 or 95 octane (minimum) premium unleaded fuel	as 1	as 1
Cars incorporating a catalytic converter	Unleaded fuel only 91 RON (87 AKI in North America) minimum	as 1	*1989 model year* Unleaded fuel only 95 RON (91 AKI in North America) minimum	as 1	as 1
Fuel pump(s)	Roller cell type main pump, a pre-pump unit fitted inside the fuel tank primes the main pump	as 1	as 1	as 1	as 1
Fuel cooler *1989 model year*	Incorporated in ACU refrigerant system	as 1	as 1	as 1	as 1
Fuel injection system	Bosch K-Jetronic continuous fuel injection	as 1	*Prior to 1989 model year* Bosch KE2-Jetronic, also incorporates electronic control of mixture strength *1989 model year* Bosch KE3-Jetronic. Fuel injection and ignition systems controlled together. Collectively known as Bosch K-Motronic system	as 1	as 1
Cars incorporating a catalytic converter	The fuel injection system also incorporates 'closed loop' mixture control	as 1	*1989 model year* as 1	as 1	as 1

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Kerb weights Car unladen but complete with oil, coolant, and a full tank of fuel *Cars other than those incorporating a catalytic converter prior to 1989 model year*	2245 kg (4950 lb)	2295 kg (5060 lb)	2315 kg (5105 lb) LWB 2341 kg (5161 lb)	2245 kg (4950 lb)	2360 kg (5203 lb)
Cars incorporating a catalytic converter prior to 1989 model year	2263 kg (4990 lb)	2286 kg (5040 lb)	–	2263 kg (4990 lb)	2359 kg (5200 lb)
1989 model year cars other than those conforming to a Canadian or USA specification	2320 kg (5120 lb) Mulsanne S LWB 2350 kg (5180 lb)	2350kg (5180 lb)	2390 kg (5270 lb) LWB 2410 kg (5310 lb)	2320 kg (5120 lb)	2420 kg (5340 lb)
1989 model year cars conforming to a Canadian or USA specification	2290 kg (5050 lb) Mulsanne S LWB 2300 kg (5070 lb)	2300 kg (5070 lb)	2390 kg (5270 lb) LWB 2410 kg (5310 lb)	2290 kg (5050 lb)	2370 kg (5230 lb)
Suspension Front	Independent coil spring arrangement with lower wishbones, compliant controlled upper levers, telescopic dampers, and anti-roll bar mounted on the front sub-frame.				
Rear	Independent coil spring arrangement with semi-trailing arms, suspension struts, gas springs, and anti-roll bar. Automatic levelling achieved by displacement of hydraulic system mineral oil in the struts.				
Steering	Power assisted, rack and pinion steering with centre off-take	as 1	as 1	as 1	as 1
Steering ratio	17.5:1	as 1	as 1	as 1	as 1
Turns of steering wheel lock-to-lock	3.25	as 1	as 1	as 1	as 1
Front and rear hubs	Taper roller bearings	as 1	as 1	as 1	as 1
Front wheels steering geometry Camber	0.5°±15′ negative	as 1	as 1	as 1	as 1
Caster	2°30′ to 3°30′ positive	as 1	as 1	as 1	as 1
Kingpin inclination	11.5°	as 1	as 1	as 1	as 1
Toe-in	12′±5′	as 1	as 1	as 1	as 1
Turning angle of inner steered wheel for 20° turn of outer steered wheel	21°6′	as 1	as 1	as 1	as 1

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R		4 Bentley Eight	5 Corniche Corniche II Continental
Rear wheels geometry Unloaded sub-frame settings removed from car, mounted on setting jig						
Camber	0°±15′	as 1	as 1		as 1	as 1
Maximum difference in Camber across the sub-frame	15′	as 1	as 1		as 1	as 1
Total toe-in	28′±4′	as 1	as 1		as 1	as 1
Turning circle Kerb to kerb	Silver Spirit 12,05 m (39.5 ft) Mulsanne/S 12,16 m (39.9 ft) Mulsanne S LWB 12,62 m (41.4 ft)	12,50 m (41.0 ft)	Bentley Turbo R 12,16 m (39.9 ft) Bentley Turbo R LWB 12,62 m (41.4 ft)		Steel wheels 12,05 m (39.5 ft) Aluminium wheels 12,16 m (39.9 ft)	Corniche/II 12,05 m (39.5 ft) Continental 12,16 m (39.9 ft)
Transmission **Final drive unit and drive-shafts**			*Cars without catalytic converters*	*Cars with catalytic converters*		
Crown wheel teeth	43	as 1	41	43	as 1	as 1
Bevel pinion teeth	16	as 1	18	16	as 1	as 1
Final drive unit ratio	2.69:1	as 1	2.28:1	2.69:1	as 1	as 1
Top gear speed per 1000 rev/min	48,3 km/h (30 mile/h)	as 1	Avon tyres 57,3 km/h (35.6 mile/h)	48,4 km/h (30.1 mile/h)	as 1	as 1
Overall gear ratios – Forward	6.73:1 4.04:1 2.69:1	as 1 as 1 as 1	5.70:1 3.42:1 2.28:1	6.73:1 4.04:1 2.69:1	as 1 as 1 as 1	as 1 as 1 as 1
Reverse	5.38:1	as 1	4.56:1	5.38:1	as 1	as 1
Final drive unit	Hypoid bevel	as 1	as 1		as 1	as 1
Torque converter transmission Type	Automatic torque converter	as 1	as 1		as 1	as 1
Make	General Motors Turbo Hydramatic Model 400 – 3 speed	as 1	as 1		as 1	as 1
Converter gear ratios – Forward	2.5:1 1.5:1 1.0:1	as 1	as 1		as 1	as 1
Reverse	2.0:1	as 1	as 1		as 1	as 1
Gearchange	Electrically operated, steering column mounted selector	as 1	as 1		as 1	as 1

	1 Silver Spirit Mulsanne Mulsanne S	2 Silver Spur	3 Bentley Turbo R	4 Bentley Eight	5 Corniche Corniche II Continental
Torque converter transmission (continued) Transmission lock	Engaged when gear range selector is in 'park' position, or when ignition key is removed from switchbox	as 1	as 1	as 1	as 1
Wheels and Tyres **Wheels**	Silver Spirit 6JK x 15 Mulsanne/S 6½J x 15	6JK x 15	7½J x 15	Steel wheels 6JK x 15 Aluminium wheels 6½J x 15	Corniche/II 6JK x 15 Continental 6½J x 15
Type	Silver Spirit Pressed steel Mulsanne/S Aluminium alloy	Pressed steel	Aluminium alloy	Pressed steel or Aluminium alloy	Corniche/II Pressed steel Continental Aluminium alloy
Fixing	5 stud, right-hand wheel nuts have right-hand threads; left-hand wheel nuts have left-hand threads	as 1	as 1	as 1	as 1
Tyres	235/70 HR15 (HR70 HR15) or 235/70 VR15 (HR70 VR15) steel braced radial ply dependent upon the car's specification	as 1	255/65 VR15 or 275/55 VR15 steel braced radial ply	as 1	as 1
Recommended tyre inflation pressures – cold	Refer to Chapter R – Wheels and Tyres	as 1	as 1	as 1	as 1

Data

This symbol identifies the items using hydraulic system mineral oil within this section

Automatic air conditioning system

The automatic air conditioning system supplies hot, warm, cool, or cold air to the interior of the car.

Air temperature (blend) flaps form the basis of the system as they are operated by electronic actuators controlled by signals from a micro-processor board. The micro-processor board is fed with air temperature information from certain parts of the car and, acting on this information drives the actuators so that the air temperature (blend) flaps are moved into the correct positions to achieve the required in-car air temperature. The upper and lower systems operate independently.

The system is operated by four switch controls situated on the facia.

The control marked AIR CONDITIONER has six positions and enables four automatic positions or a defrost position to be selected. The system can be switched off by turning the control to the OFF position.

The override/recirculation switch marked SCREEN-FACIA and RECIRC can be used to divert the flow of air from the windscreen to the facia outlets and vice versa, or to obtain in-car air recirculation.

The switch controls marked UPPER TEMPERATURE and LOWER TEMPERATURE control the air temperature in the upper and lower systems.

Automatic height control system

Hydraulic levelling is achieved by using suspension struts in conjunction with gas springs. Alterations to the vehicle weight are supported by the gas springs and the levelling is effected by pumping extra oil (under pressure from the accumulators) into the gas spring and strut assemblies.

Automatic speed control system

The controls for the automatic speed control system are fitted to the end of the gear range selector lever. The actuator is mounted on the engine.

Any cruising speed from 48 km/h (30 mile/h) up to speeds in excess of 161 km/h (100 mile/h) may be selected to give satisfactory operation of the system.

Warning Always ensure that the legal maximum speed limits are not exceeded.

Body

The car body is steel and is of a monocoque construction. The doors, luggage compartment lid, and bonnet are made of light alloy, combining lightness with strength and rigidity.

Braking system

Pressurized mineral oil is supplied from two camshaft driven pumps and fed into two hydraulic accumulators. Power pressure is metered out to the brakes by two distribution valves actuated by operation of the brake pedal.

The system comprises two independent power hydraulic circuits.

On cars incorporating anti-lock braking features (ABS), one hydraulic circuit operates two twin-piston caliper assemblies on each front wheel. The other circuit operates a four-piston caliper assembly on each rear wheel.

On cars not incorporating anti-lock braking features, each hydraulic circuit operates a twin-piston caliper assembly on each front wheel and a pair of pistons, housed in a four-piston caliper assembly, on each rear wheel.

All cars

A pad wear sensor, linked with a warning panel on the facia, is fitted into the inboard brake pad on each leading front brake caliper assembly.

Braking units

Discs front (ventilated) and rear; two double cylinder calipers on each front wheel and one four cylinder caliper on each rear wheel.

Parking brake

Separate mechanically controlled calipers are attached to the service brake calipers at each rear wheel. Parking brake operation is by foot pedal application with separate hand lever release.

Electrical system

Battery

The battery is situated in a well below the floor of the luggage compartment. To gain access to the battery, turn back the carpet at the right-hand side of the luggage compartment and lift off the battery cover panel.

Battery master switch

On cars other than those conforming to a West German specification, a battery master switch (which enables the battery to be isolated from the electrical circuits) is provided on the right-hand side of the luggage compartment.

Note Never operate the master switch with the engine running.

Exterior lamps

Four headlamps, or two headlamps and two fog lamps are fitted dependent upon the car and country specification. The headlamps contain either sealed beam

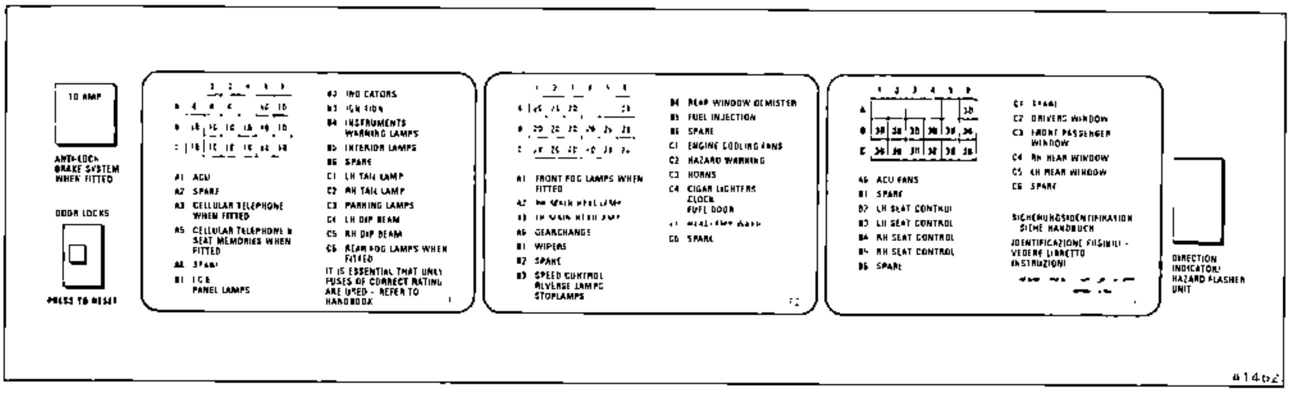


Fig. A5-1 Typical fuseboard identification plate

units or bulbs dependent upon the car's specification. The two inner headlamps provide long range illumination. The two outer headlamps may be dual purpose or single, dependent upon the car's specification. The dual purpose headlamps provide both long range illumination and short range 'flood' illumination. When switched to main beam all headlamps are illuminated.

On cars conforming to a United Kingdom specification, the two dual purpose outer lamps also operate at a reduced intensity when switched to the PARK position, with the ignition key in the RUN position.

1989 model year cars

All Bentley cars have twin round headlamps. The only exception being *four door cars conforming to a Japanese or USA specification,* which have separately switched fog lamps in the inner positions.

On cars conforming to a Canadian specification, the two dual purpose outer lamps also operate at a reduced intensity, with the ignition key in the RUN position.

All cars

A warning lamp situated on the facia illuminates when the headlamps are switched to main beam.

For certain countries twin front and/or rear fog lamps are fitted.

The front position (side), rear position (tail) and rear number plate lamps illuminate whenever the main lighting switch is moved from the OFF position.

Interior lamps

Four door cars

Interior roof lamps, footwell illumination lamps, and step illumination lamps are fitted. These lamps illuminate whenever a door is opened. Certain interior lamps will also illuminate when the main lighting switch is withdrawn, or the map/mirror switch and rear companion switches are operated. Also, the vanity mirror (if fitted) in the passenger's sun visor has a small illumination lamp (except Bentley Eight; *cars other than those conforming to a North American specification).* This lamp is operated from a dual function switch alongside the facia stowage compartment. However, if the lamp is left switched on and the sun visor is raised, the lamp will extinguish.

Corniche/Continental

Interior roof lamps and footwell illumination lamps are fitted. These lamps illuminate whenever a door is opened. The roof lamps and rear footwell lamps can also be illuminated by withdrawing the main lighting switch, or by operating either of the two rear switches situated on each rear arm rest. When a rear switch is operated, only the lamps on the same side of the car as the switch will be illuminated.

Fuseboard

The fuseboard is situated in the lower facia below the stowage compartment. Access is gained by pressing a button situated in the outer edge of the facia panel.

The fuseboard identification plate is visible when the cover is lowered (see fig. A5-1).

Windscreen washers reservoir

The windscreen washers reservoir is located in the engine compartment on the right-hand valance, adjacent to the front road spring pot.

Operation of the washers is controlled by a switch situated in the end of the direction indicator lever. If there is a low level of fluid in the washers reservoir, the warning panel marked WASHER FLUID situated on the facia will illuminate whenever the switch is depressed with the ignition switched on.

Headlamps power wash reservoir

Four door cars – Prior to 1989 model year

The headlamps power wash reservoir is situated under the right-hand front wing, directly behind the headlamp unit(s). If there is a low level of fluid in the reservoir, the warning panel marked WASHER FLUID situated on the facia will illuminate whenever the washer switch is depressed with the ignition switched on.

Note If the warning panel marked WASHER FLUID is illuminated, the level may be low in **either** the windscreen or headlamps washer bottles.

Windscreen/headlamps power wash reservoir

Four door cars – 1989 model year

The windscreen/headlamps power wash reservoir is situated under the left-hand front wing, directly behind the headlamp unit(s). If there is a low level of fluid in the reservoir, the warning panel marked WASHER FLUID on the facia will illuminate whenever the washer switch is depressed with the ignition switched on.

Headlamps power wash

Four door cars

Cars other than those conforming to a Japanese or USA specification, two jets in the bumper; one mounted centrally to each headlamp unit.

Cars conforming to a Japanese or USA specification, four jets; one mounted above each headlamp unit.

1989 model year Bentley cars, two twin jet modules in the bumper; one mounted centrally to each pair of headlamp units.

The headlamp power wash system is controlled by the push button switch situated in the end of the direction indicator lever. The system will only operate when the main lighting switch is moved to the HEAD position.

Windscreen wipers

Operation of the wipers is controlled by a switch on the facia marked . The switch has two clockwise positions and four anti-clockwise positions. The first clockwise position provides wiping at the normal speed, the second position increases the speed.

However, turning the switch anti-clockwise provides four intermittent operations at pre-set intervals of approximately 4, 7, 14, and 21 seconds. The time intervals increase as the switch is rotated anti-clockwise.

Engine

Lubrication system

The engine oil from the sump is circulated by a gear type pump mounted to the front of the crankcase and driven by the crankshaft through skew gears.

High pressure oil is fed to the turbocharger (if fitted), crankshaft, big-end bearings, camshaft bearings and timing gears, tappets, push rods, and rocker ball end seatings. Low oil pressure is fed through the front camshaft bearing to the rocker shafts, rocker arms and valve tips. The connecting rod small-ends, gudgeon pins, and cylinder walls are lubricated by a splash feed.

Cooling system

The engine cooling system comprises a pressurized expansion bottle, a radiator matrix, and a centrifugal pump. The pump is driven by the crankshaft through twin matched belts. The expansion bottle is mounted separately on the left-hand valance.

A viscous drive coupling is fitted in conjunction with the fan attached to the coolant pump pulley, to reduce fan noise at high speeds.

Twin electrically operated booster fans are mounted behind the radiator grille. Both fans are switched from either engine coolant temperature, or from refrigerant pressure.

Cooling system corrosion and freeze protection

ICI 007/400F Coolant/Anti-freeze.

A 50% mixture with water gives frost protection down to a temperature of −37°C (−35°F). This mixture should be used all the year round as it not only provides protection against frost but also prevents corrosion of the cooling passages.

Specific gravity of coolant

The coolant should be checked for a 50% concentration with a refractometer (see Chapter L). However, if a refractometer is not available and a hydrometer has to be used, a scale reading of between 1.060 and 1.070 should be obtained, with the coolant at room temperature for the mixture to be correct.

Front and rear hubs

The front hubs are mounted onto the yoke stub axle. The rear hubs are mounted on hollow stub axles and are connected to the final drive unit by constant velocity joints and drive-shafts.

Power assisted steering

Power assisted steering with energy absorbing collapsible steering column is fitted. The steering unit, which is a rack and pinion arrangement with centre off-take, is supplied with hydraulic fluid under pressure by an engine driven pump. The fluid feed line incorporates an anti-joggle valve and a fluid cooler is fitted into the return line.

Sub-frames

The front sub-frame manufactured from welded sheet steel is mounted on rubber mounts to the car underframe.

The rear sub-frame is mounted to the car body at its four corners by cylindrical rubber mounts.

Suspension

The compliant front suspension is an independent coil spring arrangement with double acting hydraulic shock dampers, anti-roll stabilizer bar, and compliance rods, all of which are attached to the front sub-frame.

The rear suspension is an independent coil spring arrangement with trailing arms, suspension struts, and anti-roll bar. The trailing arms are pivoted on the rear suspension crossmember. Suspension struts are attached to extension brackets on the rear ends of the trailing arms.

Transmission

Final drive unit and drive-shafts

The final drive unit is mounted onto a crossmember which forms part of the rear sub-frame. Bolt on extension brackets connect the final drive crossmember to rubber mounts attached to the body underfloor. The rear suspension crossmember is attached to the final drive crossmember by six frame tubes and a torque arm.

The final drive unit comprises a centre differential gearbox which contains the hypoid crownwheel, pinion gears, a differential housing, and two drive-shafts which transmit the drive to the rear wheels. The joints on the drive-shafts are enclosed by convoluted seals to prevent dirt and water entering the joint and to prevent oil leakage.

Propeller shaft
The shaft is connected to the torque converter transmission output shaft flange and to the final drive input flange by either universal joints or flexible couplings, depending upon the car's specification.

The propeller shaft assembly is dynamically balanced to fine limits.

Torque converter transmission
The torque converter transmission transmits the drive automatically in three forward ranges and reverse. Gear changes are made automatically and are obtained through a three element hydraulic torque converter and a compound planetary gear train. A parking lock incorporated in the torque converter transmission operates when the gear range selector lever is moved to the park position or when the ignition key is removed from the switchbox.

Body and coachwork

Care of the exterior

Retractable mascot

The following information is applicable to Rolls-Royce cars conforming to an Australian, European, Middle East, or United Kingdom specification.

The 'Flying Lady' mascot will retract into a well in the radiator shell if it is deflected by a rearward or sideways force.

The mascot retracts quite suddenly, therefore care must be taken to avoid any contact with the mascot as it retracts.

To prevent retraction, all contact with the mascot should be kept to a minimum and when cleaning the mascot or adjacent parts of the car, the mascot should be held with a slight pressure so that the locking catch cannot disengage.

When the mascot has retracted, it can easily be returned to its raised position by lifting it upwards, against spring pressure, until it locks into position. Do not release the mascot until the locking catch has engaged.

Should it be required to retract the mascot, for example to avoid damage when the car is being transported, press the mascot rearward to disengage the locking catch. Care must be taken to avoid contact with the mascot as it retracts.

When the mascot is to remain in the retracted position for any length of time, the retraction well should be covered with masking tape to prevent any items falling into the recess which could cause damage to the retraction mechanism.

Paintwork

In order to maintain the paintwork in good condition, the following procedures are recommended.

Always wash the paintwork with clean, preferably running, cold water. Frequent washing is the best safeguard against contaminants.

Do not use excessive pressure from the hose but thoroughly wet the car all over before commencing cleaning.

Start at the top of the car and work down using clean sponges and fresh water. If washing with cold water is not effective, warm water with a small amount of a mild detergent such as Teepol will help remove the gummy deposits exuded by some trees in the summer months, but always rinse off well with clean cold water.

Remove the water with a chamois leather. When leathering off the car, the leather should be washed frequently in clean, cold water. Also sponge and leather all window frames, door edges, exterior lamps, mirrors, air dams, bumpers, and wheel trims.

Finally, using clean water clean the windscreen, rear window, and door windows inside and out. Lower the door windows to clean the portion normally covered by the channels.

Remove any road tar from the car by gently rubbing with a soft cloth moistened with turpentine substitute.

Under no circumstances should any attempt be made to remove remove dirt, mud, or dust when dry or with a dry cloth. This practise can produce serious scratching of the surface finish.

The use of automatic car washes is not recommended as the detergents used and the nylon brush washing action may stain or seriously scratch the paintwork, or damage the windows and radiator shell.

At least every three months, after normal cleaning with cold water, the paintwork should be restored by the application of a suitable cleaner/polish. In climatic conditions where long periods of sunshine prevail, more frequent cleaning/polishing may be necessary.

Do not polish the car in a dusty or gritty atmosphere or in direct sunlight.

When polishing the car, do not apply a wax polish on top of previous wax layers and traffic film as a build-up of wax can induce its own type of rain spotting or discolouration defects. A good quality friction emulsion cleaner/polish should be applied in accordance with the manufacturer's instructions.

After the cleaner/polish has been applied and removed, a good quality wax polish should then be applied.

If regular maintenance polishing is not carried out, the original gloss will become obscured and rain spotting may reach objectionable proportions.

Roof materials

Should the material which is used to cover the hood/roof panel on certain cars become ingrained with dirt, wash the material with a solution of water and a mild detergent such as Teepol. If necessary, use a soft bristled brush to work the detergent into the material; brush in a fore-aft direction along the line of the stitching, not across the material. Afterwards, wash with clean cold water to remove all traces of the detergent.

Under no circumstances should chemical solvents, polishes, or detergents (other than those specified) be applied to the roof materials.

The following is applicable to Everflex roof material only.

A special vinyl top dressing preparation is applied to protect the Everflex roof material prior to delivery. Also, as a further protection the stitching is sealed with a wax dressing, which is rubbed into the stitching after the vinyl dressing has been applied. Further applications may be required at approximately 18 monthly intervals. Both of these preparations are

Printed in England

available from the Parts Distribution Centre at Rolls-Royce Motor Cars Limited, Crewe.

Power operated hood
To avoid creasing the hood material it is advisable to always erect the hood when the car is immobile for any length of time.

Plating
Stainless steel and chromium plating should be cleaned with a damp cloth and then polished with a soft dry cloth. Under no circumstances should a metal polish be applied.

Where tarnishing has occured, a dilute solution of ammonia will usually suffice to remove it. This solution must not be allowed to lie upon the paintwork for any length of time.

De-icing fluid
If de-icing fluid is used on the exterior of windows, the instructions marked on the fluid container should be strictly observed. Undiluted de-icing fluid should not be allowed to come into contact with the paintwork or with the windscreen wiper blades, if it does however wipe off immediately.

Windscreen washer jet adjustment
The windscreen washer jets are situated on the scuttle between the air intake grilles.

On four door cars, fluid from the jets should impinge onto the windscreen approximately 419 mm (16.5 in) from the centre line of the windscreen and 190 mm (7.5 in) below the windscreen top finisher.

On Corniche/Continental cars, fluid from the jets should impinge onto the windscreen towards the top of the arc traversed by the wiper blades.

To adjust the direction of spray from a jet, place a suitable tube over the jet nozzle and swivel it to the required position.

Windscreen wiper blade replacement
When the windscreen wiper blades are worn, causing unsatisfactory cleaning of the windscreen, they should be replaced.

Four door cars

To renew the wiper blade fitted to the passenger's side of the windscreen, lift the wiper arm away from the windscreen and pivot the blade backwards through 90°. Press the small release tag, situated on the underside of the blade pivot block and push the blade out of the crooked end on the wiper arm. Withdraw the wiper blade from the arm. Fit the new blade by reversing the removal procedure.

To renew the wiper blade on the driver's side of the windscreen, lift the wiper arm away from the windscreen. Press the top half of the blade forward until the blade is released from its location clip on the wiper arm. To fit the new blade position it on the wiper arm and press it firmly into the location clip.

Corniche/Continental

Move the wiper arm away from the windscreen, then press the small tab situated on the wiper blade in order to release the blade. Pull the wiper blade off the arm and press on the new blade. Check that the new blade is held securely onto the arm, then return the arm to the windscreen.

Note Care must be taken during these operations. Ensure that the wiper arm is not allowed to spring back on to the windscreen when the blade has been removed or damage to the windscreen could occur.

Radio aerial
To ensure the best reception, the aerial should be kept clean and periodically lubricated with a non-abrasive electrical contact cleaner.

Care of the interior

Carpets
The carpets should be cleaned periodically with a vacuum cleaner or soft brush in order to remove dust and dirt. The carpets are secured in position by press fasteners and can easily be removed to facilitate cleaning.

Stains or grease marks may be removed from the carpets by means of a mild detergent diluted with clean, warm water but care should be taken not to over-wet the material.

Lambswool rugs
To clean the rugs remove them from the car, then shake and beat them to release any dust and grit. Comb the wool with a suitable wire comb or coarse bristle brush to free the wool fibres.

If a rug is wet, allow it to dry at room temperature. Never expose the rug to direct heat or dry it on a radiator or towel rail.

To remove slight stains or congealed dirt use a mild carpet shampoo solution.

Immerse a clean cloth into the solution, then lightly wring out. Clean an area of approximately 0,1 m^2 (1 ft^2), taking care not to over-wet the rug, then wipe with a clean dry cloth. Repeat this procedure over the remaining area of the rug.

Allow the rug to dry then comb the rug to free the wool fibres.

If the rugs become heavily soiled or stained they should be sent to a specialist sheepskin cleaner.

Never send the rugs to a laundry or drycleaner.

Never use an aqueous washing process.

Always ensure that the cleaning specialist is aware that the inner felt of the rugs **must** be removed prior to the cleaning process being carried out.

Leather upholstery
Leather upholstery should be cleaned with a damp cloth. If necessary, the application of a little neutral soap will remove more obstinate marks.

Caustic soap, petrol, or volatile cleaning solvents such as acetone, thinners, and nail varnish remover, must not be used to clean the upholstery.

An occasional application of Connolly's Hide Food, used in accordance with the manufacturer's instructions, will preserve the upholstery.

Cloth upholstery
Cloth upholstery should be cleaned by first brushing the soiled area to remove any loose particles of dirt.

The affected area should then be cleaned with a good quality carpet shampoo, used in accordance with the manufacturer's instructions. Alternatively, a solution of a synthetic detergent and lukewarm water can be used. Whichever method is used, care should be taken not to over-wet the upholstery.

Finally, the upholstery should be wiped with a clean cloth and allowed to dry naturally.

Headlining material
For cloth headlining, clean as 'Cloth upholstery'.

For simulated leather and hide headlinings, clean as 'Leather upholstery'.

Interior woodwork
Interior woodwork should be cleaned with a damp cloth, then dried and polished with a clean, dry cloth.

Water must never be allowed to lie upon the woodwork.

Special procedures

This symbol identifies the items using hydraulic system mineral oil within this section

Heli-coil inserts

Heli-coil inserts are used on various aluminium parts of the engine. They offer a far greater resistance to wear, stripping, seizing, and corrosion than direct type threads.

Heli-coils have been used only where the parts are secured by setscrews, not where studs are fitted.

The Heli-coil inserts are made of stainless steel wire and can therefore be easily identified when fitted into their aluminium components.

Heli-coil insert – To remove (see fig. A7-1)

1. Fit the blade of the Heli-coil insert extraction tool into the top of the threaded insert.
2. Press downwards onto the insert and then turn the blade anti-clockwise; the insert should then wind out of the hole.
3. Examine the condition of the threads in the hole from which the Heli-coil was removed. If necessary rectify any damage by using a special Heli-coil insert tap.

Heli-coil insert – To fit

As it is necessary to remove the tang from the end of the Heli-coil insert after fitting, it is important to ensure that the insert tang is notched.

Using the Heli-coil insertion tool shown in figure A7-2 proceed as follows.

1. Withdraw the mandrel from the threaded nozzle and loading chamber.
2. Fit the insert into the chamber with the tang end positioned towards the nozzle.
3. Slide the mandrel through the insert and engage the tang into the slot.
4. Turn the handle clockwise, applying gentle pressure on the insert until it is located into the nozzle.
5. Continue turning until the first coil of the insert just emerges from the nozzle.
6. Fit the insertion tool over the tapped hole ensuring that is square to the work face.
7. Commence winding until the insert is transferred from the nozzle to the tapped hole. Do not apply any pressure during this operation.
8. The Heli-coil insert is finally fitted when the coil is between ¼ and ½ a pitch below the surface of the work face.
9. Fit the special tang break off tool (punch) into the insert as shown in figure A7-3.
10. Allow the innerpiece of the punch to slide downward to locate onto the tang.
11. Apply a sharp tap to the end of the punch so that the tang breaks off at the notch.

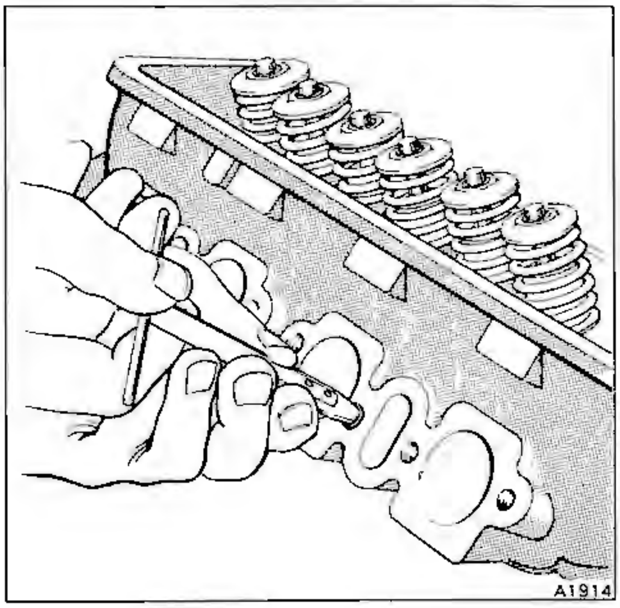


Fig. A7-1 Heli-coil extraction tool

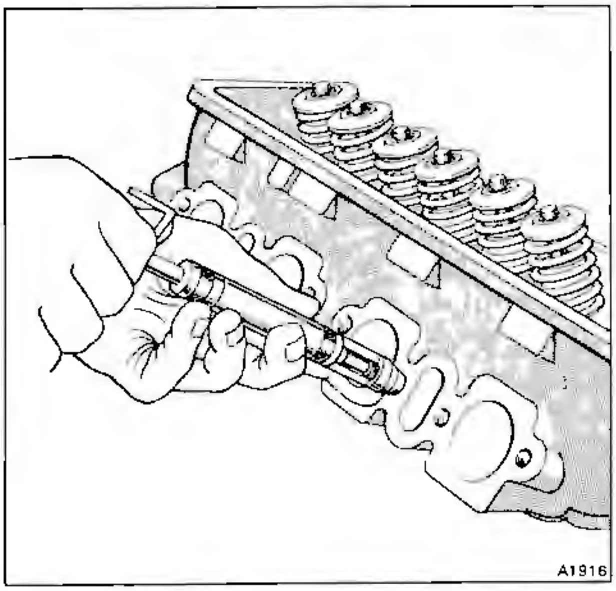


Fig. A7-2 Heli-coil insertion tool

12. Ensure that the tang does not fall into any part of the engine, etc., where it could cause damage.

Hydraulic systems to depressurize

Either of the two following methods may be employed to depressurize the systems but generally it will be found that the first is the more convenient.

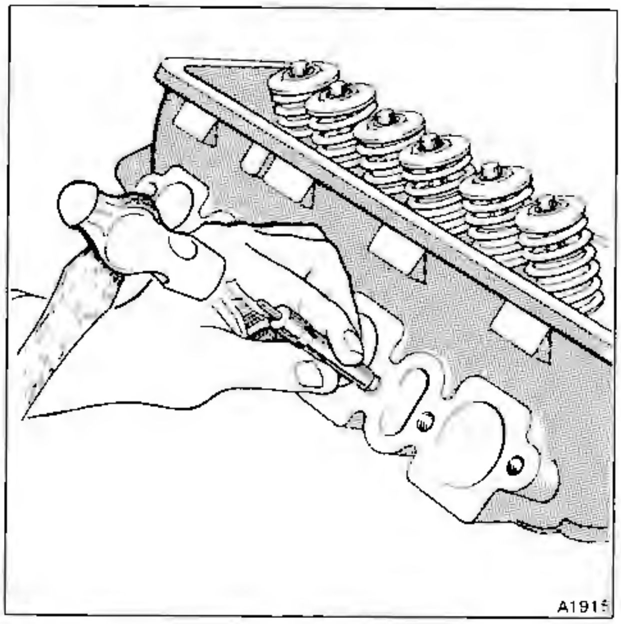


Fig. A7-3 Heli-coil tang 'break-off' tool

Method 1

Switch on the ignition and pump the brake pedal 50 to 60 times until the resistance felt at the pedal reduces indicating that the systems are depressurized. The facia warning panels should be illuminated. Switch off the ignition.

To depressurize the rear suspension struts, attach a bleed tube to the struts bleed screw. Open the bleed screw and allow the hydraulic system mineral oil to bleed into a clean container until the flow ceases.

Method 2

Open the bleed screw on both accumulators and allow sufficient time for the mineral oil pressure to discharge back to the reservoir. These bleed screws are an integral part of the accumulator, the mineral oil being allowed to flow from the accumulator sphere back to the reservoir when the bleed screw is opened. Switch on the ignition and check that the facia warning panels are illuminated.

Depressurize the rear suspension struts as described in Method 1.

Raising and supporting the car

Workshop safety
Never work beneath the car if it is only supported on a jack. Always ensure car stands or blocks are used as a safety precaution.

Raising the front of the car
Position the car on a level surface, place the gear range selector lever in the park position, remove fuse A6 from fuse panel F2 on the main fuseboard, apply the parking brake, and chock the rear road wheels.

To jack up the front of the car, position a trolley jack under the front pivot mounting for the lower triangle levers on the sub-frame (see fig. A8-1, item 1).

Alternatively, jack up the car using one of the two front jacking points situated on the car underbody (see fig. A8-1, item 3), utilizing the car jack.

Raising the rear of the car
Position the car on a level surface, place the gear range selector lever in the park position, remove fuse

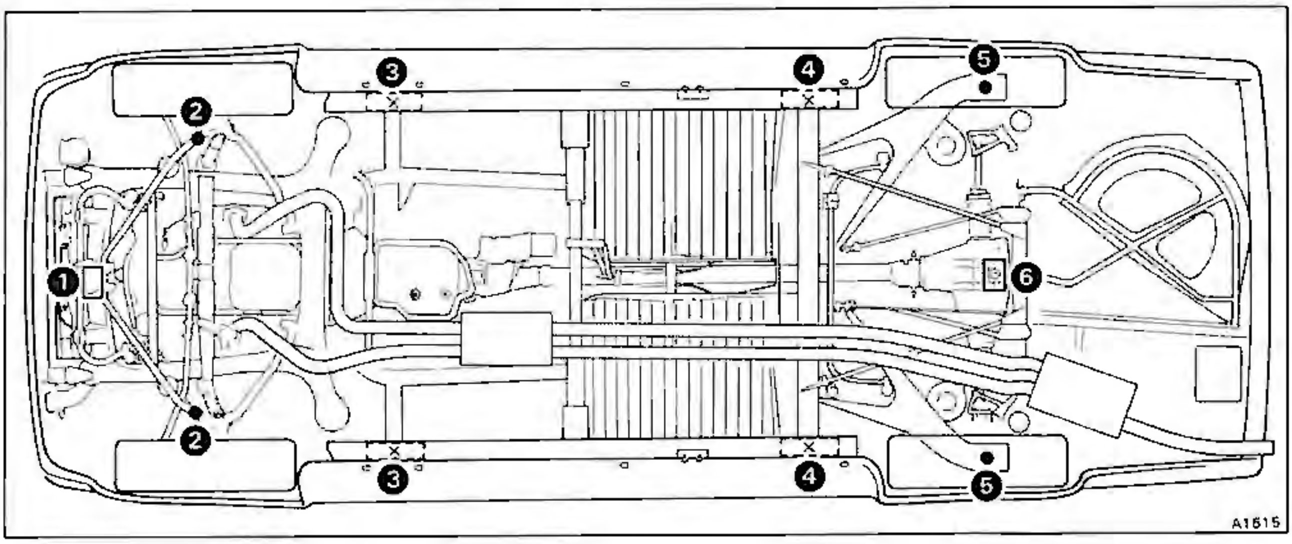


Fig. A8-1 Car jacking positions and support locations
1 Trolley jack position (front)
2 Car stands (front)
3 Car jack and sill block positions (front)
4 Car jack and sill block positions (rear)
5 Car stands (rear)
6 Trolley jack position (rear)

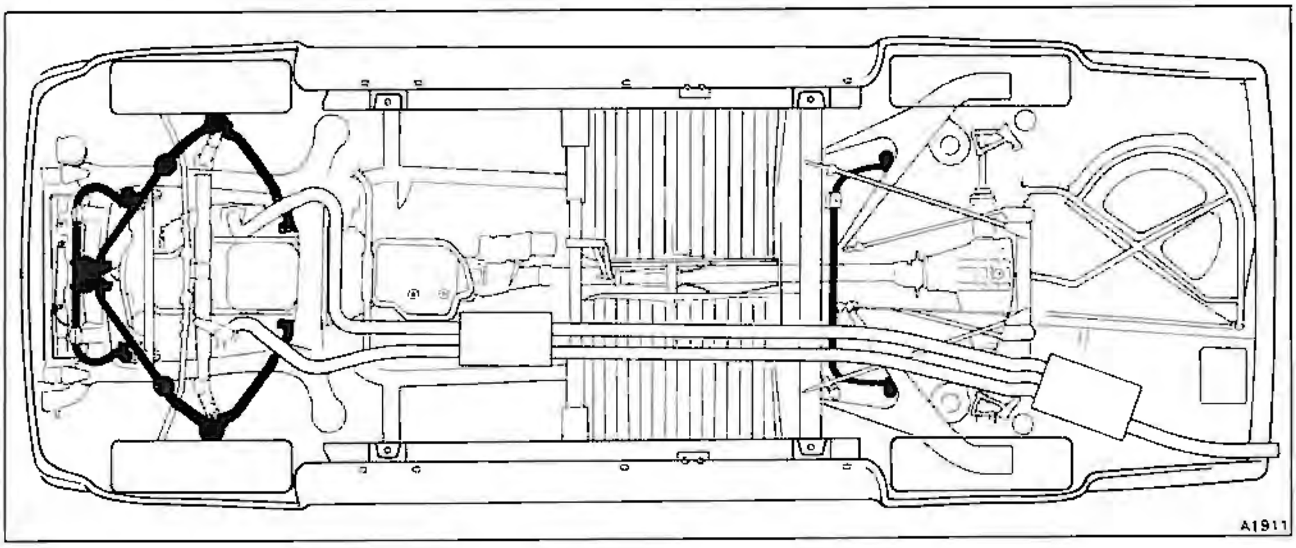


Fig. A8-2 Suitable suspension members for securing when transporting

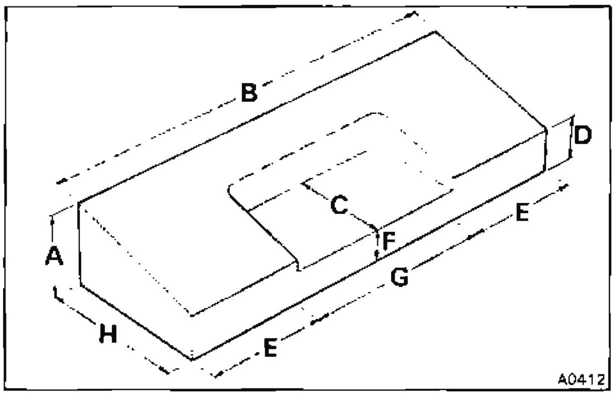


Fig. A8-3 Hardwood sill block
A 44,45 mm (1.750 in)
B 228,60 mm (9.0 in)
C 53,98 mm (2.125 in)
D 25,40 mm (1.0 in)
E 63,50 mm (2.50 in)
F 19,05 mm (0.750 in)
G 101,60 mm (4.0 in)
H 79,38 mm (3.125 in)

A6 from fuse panel F2 on the main fuseboard, apply the parking brake, and chock the front road wheels.

To jack up the rear of the car, position a trolley jack under the centre of the final drive casing (see fig. A8-1, item 6), **not on the final drive crossmember.** Ensure a piece of hardwood is placed between the jack head and the final drive casing.

Alternatively, jack up the car using one of the two rear jacking points situated on the car underbody (see fig. A8-1, item 4), utilizing the car jack.

Supporting the car on stands and/or blocks

When jacking up the rear of the car to support on stands and/or blocks, follow the procedure described previously, then remove the road wheels. Place axle stands under the positions shown in figure A8-1, item 5.

When jacking up the front of the car, follow the procedure described previously, then place axle stands under the positions shown in figure A8-1, item 2. Remove the road wheels if necessary.

If all the car is to be supported on stands and/or blocks, the car body should also be supported using wooden sill blocks, etc., placed under the jacking points of the car (see fig. A8-1, items 3 and 4). Refer to figure A8-3 when producing these wooden sill blocks.

Transporting the car

The ideal and simplest method of securing the car for transportation, is by strapping all the wheels to the carrier, using strong webbing straps, **not chains.**

This method securely fastens the car without damage and undue strain on any of the suspension or body components. However, the car is still free to move on its own suspension system. Therefore, it is important to ensure that there is sufficient clearance all round the car to accommodate this movement.

An alternative method is to use slings/chains around the front lower triangle levers and also around the front and rear anti-roll bars (see fig. A8-2).

Note Never use any other components beneath the car other than those specified.

Raising, supporting, and transporting the car

Workshop safety
Never work beneath the car if it is only supported on a jack. Always ensure car stands or blocks are used as a safety precaution.

Raising the front of the car
Position the car on a level surface, place the gear range selector lever in the park position, remove fuse A6 from fuse panel F2 on the main fuseboard, apply the parking brake, and chock the rear road wheels.

To jack up the front of the car, position a trolley jack under the front pivot mounting for the lower triangle levers on the sub-frame (see fig. A8-1, item 1).

Alternatively, jack up the car using one of the two front jacking points situated on the car underbody (see fig. A8-1, item 3), utilizing the car jack.

Raising the rear of the car
Position the car on a level surface, place the gear range selector lever in the park position, remove fuse

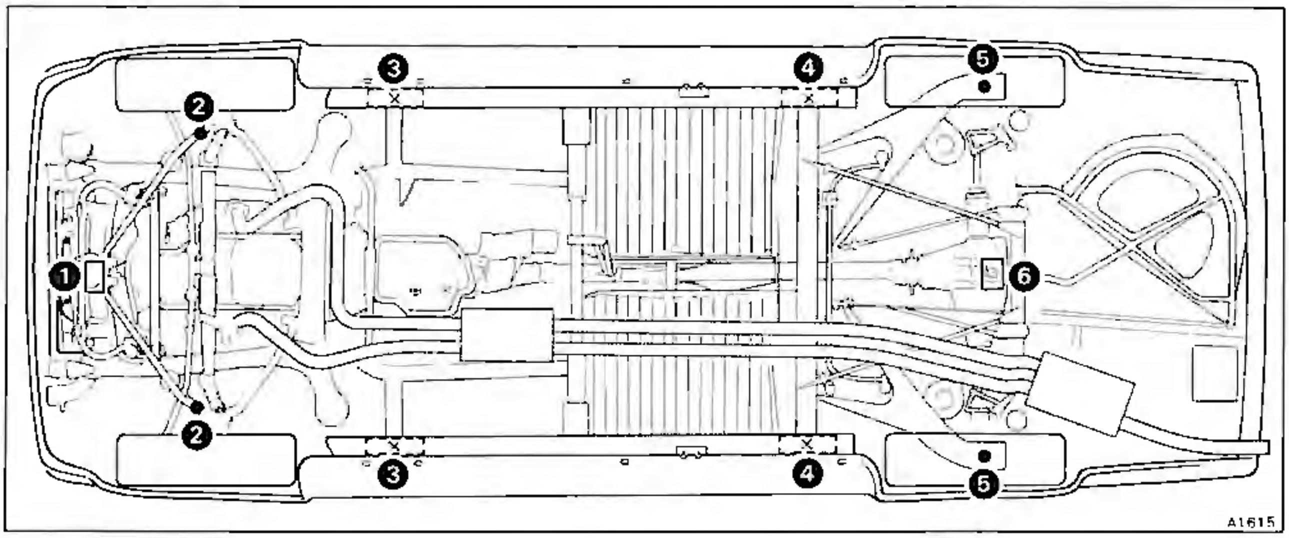


Fig. A8-1 Car jacking positions and support locations
1 Trolley jack position (front)
2 Car stands (front)
3 Car jack and sill block positions (front)
4 Car jack and sill block positions (rear)
5 Car stands (rear)
6 Trolley jack position (rear)

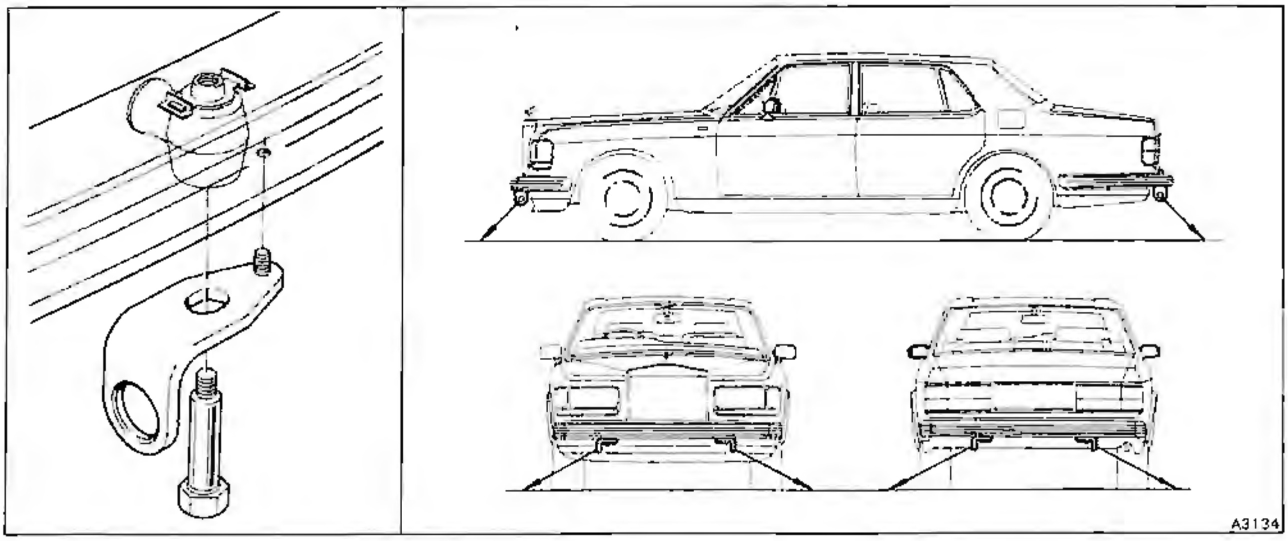


Fig. A8-2 Securing points for transporting the car

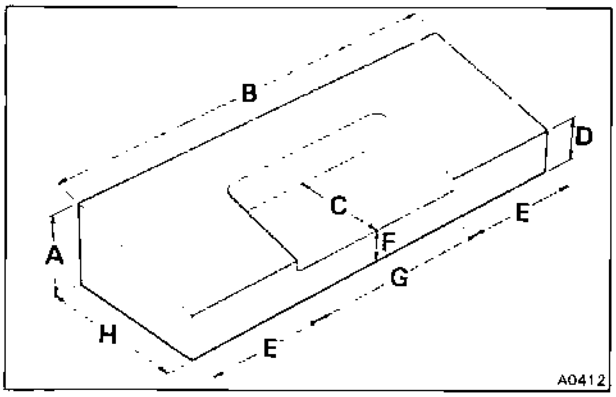


Fig. A8-3 Hardwood sill block
A 44,45 mm (1.750 in)
B 228,60 mm (9.0 in)
C 53,98 mm (2.125 in)
D 25,40 mm (1.0 in)
E 63,50 mm (2.50 in)
F 19,05 mm (0.750 in)
G 101,60 mm (4.0 in)
H 79,38 mm (3.125 in)

A6 from fuse panel F2 on the main fuseboard, apply the parking brake, and chock the front road wheels.

To jack up the rear of the car, position a trolley jack under the centre of the final drive casing (see fig. A8-1, item 6), **not on the final drive crossmember.** Ensure a piece of hardwood is placed between the jack head and the final drive casing.

Alternatively, jack up the car using one of the two rear jacking points situated on the car underbody (see fig. A8-1, item 4), utilizing the car jack.

Supporting the car on stands and/or blocks
When jacking up the rear of the car to support on stands and/or blocks, follow the procedure described previously, then remove the road wheels. Place axle stands under the positions shown in figure A8-1, item 5.

When jacking up the front of the car, follow the procedure described previously, then place axle stands under the positions shown in figure A8-1, item 2. Remove the road wheels if necessary.

If all the car is to be supported on stands and/or blocks, the car body should also be supported using wooden sill blocks, etc., placed under the jacking points of the car (see fig. A8-1, items 3 and 4). Refer to figure A8-3 when producing these wooden sill blocks.

Transporting the car (see fig. A8-2)
To secure the car for transporting, lashing eyes must be fitted to the front and rear bumper mountings.

Four lashing eyes must be fitted. However, if a car has two towing eyes fitted as standard these can be utilized for transporting, in addition to two lashing eyes.

To fit a lashing eye, simply remove the isolator bolt from the bumper bar. Then, fit the lashing eye using the longer isolator bolt.

Note The lashing eyes must always be removed and the original bolts fitted when transporting has been completed.

Abbreviations, terminology, and symbols

This symbol identifies the items using hydraulic system mineral oil within this section

This section gives details of the abbreviations and symbols used throughout this Workshop Manual.

A list containing the interpretation of specialized motor engineering terminology is also included in this section.

Abbreviations

Across flats	A/F
After bottom dead centre	abdc
After top dead centre	atdc
Ampere	A
Bar (pressure)	bar
Before bottom dead centre	bbdc
Before top dead centre	btdc
Bottom dead centre	bdc
Brake horse power	bhp
Brake mean effective pressure	bmep
British standards	BS
Carbon monoxide	CO
Centigrade (Celsius)	C
Cubic feet	ft^3
Cubic inch	in^3
Cubic metre	m^3
Degree (angle)	deg or °
Degree (Centigrade)	°C
Degree (Fahrenheit)	°F
Diameter	d
Farad	F
Feet	ft
Feet per second	ft/s
Fluid ounce	fl oz
Gallon (Imperial)	Imp gal
Gallon (US)	US gal
Gram (mass)	g
Hertz	Hz
Hour	h
Inch	in
Inches of mercury	in Hg
International Standards Organisation	ISO
Joule	J
Kelvin	K
Kilogram (mass)	kg
Kilohertz	KHz
Kilojoules	kJ
Kilometres	km
Kilometres per hour	km/h
Kilonewton (force)	kN
Kilonewton per metre	kN/m
Kilopascal	kPa
Kilowatt	kW
Litres	litre
Litres per 100 kilometres	litre/100 km
Maximum	max
Megahertz	MHz
Metre	m
Metres per second	m/s
Microfarad	μF
Miles per Imperial gallon	mpg
Miles per US gallon	mile/US gal
Miles per hour	mile/h
Milligram	mg
Millilitre	ml
Millimetres	mm
Millimetres of mercury	mm Hg
Minute (angle)	′
Minute (time)	min
Newton (force)	N
Newton metres (torque)	Nm
Newton metre per degree	Nm/deg
Newtons per square metre	Nm^2
Number	No
Ohm	Ω
Ounce (mass)	oz

Part number	Part No
Pascal	Pa
Percentage	%
Pints (Imperial)	Imp pt
Pints (US)	US pt
Pound (force)	lbf
Pounds force inch	lbf in
Pound (mass)	lb
Pound feet (torque)	lbf ft
Pound inch (torque)	lbf in
Pounds per square inch	lbf/in^2
Pound (force) inch per degree	lbf in/deg
Ratio	:
Revolutions per second	rev/s
Revolutions per minute	rev/min
Second (time)	s
Second (angle)	"
Society of Automobile Engineers	SAE
Square centimetres	cm^2
Square feet	ft^2
Square inch	in^2
Square metre	m^2
Square millimetre	mm^2
Standard	Std
Standard wire gauge	swg
Thread formations	
British Association	BA
American pipe, taper fuel (dry seal)	NPTF
Unified coarse	UNC
Unified fine	UNF
Metric	M
Top dead centre	tdc
Ton	ton
Tonne	t
Volt	V
Watt	W

Terminology

Allen key
Cranked wrench of hexagonal section for use with socket head screws.

Alternator
Electrical generator producing alternating current. Rectified to direct current for battery charging.

Ambient temperature
Surrounding temperature.

Ampere hours
Refers to battery capacity (current X hours it flows).

Annulus
The outer ring gear of an epicyclic gear train.

'A' post
The forward post of the front door aperture.

Armature
The shaft carrying the windings, which rotates in the magnetic field of a generator or starter motor. That part of a solenoid or relay which is activated by the magnetic field.

Axial
In line or pertaining to an axis.

Backlash
Play in meshing gears.

Bevel pinion
A conical shaped gearwheel, designed to mesh with a similar gear with an axis usually at 90 deg to its own.

'B' post
The rearward post of the front door aperture.

Brake caliper
Cylinders with hydraulic operated pistons acting on brake pads.

Brake disc
Steel disc rotating with wheel. Operation of brake pedal causes two friction pads to contact the disc and reduce speed.

Brake horse-power (bhp)
Horse-power available at the flywheel, usually measured on a dynamometer.

Brake mean effective pressure (bmep)
Average pressure on a piston during the working stroke.

Bulkhead
Vertical partition dividing the engine compartment and car interior.

Abbreviations, terminology, and symbols

This symbol identifies the items using hydraulic system mineral oil within this section

This section gives details of the abbreviations and symbols used throughout this Workshop Manual.

A list containing the interpretation of specialized motor engineering terminology is also included in this section.

Abbreviations

Across flats	A/F
After bottom dead centre	abdc
After top dead centre	atdc
Ampere	A
Bar (pressure)	bar
Before bottom dead centre	bbdc
Before top dead centre	btdc
Bottom dead centre	bdc
Brake horse power	bhp
Brake mean effective pressure	bmep
British standards	BS
Carbon monoxide	CO
Centigrade (Celsius)	C
Cubic feet	ft^3
Cubic inch	in^3
Cubic metre	m^3
Degree (angle)	deg or °
Degree (Centigrade)	°C
Degree (Fahrenheit)	°F
Diameter	d
Farad	F
Feet	ft
Feet per second	ft/s
Fluid ounce	fl oz
Gallon (Imperial)	Imp gal
Gallon (US)	US gal
Gram (mass)	g
Hertz	Hz
Hour	h
Inch	in
Inches of mercury	in Hg
International Standards Organisation	ISO
Joule	J
Kelvin	K
Kilogram (mass)	kg
Kilohertz	KHz
Kilojoules	kJ
Kilometres	km
Kilometres per hour	km/h
Kilonewton (force)	kN
Kilonewton per metre	kN/m
Kilopascal	kPa
Kilowatt	kW
Litres	litre
Litres per 100 kilometres	litre/100 km
Maximum	max
Megahertz	MHz
Metre	m
Metres per second	m/s
Microfarad	μF
Miles per Imperial gallon	mpg
Miles per US gallon	mile/US gal
Miles per hour	mile/h
Milligram	mg
Millilitre	ml
Millimetres	mm
Millimetres of mercury	mm Hg
Minute (angle)	′
Minute (time)	min
Newton (force)	N
Newton metres (torque)	Nm
Newton metre per degree	Nm/deg
Newtons per square metre	Nm^2
Number	No
Ohm	Ω
Ounce (mass)	oz

Part number	Part No
Pascal	Pa
Percentage	%
Pints (Imperial)	Imp pt
Pints (US)	US pt
Pound (force)	lbf
Pounds force inch	lbf in
Pound (mass)	lb
Pound feet (torque)	lbf ft
Pound inch (torque)	lbf in
Pounds per square inch	lbf/in^2
Pound (force) inch per degree	lbf in/deg
Ratio	:
Revolutions per second	rev/s
Revolutions per minute	rev/min
Second (time)	s
Second (angle)	"
Society of Automobile Engineers	SAE
Square centimetres	cm^2
Square feet	ft^2
Square inch	in^2
Square metre	m^2
Square millimetre	mm^2
Standard	Std
Standard wire gauge	swg
Thread formations	
British Association	BA
American pipe, taper fuel (dry seal)	NPTF
Unified coarse	UNC
Unified fine	UNF
Metric	M
Top dead centre	tdc
Ton	ton
Tonne	t
Volt	V
Watt	W

Terminology

Allen key
Cranked wrench of hexagonal section for use with socket head screws.

Alternator
Electrical generator producing alternating current. Rectified to direct current for battery charging.

Ambient temperature
Surrounding temperature.

Ampere hours
Refers to battery capacity (current X hours it flows).

Annulus
The outer ring gear of an epicyclic gear train.

'A' post
The forward post of the front door aperture.

Armature
The shaft carrying the windings, which rotates in the magnetic field of a generator or starter motor. That part of a solenoid or relay which is activated by the magnetic field.

Axial
In line or pertaining to an axis.

Backlash
Play in meshing gears.

Bevel pinion
A conical shaped gearwheel, designed to mesh with a similar gear with an axis usually at 90 deg to its own.

'B' post
The rearward post of the front door aperture.

Brake caliper
Cylinders with hydraulic operated pistons acting on brake pads.

Brake disc
Steel disc rotating with wheel. Operation of brake pedal causes two friction pads to contact the disc and reduce speed.

Brake horse-power (bhp)
Horse-power available at the flywheel, usually measured on a dynamometer.

Brake mean effective pressure (bmep)
Average pressure on a piston during the working stroke.

Bulkhead
Vertical partition dividing the engine compartment and car interior.

Camber
Angle at which a road wheel is tilted from the vertical when viewed from the front or rear of the car.

Camshaft
Revolving shaft with eccentric projections to operate valve mechanism and hydraulic systems pumps.

Cantrail
Connecting rail between the top of the 'A' post and the top of the 'D' post, viewed from inside the car.

Capacitor
Term for an electrical condenser. Part of a distributor assembly. Also acts as an interference suppressor.

Castellated
Top face of a nut, slotted across the flats, to take a locking split pin.

Caster
Angle at which the kingpin or swivel-pin is tilted when viewed from the side of the car.

Clevis
'U'-shaped fork connector used with a clevis pin.

Clevis pin
A pin that is used to secure components within the fork type of clevis connector; usually retained by a split pin.

Collet
A type of collar, split and located in a groove in a shaft, and held in place by a retainer. The arrangement usually used to retain the spring on a valve stem.

Commutator
Rotating segmented current distributor between armature windings and brushes in generator or motor.

Companion frame
Contained within the rear quarter panel, it houses the rear interior lamps switch, etc.

Compression ratio
Ratio of volume above piston at bottom of stroke and top of stroke.

'C' post
The forward post of the rear door aperture.

Crankshaft
Converts vertical movement of the pistons into rotary motion.

Crownwheel
Large bevel gear in rear axle, driven by a bevel pinion attached to the propeller shaft.

Demister
Directs heated air over the screen to clear internal condensation. The system will also melt frost on the outside of the windscreen.

Depression
The lowering of atmospheric pressure (as in the inlet manifold).

Diaphragm panel
Upright body panel directly behind the front headlamps.

Dowel
Close tolerance pin, peg, tube, or bolt, which accurately locates mating parts.

'D' post
The rearward post of the rear door aperture.

Electrode
Terminal, part of an electrical component, such as the points or 'Electrodes' of a sparking plug.

Electrolyte
In lead-acid car batteries a solution of sulphuric acid and distilled water.

End-float
The axial movement between associated parts, end play.

Engine capacity
Engine capacity is derived by multiplying the volume of the cylinder (bore area X stroke) by the number of cylinders (i.e. swept volume X number of cylinders).

Engine cylinder
Bore in the engine crankcase is sleeved with a wet cylinder liner. Piston operates within the cylinder/liner.

EP
Extreme pressure. In lubricants, special grades for heavily loaded bearing surfaces, such as the crownwheel and pinion assembly in the final drive unit.

Field coils
Windings on the polepieces of electric motors.

Fillets
Narrow finishing strips usually applied to interior bodywork.

Flexplate
Combined plate and starter ring attached to the rear of the crankshaft which forms a positive connection to the torque converter.

Frame tubes
Link members of the rear sub-frame, between the rear crossmember and final drive crossmember.

Full flow filter
One which filters all the oil pumped to the engine. If the element becomes clogged, a by-pass valve operates to pass unfiltered oil to the engine.

Gas spring
A sphere, half filled with nitrogen gas (above a diaphragm), part of the suspension strut.

Gear pump
Two meshing gears in a close fitting casing. Oil is carried from the inlet round the outside of both gears in the spaces between the gear teeth and casing to the outlet, the meshing gear teeth prevent oil passing back to the inlet, and the oil is forced through the outlet port.

Gear ratio
Relative speeds at which two gears revolve. If the input gear rotates twice as fast as the output gear, the gear ratio is 2:1.

Grommet
A ring of protective or sealing material. Can be used to protect pipes or leads passing through dividing partitions.

Gudgeon pin
Shaft which connects a piston to its connecting rod.

Heelboard
Vertical body panel connecting the floorpan and the rear seat pan.

Helical
In spiral form. The teeth of helical gears are cut at a spiral angle to the side faces of the gearwheel.

Hot spot
Hot area that assists vaporization of fuel on its way to the cylinders.

HT
High tension. The secondary voltage produced by the ignition coil for the sparking plugs.

Hydrometer
A device for checking the specific gravity of liquids. Used to check specific gravity of electrolyte or coolant.

Hypoid bevel gears
A form of bevel gear used in the rear axle drive gears. The bevel pinion meshes below the centre line of the crownwheel, giving a lower propeller shaft line.

Impeller
A centrifugal pumping element. Used in coolant pumps to generate flow.

Inner wing valance panel
Connecting panel between outer wing panel and longeron.

Journals
Those parts of a shaft that are in contact with the bearings.

'Jury' bolt
Used on the rear suspension when removing the frame tubes. Holds the suspension rigid by temporarily being fitted in place of the short in-line damper.

Laminated glass
Two thin sheets of glass bonded one to each side of a thin sheet of transparent plastic, giving good resistance to shattering and penetration.

lbf ft
A measure of twist or torque. A pull of 10 lbf at a radius of 1 ft is a torque of 10 lbf ft.

Longeron
Longitudinal box section; part of the body underframe.

LT
Low tension. The voltage output from the battery.

Mandrel
Accurately manufactured bar or rod used for test or centring purposes.

Manifold
A pipe, duct or chamber, with several branches.

Needle rollers
Bearing rollers with a length many times their diameter.

Overall gear ratio
Number of engine revs per revolution of the driving wheels (gearbox ratio X final drive ratio).

Overlap
Period during which inlet and exhaust valves are open together.

Parking pawl
Pivoted catch that engages in the gear ring on the transmission rear unit planet carrier and locks the output shaft.

Phillips/Pozidriv screwdriver
A cross-point screwdriver for use with the cross-slotted heads of Phillips/Pozidriv screws.

Pinion
A small gear, usually in relation to another gear.

Pre-loading
Pre-set static pressure on ball or roller bearings not due to working loads.

Radial ply tyres
Refers to the construction of the tyres because the cords of the plies are at right-angles to the rim.

Rear decking panel
Body panel between the bottom of the rear window aperture and the luggage compartment.

Rear squab panel
Connecting panel between rear seat base and parcel shelf.

Scuttle panel
Detachable body panel between bonnet and windscreen aperture.

Shock absorber
Damper to control body movement in relation to the suspension preventing continuous bouncing on the spring.

Small-end
The small, or piston end of a conecting rod. Sometimes called the 'little-end'.

Stoichiometric ratio
Ideal air/fuel ratio for full combustion of the fuel.

Strut
Integral damper and height control ram. Damping achieved by displacement of hydraulic system mineral oil under pressure from the gas spring.

Thermostat
In cooling system, prevents coolant circulating to the radiator until the engine has warmed up.

Toeboard panel
Lower body panel between bulkhead and floor pan.

Torque
Mean turning effort exerted on crankshaft by pistons, available for propelling the car.

Wet liner
Engine cylinder liner fitted into the crankcase bore and sealed top and bottom thus allowing engine coolant to circulate directly onto the liner. Should excessive wear take place a new liner can be installed.

Woodruff key
A semi-circular piece of metal that fits into a similar shaped slot on a shaft. The flat edge of the key protrudes out from the shaft and locates in a groove in the internal bore of a gear thus accurate location of the gear to the shaft is obtained.

Symbols
The ISO symbols used on the car are as follows

Low brake pressure, System 1 (Non anti-lock system)

Low brake pressure, System 2 (Non anti-lock system)

Low brake pressure, System 1 (Anti-lock system)

Low brake pressure, System 2 (Anti-lock system)

Brake pad wear

Brake stop lamp failure

Parking brake

Hazard warning

Fasten seat belts

Battery charging

Oil pressure

Fuel

Engine coolant temperature

Windscreen wipers

Windscreen washers

Windscreen demist

Lights

Headlamp main beam

Headlamp beam selector and flashing switch

Front and rear position lamps

Rear fog lamps

Front fog lamps

Direction indicators

Horns

Pad wear and stop lamp failure
(Corniche/Continental)

Static sensitive components

Components containing asbestos

Conversions

mm	to	in	×0.0394
in	to	mm	×25.4
m	to	ft	×3.281
ft	to	m	×0.305
m	to	yd	×1.094
yd	to	m	×0.914
km	to	mile	×0.621
mile	to	km	×1.609
mm^2	to	in^2	×0.0015
in^2	to	mm^2	×645.16
cm^2	to	in^2	×0.155
in^2	to	cm^2	×6.452
m^2	to	ft^2	×10.764
ft^2	to	m^2	×0.093
m^2	to	yd^2	×1.196
yd^2	to	m^2	×0.836
cm^3	to	in^3	×0.061
in^3	to	cm^3	×16.387
m^3	to	ft^3	×35.315
ft^3	to	m^3	×0.028
m^3	to	yd^3	×1.308
yd^3	to	m^3	×0.765
g	to	oz (Avoir)	×0.035
oz (Avoir)	to	g	×28.35
ml	to	fl oz	×0.035
fl oz	to	ml	×28.41
kg	to	lb (Avoir)	×2.205
lb (Avoir)	to	kg	×0.454
kg	to	cwt	×0.019
cwt	to	kg	×50.802
tonne	to	ton	×0.984
ton	to	tonne	×1.01604
ton	to	kg	×1016.0
Imp gal	to	US gal	×1.201
US gal	to	Imp gal	×0.833
litre	to	Imp gal	×0.220
Imp gal	to	litre	×4.546
litre	to	US gal	×0.264
US gal	to	litre	×3.785

litre	to	Imp pt	×1.76
Imp pt	to	litre	×0.57
lbf ft	to	Nm	×1.356
Nm	to	lbf ft	×0.7376
lbf	to	N	×4.448
N	to	lbf	×0.225
lbf in	to	Nm	×0.113
Nm	to	lbf in	×8.851
lbf/in^2	to	bar	×0.069
bar	to	lbf/in^2	×14.5
mile/h	to	km/h	×1.609
km/h	to	mile/h	×0.621
litre/100 km	to	mpg	$=\frac{282.473}{\text{litre/100 km}}$
mpg	to	litre/100 km	$=\frac{282.473}{\text{mpg}}$
km/litre	to	mpg	×2.825
mpg	to	km/litre	×0.354
km/litre	to	mile/US gal	×2.352
mile/US gal	to	km/litre	×0.425
kgf m	to	lbf ft	×7.233
lbf ft	to	kgf m	×0.1383
kgf cm	to	lbf in	×0.868
lbf in	to	kgf cm	×1.152
oz in	to	g cm	×0.1116
g cm	to	oz in	×8.960

Printed in England

Special processes

Contents

	Sections						
	Rolls-Royce			Bentley			
	Silver Spirit	Silver Spur	Corniche / Corniche II	Eight	Mulsanne / Mulsanne S	Turbo R	Continental
Contents and issue record sheet	B1	B1	B1	B1	B1	B1	B1
Storage and recommissioning	B2	B2	B2	B2	B2	B2	B2
Shipping precautions	B3	B3	B3	B3	B3	B3	B3

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	B1	B2	B3							
1	5/88	5/88	5/88							
2		5/88								
3	5/88	5/88								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Sections / Page No.										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Storage and recommissioning

Storage

To ensure the correct degree of protection the information given under the heading 'Recommended storage procedure' should be adopted.

The success of this procedure depends upon correct initial preparation, regular inspection, and maintenance.

When the car is stored always ensure that the battery master switch is turned anti-clockwise to the off position. On cars not fitted with a master switch, disconnect the battery leads.

The storage building should be dry and well ventilated. If the building is heated, the temperature must remain constant.

On Convertible cars, ensure that the hood is raised with the hood clips securely fastened.

Throughout the storage period, the following recommended storage procedure should be carried out every two weeks.

Recommended storage procedure

1. Inspect the coolant hoses. If any are found to be defective, report them to the Owner.
2. Check the engine coolant level and top-up if necessary.
3. Ensure that the fluid levels in the engine sump, torque converter transmission, steering pump, final drive unit, and the braking and levelling system reservoirs are to the maximum level marks; top-up if necessary.

On Convertible cars, also ensure that the fluid level of the power operated hood reservoir is to the maximum level mark.

It must be noted that the braking and levelling systems of the car are filled with hydraulic system mineral oil. When filling or topping-up the reservoirs it is important that the correct oil is used.

4. Check the tyre pressures including the spare and adjust if necessary (See Chapter R).
5. Ensure that all controls, instruments, warning panels, and lamps are operating correctly.
6. Run the car for a minimum of 16 kilometres (10 miles) to ensure complete lubrication of the internal components.
7. Allow the car to cool, then thoroughly wash the exterior bodywork as described in Chapter A. Any damaged paintwork discovered during this operation should be reported to the Owner.
8. On initial storage, apply a good quality cleaner/ polish followed by a good quality wax polish. Also thoroughly clean the carpets and upholstery; treat all leather upholstery with Connolly's Hide Food.
9. Cover the car with a light cotton or muslin dust sheet. It should be noted that plastic or similar materials **must not** be used for this purpose as they can create condensation which, under certain climatic conditions, can damage the paintwork.
10. Ensure that the tyres are covered if there is a possibility of sunlight penetrating into the storage area.

Alternative storage procedures

If it is not possible to carry out the recommended storage procedure every two weeks, the following procedures may be adopted though they will not provide the same degree of protection.

Storage periods between one and three months

Initially, carry out the recommended storage procedure.

In addition increase the tyre pressures as follows.

Other than Bentley Turbo R cars 2,8 bar (40 lbf/in^2). Bentley Turbo R cars 3,5 bar (50 lbf/in^2). The pressure of the spare tyre does not need increasing.

Storage periods between three and six months

Initially, carry out the recommended storage procedure.

The following additional measures should also be undertaken.

1. Remove the sparking plugs and inject two tablespoons of a corrosion preventive oil into each cylinder. Suitable oils are BP Energol Protective Oil 20 and Castrol Storage Oil 20. Using the ignition key, crank the engine to distribute the oil over the cylinder walls. Fit the sparking plugs.
2. Clean all chromium plating and stainless steel, then lightly smear with petroleum jelly.
3. Remove, clean, and fully charge the battery. If necessary top-up with distilled water.
4. Jack up the car and place supports under the rear trailing arms and the outer ends of the front lower triangle levers. Do not deflate the tyres.

Storage periods exceeding six months

The following additional measures to those listed for storage periods between three and six months are recommended.

1. Drain the final drive unit and the engine sump, then fill them to the normal levels with one of the corrosion preventive oils previously quoted. Run the engine for one minute to distribute the oil.
2. Syphon the fuel tank. **Do not** run the engine to completely drain the system as damage to the fuel pump and catalytic converter (if fitted) could occur.

Warning It is most important that prior to working on the fuel system reference is made to the information under the heading Safety procedures.

3. Position a note on the facia stating that the fuel

tank is empty and that no attempt must be made to start the engine until the tank contains fuel.
4. Dust the carpets and rugs with anti-moth powder and store them in a dry place.
5. If the storage building is dry, leave the car windows slightly open.

If there is any tendency towards dampness, close the doors and windows and place an anti-moisture compound, such as silica-gel or calcium chloride, in an open metal container inside the car.
6. **Every six months,** remove, clean, and fully charge the battery. If necessary top-up with distilled water.

Recommissioning procedure

Dependent on the procedure adopted the following points are all that should require attention before the car is roadworthy.
1. Lower the car onto its tyres. Check the tyre pressures and adjust if necessary (see Chapter R).
2. Fully charge and fit the battery. If necessary top-up with distilled water.
3. Drain any corrosion preventive oil from the engine sump and final drive unit. Fit a new engine oil filter element and then fill the engine sump and final drive unit with the approved oils (see Chapter D).
4. Check the engine coolant level and top-up if necessary.
5. Remove the sparking plugs.

If the car has not been run every two weeks during the storage period, prime the cylinders with engine oil. Using the ignition key, crank the engine to distribute the oil and to prevent a hydraulic lock.
6. Clean the sparking plugs and if necessary set the gaps (see Chapter A). Fit the plugs.
7. Ensure that the fluid levels in the engine sump, torque converter transmission, steering pump, final drive unit, and the braking and levelling system reservoirs are to the maximum level marks.

On Convertible cars, also ensure that the fluid level of the power operated hood reservoir is to the maximum level mark.

It must be noted that the braking and levelling systems of the car are filled with hydraulic system mineral oil. When filling or topping-up the reservoirs it is important that the correct oil is used.
8. On cars other than Bentley Turbo R lubricate the distributor by removing the rotor and applying a drop of clean engine oil to the top of the spindle.
9. Lubricate all grease points with approved grease (see Chapter D).
10. If the fuel has been syphoned, fill the tank and start the engine. Check that the engine oil pressure and ignition warning lamps extinguish. Also check for coolant, oil, or fuel leaks.
11. Check the operation of all controls, instruments, warning panels, lamps, and accessories.

Note Should the brake pressure warning panels remain illuminated for more than a few minutes after starting the engine, refer to Chapter G.

12. Should the battery leads be disconnected for 4 weeks or longer during the storage period, the front seat adjustment memory function (if fitted) will be lost.

If this has occurred, it will be necessary to reactivate the memory by tapping-in the memory code as follows.

Warning When the seat memory is reactivated, the seat will move immediately and automatically to a set adjustment position. Take care therefore to avoid contact with the seat when carrying out the following procedure.

13. Ensure that the gear range selector lever is in the park position, then turn the ignition switch to either the ACC or RUN position.
14. Briefly depress one of the seat memory switches (MEM), situated on the centre console, five times. Then, immediately depress the numbered store/recall buttons on the same panel in the sequence 4, 3, 3, 4.
15. To store a selected seat position in the memory proceed as follows.

Depress the switch marked MEM. This will activate the memory which will then remain receptive for a period of five seconds. During this period, press one of the four numbered personal allocation switches. The personal seat position data will then be stored in the memory until new data is programmed into the memory by repeating the procedure for a new seat position.
16. To recall the stored seat position press and hold down the personal allocation switch until the seat has reached its programmed position. Seat movement can be stopped at any time by releasing the switch. Seat adjustments that are made using the independent manually operated seat position switches will not affect the memory.

Safety procedures

In addition to the usual workshop safety procedures note the following.
1. Extreme care must be exercised whenever any work is carried out on the fuel system. Always ensure that the no smoking rule is strictly observed and that there is either a foam, dry powder, or CO_2 (carbon dioxide) fire extinguisher readily to hand.
2. Fuel may contain up to 5% of Benzene as an anti-knock additive. Benzene is extremely injurious to health (being carcinogenic) **and therefore all contact should be kept to an absolute minimum, particularly inhalation.**
3. The fuel system may contain fuel under pressure. Therefore, prior to opening the system (i.e. disconnecting pipes or unions), disconnect the battery and ensure that the system is depressurized (refer to TSD 4737 Engine Management Systems Manual). Protective clothing including safety goggles, gloves, and apron should be worn at all times by the operator.
4. Fuel has a sufficiently high vapour pressure to cause a hazardous build-up of vapour in poorly ventilated areas.
5. The fuel is irritant to the eyes and skin and any affected parts should be washed immediately with clean water. The fuel vapours are irritant to the lungs

and if high concentrations are inhaled it may cause nausea, headaches, and depression.

6. The danger from inhaling exhaust gases cannot be over emphasized. When operating the engine in a confined space or workshop, **always** ensure that the area is well ventilated. Whenever possible the exhaust gases should be ducted out of the building.

Sitting in the car with the car's air conditioning system operating will not eliminate the danger.

Shipping precautions

When transporting a car overseas always contact a reputable shipping agent to obtain the correct advice and service. The following points should also be brought to the notice of the shipping agent.

1. If it is necessary to syphon the fuel from the tank note the following.

Do not run the engine to completely drain the system as damage to the fuel pump and catalytic converter (if fitted) could occur.

Position a note on the facia stating that the fuel tank is empty and that no attempt must be made to start the engine until the tank contains fuel.

2. It is of the utmost importance that service personnel should fully appreciate that the hydraulic systems of the car operate at **high pressures** and that they are fully conversant with the precautions which must be taken to ensure correct operation of the systems. Special attention should therefore be given to the items on Special Precautions in Chapters A and G.
3. Ensure that the battery is disconnected and the terminals taped up.
4. Cover all outer chromed parts with masking tape.
5. When the car is shipped in a container, place a bag of silica-gel adjacent to each wheel trim and below each suspension spring.

Safety procedures

In addition to the usual workshop safety procedures note the following.

1. Extreme care must be exercised whenever any work is carried out on the fuel system. Always ensure that the no smoking rule is strictly observed and that there is either a foam, dry powder, or CO_2 (carbon dioxide) fire extinguisher readily to hand.
2. Fuel may contain up to 5% of Benzene as an anti-knock additive. Benzene is extremely injurious to health (being carcinogenic) **and therefore all contact should be kept to an absolute minimum, particularly inhalation.**
3. The fuel system may contain fuel under pressure. Therefore, prior to opening the system (i.e. dis-connecting pipes or unions), disconnect the battery and ensure that the system is depressurized (refer to TSD 4737 Engine Management Systems Manual). Protective clothing including safety goggles, gloves, and apron should be worn at all times by the operator.
4. Fuel has a sufficiently high vapour pressure to cause a hazardous build-up of vapour in poorly ventilated areas.
5. The fuel is irritant to the eyes and skin and any affected parts should be washed immediately with clean water. The fuel vapours are irritant to the lungs and if high concentrations are inhaled it may cause nausea, headaches, and depression.
6. The dangers from inhaling exhaust gases cannot be over emphasized. When operating the engine in a confined space or workshop, **always** ensure that the area is well ventilated. Whenever possible the exhaust gases should be ducted out of the building.

Sitting in the car with the car's air-conditioning system operating will not eliminate the danger.

Air conditioning system

Contents

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	C1	C2	C3	C4	C5	C6	C7			
1	1/87	1/87		7/89			1/87			
2										
3	7/89			1/87						
4				7/89						
5				7/89						
6				1/87						
7				2/87						
8				1/87						
9				1/87						
10				1/87						
11				1/87						
12				1/87						
13				7/89						
14				7/89						
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Precautions

Danger – Exhaust gases
To ensure adequate ventilation, always open garage doors fully before starting the car in a garage, or any confined space.

The exhaust gases contain carbon monoxide (CO), which is odourless and invisible, but very poisonous.

Operating the air conditioning system increases the danger of these gases entering the car.

General precautions
Before commencing work on the electrical system it is recommended that either the battery master switch be turned to the OFF position or that the battery is disconnected.

If the master switch has to be left in the ON position or if the battery is left connected, the gear range selector lever **must be** placed in the park position and the gearchange isolating fuse (fuse A6) **removed** from fuseboard F2 at the main fuseboard. Then remove the ignition key.

Never disconnect the battery or switch off the battery master switch when the engine is running.

Always ensure correct polarity when making cable connections.

It is recommended that when carrying out tests on the car wiring, a good quality multi-meter is used. **Never** use generator type meters.

Do not use a test lamp on circuitry that contains electronic components, such as the air conditioning system.

When working on or in the vicinity of the air conditioning micro-processor, anti-static precautions, in particular the wearing of an anti-static wristband connected to a good earth, must be observed.

Special precautions
The refrigerant used in the air conditioning system is dichlorodifluoromethane (Refrigerant 12). It is supplied to the service network in disposable containers or metal drums.

When correctly handled the refrigerant is perfectly safe, however, incorrect handling could result in injury or accident.

The following precautions must always be observed.

1. Do not smoke in the vicinity of refrigerant or a refrigeration system.
2. Always wear safety glasses when working on a refrigeration system.
3. Store refrigerant containers upright and away from direct sunlight.
4. When transporting refrigerant, ensure that the containers are secured, remain upright and away from direct sunlight.
5. Ensure that caps are fitted to drums not in use.
6. Refrigerant containers must not be overfilled, increased pressure could cause an explosion.
7. To heat the drum when charging a system, immerse in warm water at a maximum temperature of 51°C (124°F).

   Never place the drum on a hot surface or attempt to heat the drum by means of a blowlamp, etc.
8. Do not discharge refrigerant in confined spaces or near to exposed flames. Contact with exposed flames can produce a toxic gas.

   Always keep refrigerant clear of engine air intakes.
9. Excessive heat applied to any part of the refrigeration system will create high pressures within the system. Therefore, welding, soldering, or brazing should not be carried out on the system, or to any adjacent part of the car.

First aid – Refrigerant burns
If the skin comes into contact with refrigerant, it should be bathed with clean cold water and medical attention sought immediately. Do not apply localized heat, hot dressings, etc.

If an eye should become affected by refrigerant, it must be immediately washed with clean cold water. The eye must not be rubbed as this will aggravate the injury.

After administering this emergency treatment a doctor should be consulted as soon as possible.

1/87
Printed in England

Electrical test and fault diagnosis

Contents

Printed in England

Electrical test and fault diagnosis

Introduction
If an electrical fault is suspected on the air conditioning system it will be necessary to determine whether the fault is in the wiring of the air conditioning system or on the micro-processor board.

If it is determined that the fault is on the micro-processor board, the board must be replaced as it is a non-serviceable item.

The wiring can be tested using the air conditioning test box RH 9884. Alternatively, test the wiring using a good quality multi-meter capable of measuring continuity, resistance, and direct current voltage.

If using the test box it is recommended that the test procedures be carried out in full, noting any malfunction. On completion of the test box procedures, correct any malfunction by selecting the appropriate sub-heading under Test procedures using a multi-meter. Carry out that particular procedure before retesting the system with the test box.

When correcting a malfunction or carrying out the test procedures using a multi-meter, identification of cable routes and connections, also components, can be made using the wiring diagrams and component locations contained within this section.

When working on or in the vicinity of the air conditioning micro-processor, anti-static precautions, in particular, the wearing of an anti-static wristband connected to a good earth, must be observed.

To avoid damage to the mating surfaces of plug or socket connections it is recommended that meter probes, etc., are applied from the rear, cable entry side. It may be necessary to release the locking bar of the plug or socket to achieve this.

Where it is necessary to start the car engine, all normal workshop safety precautions must be observed.

Before commencing the test procedures always ensure that the battery is in a fully charged condition.

Test procedures using test box RH 9884

Initial procedure
1. Remove fuse A1 at fuseboard F1.
2. Disconnect both the left-hand and right-hand 18-way plugs at the micro-processor. To avoid damage to the board it will be necessary to hold the opposite end of the board when removing a plug.
3. With all switches on the test box in the up position, connect the test box as follows.

a. Connect the lead from the test box marked LEFT to the left-hand 18-way plug from the micro-processor.
b. Connect the lead from the test box marked RIGHT to the right-hand 18-way plug from the micro-processor.
c. Ensure that the termination on the single red cable from the test box is insulated and free from any earth potential.
d. Connect the single purple cable from the test box to a known, fused, 12 volts positive supply.

4. Select ON position at the POWER switch on the test box noting that.

a. Dependent on the position of the air conditioning function switch on the facia, the corresponding lamp on the test box will be illuminated.
b. When testing with a cold engine [engine coolant temperature below 44°C (111°F)] the 44°C lamp on the test box will be illuminated.
c. The ALT (alternator) lamp on the test box will only be illuminated when the engine is running.

Air conditioning function switch – To test
1. Select OFF position at the air conditioning function switch on the facia. The OFF lamp at the test box should illuminate.
2. Rotate the function switch from OFF through each position to the (defrost) position. At each switch position the corresponding lamp on the test box should illuminate.

Fans control circuit – To test
1. Move the left-hand FAN CONTROL switch on the test box to the down (ON) position. The fans should operate at minimum speed.
2. From left to right select the down position on the four remaining FAN CONTROL switches noting that as each switch is operated the speed of the fans increases.
3. Switch OFF the left-hand FAN CONTROL switch. Both fans should stop.

Mode change actuator – To test
1. Move the MODE switch on the test box to the down position. The mode change actuator should operate, directing air to the facia position.
2. Move the MODE switch on the test box to the SCREEN (up) position. The mode change actuator should operate, directing air to the screen position.
3. Ensure that the mode change flap seals effectively, especially in the screen position.

Left-hand recirculation actuator – To test
1. Move the L.H. switch on the test box to the down position. The left-hand recirculation actuator should operate, directing air to the fresh air position.
2. Move the L.H. switch on the test box to the RECIRC (up) position. The actuator should operate, directing air to the recirculation position.
3. Ensure that the flap seals effectively, especially in the recirculation position.

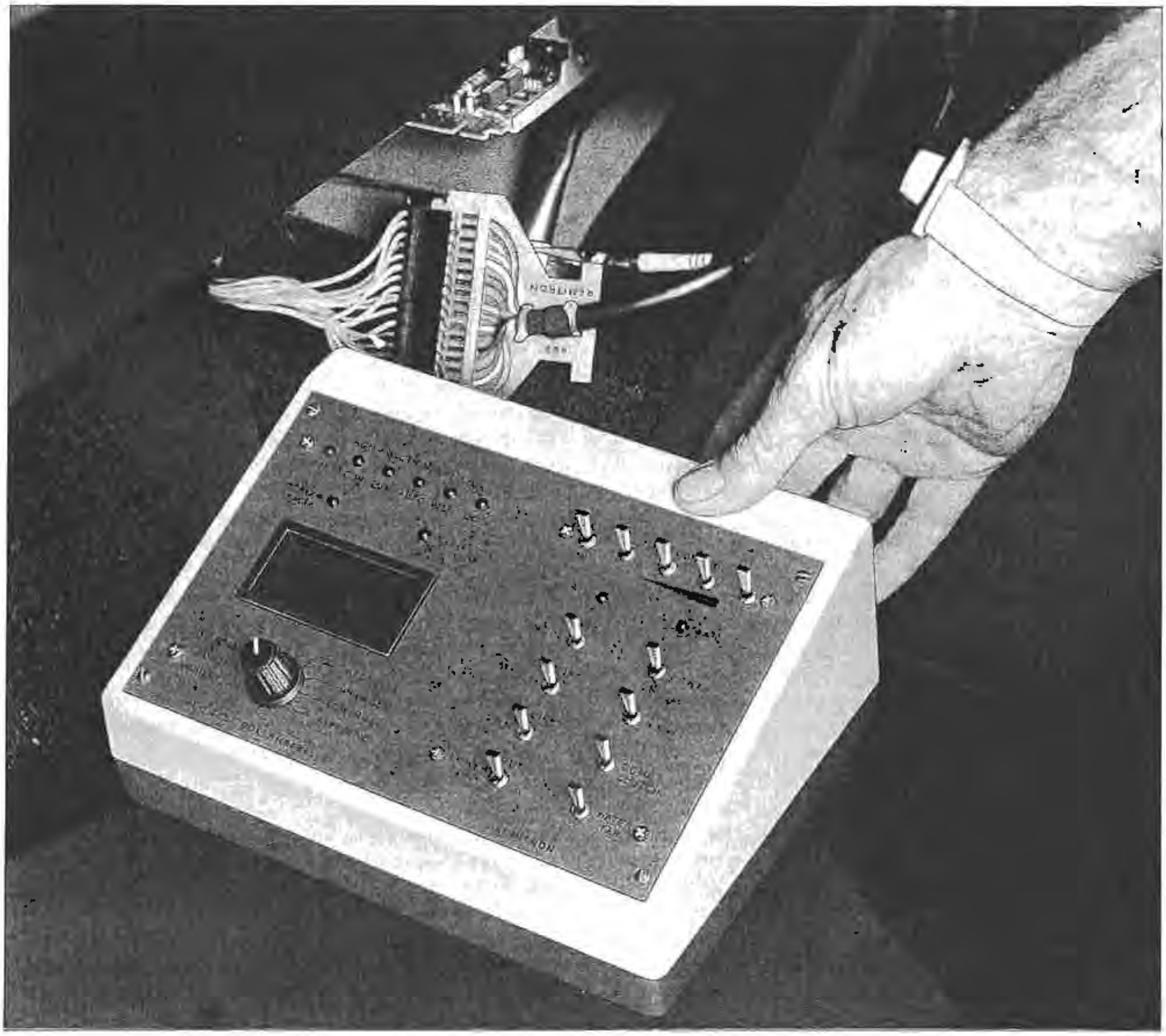


Fig. C4-1 Air conditioning system test box RH 9884

Right-hand recirculation actuator – To test

1. Move the R.H. switch on the test box to the down position. The right-hand recirculation actuator should operate, directing air to the fresh air position.
2. Move the R.H. switch on the test box to the RECIRC (up) position. The actuator should operate, directing air to the recirculation position.
3. Ensure that the flap seals effectively, especially in the recirculation position.

Lower quantity actuator – To test

1. Move the LOWER FLAP switch on the test box to the down position. The lower quantity actuator should operate, directing air to the lower outlets.
2. Move the LOWER FLAP switch on the test box to the SHUT (up) position. The lower quantity actuator should operate, closing off air from the lower outlets.
3. Ensure that the flap seals effectively, especially in the closed position.

Air conditioning temperature sensors – To test

1. Rotate the selector switch on the test box to the AMBIENT position. Read off the voltage.

   Compare the voltage reading with the Temperature sensor voltage response graph and table given in figure C4-2. If the reading is within a ± 5% tolerance the sensor is functioning correctly.
2. Repeat procedure 1 with the selector switch in the LOWER position.
3. Repeat procedure 1 with the selector switch in the TOP ROLL (solar) position.
4. Repeat procedure 1 with the selector switch in the UPPER position.

Screen-facia/recirc switch – To test

1. Press and hold the SCREEN-FACIA/RECIRC switch on the facia to the SCREEN/FACIA position. The SCREEN FACIA lamp on the test box should illuminate.

It should be noted that when carrying out this operation on certain 1987 model year cars the RECIRC lamp on the test box also illuminates but at a slightly lower intensity. If illumination of the lamp does occur, before continuing with the test procedure, the pink cables connected between the SCREEN-FACIA/RECIRC switch and the inner switch panel plug and socket 6-way must be disconnected and permanently removed.

2. Select the RECIRC position at the SCREEN-FACIA/RECIRC switch. The RECIRC lamp on the test box should illuminate.

3. Return the SCREEN-FACIA/RECIRC switch to the central position. The RECIRC lamp will be restored to its original condition, i.e. not necessarily extinguished.

Temperature selector controls test procedure

1. Rotate the selector switch on the test box to the REFERENCE position. Read off the voltage (approximately 2.5 volts).

2. Rotate the upper temperature selector on the facia to the mid-position and the selector switch on the test box to the UPPER SEL position. Read off the voltage. This output voltage should be within ± 0.5 volt of the reference voltage.

3. Rotate the lower temperature selector on the facia to the mid-position and the selector switch on the test box to the LOWER SEL position. Read off the voltage. This output voltage should be within ± 0.5 volt of the reference voltage.

Rear window demister and mirror heaters, compressor clutch, and water tap test procedure

1. Rotate the selector switch on the test box to the BAT. VOLTS position.

2. Move the H.R.W. switch to the down position. The voltage reading on the test box should decrease.

3. Move the H.R.W. switch to the up (off) position.

4. Move the COMP. CLUTCH switch to the down position. The compressor clutch in the engine compartment should be heard to operate.

5. Move the COMP. CLUTCH switch to the up (off) position.

6. Move the WATER TAP switch to the down position. The water tap situated in the engine compartment should operate.

7. Move the WATER TAP switch to the up (off) position.

Air conditioning coolant temperature switch – To test

This test must be carried out with a cold engine (i.e. engine coolant temperature below 44°C (111°F)).

1. The 44°C lamp on the test box will be illuminated.

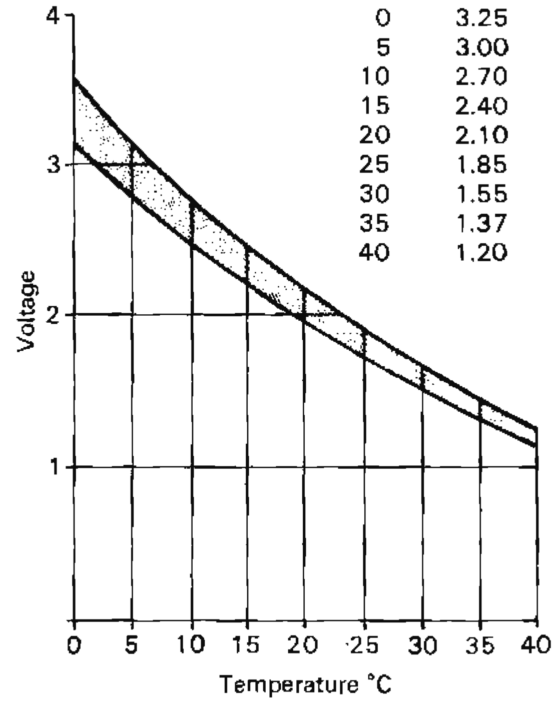
2. Disconnect the coolant temperature switch on the thermostat housing. The 44°C lamp on the test box should extinguish.

3. Re-connect the coolant temperature switch.

Test procedures conclusion

1. Having verified the car wiring.

a. Disconnect the 12 volts positive supply to the test box.



Temperature °C	Voltage
0	3.25
5	3.00
10	2.70
15	2.40
20	2.10
25	1.85
30	1.55
35	1.37
40	1.20

Fig. C4-2 Temperature sensor voltage response graph and table

b. Disconnect the test box.

c. Re-connect the 18-way plugs to the micro-processor.

d. Replace fuse A1 at fuseboard F1.

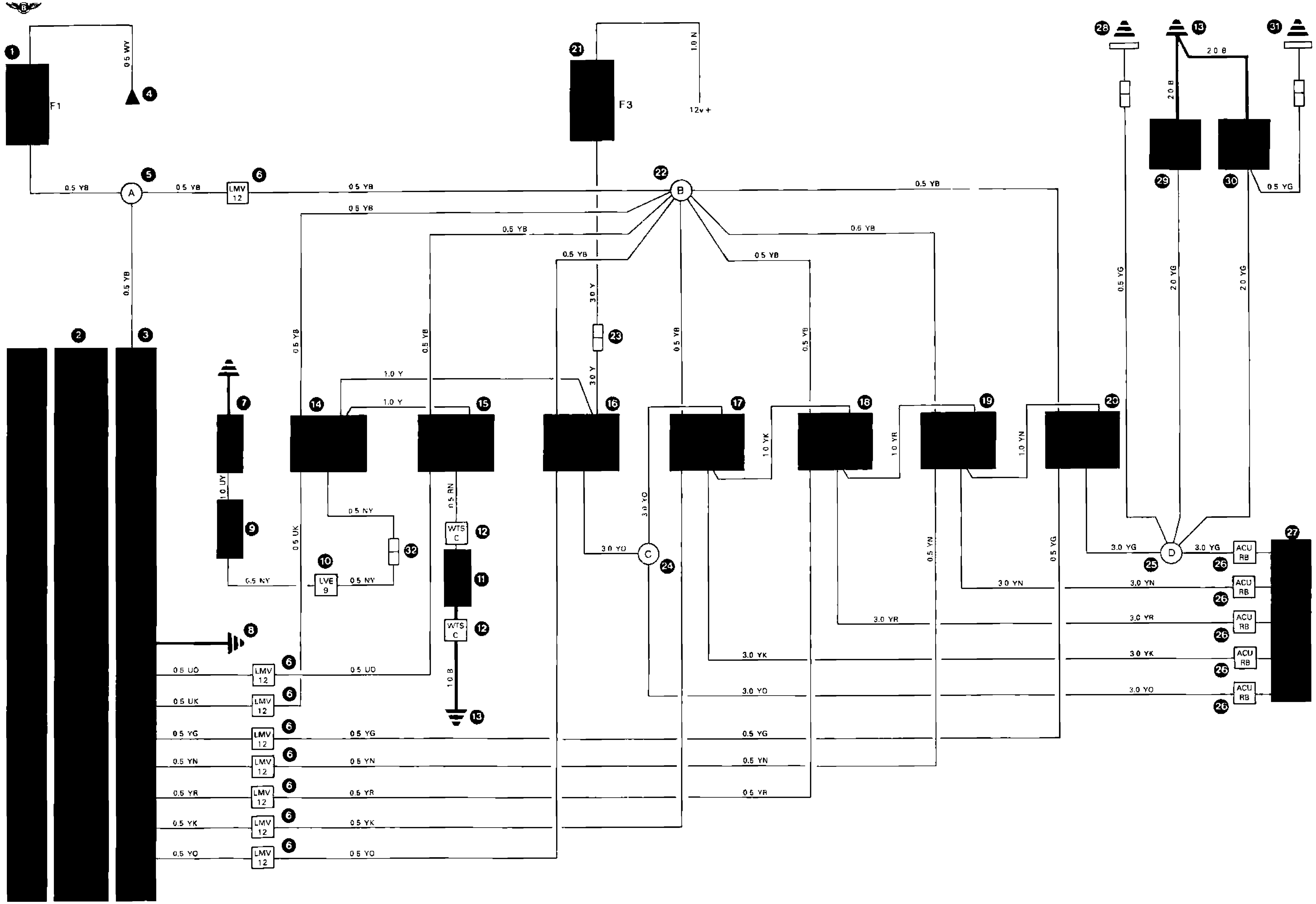
2. Test the air conditioning system. If a malfunction is still apparent carry out the Micro-processor initializing procedure given under the heading Air conditioning micro-processor board.

If correct operation of the upper and lower blend flap actuators is verified by the initializing procedure the fault will be on the micro-processor board. Therefore, fit a new board.

If the correct operation of the upper and lower blend flap actuators cannot be verified by the initializing procedure, first substitute the actuator(s) to determine whether the fault is with the actuator(s) or on the micro-processor board. Renew as necessary.

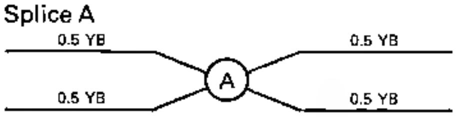
Fan control circuit

Wiring diagram and component location

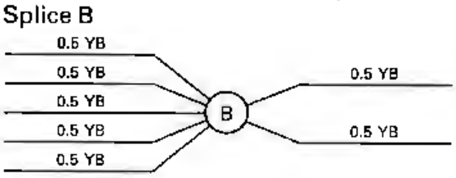


F1
F3
12v +
0.5 WY
1.0 N
0.5 YB
LMV 12
A
B
C
D
1.0 Y
3.0 Y
1.0 UY
0.5 UK
0.5 NY
LVE 9
0.5 RN
WTS C
1.0 B
2.0 B
0.5 YG
2.0 YG
1.0 YK
1.0 YR
1.0 YN
3.0 YO
3.0 YG
3.0 YN
3.0 YR
3.0 YK
ACU RB
0.5 UO
0.5 YN
0.5 YR
0.5 YK
0.5 YO

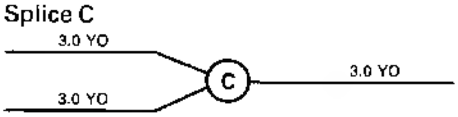
1 Fuseboard F1, fuse A1, 10 Amp
2 Air conditioning unit micro-processor
3 Air conditioning unit micro-processor plug 18-way – right-hand
4 12 volts positive supply when engine is running
5 Splice A



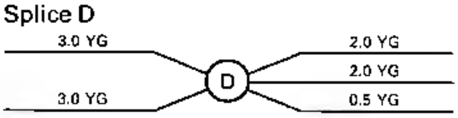
6 Left-hand main to valance loom plug and socket 12-way
7 Compressor clutch solenoid
8 Transmission tunnel earth point
9 Compressor ambient thermostat
10 Left-hand valance to engine loom plug and socket 9-way
11 Water tap solenoid
12 Water tap solenoid connection
13 Front valance earth point
14 Compressor clutch relay
15 Water tap relay
16 Fans control relay
17 Fan speed relay 4
18 Fan speed relay 3
19 Fan speed relay 2
20 Fan speed relay 1
21 Fuseboard F3, fuse A6, 30 Amp
22 Splice B



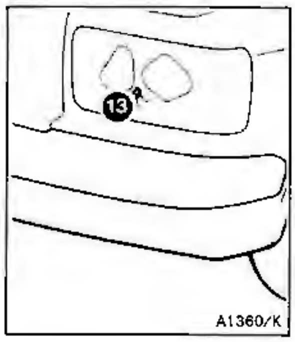
23 Left-hand main to valance loom connection
24 Splice C

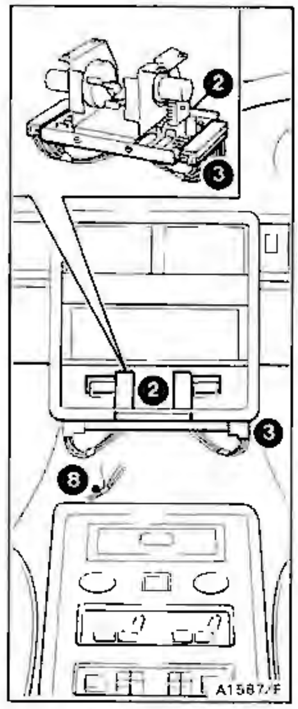


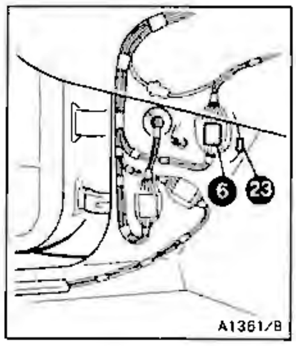
25 Splice D

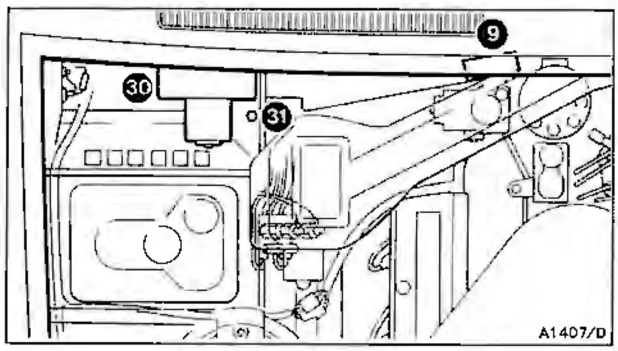


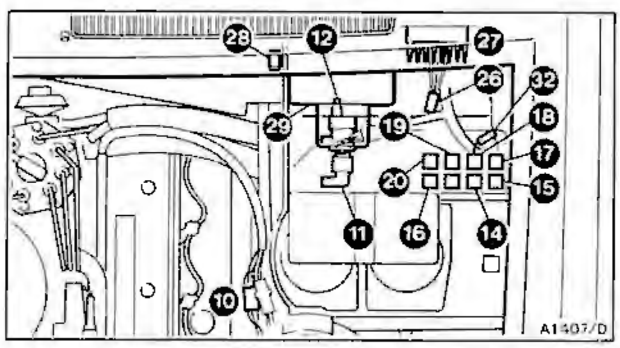
26 Air conditioning unit resistor block plug and socket
27 Air conditioning unit resistor block
28 Air conditioning fan suppressor – left-hand
29 Air conditioning fan – left-hand
30 Air conditioning fan – right-hand
31 Air conditioning fan suppressor – right-hand
32 Air conditioning loom to left-hand valance loom connection

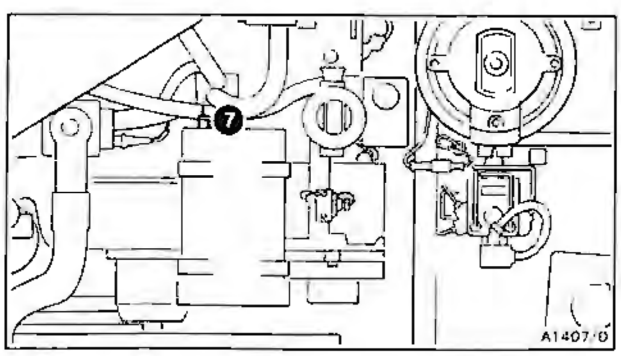






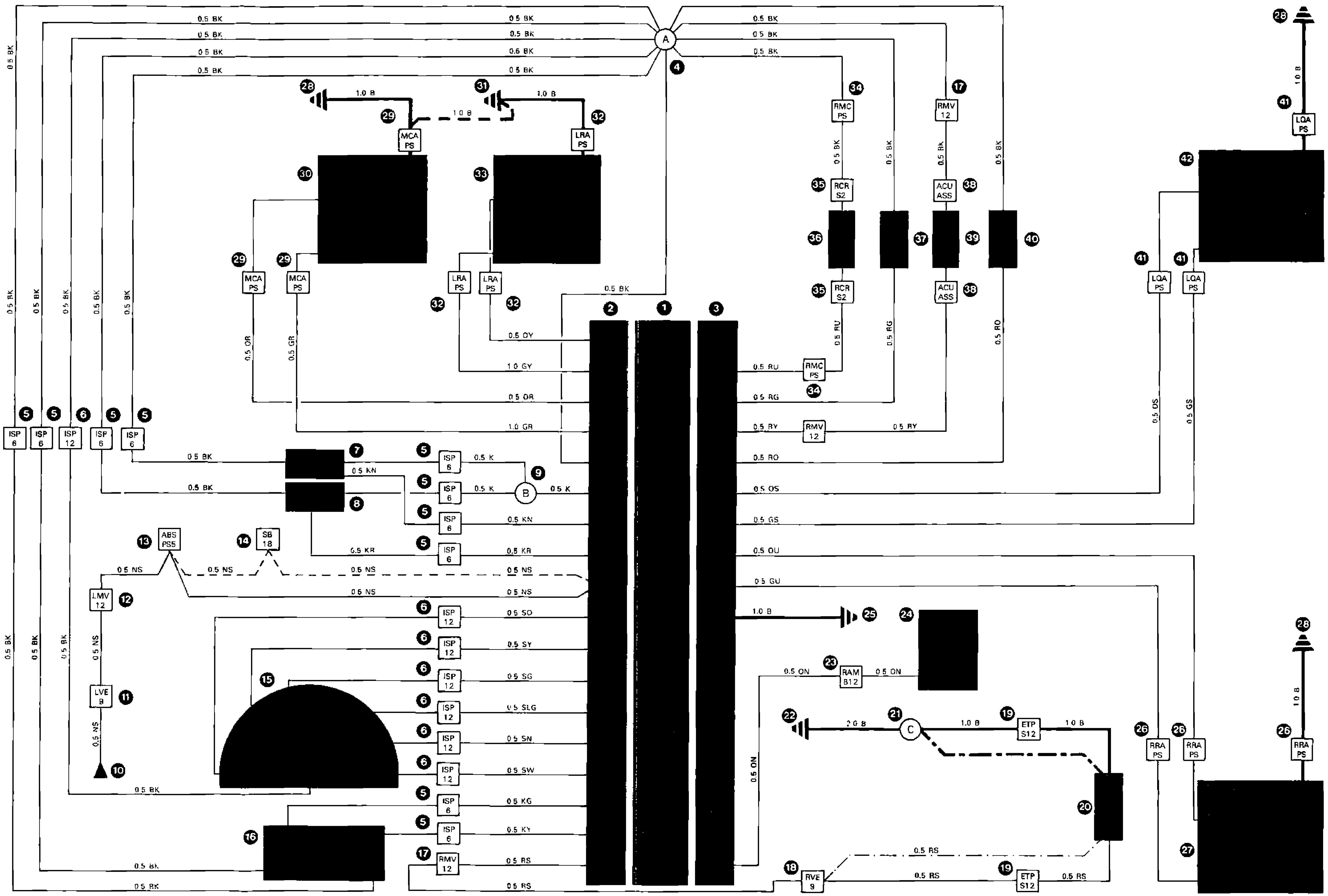






Temperature control circuit

Wiring diagram

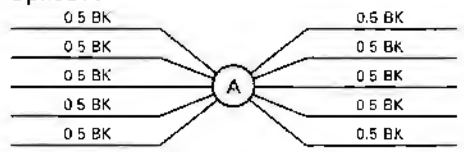


A
B
C
0.5 BK
0.6 BK
1.0 B
2.0 B
MCA PS
LRA PS
RMC PS
RMV 12
LQA PS
RCR S2
ACU ASS
ISP 6
ISP 12
ABS PS5
SB 18
LMV 12
LVE 9
RAM B12
ETP S12
RVE 9
RRA PS
0.5 OY
1.0 GY
0.5 OR
1.0 GR
0.5 GR
0.5 K
0.5 KN
0.5 KR
0.5 NS
0.5 SO
0.5 SY
0.5 SG
0.5 SLG
0.5 SN
0.5 SW
0.5 KG
0.5 KY
0.5 RS
0.5 RU
0.5 RG
0.5 RY
0.5 RO
0.5 OS
0.5 GS
0.5 OU
0.5 GU
0.5 ON

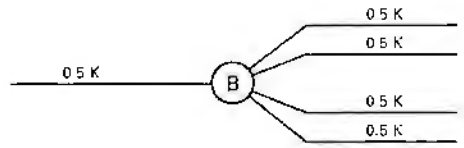
Temperature control circuit

Component location

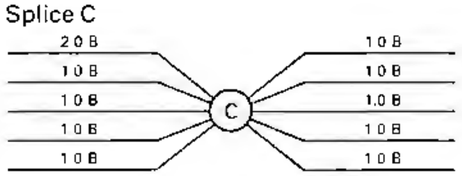
1 Air conditioning unit micro-processor
2 Air conditioning unit micro-processor plug 18-way – left-hand
3 Air conditioning unit micro-processor plug 18-way – right-hand
4 Splice A



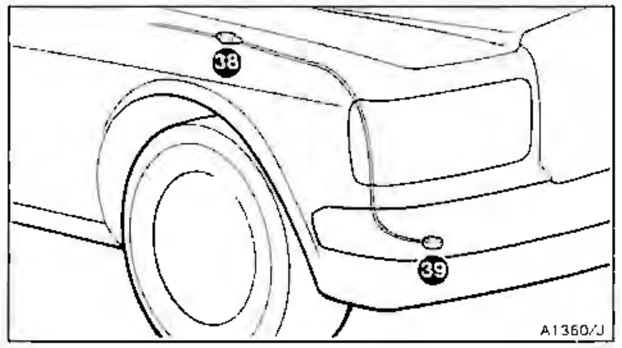
5 Inner switch panel plug and socket 6-way
6 Inner switch panel plug and socket 12-way
7 Upper temperature selector
8 Lower temperature selector
9 Splice B

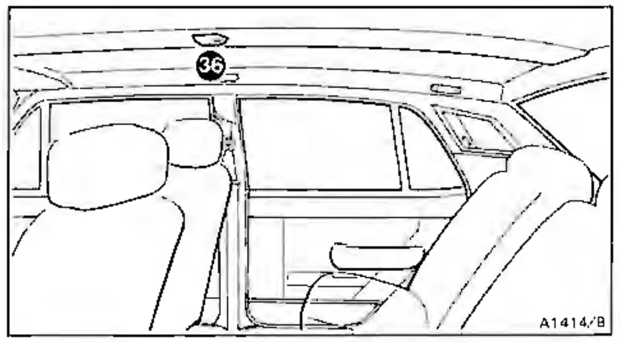


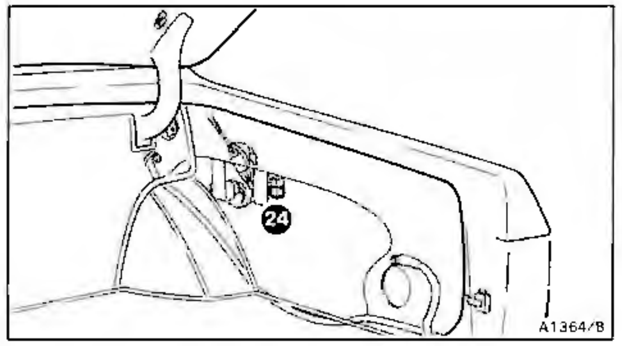
10 Monitor supply from alternator (14 volts positive with engine running) to allow rear window and door mirror demisting
11 Left-hand valance to engine loom plug and socket 9-way
12 Left-hand main to valance loom plug and socket 12-way
13 Anti-lock braking system plug and socket 5-way
14 Switchbox plug and socket 18-way
15 Air conditioning control switch
16 Screen-facia/recirc switch
17 Right-hand main to valance loom plug and socket 12-way
18 Right-hand valance to engine loom plug and socket 9-way
19 Engine thermostat loom plug and socket 12-way
20 Coolant temperature switch
21 Splice C



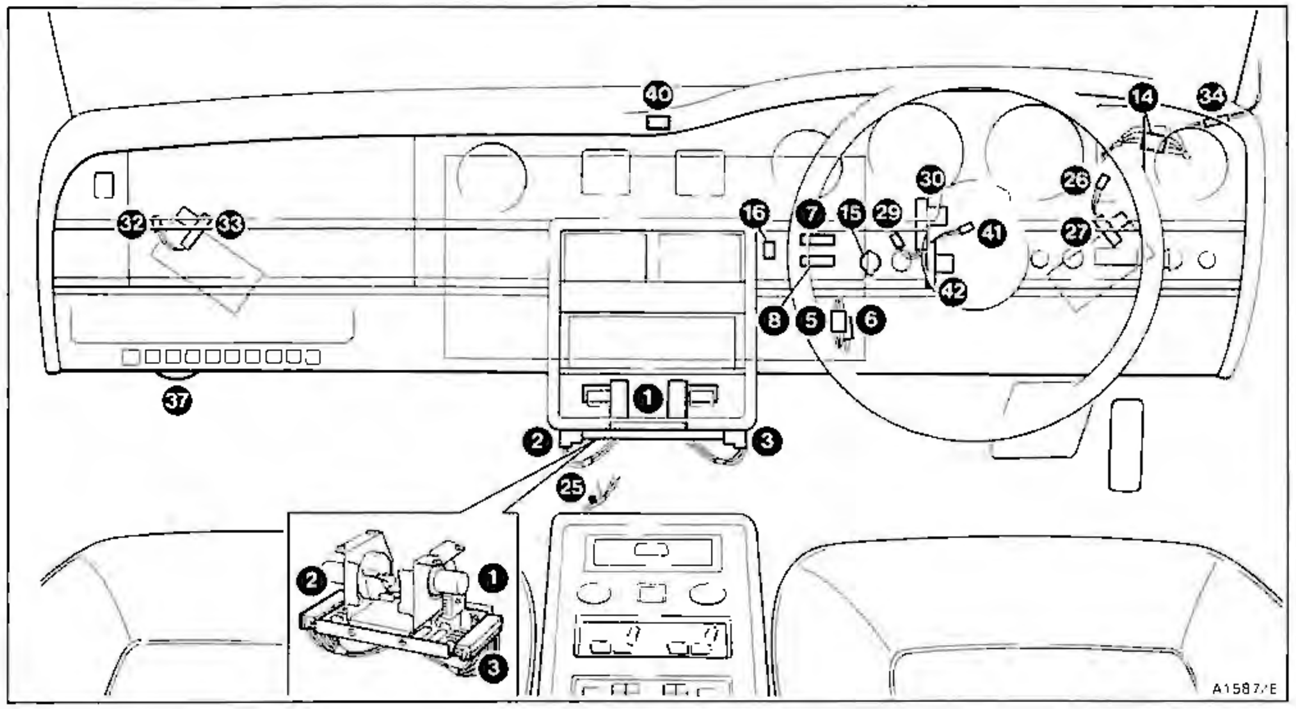
22 Engine earth point
23 Right-hand 'A' post main to body loom plug and socket 12-way
24 Rear window demister relay – for details of the rear window demister and mirror heaters circuit refer to TSD 4701 Workshop Manual – Electrical, Section 16
25 Transmission tunnel earth point
26 Right-hand recirculation actuator plug and socket
27 Right-hand recirculation actuator
28 Right-hand 'A' post earth point
29 Mode change actuator plug and socket
30 Mode change actuator
31 Left-hand 'A' post earth point

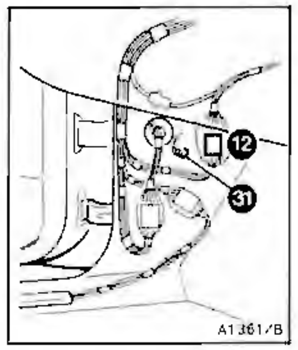


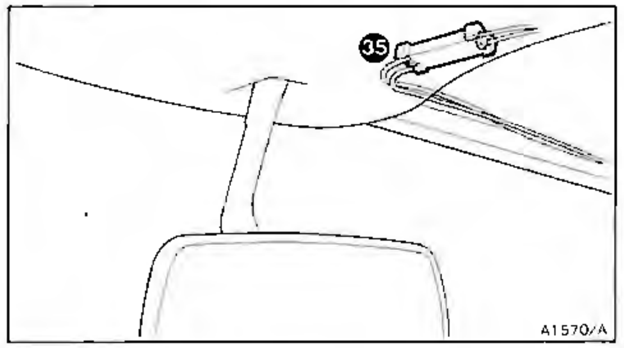


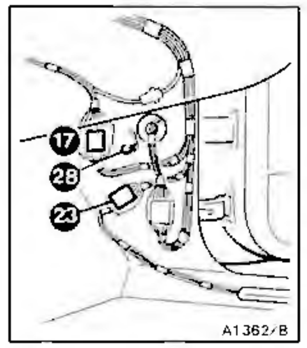


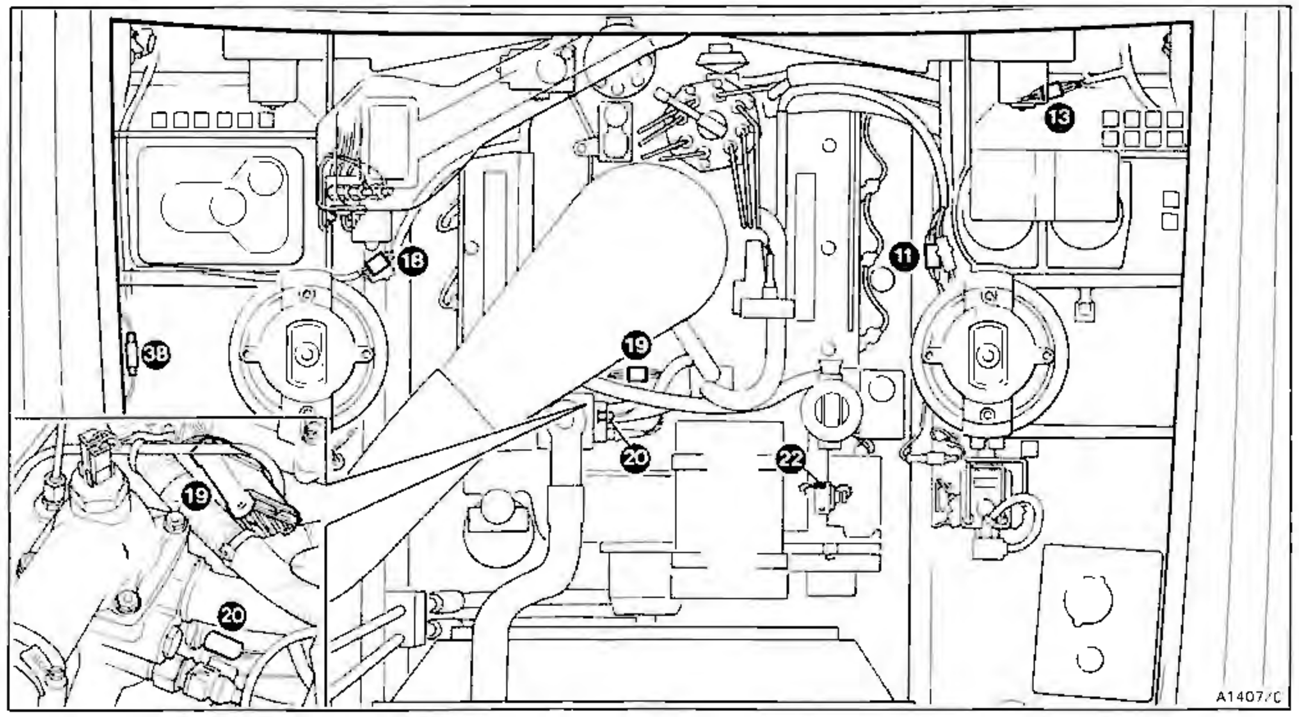
32 Left-hand recirculation actuator plug and socket
33 Left-hand recirculation actuator
34 Right-hand main to cantrail loom plug and socket 6-way
35 Right-hand cantrail to sensor loom plug and socket 2-way
36 Cantrail sensor
37 Knee roll sensor
38 Air conditioning unit ambient sensor plug and socket
39 Ambient sensor
40 Top roll (solar) sensor
41 Lower quantity actuator plug and socket
42 Lower quantity actuator
— — · — Denotes alternative cable route on Turbocharged cars











Test procedures using a multi-meter

Initial procedure

1. Disconnect both the left-hand and right-hand 18-way plugs at the micro-processor.
2. Start the engine. Ensure that there is a 12 volts positive supply on the yellow/black cable at pin 18 of the right-hand plug.

If no supply is present.

a. Check the continuity of the yellow/black cable from the 18-way plug to fuse A1 at fuseboard F1.
b. Ensure that the fuse is intact.
c. Check that there is a 12 volts positive supply to the white/yellow cable at connection 1U of fuse A1.

If no supply is present, the fault lies within the engine running sensor circuitry.

3. Ensure that there is a 14 volts positive supply (charging voltage) from the alternator at the brown/slate cable at pin 10 of the left-hand 18-way plug.

This supply monitors the car's electrical load, and in a situation where an excessive load is being used, will cause the micro-processor to switch off the rear window and door mirror demisting functions.

4. Switch off the engine.
5. Ensure the continuity of the black cable from pin 9 of the right-hand 18-way plug to the transmission tunnel earth point. Verify that the earth point is in good condition.

Air conditioning function switch – To test

Test procedure carried out at the left-hand 18-way plug.

1. In each switch position ensure continuity to the black/pink cable at pin 14 from the following.

OFF from the slate/orange cable at pin 9.
ECON from the slate/yellow cable at pin 8.
LOW from the slate/green cable at pin 7.
AUTO from the slate/light green cable at pin 6.
HIGH from the slate/brown cable at pin 5.
(defrost) from the slate/white cable at pin 4.

Fans control circuit – To test

Test procedure carried out at the right-hand 18-way plug.

1. Remove fuse A1 at fuseboard F1.
2. Apply a known 12 volts positive supply to the yellow/black cable connection at terminal 1 of the fuseboard.
3. Apply a known earth to the following cables ensuring in each case that the appropriate relay energizes.

Yellow/orange cable at pin 2 – fans control relay.
Yellow/pink cable at pin 3 – fan speed relay 4.
Yellow/red cable at pin 4 – fan speed relay 3.
Yellow/brown cable at pin 5 – fan speed relay 2.
Yellow/green cable at pin 6 – fan speed relay 1.

4. Should a relay not energize, first replace the relay and repeat the appropriate test.

If the relay still does not energize, disconnect the 12 volts positive supply before checking the continuity of the yellow/black cable from the fuse to the relay. If necessary, check the continuity of the appropriate cable to the other side of the relay coil (from the 18-way plug).

5. If all relays energize in procedure 3, and a fault is still suspected on the fans circuit, refer to the appropriate wiring diagram within this section for further details.

Mode change actuator – To test

Test procedure carried out at the left-hand 18-way plug.

1. Apply a known 12 volts positive supply to the green/red cable at pin 15. The actuator should move the flap to the screen position.

Should the actuator fail to move.

a. Ensure that there is a good earth connection to the actuator.
b. Disconnect the 12 volts positive supply before checking the continuity of the green/red cable from pin 15 to the actuator.

2. Apply a known 12 volts positive supply to the orange/red cable at pin 16. The actuator should move the flap to the facia position.

Should the actuator fail to move, disconnect the 12 volts supply before checking the continuity of the orange/red cable to the actuator.

3. If no fault is found, renew the actuator.

Left-hand recirculation actuator – To test

Test procedure carried out at the left-hand 18-way plug.

1. Apply a known 12 volts positive supply to the green/yellow cable at pin 17. The actuator should move the flap to the fresh air (closed) position.

Should the actuator fail to move.

a. Ensure that there is a good earth connection to the actuator.
b. Disconnect the 12 volts positive supply before checking the continuity of the green/yellow cable from pin 17 to the actuator.

2. Apply a known 12 volts positive supply to the orange/yellow cable at pin 18. The actuator should move the flap to the recirculation (open) position.

Should the actuator fail to move, disconnect the 12 volts positive supply before checking the continuity of the orange/yellow cable to the actuator.

3. If no fault is found renew the actuator.

Right-hand recirculation actuator – To test

Test procedure carried out at the right-hand 18-way plug.

1. Apply a known 12 volts positive supply to the green/blue cable at pin 10. The actuator should move the flap to the fresh air (closed) position.

Should the actuator fail to move.

a. Ensure that there is a good earth connection to the actuator.
b. Disconnect the 12 volts positive supply before checking the continuity of the green/blue cable to the actuator.

2. Apply a known 12 volts positive supply to the orange/blue cable at pin 11. The actuator should move the flap to the recirculation (open) position.

Should the actuator fail to move, disconnect the 12 volts positive supply before checking the continuity of the orange/blue cable to the actuator.

3. If no fault is found, renew the actuator.

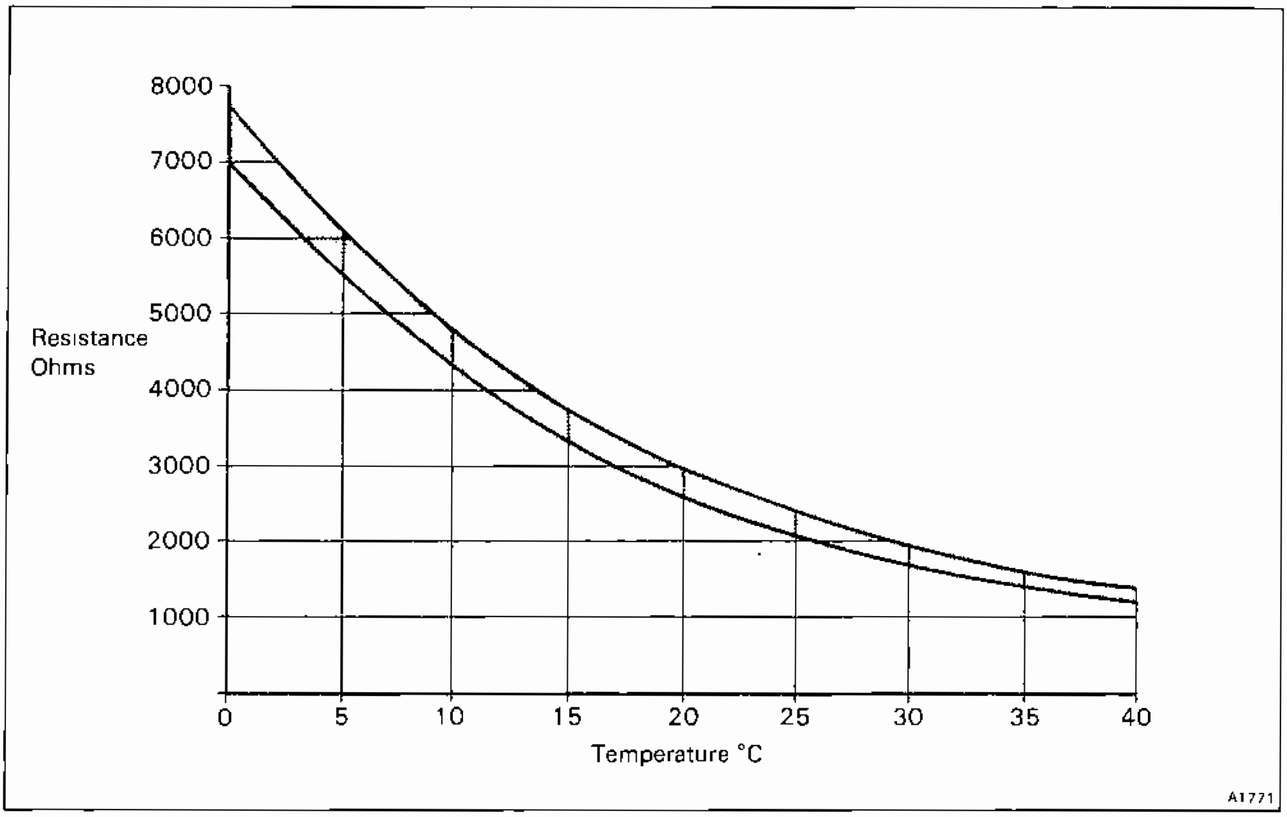


Fig. C4-3 Temperature sensor resistance graph

Lower quantity actuator – To test
Test procedure carried out at the right-hand 18-way plug.

1. Apply a known 12 volts positive supply to the green/slate cable at pin 12. The actuator should move the flap to the closed position.
   Should the actuator fail to move.

a. Ensure that there is a good earth connection to the actuator.
b. Disconnect the 12 volts positive supply before checking the continuity of the green/slate cable to the actuator.

2. Apply a known 12 volts positive supply to the orange/slate cable at pin 13. The actuator should move the flap to the open position.
   Should the actuator fail to move, disconnect the 12 volts positive supply before checking the continuity of the orange/slate cable to the actuator.
3. If no fault is found renew the actuator.

Air conditioning temperature sensors – To test
Test procedure carried out at the right-hand 18-way plug.

1. Disconnect the battery.
2. With the multi-meter set to ohms range.

a. Measure the resistance of each sensor between its connection at the plug (see item f) and a known earth point.
b. Compare the resistance measurement with the temperature/resistance graph shown in figure C4-3
c. If the resistance falls to within ± 5% of the graph reading, the sensor is operating correctly.
d. If the graph reading is significantly outside the ± 5% tolerance, renew the sensor.
e. If a measurement cannot be obtained, check the continuity of the sensor wiring.
f. Sensor connections.

Red/orange cable at pin 14 – Solar (top roll) sensor.
Red/yellow cable at pin 15 – Ambient sensor.
Red/green cable at pin 16 – Lower air (knee roll) sensor.
Red/blue cable at pin 17 – Upper air (roof) sensor.

3. Re-connect the battery.

Screen-facia/recirc switch – To test
Test procedure carried out at the left-hand 18-way plug.

1. Ensure the continuity of the pink/yellow cable at pin 2 to the black/pink cable at pin 14 when the SCREEN-FACIA/RECIRC switch is in the SCREEN-FACIA position.
2. Ensure the continuity of the pink/green cable at pin 3 to the black/pink cable at pin 14 when the SCREEN-FACIA/RECIRC switch is in the RECIRC position.

Temperature selector controls test procedure
Test procedure carried out at the left-hand 18-way plug.

1. Disconnect the battery.

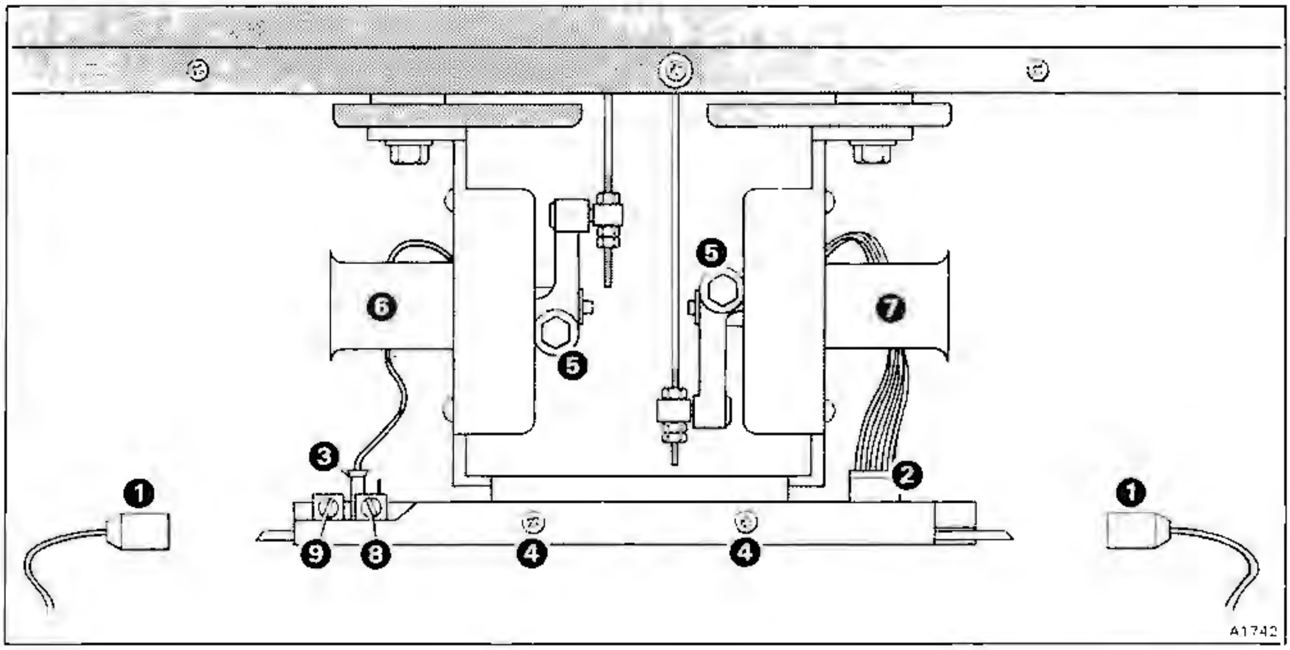


Fig. C4-4 Micro-processor and blend flap actuators assembly

2. With the multi-meter set to ohms range, measure the resistance from the pink cable at pin 13 to the black/pink cable at pin 14. The reading should be 500Ω.

If a reading of 1000Ω is recorded, one of the selector potentiometers is open circuit and must be replaced.

3. Rotate the lower temperature selector to the mid-position. Measure the resistance between the pink/red cable at pin 11 and the black/pink cable at pin 14. The reading should be 500Ω.

Rotate the lower temperature selector ensuring that a lower reading is measured as the red section is exposed, and a higher resistance is measured as the blue section is exposed.

4. Rotate the upper temperature selector to the mid-position. Measure the resistance between the pink/brown cable at pin 11 and the black/pink cable at pin 14. The reading should be 500Ω.

Rotate the upper temperature selector ensuring that a lower resistance is measured as the red section is exposed, and a higher resistance is measured as the blue section is exposed.

5. Re-connect the battery.

Rear window demister and mirror heaters, compressor clutch, and water tap test procedure

Test procedure carried out at the right-hand 18-way plug.

1. Remove fuse A1 at fuseboard F1.
2. Apply a known 12 volts positive supply to the yellow/black cable connection at terminal 1 of the fuseboard.
3. Apply a known earth to the following cables ensuring in each case that the appropriate relay energizes.

Orange/brown cable at pin 1 – rear window demister relay.
Blue/pink cable at pin 7 – compressor relay.
Blue/orange cable at pin 8 – water tap relay.

4. Should a relay not energize, first replace the relay and repeat the appropriate test.

If the relay still does not energize, disconnect the 12 volts positive supply before checking the continuity of the yellow/black cable from the fuse to the relay. If necessary, check the continuity of the appropriate cable to the other side of the relay coil (from the 18-way plug).

5. If all relays energize in procedure 3, and a fault is still suspected, refer to the appropriate wiring diagram for further details.

Note The wiring diagram for the compressor clutch and the water tap are contained within this section. However, the wiring diagram for the Rear window demister and mirror heaters circuit is contained in TSD 4701 Workshop Manual – Electrical, Section 16.

Air conditioning coolant temperature switch – To test

This test must be carried out with a cold engine [i.e. engine coolant temperature below 44°C (111°F)].

1. Check the continuity of the red/slate cable at pin 1 of the left-hand 18-way plug to a known earth point.
2. Disconnect the air conditioning coolant temperature switch and ensure that the red/slate cable now reads open circuit. Re-connect the switch.

Test procedures conclusion

1. Having verified the car wiring.

a. Ensure that all connections are remade.

b. If a fault has been found, retest the air conditioning system.

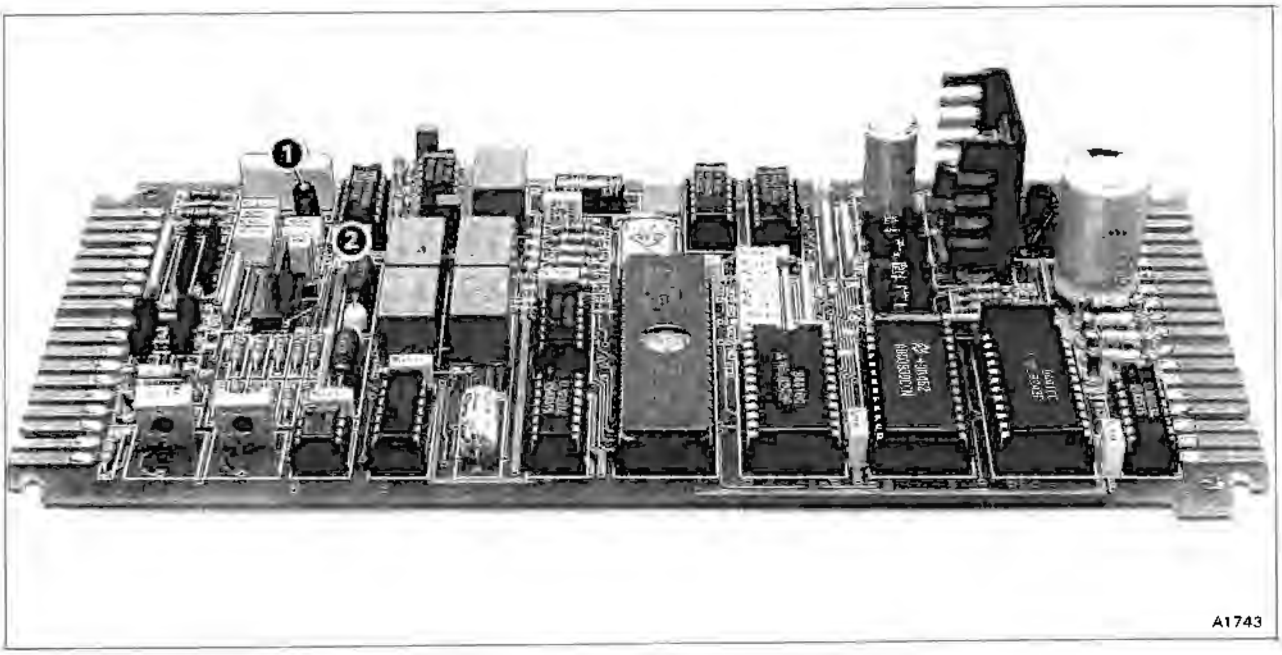


Fig. C4-5 Air conditioning micro-processor board

2. If no fault has been found and the air conditioning system circuitry is still faulty, replace the micro-processor board.

Air conditioning micro-processor board

Handling precautions

The micro-processor board and connectors are durable if handled correctly. However, they are vulnerable to stray voltages, wrong polarity and especially static electricity. Therefore anti-static precautions, in particular the wearing of an anti-static wristband connected to a good earth, must be observed at all times.

The board is particularly vulnerable before the edge connectors are fitted (i.e. before it is earthed). Handling should therefore be kept to a minimum.

Boards must be stored in anti-static containers and kept dry and free from grease.

Micro-processor board – To remove (see fig. C4-4)

1. Remove fuse A1 at fuseboard F1.
2. To avoid damage when disconnecting or re-connecting a micro-processor board 18-way plug, it will be necessary to hold the opposite end of the board.

   Disconnect both the left-hand and right-hand 18-way plugs from the micro-processor board (see item 1).
3. Disconnect the upper and lower blend flap actuator plugs from the micro-processor board (see items 2 and 3).
4. Remove the two setscrews securing the micro-processor board front retaining channel (see item 4). Remove the channel.
5. Lower the front edge of the micro-processor board and carefully withdraw.

Micro-processor board – To fit

Reverse Operations 2 to 5 inclusive of Micro-processor board – To remove. Then, carry out the Micro-processor initializing procedure.

Micro-processor initializing procedure (refer to figs. C4-4 and C4-5).

To carry out this procedure it may be necessary on some cars to remove the centre console. Refer to Chapter S of this manual for details.

1. Ensure that fuse A1 at fuseboard F1 is removed.
2. Ensure that the SCREEN-FACIA/RECIRC switch is set to the mid position.
3. Fit the micro-processor board test pins link RH 9884 DET 2 or bridge the test pins (see fig. C4-5 item 2).
4. Slacken the actuator arm securing bolts at the upper and lower blend flap actuators (see fig. C4-4 item 5).
5. Apply a known, fused, 12 volts positive supply to the yellow/black cable connection at the fuseboard.

   If using test box RH 9884 with the purple cable connected to a 12 volts positive supply, the red cable from the test box can be connected to the yellow/black cable at the fuseboard. It should be noted that the large cables marked LEFT and RIGHT from the test box are not connected during this procedure.
6. Select OFF position at the air conditioning function switch on the facia. The lower blend flap actuator (see fig. C4-4 item 6) will operate and continue to operate during procedure 7.
7. Rotate the lower blend flap potentiometer (see fig. C4-4 item 8) throughout the full range of its travel, noting the portion of travel for which the LED (light emitting diode) on the micro-processor board (see fig. C4-5 item 1) illuminates.

Adjust the potentiometer to the centre of the illuminated portion of travel.

8. Select the 🄦 (defrost) position at the air conditioning switch on the facia. The upper blend flap actuator will operate and continue to operate during procedure 9.

9. Rotate the upper blend flap potentiometer (see fig. C4-4 item 9) throughout the full range of its travel, noting the portion of travel for which the LED on the micro-processor board illuminates.

Adjust the potentiometer to the centre of the illuminated portion of travel.

10. Remove the test pins link RH 9884 DET 2 or remove the bridge from the test pins.

11. Tighten the actuator arm securing bolts at the upper and lower blend flap actuators (see fig. C4-4 item 5).

12. Disconnect the 12 volts positive supply from fuse A1 yellow/black cable connection.

13. Replace fuse A1 at fuseboard F1.

14. Test the air conditioning system.

Workshop tools

RH 9884	Air conditioning system test box
RH 9884 DET 1	Anti-static wristband
RH 9884 DET 2	Test pins link (air conditioning micro-processor board)

Printed in England

Lubricants

Contents

	Pages						
	Rolls-Royce			Bentley			
	Silver Spirit	Silver Spur	Corniche / Corniche II	Eight	Mulsanne / Mulsanne S	Turbo R	Continental
Contents and issue record sheet	D1	D1	D1	D1	D1	D1	D1
Countries other than Canada and the USA	D2	D2	D2	D2	D2	D3	D2
Canada and the USA	D4	D4	D4	D4	D4	D5	D4

Printed in England

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections	D1	D2	D3	D4	D5					
Page No.										
1	5/88	5/88	5/88	5/88	5/88					
2		5/88	5/88	5/88	5/88					
3	5/88									
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Sections										
Page No.										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Lubricants

All cars except Bentley Turbo R

†Engine, Hand oiling points

BP
BP Super Viscostatic
BP Visco 2000
BP Visco Route
BP Visco Coranda
BP Pilote 2500
BP Pilote 3000
BP Strato

Castrol
Castrol GTX
Castrol GTX2 (Turbo Tested)
Castrol Syntron
Castrol Syntron-X 5W/50
Castrol Formula RS

Duckhams
Duckhams Hypergrade
Duckhams 'QXR'

Esso
UNIFLO
Esso SUPERLUBE +
Esso Super Oil

Mobil
Mobil Super
Mobil 1 Rally Formula

Shell
Shell Super Motor Oil 20W/50
Shell Super Motor Oil 15W/50
Shell Super Motor Oil 15W/40
Shell Super Motor Oil 10W/40
Shell Super II

Texaco
Havoline 15W/40

†Recommended engine oil grades for cars operating in low temperatures.

For constant operation in ambient temperatures of between 0°C and −23°C (32°F and −10°F) use a 10W/30 grade oil.

For constant operation in ambient temperatures below −23°C (−10°F) use a 5W/20 grade oil alternatively, use Castrol Syntron-X 5W/50 oil or Mobil 1 Rally Formula (5W/50) oil.

Torque converter transmission, Steering pump

BP
BP Autran DX II

Castrol
Castrol TQ Dexron® II
Castrol Transmax M
Castrol Transmax S

Duckhams
Duckhams D-Matic ATF (Dexron II)

Esso
Esso ATF Dexron II

Gulf
Gulf Automatic Transmission Fluid Dexron II

Mobil
Mobil ATF 220 (Dexron)

Shell
Shell Automatic Transmission Fluid Dexron II

Texaco
Texamatic Fluid 9226 Dexron II

Also approved any other Dexron II Transmission Fluid.

Final drive unit, Rack and pinion steering unit

BP
BP Gear Oil 90 EP
BP Multigear FE 80W/90
BP Multigear FE 85W/140

Castrol
Castrol Hypoy EP 90
Castrol Hypoy B EP 90
Castrol EP 90
Castrol EPX 90
Castrol EPX 85W/140
Castrol EPX 80W/90

Duckhams
Duckhams Hypoid 90S

Esso
Esso Gear Oil GX 85W/90
Esso Gear Oil GX 80W

Gulf
Gulf Multi Purpose Gear Lubricant 80W/90

Mobil
Mobilube HD 90

Shell
Shell Spirax 90 EP

Front and rear hubs

BP
BP Energrease L2

Castrol
Castrol LM Grease

Duckhams
Duckhams LB 10 Grease

Esso
Esso Multi-purpose Grease

Gulf
Gulf Crown Grease No. 2 EP

Mobil
Mobilgrease MP

Shell
† Shell Retinax A

† First preference

Rear drive-shaft constant velocity joints,
Levelling valve operating rod ball joints,
Parking brake linkage clevis and fulcrum pins

Rocol
Rocol MTS 1000 Grease

Parking brake inner cable

Midlands Silicones
Midlands Silicones MS 44 Grease

Refrigeration compressor

Suniso
Suniso No. 5 GS Oil

Hydraulic braking and levelling systems

Castrol
Castrol Hydraulic System Mineral Oil

Power operated hood reservoir

BP
BP Energol HLP 22

Castrol
Castrol Hyspin VG 22
Castrol Hyspin AWS 22

Esso
Esso Nuto H22

Gulf
Gulf Hydrasil 22

Mobil
Mobil DTE 11
Mobil DTE 12
Mobil DTE 13

Shell
Shell Tellus Oil 22

Alloy wheel trim locks

BP
Keenomax L3

Lubricants

Bentley Turbo R

† Engine, Hand oiling points

BP
BP Super Viscostatic
BP Visco 2000

Castrol
Castrol GTX
Castrol GTX 2 (Turbo Tested)
Castrol Syntron
Castrol Syntron-X 5W/50
Castrol Formula RS

Duckhams
Duckhams Hypergrade
Duckhams 'QXR'

Esso
Esso SUPERLUBE +
Esso Super Oil 15W/40

Mobil
Mobil Super
Mobil 1 Rally Formula

Shell
Shell Super Motor Oil 20W/50
Shell Super Motor Oil 15W/50
Shell Super Motor Oil 15W/40
Shell Super II

Texaco
Havoline 15W/40

† Recommended engine oil grades for cars operating in low temperatures.

For constant operation in ambient temperatures of between 0°C and −23°C (32°F and −10°F) use a 10W/40 grade oil.

For constant operation in ambient temperatures below −23°C (−10°F) use a 5W/20 grade oil or alternatively, use Castrol Syntron-X 5W/50 oil or Mobil 1 Rally Formula (5W/50) oil.

Torque converter transmission, Steering pump

BP
BP Autran DX II

Castrol
Castrol TQ Dexron® II
Castrol Transmax M
Castrol Transmax S

Duckhams
Duckhams D-Matic ATF (Dexron II)

Esso
Esso ATF Dexron II

Gulf
Gulf Automatic Transmission Fluid Dexron II

Mobil
Mobil ATF 220 (Dexron)

Shell
Shell Automatic Transmission Fluid Dexron II

Texaco
Texamatic Fluid 9226 Dexron II

Also approved any other Dexron II Transmission Fluid.

Final drive unit, Rack and pinion steering unit

BP
BP Gear Oil 90 EP
BP Multigear FE 80W/90
BP Multigear FE 85W/140

Castrol
Castrol Hypoy EP 90
Castrol Hypoy B EP 90
Castrol EP 90
Castrol EPX 90
Castrol EPX 85W/140
Castrol EPX 80W/90

Duckhams
Duckhams Hypoid 90S

Esso
Esso Gear Oil GX 85W/90
Esso Gear Oil GX 80W

Gulf
Gulf Multi Purpose Gear Lubricant 80W/90

Mobil
Mobilube HD 90

Shell
Shell Spirax 90 EP

Front and rear hubs, Propeller shaft universal joints

BP
BP Energrease L2

5/88
Printed in England

Castrol
Castrol LM Grease

Duckhams
Duckhams LB 10 Grease

Esso
Esso Multi-purpose Grease

Gulf
Gulf Crown Grease No. 2 EP

Mobil
Mobilgrease MP

Shell
† Shell Retinax A

† First preference

Rear drive-shaft constant velocity joints,
Levelling valve operating rod ball joints,
Parking brake linkage clevis and fulcrum pins

Rocol
Rocol MTS 1000 Grease

Parking brake inner cable

Midlands Silicones
Midlands Silicones MS 44 Grease

Refrigeration compressor

Suniso
Suniso No. 5 GS Oil

Hydraulic braking and levelling systems

Castrol
Castrol Hydraulic System Mineral Oil

Alloy wheel trim locks

BP
Keenomax L3

Lubricants

All cars except Bentley Turbo R

† Engine, Hand oiling points

BP
BP Super Viscostatic
BP Visco 2000

Castrol
Castrol GTX (USA)
Castrol XLR (Canada)
Castrol Syntron-X 5W/50

Duckhams
Duckhams Hypergrade
Duckhams 'QXR'

Exxon/Esso
Superflo Supreme Performance (USA)
Protec Ultra (Canada)
UNIFLO

Mobil
Mobil Super
Mobil 1 Rally Formula

Shell
Fire and Ice (USA)
Super Plus (Canada)

Texaco
Havoline 15W/40

† Recommended engine oil grades for cars operating in low temperatures.

For constant operation in ambient temperatures of between 0°C and −23°C (32°F and −10°F) use a 10W/30 grade oil.

For constant operation in ambient temperatures below −23°C (−10°F) use a 5W/20 grade oil alternatively, use Castrol Syntron-X 5W/50 or Mobil 1 Rally Formula (5W/50) oil.

Torque converter transmission, Steering pump

BP
BP Autran Universal

Castrol
Castrol TQ Dexron® II
Castrol Transmax M
Castrol Transmax S

Duckhams
Duckhams D-Matic ATF (Dexron II)

Exxon/Esso
Esso ATF Dexron II

Gulf
Gulf Automatic Transmission Fluid Dexron II

Mobil
Mobil ATF 220 (Dexron)

Shell
Shell Automatic Transmission Fluid Dexron II

Texaco
Texamatic Fluid 9226 Dexron II

Also approved any other Dexron II Transmission Fluid

Final drive unit, Rack and pinion steering unit

BP
BP GEAREP 80W/90
BP GEAREP 80W/140
BP GEAREP 85W/140

Castrol
Castrol EP 90
Castrol EPX 90
Castrol EPX 85W/140
Castrol EPX 80W/90

Duckhams
Duckhams Hypoid Gear Oil 80W/90

Exxon/Esso
Esso Gear Oil GX 85W/140
Esso Gear Oil GX 85W/90
Esso Gear Oil GX 80W/90
Esso Gear Oil GX 80W

Gulf
Gulf Multi Purpose Gear Lubricant 80W/90

Mobil
Mobilube HD 90

Shell
Shell Spirax 90 EP

Front and rear hubs

BP
BP Energrease L2

Castrol
Castrol MP Grease
Castrol LM Grease
Castrol Universal Wheel Bearing Grease (Canada)

Duckhams
Duckhams LB 10 Grease

Exxon/Esso
Ronex MP
Esso Unitol

Gulf
Gulf Crown Grease No. 2 EP

Mobil
Mobilgrease MP

Shell
Shell Darina AX

Rear drive-shaft constant velocity joints,
Levelling valve operating rod ball joints,
Parking brake linkage clevis and fulcrum pins

Rocol
Rocol MTS 1000 Grease

Parking brake inner cable

Midlands Silicones
Midlands Silicones MS 44 Grease

Refrigeration compressor

Suniso
Suniso No. 5 GS Oil

Hydraulic braking and levelling systems

Castrol
Castrol Hydraulic System Mineral Oil

Power operated hood reservoir

BP
BP Energol HLP 22

Castrol
Castrol Hyspin AWS 22

Exxon/Esso
Esso Nuto H22

Gulf
Gulf Harmony 22 AW

Mobil
Mobil DTE 11
Mobil DTE 12
Mobil DTE 13

Shell
Shell Tellus Oil 22
Shell Tellus Oil 23

Alloy wheel trim locks

BP
Keenomax L3

Lubricants

Bentley Turbo R

† Engine, Hand oiling points

BP
BP Super Viscostatic 10W/40
BP Visco 2000

Castrol
Castrol GTX (USA)
Castrol XLR (Canada)
Castrol Syntron-X 5W/50

Duckhams
Duckhams Hypergrade
Duckhams 'QXR'

Exxon/Esso
Superflo Supreme Performance (USA)
Protec Ultra (Canada)

Mobil
Mobil Super
Mobil 1 Rally Formula

Shell
Fire and Ice (USA)
Super Plus (Canada)

Texaco
Havoline 15W/40

† Recommended engine oil grades for cars operating in low temperatures.

For constant operation in ambient temperatures of between 0°C and −23°C (32°F and −10°F) use a 10W/40 grade oil.

For constant operation in ambient temperatures below −23°C (−10°F) use a 5W/20 grade oil alternatively, use Castrol Syntron-X 5W/50 or Mobil 1 Rally Formula (5W/50) oil.

Torque converter transmission, Steering pump

BP
BP Autran Universal

Castrol
Castrol TO Dexron® II
Castrol Transmax M
Castrol Transmax S

Duckhams
Duckhams D-Matic ATF (Dexron II)

Exxon/Esso
Esso ATF Dexron II

Gulf
Gulf Automatic Transmission Fluid Dexron II

Mobil
Mobil ATF 220 (Dexron)

Shell
Shell Automatic Transmission Fluid Dexron II

Texaco
Texamatic Fluid 9226 Dexron II

Also approved any other Dexron II Transmission Fluid.

Final drive unit, Rack and pinion steering unit

BP
BP GEAREP 80W/90
BP GEAREP 80W/140
BP GEAREP 85W/140

Castrol
Castrol EP 90
Castrol EPX 90
Castrol EPX 85W/140
Castrol EPX 80W/90

Duckhams
Duckhams Hypoid Gear Oil 80W/90

Exxon/Esso
Esso Gear Oil GX 85W/140
Esso Gear Oil GX 85W/90
Esso Gear Oil GX 80W/90
Esso Gear Oil GX 80W

Gulf
Gulf Multi Purpose Gear Lubricant 80W/90

Mobil
Mobilube HD 90

Shell
Shell Spirax 90 EP

Front and rear hubs, Propeller shaft universal joints

BP
BP Energrease L2

Castrol
Castrol MP Grease
Castrol LM Grease
Castrol Universal Wheel Bearing Grease (Canada)

Duckhams
Duckhams LB 10 Grease

Exxon/Esso
Ronex MP
Esso Unitol

Gulf
Gulf Crown Grease No. 2 EP

Mobil
Mobilgrease MP

Shell
Shell Darina AX

Rear drive-shaft constant velocity joints,
Levelling valve operating rod ball joints,
Parking brake linkage clevis and fulcrum pins

Rocol
Rocol MTS 1000 Grease

Parking brake inner cable

Midlands Silicones
Midlands Silicones MS 44 Grease

Refrigeration compressor

Suniso
Suniso No. 5 GS Oil

Hydraulic braking and levelling systems

Castrol
Castrol Hydraulic System Mineral Oil

Alloy wheel trim locks

BP
Keenomax L3

Engine

Contents

	Sections						
	Rolls-Royce			Bentley			
	Silver Spirit	Silver Spur	Corniche / Corniche II	Eight	Mulsanne / Mulsanne S	Turbo R	Continental
Contents and issue record sheet	E1	E1	E1	E1	E1	E1	E1
Introduction	E2	E2	E2	E2	E2	E2	E2
Specification	E3	E3	E3	E3	E3	E3	E3
Dimensional data	E4	E4	E4	E4	E4	E4	E4
Crankcase, cylinder liners, and crankshaft	E5	E5	E5	E5	E5	E5	E5
Connecting rods and pistons	E6	E6	E6	E6	E6	E6	E6
Camshaft and valve mechanism	E7	E7	E7	E7	E7	E7	E7
Cylinder heads and valves	E8	E8	E8	E8	E8	E8	E8
Crankcase breather system	E9	E9	E9	E9	E9	E9	E9
Engine lubrication system	E10	E10	E10	E10	E10	E10	E10
Hydraulic pump push rod assemblies	E11	E11	E11	E11	E11	E11	E11
Engine removal and installation	E12	E12	E12	E12	E12	E12	E12
Engine drive belts	E13	E13	E13	E13	E13	E13	E13
Fault diagnosis	E14	E14	E14	E14	E14	E14	E14
Special torque tightening figures	E15	E15	E15	E15	E15	E15	E15
Workshop tools	E16	E16	E16	E16	E16	E16	E16

Protection of paintwork
Before commencing work within the engine compartment, always fit new liners RH 2685 to the inside of the wing covers RH 2684 and position them on the front wings of the vehicle.

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
1	11/87	5/88	5/88	11/87	11/87	12/87	12/87	11/88	5/88	11/88
2		5/88	5/88	11/87	5/88	12/87	12/87	12/87	5/88	1/88
3	9/90			5/88	5/88	12/87	12/87	12/87		1/88
4				5/88	11/87	12/87	2/89	12/87		5/88
5				9/90	5/88	12/87	2/89			
6				5/88	5/88		2/89			
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Sections / Page No.	E11	E12	E13	E14	E15	E16				
1	1/88	11/88	2/89	11/88	2/89	2/89				
2	9/90	11/88	2/89	2/88	11/88					
3		11/88		2/88	5/88					
4		11/88								
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Introduction

The power unit is an over square, eight cylinder four stroke, designed in a 90° Vee formation.

The two banks (each of four cylinders) are designated 'A' bank and 'B' bank. 'A' bank of cylinders is situated on the right-hand side when viewed from the driver's seat. It is located 25,40 mm (1.0 in) further forward than the cylinders of 'B' bank.

The crankcase is manufactured from cast aluminium alloy and on 1989 model year engines it is also ribbed and cross-bolted. It is fitted with detachable, full length, wet cylinder liners of centrifugally spun cast iron. Rubber 'O' rings are used at the top and bottom of each liner to seal in engine coolant. This allows the coolant to circulate directly onto and around the centre portion of the liners.

The crankshaft is forged from chrome molybdenum steel which is subsequently nitride hardened.

Five main bearings support the crankshaft. The bearings are split steel backed shells, lined with an aluminium-tin material. They are retained in position by forged aluminium bearing caps. Crankshaft end-float is controlled by thrust washers fitted on each side of the centre main bearing.

The 'H' section connecting rods and caps are forged from chrome molybdenum steel. The small-end bushes are lead-bronze with a steel backing. The bushes are pressed into the connecting rods and machined to size. The big-end bearings are split, steel backed shells with an aluminium-tin lining.

The pistons are manufactured from aluminium alloy and are tin plated. They are carried on fully floating, hardened steel gudgeon pins.

The compression ratio is either 8:1 or 9:1 depending upon the specification of the engine. The shape of the piston crown changes the compression ratio.

On all engines, steel struts are cast into the wall of each piston.

The pistons have two compression rings and an oil control ring.

The two aluminium alloy cylinder heads each have four separate inlet and exhaust ports. The cylinder heads are fitted with phosphor-bronze

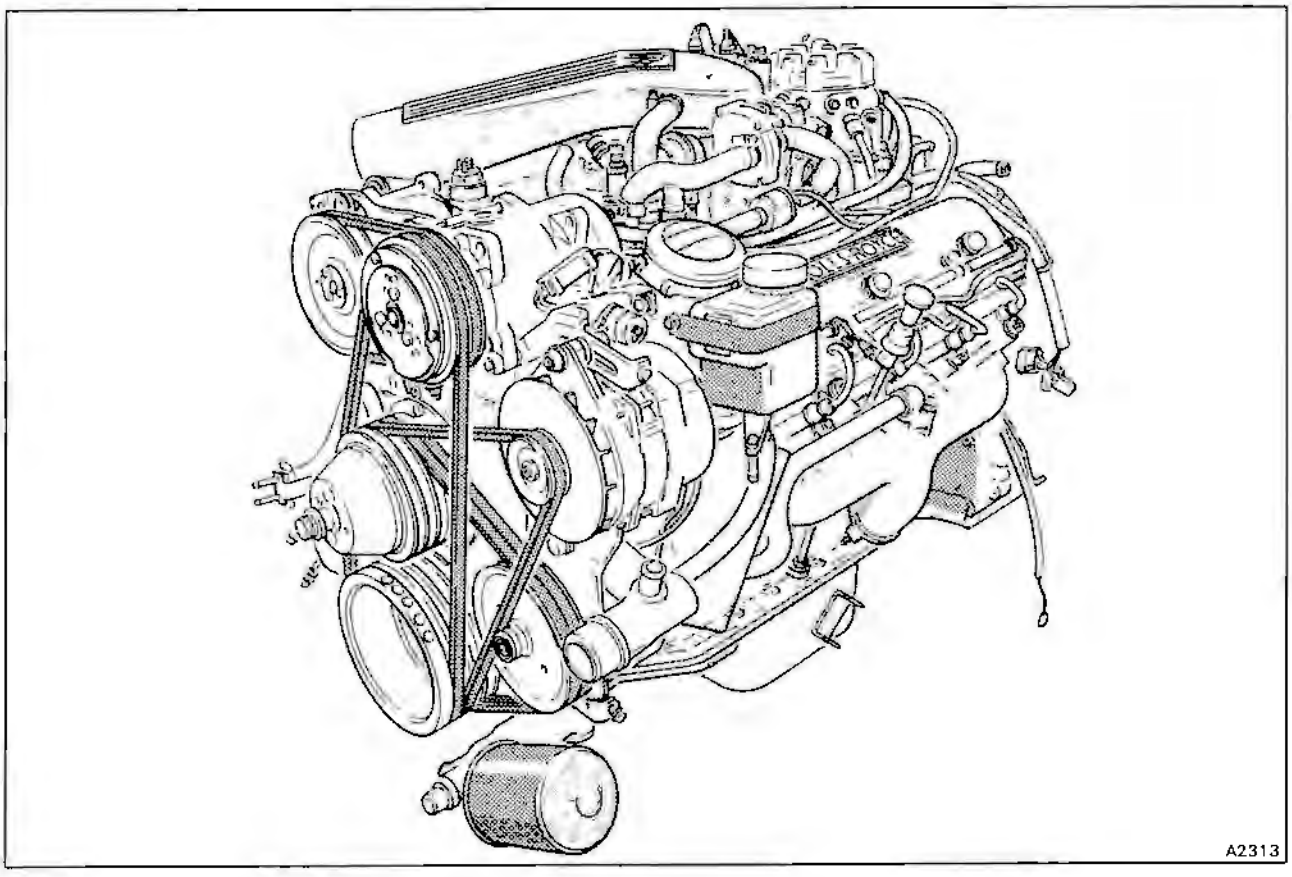


Fig. E2-1 Fuel injected engine

exhaust valve guides, cast iron inlet valve guides, and heat treated alloy cast iron valve seat inserts.

The exhaust valves are austenitic steel with stellite tips and valve seat faces. Early inlet valves are alloy steel with induction hardened tips. However, from approximately mid-March 1988, they are manufactured from austenitic steel.

On turbocharged engines, the inlet valves are manufactured from austenitic steel.

The overhead valve mechanism is operated by push rods, rocker arms, and self-adjusting hydraulic tappets from a centrally positioned camshaft which is carried directly in bores machined in the crankcase. The hydraulic tappets are carried in detachable blocks located in the crankcase.

Two eccentrics on the camshaft drive the hydraulic pumps mounted on the tappet cover. These pumps provide the hydraulic pressure for the braking and levelling systems.

Engine lubrication is provided by a pressurized system. First stage filtration is accomplished through a fine mesh strainer and pick-up located in the engine oil sump. Oil from the sump strainer passes into a gear type pump situated at the front of the crankcase. The pump is driven by skew gears from the crankshaft. A relief valve in the oil pump regulates the oil pressure at approximately 2,76 bar (40 lbf/in^2). Final filtration of the oil is through a disposable 'full flow' filter, prior to its circulation around the engine.

High pressure oil is delivered to the turbocharger assembly (if fitted), crankshaft, connecting rods, camshaft bearing surfaces, timing gears, tappets, push rods, and rocker ball end seatings.

Low pressure oil is fed through the front camshaft bearing to the rocker shaft, rocker arms, and valve tips. The connecting rod small-ends, gudgeon pins, and cylinder walls are splash fed with oil from the crankcase.

The engine is cooled by a mixture of anti-freeze and water circulating around the coolant passages. A coolant pump which is mounted at the front of the power unit and belt driven from the crankshaft, circulates the warm coolant around the engine, through the thermostat and then to the radiator where it is cooled.

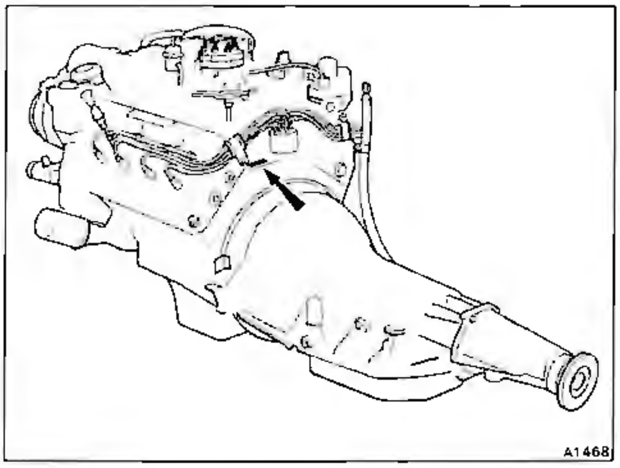


Fig. E2-2 Engine identification number

Crankcase emissions are controlled by a recirculatory closed breather system. Basically, two systems are used depending upon the engine i.e. naturally aspirated or turbocharged.

For further details of the crankcase emission control system, refer to TSD 4737, Engine Management Systems.

Engine identification number

The identification number is stamped on a crankcase boss adjacent to the ignition distributor (see fig. E2-2). It is the only number stamped on the engine and should be used for all identification purposes.

The number is made up of the following components.

1. A five digit build sequence number which commences at 60000.
2. A 5 or 6 character engine type code which denotes whether the engine is naturally aspirated or turbocharged (L410I or L410IT).
3. A single digit compression ratio identification, either 8 (8:1 compression ratio), or 9 (9:1 compression ratio).

Example

60001 L410IT/8=Turbocharged with 8:1 compression ratio.

In addition, 1989 model year turbocharged cars have the letter I as the final digit.

Example

60001 L410IT/I=Turbocharged with intercooler.

Engine oils

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation, and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities should be provided.

For full details on engine oil precautions, reference should be made to Chapter A.

Specification

General

Type	Over square 90° Vee formation liquid cooled.
Number of cylinders	Eight – in two banks of four.
Bore	104,14 mm (4.10 in).
Stroke	99,06 mm (3.90 in).
Cubic capacity	6,75 litres (411.91 in^3) nominal.
Compression ratio	9:1 or 8:1 dependent upon the specification of the vehicle.
Firing order	A1, A3, B3, A2, B2, B1, A4, B4.

Cylinder block

Type	Monobloc casting.
1989 model year	Ribbed and cross-bolted.
Material	Cast aluminium alloy.

Cylinder liners

Type	Detachable wet liners.
Material	Centrifugally spun cast iron.

Cylinder heads

Description	Two detachable heads, each having four separate inlet and exhaust ports.
Material	Aluminium alloy, with phosphor-bronze exhaust valve guides and cast iron inlet valve guides. Valve seat inserts of heat treated alloy cast iron.

Crankshaft

Description	Dynamically balanced, five journal crankshaft with four crankpins (incorporating integral balance weights and sludge traps).
Material	Chrome molybdenum steel with nitride hardened journals and crankpins.
Damper	Metalastik rubber vibration damper.
Direction of rotation	Clockwise (viewed from the front of the engine).
End thrust	Taken on centre main bearing.

Main bearings

Material	Steel backed shells with a tin-aluminium lining.
Number	Five.

Connecting rods

Type	'H' section. Forged to size. Weighed and colour coded into sets.
Material	Chrome molybdenum steel.
Big-end bearings	Steel backed shells with a tin-aluminium lining.
Gudgeon pin bushes	Pressed into connecting rod small-end bosses and machined to size.
Material	Lead-bronze, steel backed.
Gudgeon pins	Fully floating.
Material	EN 32 B.

Pistons

Type	Aeconoguide, skirt relieved for crankweb clearance. Recessed crown and offset gudgeon pin. All engines have steel struts cast into the wall of the pistons.
Material	Aluminium alloy – Tin plated.
Rings	Three a. Two compression, manufactured from cast iron. Top ring molybdenum sprayed on periphery. b. One oil control ('H' flex). Top and bottom steel rails have a chromium plated periphery. Equalizer (expander and centre spacer) is manufactured from carbon steel.

Valve gear

Valves	Overhead push rod operated. Seat angle 45°.
Material	
Inlet valve	**Naturally aspirated engines.** Alloy steel with induction hardened tips. From approximately mid-March 1988, as Turbocharged engines. **Turbocharged engines.** Austenitic steel with Stellited tips.
Exhaust valve	Austenitic steel with Stellited tips and valve seats.
Valve timing	Marks on gears.
Tappets	Self-adjusting hydraulic tappets with spherical base.

Material	Heat treated chilled cast iron.
Push rods	Ball-ended tubes.
Material	Cold drawn steel or copper plated bundy tube.

Camshaft

Material	Chilled cast iron.
Cams	5' to 7' longitudinal taper.
Number of journals	Four.
Bearings	Runs direct in crankcase.
Thrust taken	On front end.
Drive	Through helical tooth gears.
Material	Crankshaft gear – steel. Camshaft gear – aluminium.

Lubrication system

General	High pressure oil feed to turbocharger (if fitted), crankshaft, connecting rods, camshaft bearings, camshaft timing gears, tappets, push rods, and rocker ball end seatings. Low oil pressure fed through the front camshaft bearing to rocker shafts, rocker arms, and valve tips. Splash feed to connecting rod small-ends, gudgeon pins, and cylinder walls.
Type	Pressurized, wet sump system.
High pressure supply	2,76 bar (40 lbf/in²) at 2000 rev/min.
Relief valve	2,76 bar (40 lbf/in²).
Oil pump	Helical gear type with fine mesh strainer pick-up.
Drive	By gears from crankshaft.
Oil filter	Full flow, disposable canister type.

Associated systems

Fuel and ignition systems	Refer to TSD 4737, Engine Management Systems.
Cooling system	Refer to Chapter L.
Exhaust system	Refer to Chapter Q.

Dimensional data

Description	Dimension	Permissible worn dimensions	Remarks
Crankcase and cylinders			
Cylinder liner bore grading	S 4.10040 in to 4.10095 in T 4.10095 in to 4.10150 in X 4.1016 in to 4.1020 in	0.004 in wear	If these measurements are exceeded a new assembly of liner and piston must be fitted
Cylinder liner 'nip'	0.002 in to 0.003 in		New liners must be selectively fitted or ground on the end to give this dimension
Pistons			
Piston grading	S 4.0988 in to 4.0994 in T 4.0994 in to 4.0999 in X 4.0999 in to 4.1006 in		Pistons measured between 2.480 in and 1.338 in from the top of the piston across the thrust axis
Compression ring groove widths	0.0799 in to 0.0809 in		The rings should be assembled with staggered gaps
Compression ring widths	0.0777 in to 0.0783 in		
Clearance	0.0016 in to 0.0032 in	0.005 in	
Compression rings closed gap	0.015 in to 0.025 in		
Oil control ring groove width	0.1575 in to 0.1585 in		
Oil control ring closed gap	0.0149 in to 0.0448 in		
Crankshaft and connecting rods			
Connecting rod small-end bush internal diameter	1.0004 in to 1.0006 in		
Gudgeon pin clearance in small-end bush	0.0001 in to 0.0005 in		At room temperature, 20°C to 22°C (68°F to 72°F)
Big-end bearing housing, internal diameter	2.395 in to 2.3955 in		This diameter should be checked with the big-end bolts in position and the nuts torque tightened to 47,08 Nm (4,8 kgf m; 35 lbf ft)
Big-end bearing shell, internal diameter	2.2505 in to 2.2515 in		

Description	Dimension	Permissible worn dimensions	Remarks
Crankpin diameter	2.2485 in to 2.249 in	2.2475 in	
Clearance	0.0015 in to 0.003 in	0.004 in	Clearance measured vertically
Small-end bush housing internal diameter	1.140 in to 1.1405 in		
Connecting rod twist	Maximum of 0.003 inch per inch in length		
Connecting rod vertical alignment	Maximum of 0.001 inch per inch in length		
Connecting rod and cap bolt holes diameter for location	0.375 in to 0.3755 in		On location diameter
Connecting rod bolt diameter for location	0.3745 in to 0.375 in		On location diameter
Clearance	Size to 0.001 in		
Connecting rod bolt interference on knurled diameter	0.0032 in to 0.0072 in		Bolts should not be removed from rods unless they are to be renewed
Connecting rod end-float	0.008 in to 0.017 in		Controlled by clearance between rods and crankpin end faces
Main bearing diametral clearance	0.0015 in to 0.0030 in	0.0035 in	
Crankshaft end-float	0.004 in to 0.010 in	0.012 in	
Connecting rod bolt stretch			Refer to Section E6
Crankshaft bow		0.01 in	Regrind crankshaft if this figure is exceeded
Crankshaft journals and crankpins		0.001 in	Regrind crankshaft if this figure is exceeded
Gudgeon pins			
Bore diameter in piston	Green 1.0003 in to 1.0004 in		Colour code marked on the underside of the piston boss
	Red 1.0004 in to 1.0005 in		
Gudgeon pin diameter	Green 1.0001 in to 1.0002 in		Colour code marked on the end of the gudgeon pin
	Red 1.0002 in to 1.0003 in		
Clearance in boss	0.0001 in to 0.0003 in		

Description	Dimension	Permissible worn dimensions	Remarks
Main bearing housings			
Bore diameter	2.8735 in to 2.8740 in		This diameter should be checked with the main bearing caps in position and the retaining bolts tightened to between 79 Nm and 84 Nm (8,0 kgf m and 8,5 kgf m; 58 lbf ft and 62 lbf ft)
Main bearing cap			
Width of cap	5.1005 in to 5.1010 in		
Crankcase location gap	5.1000 in to 5.1010 in		
Fit – Interference	0.001 in		
Clearance	0.0005 in		
Cross-bolting beam			
Width of beam	6.4000 in to 6.4005 in		
Crankcase location gap	6.4000 in to 6.402 in		
Fit – Interference	0.0005 in		
Clearance	0.002 in		

Crankshaft diameter	**Crankshaft journal diameter**	**Main shell bearing diameter**
Crankshaft grinding dimensions		
Standard	2.6378 in – 0.0005 in	2.6388 in + 0.001 in
0.010 in undersize	2.6278 in – 0.0005 in	2.6288 in + 0.001 in
0.020 in undersize	2.6178 in – 0.0005 in	2.6188 in + 0.001 in
Crankshaft size	**Crankpin**	**Big-end bearing**
Crankshaft grinding dimensions		
Standard	2.249 in – 0.0005 in	2.2505 in + 0.001 in
0.010 in undersize	2.239 in – 0.0005 in	2.2405 in + 0.001 in
0.020 in undersize	2.229 in – 0.0005 in	2.2305 in + 0.001 in

Valve gear			
Camshaft timing gear backlash	0.001 in to 0.0035 in	0.006 in	
Camshaft gear face run-out	0.000 in to 0.002 in		

Description	Dimension	Permissible worn dimensions	Remarks
Camshaft end-float	0.002 in to 0.006 in		
Camshaft journal diameter	1.9975 in to 1.998 in	1.9965 in	
Camshaft bearing bore	2.000 in to 2.0005 in	2.002 in	
Camshaft journal clearance	0.002 in to 0.003 in	0.004 in	
Cam base circle (inlet and exhaust)	1.467 in to 1.472 in	1.457 in	Dimensions apply on centre line of cam at the small end
Height of cam (inlet and exhaust)	1.721 in		
Exhaust valve guide – external diameter	0.6275 in to 0.628 in		Standard Blue + 0.002 in Green + 0.005 in Yellow + 0.010 in
Cylinder head bore diameter for exhaust valve guide	0.625 in to 0.626 in		
Interference in head	0.0015 in to 0.003 in		
Exhaust valve guide – internal diameter	0.375 in to 0.3755 in	0.3775 in	Finish reamed after fitting. 'Bellmouth' at the lower end is permissible up to 0.006 in for a depth of 0.3725 in
Inlet valve stem diameter	0.3735 in to 0.374 in	0.37275 in	New diameter will increase nominally 0.0002 in after tufftriding
Clearance	0.001 in to 0.002 in	0.0035 in	
Valve spring poundage test (inlet and exhaust)	1st test Weight between 83.6 lbf and 92.4 lbf to compress spring to 1.340 in 2nd test Weight between 158 lbf and 170 lbf to compress spring to 0.940 in		
Exhaust valve – overall length	4.891 in		Nominal dimension
Exhaust valve stem diameter	0.3735 in to 0.374 in	0.37275 in	New diameter will increase nominally 0.0002 in after tufftriding
Clearance	0.001 in to 0.002 in	0.0035 in	
Exhaust and inlet valve seat angle	45°		After regrinding the exhaust valve seat can be 'crowned' with 30° cutter to avoid pocketing

Description	Dimension	Permissible worn dimensions	Remarks
Exhaust valve seat insert – external diameter	1.7540 in to 1.7545 in		Standard Green + 0.005 in Yellow + 0.010 in Blue + 0.015 in
Cylinder head bore diameter for exhaust seat insert	1.750 in to 1.751 in		
Interference	0.003 in to 0.0045 in		
Inlet valve seat insert – external diameter	2.0290 in to 2.0295 in		Standard Green + 0.005 in Yellow + 0.010 in Blue + 0.015 in
Cylinder head bore diameter	2.025 in to 2.026 in		
Interference	0.003 in to 0.0045 in		
Inlet valve guide – external diameter	0.6275 in to 0.628 in		Standard Blue + 0.002 in Green + 0.005 in Yellow + 0.010 in
Cylinder head bore diameter for inlet valve guide	0.625 in to 0.626 in		
Interference in head	0.0015 in to 0.003 in		
Inlet valve guide – internal diameter	0.375 in to 0.3755 in	0.3775 in	Finish reamed after fitting
Inlet valve – overall length	4.905 in		Nominal dimension
Distributor gear backlash	0.002 in to 0.008 in	0.009 in	Measured by turning small gear on distributor drive-shaft
Rocker bore diameter	0.74925 in to 0.74975 in	0.751 in	
Rocker shaft diameter	0.74825 in to 0.7485 in		
Clearance	0.00075 in to 0.0015 in	0.0035 in	
Hydraulic brake pump push rod lift	0.525 in to 0.528 in		This measurement is taken from the top face of the mounting flange to the top of the push rod
Hydraulic brake pump shim sizes	0.002 in, 0.003 in, and 0.008 in		

Oil pump

Driving shaft diameter	0.4990 in to 0.4995 in	0.4970 in	
Shaft bore diameter	0.500 in to 0.5005 in		

Description	Dimension	Permissible worn dimensions	Remarks
Shaft clearance in casing bore	0.0005 in to 0.0015 in	0.003 in	
Stationary spindle diameter	0.499 in to 0.4995 in	0.4975 in	
Driven gear internal diameter	0.500 in to 0.5005 in	0.5015 in	
Clearance on spindle	0.0005 in to 0.0015 in	0.003 in	Permissible only when the radial clearance of the gears in the case exceeds this figure
Diametrical clearance between gears and side of chamber	0.002 in to 0.0035 in	0.006 in	
Pump gears backlash	0.003 in to 0.007 in	0.0085 in	Oil pump internal gears
Pump gears end-float	0.001 in to 0.004 in	0.005 in	
Drive gear backlash	0.001 in to 0.008 in	0.012 in	Measured by turning small gear on oil pump
Drive gear end-float	0.001 in to 0.004 in	0.005 in	

Crankcase, cylinder liners, and crankshaft

Crankcase
The crankcase is a monobloc casting of aluminium alloy.

Centrifugally spun cast iron 'wet type' cylinder liners are sealed in the crankcase by a single 'O' ring at the top and by two 'O' rings at the bottom.

The main bearing caps are aluminium forgings and have an interference fit in the crankcase.

Various setscrew holes in the crankcase have heli-coil inserts. The threads in the crankcase (into which these heli-coil inserts screw) are non-standard sizes. Therefore, setscrews should not be fitted until the heli-coils have been correctly installed.

Cylinder head studs (colour coded for size) screw directly into the crankcase, their threads having an interference fit of up to 0,05mm (0.002in).

Cylinder liners and seals (see fig. E5-1)
The cylinder bore dimensions should only be checked when all the liners from any one bank are in position. Any deviation from this rule could result in false readings.

From the measurements taken of the cylinder bore, calculate the wear and ovality. If the figures exceed those quoted in Section E4, Dimensional data, a new liner assembly and piston assembly must be fitted.

Cylinder liner seal leakage can be detected by 'tell-tale' holes in the side of the crankcase.

If engine coolant issues from the 'tell-tale' hole, the upper of the two bottom rings is leaking. If oil issues from the 'tell-tale' hole, the lower sealing ring is leaking. In either case, the appropriate liner should be removed and new sealing rings fitted.

Note The sealing ring lubricant used during engine assembly, will melt when the engine is initially run and may flow from the 'tell-tale' holes, staining the crankcase. This situation is normal and must not be confused with a sealing ring leak.

Cylinder liner – To remove (see fig. E5-1)
This operation can be carried out whether or not the crankcase is fitted in the vehicle.

1. Dismantle the engine as necessary.
2. Using the cylinder liner extraction tool RH 7095, withdraw the liner from the top face of the crankcase.

In certain instances it may be beneficial to carry out this operation with the crankcase heated.

Cylinder liner – To fit (see fig. E5-1)

1. Ensure that the coolant drain hole and the seal leakage 'tell-tale' holes in the crankcase wall are clean and unobstructed.
2. Ensure that the sealing ring grooves are absolutely clean.
3. Inspect the cylinder liner (item 1), the liner location bore, and the crankcase counterbore. Remove any burrs and thoroughly clean the parts, particularly the mating faces, with Genklene or a similar alternative.

Meticulous care should be taken when carrying out these operations. Any dirt or burrs will have an adverse effect on the fit of the liner in the crankcase and may also distort the liner bore.

4. When a cylinder liner is fitted into the crankcase, it should stand proud of the top face by the amount stated in Section E4, Dimensional data. This is to provide a 'nip' when the cylinder head and gasket are fitted.

To obtain the correct 'nip' (item 2), carry out Operations 5 to 8 inclusive.

5. Measure the depth of the cylinder liner collar and also that of the counterbore in the crankcase.
6. Subtract the counterbore dimension from the collar measurement, to obtain the 'nip' figure.
7. If the figure obtained does not correspond with the figures quoted in Section E4,

either,

a. grind the excess metal from the top face of the liner (always clean the liner after grinding).

b. try another liner.

8. Ensure that the bore number is etched onto the top face. Other information that is etched onto the top of the liner includes the piston grade (always ensure that the cylinder liner is of the required grade).
9. Fit three new rubber sealing rings into the crankcase. Smear the rings and location diameters with Palmolive grease or its equivalent.
10. Ensure that the crankcase counterbore and liner are clean.
11. Fit the cylinder liner into the crankcase bore, ensuring that the cylinder bore reference number etched on the top face of the liner is positioned at the top (i.e. nearest point to the camshaft).
12. Using a plastic headed mallet, tap evenly around the top face of the liner to ensure that it is seating correctly.

Note In certain instances it may be beneficial to carry out Operations 11 and 12 with the crankcase heated.

13. Using a depth micrometer, measure the amount that the liner stands proud above the crankcase face (refer to Section E4, Dimensional data).
14. If the liner stands proud by more than the specified limits, again tap around the top face of the liner using a plastic headed mallet.
15. If fitment does not conform with the figures given in Section E4, the liner should be withdrawn and the cause investigated.

Crankshaft pulley/damper – To remove (see fig. E5-1)

1. Carry out the usual workshop safety precautions.
2. Slacken the driving belts.
3. Remove the setscrews (item 3) from the centre of the crankshaft pulley.
4. Withdraw the pulley/damper assembly.

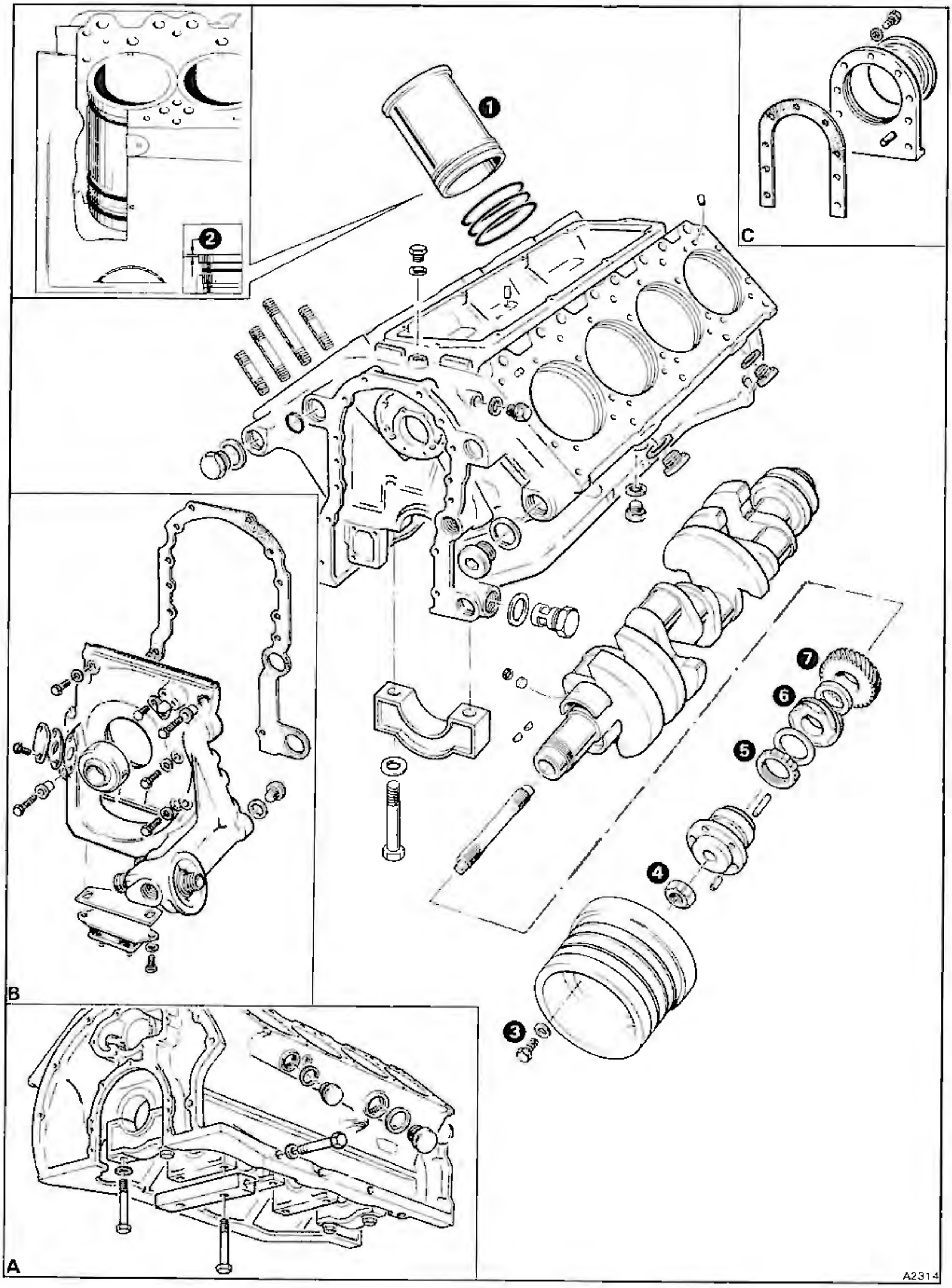


Fig. E5-1 Crankcase, crankshaft, and cylinder liners

Crankshaft pulley/damper – To fit (see fig. E5-1)
To fit the pulley/damper, reverse the procedure given for removal noting the following.
1. The pulley/damper assembly can only be fitted one way due to the locating pin.
2. Fit the setscrews and torque tighten them to the figures given in Section E15.
3. Fit the drive belts and tension them as described in Section E13.

Crankshaft – To remove (see fig. E5-1)
It is important that the position of any component removed from the engine is noted so that it can be returned to its original position. Otherwise, wear characteristics and engine balance may be impaired.
1. Remove the engine from the vehicle (see Section E12).
2. Fit the engine to a turnover stand.
3. Ensure that the engine oil has been drained.
4. Turn the engine over.
5. Remove the retaining setscrews and withdraw the sump. Discard the gasket.
6. Remove the setscrews and withdraw the oil pedestal and strainer assembly.
7. Remove the coolant pump (see Chapter L).
On turbocharged engines also remove the heatshields.
8. Unscrew and remove the setscrews (item 3) in the centre of the crankshaft pulley.
9. Withdraw the pulley/damper assembly.
10. Remove the nut (item 4) securing the drive flange to the crankshaft.
11. Using extractor RH 9765, withdraw the drive flange. The flange is dowelled to the crankshaft.
12. Ensure that all weight is removed from the engine front mounting foot. Then, remove the setscrews from the engine mounting situated below the timing cover.
13. Remove all the setscrews securing the lower timing cover (see inset B).
14. Carefully withdraw the lower timing cover (the cover is dowelled to the crankcase).
15. Remove the setscrews retaining the oil pump. Withdraw the assembly and dowel inserts, together with the pipes and 'O' rings.
16. Remove the setscrews securing the flexplate assembly to the rear of the crankshaft. Withdraw the flexplate assembly.
17. Unscrew the setscrews and withdraw the backplate (see inset C). The backplate is dowelled to the crankcase. Discard the gasket.
18. Remove the nuts from the connecting rod bolts. Then, withdraw the connecting rod caps.
19. Fit protective rubber tubing over the connecting rod bolts to prevent damage to the crankpins.
20. Remove the shell bearings from both the connecting rods and caps.
21. Push the connecting rod and piston assemblies to the top of their respective bores.
22. On 1989 model year engines, remove the cross-bolting setscrews from either side of the crankcase in the three inner bearing cap positions (see inset A).
23. Unscrew the main bearing cap bolts. Withdraw the cross-bolting beams (if fitted) and caps.
24. Remove the crankshaft thrust washers from the centre main bearings.
25. Carefully lift the crankshaft from the crankcase.

Crankshaft – To dismantle (see fig. E5-1)
1. Using the special spanner RH 12055, unscrew and remove the serrated nut (item 5) and washer from the front of the crankshaft (the nut has a left-hand thread).
2. Ensure that the front face of the oil pump drive gear is identified (to enable it to be installed in its original position).
3. Withdraw the oil pump drive gear (item 6). Remove the Woodruff key.
4. Withdraw the distance piece (spacer).
5. Withdraw the timing gear (item 7). Remove the Woodruff key.
6. Dismantle the sludge traps by removing the retaining circlip and withdrawing the plug (item 8).
7. Remove the stud from the front of the crankshaft (if necessary) using tool RH 12054.

Crankshaft – To inspect (see fig. E5-2)
1. Thoroughly clean the crankshaft. This can usually be achieved by washing the shaft in a paraffin bath, then drying it with compressed air.
2. Mount the crankshaft in 'Vee' blocks on an inspection table.
3. Using a micrometer and an indicator gauge, check the crankshaft journals and crankpins for size, ovality, parallelism, and bow. Refer to Section E4, Dimensional data, for the service dimensions. If necessary, regrind the crankshaft.
4. Inspect the Woodruff keys and keyways for wear. Oversize keys are available. However, if wear is apparent with the largest size Woodruff keys installed, a replacement crankshaft should be fitted.

Crankshaft – To regrind
1. The crankshaft should be reground when wear or ovality exceeds 0,025 mm (0.001 in), when the crankpins and journals are heavily scored, or when the bow in the crankshaft exceeds 0,25 mm (0.010 in).
2. Replacement bearings are available in the following sizes, standard, minus 0,25 mm (0.010 in), and minus 0,50 mm (0.020 in).
3. The crankpins and journals should be ground to suit the nearest undersize bearing. Refer to Section E4, Dimensional data.
4. When grinding, use a stone having a grit and grade equivalent to a NORTON A 46 MV or one grade softer.
A harder stone must not be used.
5. For 'plunge' grinding, the width of the stone must be 0,50 mm (0.020 in) less than the dimension between the journal or crankpin end faces and the machine must be fitted with hydraulic stops. For traverse grinding a suitable width of stone should be selected.
6. Care must be taken to ensure that no sharp edges are left in the radii where the grinding wheel traverse

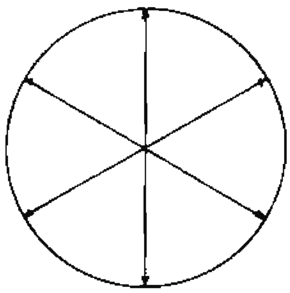
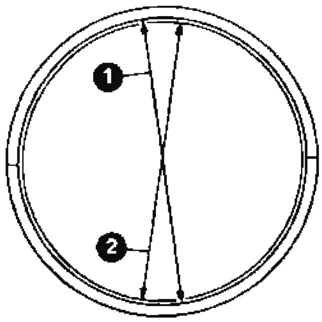
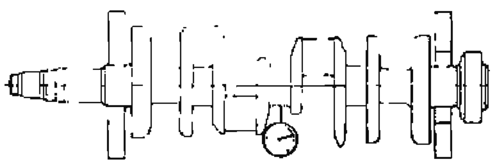
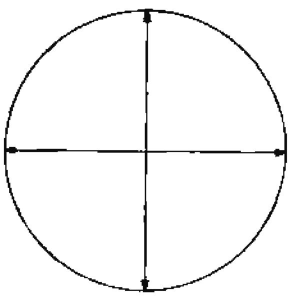
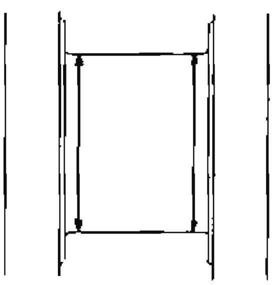
Measurement	Method
Mean size 	**Obtained on crankshaft main journal, crankpins, and bearing shells** 1. (a) Measure the diameter of the journal or crankpin in two planes one at right-angles to the other. (b) Ensure that the shell bearings are fitted in position and the retaining nuts correctly tightened. Measure the bore of the bearing in three places as shown. 2. Add the two journal or crankpin readings together (three readings for the shell bearings) and divide by two (three for shell bearings).
Bearing clearance 	**Obtained between crankshaft main journals/crankpins and bearing shells** 1. Obtain mean size of shell bearing. 2. Obtain mean size of crankshaft main journal/crankpin. 3. Subtract measurement obtained in 2 from measurement obtained in 1 to give bearing clearance.
Bow 	**Measured on the crankshaft centre main journal** 1. Mount the crankshaft main journals 1 and 5 in 'Vee' blocks on a surface table. 2. Position the indicator gauge on the side of the centre main journal. 3. Rotate the shaft until the lowest reading is obtained on the gauge. Zero the gauge. 4. Rotate the shaft 180° and note the reading on the gauge. 5. Divide the reading by two to obtain the crankshaft bow.
Ovality 	**Measured on the crankshaft main journals and crankpins** 1. Measure across the centre of the journal or crankpin in two planes one at right-angles to the other. 2. Subtract the smaller reading from the larger reading to give the ovality. **Note** This operation should be carried out at several points to establish the largest and smallest diameters.
Parallelism (Teper) 	**Measured on the crankshaft main journals and crankpins** 1. Measure the diameter at both ends of the journal or crankpin, ensure that the measurements are taken on the same plane. 2. Subtract the smaller reading from the larger reading to give the taper.

Fig. E5-2 Method of measuring the crankshaft

ends and the radii of the grinding wheel must be carefully controlled to ensure that the grinding fades out not more than half-way up the radius of the crankshaft.

On no account must the grinding wheel touch the side faces of the crankpin or journal.

7. Lubrication must be continuous during regrinding and the lubricant should be fed liberally onto the ingoing side of the grinding wheel. The grinding wheel must not be allowed to contact the journal or crankpin until the shaft is thoroughly wet. Any approved lubricant can be used.

8. After grinding, test the hardness of the journals and crankpins. The minimum acceptance figure for the hardened crankshaft is 570 VPN/30 kg using a Vickers Diamond Pyramid Machine.

9. If the necessary equipment is available, the shaft should be magnetically crack tested.

Crankshaft – To assemble (see fig. E5-1)

1. Ensure that the crankshaft is thoroughly clean.

2. If the sludge traps have been dismantled, ensure that new plugs are fitted.

Fit the plugs using a punch. Each plug must be retained with a circlip.

3. Fit a Woodruff key to the crankshaft, then fit the timing gear. Ensure the timing marks are to the front and the gear slides freely into position, making face contact with the crankshaft shoulder.

4. Check that the timing gear key does not protrude beyond the timing gear. Then, slide the spacer into position, ensuring face contact with the timing gear.

5. Fit the second Woodruff key to the crankshaft, then fit the oil pump drive gear. Ensure the gear is fitted with the front face outwards (marked during dismantling), and it locates correctly on the Woodruff key.

6. Apply a light application of engine oil onto the threads of the crankshaft. Then, fit the washer and ringnut (item 5).

Note The nut has a left-hand thread.

7. Using special spanner RH 12055 torque tighten the nut to between 488 Nm and 597 Nm (50 kgf m and 61 kgf m; 360 lbf ft and 440 lbf ft).

The crankshaft should be held firmly whilst tightening the nut. This can be accomplished by fitting two long setscrews in the rear of the crankshaft and inserting a bar between them. The force needed to tighten the nut can be off-set by levering on the bar.

Crankshaft – To fit (see fig. E5-1)

All engines

1. Ensure that the bearing shells are the correct size for the journal and crankpins.

2. Ensure that all parts are clean. A lint-free cloth should be used for wiping all parts.

3. Position the upper bearing shells in the crankcase and lightly smear them with clean engine oil.

4. Place the crankshaft into position, noting that the marks on the crankshaft and camshaft timing gears align. Fit the upper halves of the thrust washer to the centre main bearing.

Engines prior to 1989 model year

5. Fit the main bearing caps and shells together with the two lower thrust washers for the centre main bearing. When fitting the bearing caps it may be necessary to tap them lightly into position. If this is done, ensure that the bearing shells are not dislodged. Fit and torque tighten the main bearing cap bolts to the figures quoted in Section E15.

1989 model year engines

5. Fit the main bearing caps and shells together with the two lower thrust washers for the centre main bearing as follows.

a. Engage the setscrews (through the bearing caps) in the crankcase tappings and location diameters **before** the bearing caps are lightly tapped into position. Ensure the bearing shells are not dislodged.

Note Do not engage the bearing caps in the crankcase by pulling them down with the setscrews.

b. On the centre and intermediate bearing caps only, the setscrews should then be removed to allow the fitting of the cross-bolting beams.

c. The setscrews should then be passed through the beams and bearing caps and engaged in the crankcase tappings and location diameters **before** the cross-bolting beams are lightly tapped into position.

d. Before the main bearing setscrews are torque tightened, the cross-bolting setscrews must be engaged in the tappings of the cross-beams.

e. The main bearing setscrews should then be torque tightened, followed by the torque tightening of the cross-bolting setscrews, to the figures quoted in Section E15.

All engines

6. Check that the crankshaft rotates freely.

7. Check the crankshaft end-float. Refer to Section E4, Dimensional data.

8. Fit the bearing shells to the connecting rods and caps. Then, lightly smear the shells with clean engine oil.

9. Locate the lowest crankpin (with the engine inverted this will be the crankpin that is uppermost).

10. Pull the two connecting rods upwards and position the big-ends around the crankpin.

11. Remove the protective rubber sleeve from each bolt.

12. Assemble the connecting rod big-ends (see Section E6).

13. Fit the oil pump and delivery pipes, ensuring new rubber 'O' rings are used.

14. Fit the oil strainer pick-up and pedestal.

15. Assemble the front of the engine, using a new gasket.

Fit a new Neoprene seal between the lower front cover and the coolant pump.

16. On turbocharged engines, fit the turbocharger oil return pipe to the lower front cover. Remove the oil feed pipe and prime the turbocharger with engine oil. Fit the feed pipe.

17. Lightly oil the threads of the centre stud and screw it into the crankshaft, ensuring that the threads are free. Torque tighten the stud to between 305 Nm and

373 Nm (31 kgf m and 38 kgf m; 225 lbf ft and 275 lbf ft).
18. Smear the inside bore of the pulley flange and locate the flange onto the crankshaft. Ensure that the location dowel is aligned correctly.
19. Lightly oil the threads on the end of the centre stud. Then, run the centre nut down the stud to press the flange onto the interference fit of the crankshaft.
20. Torque tighten the centre nut to between 488 Nm and 597 Nm (50 kgf m and 61 kgf m; 360 lbf ft and 440 lbf ft).
21. Fit the crankshaft pulley/damper assembly, ensuring the locating pin aligns correctly.
22. Fit the driving belts, ensuring that they are correctly tightened (see Section E13).
23. Fit the engine backplate and flexplate assembly.
24. Fit the engine sump, using a new gasket.
25. Fit the engine to the vehicle (see Section E12).

Crankshaft front oil seal – To remove and fit
(see fig. E5-1)
1. Carry out the usual workshop safety precautions.
2. Remove the coolant pump (see Chapter L).
3. Remove the crankshaft pulley/damper assembly.
4. Using extractor RH 9765, withdraw the pulley driving flange.
5. Remove the setscrews that secure the sump to the front lower timing cover.
6. Remove all weight from the engine front mounting foot.
7. Withdraw the setscrews from the engine front mounting beneath the front cover.
8. Remove all setscrews retaining the front lower cover.
9. Carefully insert a feeler gauge or similar tool between the bottom of the cover and the sump gasket. Slowly work the feeler gauge around the joint to 'break' the seal.
10. Withdraw the front cover (the cover is dowelled to the crankcase). Discard the gasket.
11. Remove the oil seal from the front cover.
12. Inspect both the cover oil seal bore and the crankshaft driving flange for score marks and/or wear.
13. Press the new oil seal into the housing until it is correctly positioned.
14. Fit the cover to the engine by reversing the removal procedure, noting that a new gasket and Neoprene seal should be fitted.

Crankshaft rear oil seal – To remove and fit
(see fig. E5-1)
1. Ensure that the usual workshop safety precautions are carried out.
2. Remove the transmission (see Chapter T).
3. Remove the setscrews securing the flexplate and withdraw the assembly from the rear of the engine.
4. Locate the engine rear backplate and remove the retaining setscrews. Withdraw the backplate noting that it is dowelled to the crankcase.
5. Discard the crankcase gasket.
6. Press the seal out of the rear of the backplate.
7. Press a new seal into the backplate, **noting that it should be installed dry.** This instruction must be strictly adhered to. Fit the backplate assembly over the end of the crankshaft and into position.

Always ensure a new gasket is fitted to the crankcase prior to the installation of the backplate assembly.

8. Secure the backplate and complete the assembly by reversing the removal procedure.

Connecting rods and pistons

Connecting rod bearings – To remove (see fig. E6-1)
The big-end bearings can be renewed whilst the engine is fitted in the car. To undertake this exercise, carry out the usual workshop safety precautions and proceed as follows.

1. Place the car on a ramp beneath an overhead pulley.
2. Firmly apply the parking brake and chock the road wheels.
3. Disconnect the battery.
4. Drain the engine oil into a suitable container. Fit the sump plug.
5. Remove the steering rack assembly (see Chapter N).
6. Suitably position a sling around the front upper half of the engine. Connect the sling to the overhead pulley and 'take the weight' of the engine.
7. Remove the setscrews from the front engine mount.
8. Remove the engine oil level transmitter shield and disconnect the electrical lead.
9. Remove the setscrews securing the transmission oil cooler pipes to the sump.
10. On turbocharged cars, remove the heatshield and exhaust system connecting pipe between 'A' bank and 'B' bank manifolds.
11. Raise the engine and then remove the remaining setscrews securing the sump.

    Some difficulty may be encountered when removing the setscrews due to the close proximity of the sub-frame crossmember.

    Ensure the sump is supported before all the setscrews are withdrawn.
12. 'Break' the seal that will have formed between the sump and the crankcase bottom face.
13. Carefully withdraw the sump assembly.
14. Remove the oil pedestal and fine mesh strainer.
15. Remove the sparking plugs (this will facilitate easier rotation of the crankshaft assembly).
16. Rotate the crankshaft until one pair of connecting rod caps are at their lowest point.
17. Remove the cap retaining nuts (item 7) and carefully 'ease off' the cap (item 6).
18. Fit protective rubber sleeving over the connecting rod bolts, to prevent damage to the crankshaft journal (see inset A). **Do not remove the connecting rod bolts.**
19. To facilitate removal of the shell bearings, push the connecting rod and piston assembly upwards away from the crankshaft.
20. Collect the shell bearings (item 5) from the connecting rod (item 4) and cap (item 6).
21. Repeat Operations 16 to 20 inclusive to the other connecting rod big-end bearings on the crankpin.

Note Only one pair of big-end bearings should be dismantled at any one time. The position of the bearing shells should be noted so that if the bearings are to be used again, they can be fitted in their original position.

Crankpins and bearings – To inspect (see fig. E6-1)

1. Thoroughly clean each crankpin with a lint free cloth. Measure each crankpin diameter for wear and ovality (see Section E5, Crankshaft – To regrind).
2. The running clearance between the connecting rod big-end bearing and the crankpin is 0,038 mm to 0,076 mm (0.0015 in to 0.003 in). The size and wear tolerances are given in Section E4, Dimensional data.

    New bearing shells should be fitted if the specified limits are exceeded due to wear, or if the shells are scored.

Connecting rod bearings – To fit (see fig. E6-1)

1. Fit protective sleeves to the connecting rod bolts.
2. If both halves of a shell bearing are considered serviceable, they can be used again **provided that each is kept in its original position.** However, if the shell bearings have seen considerable service, it is advisable to replace with new ones.
3. Before fitting new bearings to the connecting rods and caps, etch the cylinder number onto the outside of the locating tang of each bearing shell.
4. Thoroughly clean the shells and the crankpin. Ensure that the crankpin oil feed holes from the main bearings are not blocked by sludge or dirt.
5. Lightly smear the upper half of the shell bearing surface with clean engine oil and fit it into the connecting rod.
6. Pull the connecting rod downwards onto the crankpin. Ensure that the rod bolts do not damage the crankpin.
7. Remove the protective sleeving from the connecting rod bolts.
8. Fit the lower half of the shell bearing into the connecting rod cap and lightly smear it with clean engine oil.
9. Ensure that the tang on each half of the shell bearing is located correctly in its respective recess.
10. Place the cap onto the rod, ensuring that the two tangs are on the same side of the crankpin.

    If necessary, carefully tap the cap into position until it is fully seated. **Take care to ensure that neither the shell nor the connecting rod bolts become displaced during this operation.**
11. Using a micrometer, measure the overall length of the connecting rod bolts. These should have an overall length of between 71,95 mm and 72,01 mm (2.833 in and 2.835 in).

    Any bolt not conforming to the dimensions quoted, should be carefully removed from the connecting rod (using a hide mallet) and a new bolt fitted.
12. Ensure that the shell bearings are correctly positioned, then fit the cap to the connecting rod.
13. Lubricate the connecting rod bolt threads with engine oil and screw the retaining nuts onto the bolts. Each nut should be screwed on by hand and lightly

12/87
Printed in England

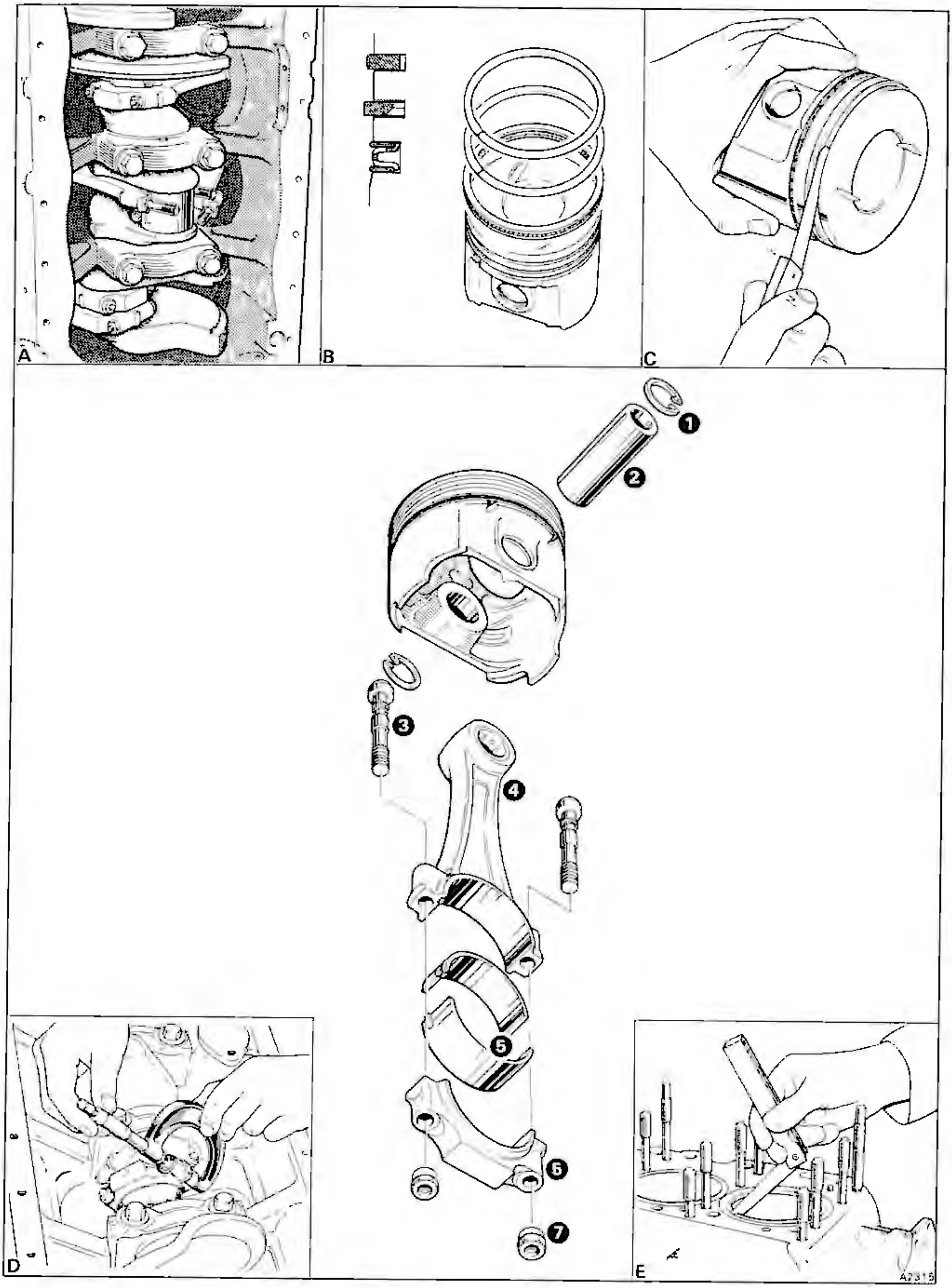


Fig. E6-1 Connecting rods and pistons

'nipped' using a handbrace and socket.

The nuts should be easy to screw on, if any effort is required, the threads should be examined for burrs, damage, or malformation and the offending parts replaced.

14. Torque tighten the nuts to obtain a bolt stretch of between 0,15 mm and 0,38 mm (0.006 in and 0.015 in). This bolt stretch range should be achieved between 48 Nm and 61 Nm (4,9 kgf m and 6,2 kgf m; 35 lbf ft and 45 lbf ft).

15. **If any bolt has not stretched sufficiently,** increase the torque tightness to 68 Nm (7,0 kgf m; 50 lbf ft) and again check the bolt stretch (see inset D).

16. If any bolt is still under stretched, slacken both nuts of that particular connecting rod and measure the free length of the offending bolt. If this measurement is outside the limits quoted in Operation II, fit a new bolt.

Should the measurement be inside the limits quoted in Operation II, repeat Operations 13 and 14. Again measure the bolt stretch. If the bolt now conforms it is acceptable. If not, slacken both nuts and replace the suspect bolt with a new one.

17. **If any bolt has been over stretched** when tightening, slacken both nuts on the connecting rod and replace the offending bolt.

18. Repeat Operations 11 to 17 inclusive to the remainder of the connecting rod big-end bearings.

19. Fit the engine sump, using a new gasket.

20. Fit all other parts by reversing the procedure given for their removal.

21. Set the engine stop plate gap (see Section E12, Engine removal and installation).

Connecting rod and piston – To remove
(see fig. E6-1)

1. Remove the cylinder head (see Section E8).
2. Remove any carbon build-up in the bore at the top of the liner.
3. Remove the connecting rod cap from the big-end bearing (see Connecting rod bearings – To remove).
4. Push the connecting rod upwards so that the piston and connecting rod assembly can be withdrawn from the top face of the crankcase.
5. Repeat these operations on the remaining piston and connecting rod assemblies.

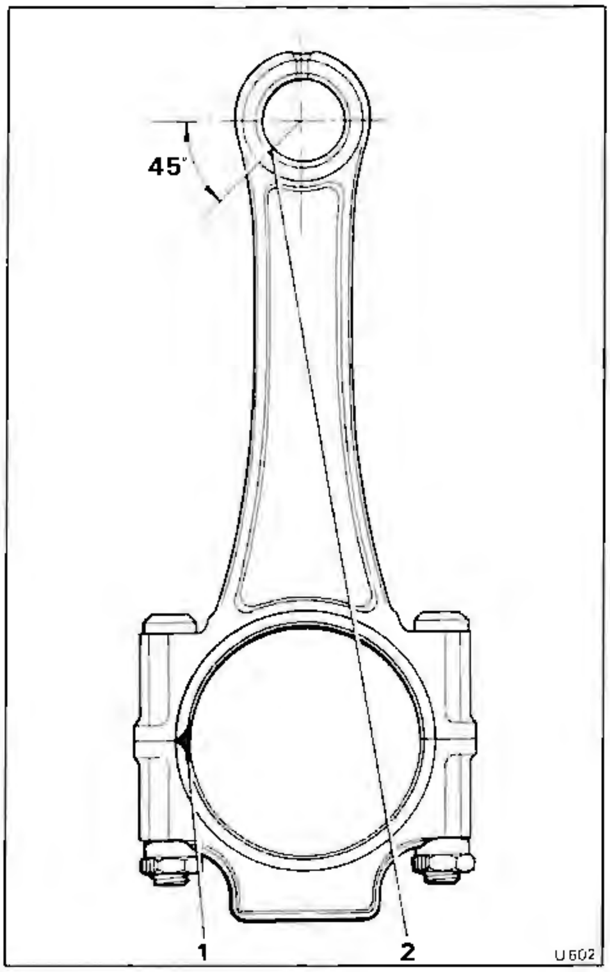


Fig. E6-2 Position of small-end bush
1 Tangs
2 Split in bush

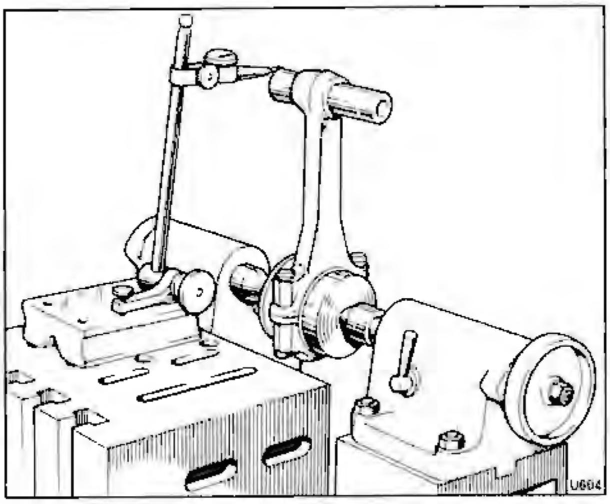


Fig. E6-3 Checking the connecting rod alignment

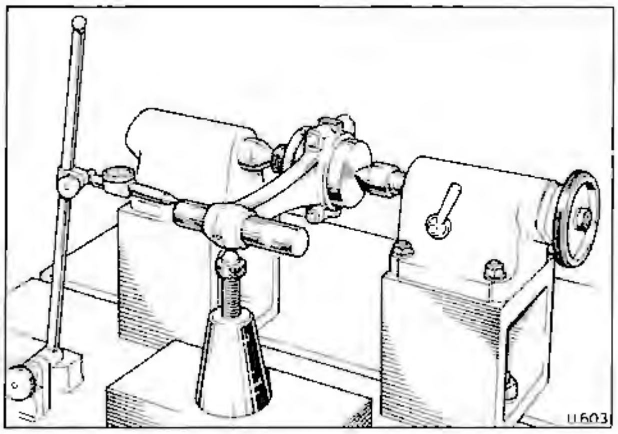


Fig. E6-4 Checking the connecting rod for twist

Connecting rod and piston – To dismantle
(see fig. E6-1)

1. Remove the circlips from the piston. The circlips are located one at either end of the gudgeon pin bore.
2. Thoroughly warm the piston assembly. This can be achieved by either immersing the piston in a bath of hot oil or placing the piston crown on a hotplate.
3. When the piston is thoroughly warm, push the gudgeon pin out using a suitable guide.

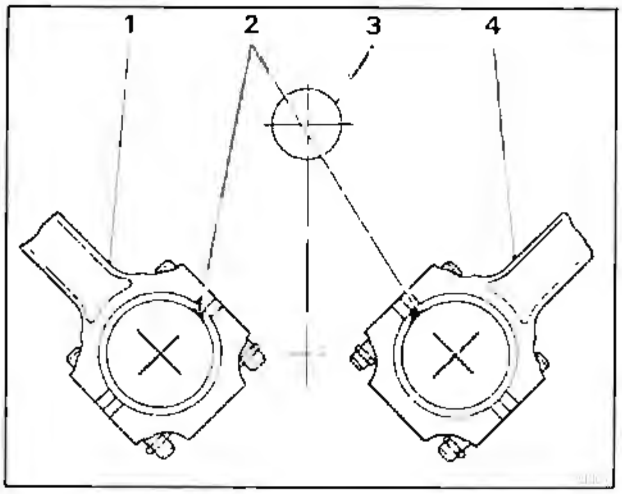


Fig. E6-5 Position of the connecting rod tangs
1 'A' bank connecting rod
2 Position of tangs
3 Camshaft
4 'B' bank connecting rod

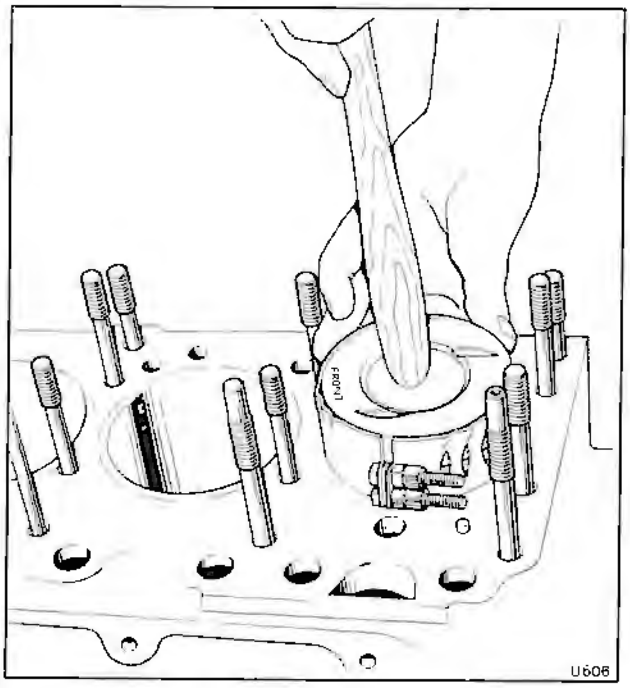


Fig. E6-6 Fitting a piston

Piston – To inspect (see fig. E6-1)

1. Remove the rings from the piston using a suitable expander tool.
2. Remove the carbon deposits from the rings and pistons. Ensure that all the deposits are removed from the piston ring grooves.
3. Thoroughly clean all components.
4. Check that the clearance of the piston rings in their respective grooves (see inset C), is as given in Section E4, Dimensional data.
5. Check the compression rings in either a 104,14 mm (4.10 in) diameter ring gauge, or an unworn part of the cylinder, after first ensuring that no carbon deposits exist in the unworn bore. If the rings are in good condition, no light should show around the circumference of the rings.
6. Check the closed gap of each compression ring whilst it is fitted into either the ring gauge or the unworn part of the cylinder (see inset E and Section E4, Dimensional data).
7. Visually check the condition of the oil control ring.
8. Check the piston dimensions. The measurements and grades of pistons are given in Section E4.

Small-end bush – To inspect and renew
(see fig. E6-1)

1. Check the diameter of both the gudgeon pin and the small-end bush. If the clearance exceeds 0,013 mm (0.0005 in) renew the bush.
2. Using a suitable drift, remove the small-end bush.
3. Visually inspect the condition of the connecting rod small-end.
4. Measure the internal diameter of the connecting rod small-end.
5. Measure the external diameter of the new small-end bush.
6. Compare the measurements obtained in Operations 4 and 5. An interference fit between the new bush and small-end bore of 0,05 mm to 0,076 mm (0.002 in to 0.003 in) is essential.
7. Position the new bush so that the chamfered outer edge is towards the connecting rod. Also ensure that the split in the bush is 45° away from the centre axis of the rod and on the same side of the rod as the locating recesses for the big-end bearing shells (see fig. E6-2). In this position the oil hole in the bush should line up with the oil hole in the small-end boss.
8. Press the small-end bush into position until it is flush with the connecting rod boss.
9. Finally, either diamond bore or ream the bush to the finished diameter quoted in Section E4, Dimensional data. The gudgeon pin clearance in the small-end bush should be between 0,003 mm and 0,013 mm (0.0001 in and 0.0005 in).

Connecting rods – To check alignment and twist
The correct alignment of a connecting rod is of the utmost importance. Any connecting rod that has had a new bush fitted and bored must be checked for alignment using a reliable alignment fixture.

Connecting rods that are bent will cause uneven and premature wear between the cylinder walls and pistons.

If an alignment fixture is not available the

alignment twist of the connecting rods can be checked as follows.

Alignment

1. Fit the gudgeon pin to the small-end bush.
2. Fit a mandrel to the big-end.
3. Mount the connecting rod on an inspection surface table as shown in figure E6-3.
4. Using a dial indicator gauge, take a reading at both ends of the gudgeon pin.
5. The difference between the two readings must not exceed 0,02 mm (0.001 in) per 25,40 mm (1.0 in) length of the gudgeon pin.

Twist

1. Fit the gudgeon pin to the small-end bush.
2. Fit a mandrel to the big-end.
3. Mount the connecting rod on an inspection surface table as shown in figure E6-4.
4. Using a dial indicator gauge, take a reading at both ends of the gudgeon pin.
5. The difference between the two readings must not exceed 0,07 mm (0.003 in) per 25,40 mm (1.0 in) length of gudgeon pin.

Connecting rods and pistons – To assemble
(see fig. E6-1)
To assemble the connecting rods to the pistons, reverse the procedure given for dismantling noting the following.

1. Pistons and gudgeon pins are supplied as an assembly, the gudgeon pin being a selective fit. On no account must pistons and gudgeon pins be interchanged.
2. When fitting the rings to the piston, fit the oil control ring assembly first.

    Commence by fitting the centre spacer, then fit the steel rails either side of the spacer. Ensure that the gaps in the various components of the oil control ring are spaced equally around the circumference of the piston.

    Fit the two compression rings (see inset B).
3. Ensure that the gudgeon pin, piston, and connecting rod are always assembled as follows.

a. Fit the pin to the piston so that the cylinder number on the pin is on the same side as the cylinder number on the pistons.
b. The tangs on the connecting rod and cap should always be nearest the camshaft (see fig. E6-5).

Connecting rods and pistons – To fit (see fig. E6-1)
To fit the connecting rods and piston assemblies to the engine, reverse the procedure for removal noting the following.

1. Space the ring gaps around the piston.
2. Liberally cover the pistons with either graphogen grease or clean engine oil. Then, fit a ring compressor over the piston rings.
3. Ensure that the head of each connecting rod bolt is seated on the connecting rod. If not, carefully tap the head of the bolt into position. Fit a protective rubber sleeve to each bolt before fitting the piston and connecting rod assembly to the engine.
4. Ensure that the shell bearings are correctly located in both the connecting rod and cap.
5. Fit the piston and connecting rod assembly into the cylinder bore from the top.
6. Tighten the piston ring compressor, hold it against the cylinder liner and push the piston into the bore (see fig. E6-6).
7. Carefully position the connecting rod onto the crankshaft big-end journal. Remove the protective sleeving from the bolts and finally check the location of the big-end bearing shells; fit the cap.
8. Fit the nuts to the connecting rod bolts and tighten them in accordance with the procedure given in Connecting rod bearings – To fit.

Camshaft and valve mechanism

This section contains information relating to the camshaft timing gear, distributor drive gear, hydraulic tappets, push rods, and rockers.

For information relating to the valves and their associated components, refer to Section E8.

Rocker shaft assembly – To remove and dismantle (see fig. E7-1)

1. Carry out the usual workshop safety precautions.
2. Unscrew the cap nuts retaining the ignition harness to the rocker cover. Also, remove the nut and bolt securing the engine dipstick tube to the harness shaft.
3. Remove the reach nuts securing the rocker cover to the cylinder head.
4. Carefully prise around the joint face of the rocker cover. Once the joint has been freed, lift the rocker cover from the engine.
5. Unscrew the five setscrews (item 1) securing the rocker shaft in position. **Do not withdraw the setscrews.**
6. Carefully withdraw the rocker shaft from its position. Leave the setscrews positioned through the pedestals to retain the rocker arms (item 2) and springs (item 3) in position on the shaft (item 4).
7. Place the rocker shaft assembly on a bench and withdraw the end setscrew whilst holding the pedestal (item 5) in position. Ensure that the spring does not force any components off the end of the shaft.

   Slowly release the hand pressure applied to the end of the rocker shaft and allow the spring to push the pedestal off the rocker shaft.
8. Collect the end pedestal, first rocker arm, spring, and second rocker arm. Ensure that the rocker arms are identified so that they can be returned to their original positions.
9. Repeat Operations 7 and 8 to the next pedestal and continue repeating the exercise until both rocker shafts are dismantled.

Rocker shaft assembly – To inspect (see fig. E7-1)

1. Examine the pads on the rocker arms for wear and renew any that are badly worn.

   Slight 'scuffing' or pitting on the pads may be removed with a smooth stone.
2. Rocker pads are case hardened to a depth of between 0,63 mm and 0,76 mm (0.025 in and 0.030 in) and the rockwell hardness value should be between C57 and C65.
3. If the hardness value is below these figures, the rocker arms should be renewed.

Rocker shaft assembly – To assemble and fit (see fig. E7-1)

Assemble and fit the rocker shaft by reversing the removal and dismantling procedures, noting the following.

1. The rockers are handed and should be fitted in pairs so that the arms point inwards to the cylinder bore (see inset A).
2. The cylinder heads have rocker shaft dowel pins fitted. Ensure that the rocker shaft is correctly located on the pins so that the oil feed holes align.
3. When tightening, commence with the centre setscrew and alternate on either side towards the end setscrew.
4. Torque tighten the rocker shaft retaining setscrews to between 11 Nm and 13 Nm (1,2 kgf m and 1,3 kgf m; 8 lbf ft and 10 lbf ft).

Push rods – To remove, inspect, and fit (see fig. E7-1)

1. Carry out the usual workshop safety precautions.
2. Remove the rocker cover and rocker shaft.
3. Withdraw the push rods (item 6). Label each one for identification purposes during assembly, noting top and bottom.
4. Check the push rods for bow. If any push rod has a total indicator reading or more then 0,51 mm (0.020 in) it should be discarded and a new push rod fitted.
5. Ensure that the holes in the ball ends are not blocked by dirt, etc.
6. When fitting the push rods reverse the removal procedure. Always ensure that the push rods are returned to their orignal positions and that they are correctly seated in both the hydraulic tappets and the rocker arms.

Hydraulic tappets (see fig. E7-1, inset C)

A tappet which is found to be defective in service should be replaced by a complete assembly.

Individual components must not be renewed.

Where a tappet is noisy but otherwise appears to be serviceable and replacement tappets are not readily available, it is recommended that the tappet is dismantled and thoroughly washed in clean paraffin.

Tappet noise

A defective tappet makes a noise like a 'rifle crack'. It is usually caused by one or more tappets collapsing and can be heard with each revolution of the camshaft. This could be caused by dirt which has infiltrated into the tappet(s), in which case the tappet(s) should be dismantled and cleaned. If cleaning the tappet does not cure the fault, the tappet should be renewed.

To determine a defective tappet, manually depress each tappet in turn whilst the engine is running. The defective tappet can be identified by a change in noise when any 'sponge' in the tappet is taken up.

If the noise is not caused by a collapsed tappet(s) one of the following causes should be suspected.

1. Air may have been drawn into the tappets if the engine has been standing for a period of time (i.e. overnight) and one of the tappets may not clear itself. It

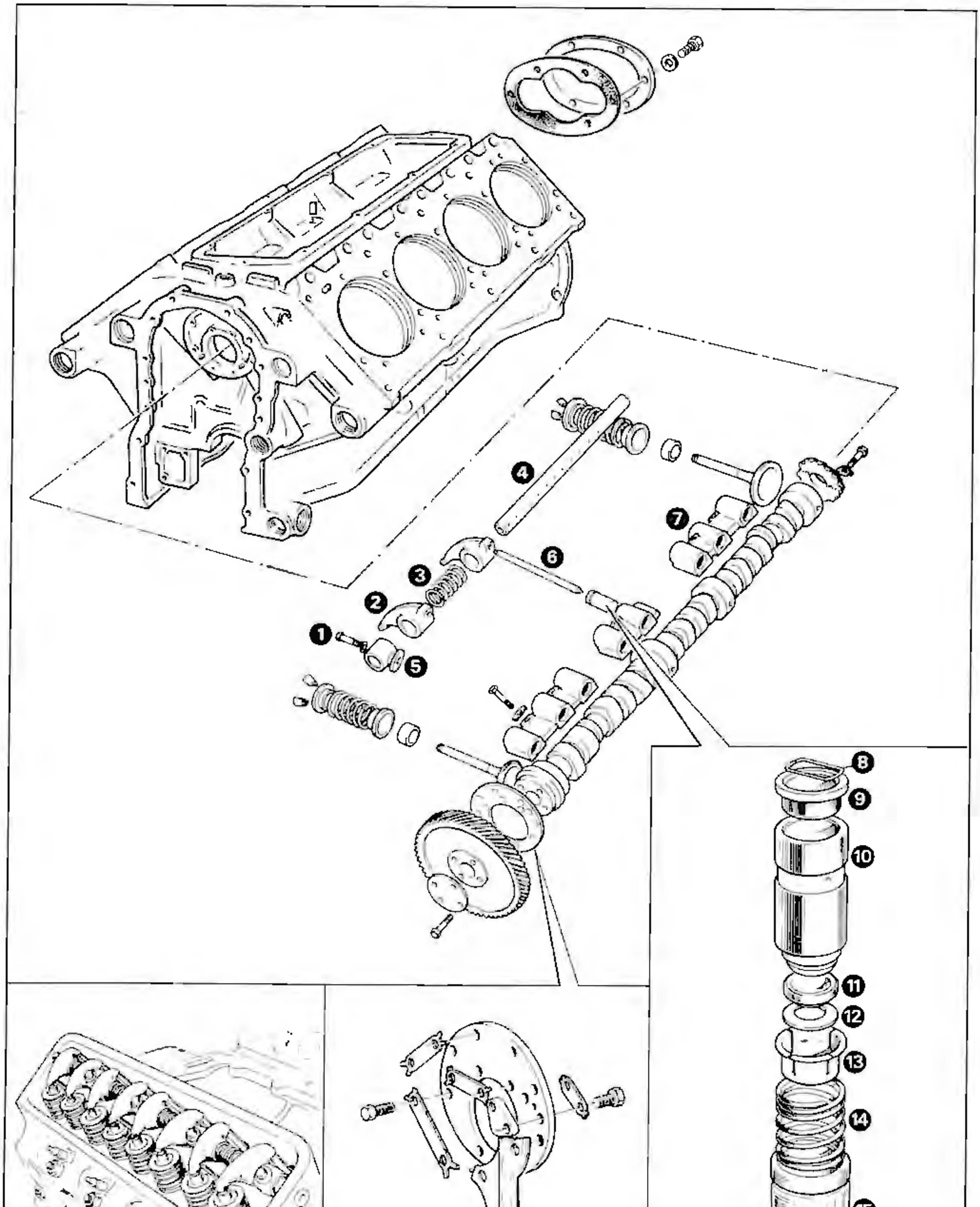


Fig. E7-1 Camshaft and valve mechanism

is possible that a tappet may not clear even after 30 minutes of hot running.
2. Occasionally a tappet leaks down too quickly at high temperatures causing a knock. This is really a milder case of the 'rifle crack' failure and should be renewed.
3. Occasionally a tappet will stick in the bore of the tappet block at high temperatures causing a knock. This will show itself by being consistently noisy when the engine is very hot but quiet at other times.

Should this situation be encountered (and all other tappet rectification measures failed to effect a cure), the suspect tappet block should be checked for incorrect crankcase bedding. Lightly smear the seating face with engineers blue and fit the block in the crankcase. If the check proves conclusively that the tappet block bedding is faulty, the crankcase can be scraped to improve the situation.

Extreme care must be exercised when carrying out this operation and the minimum amount of metal removed from the crankcase.

Tappet wear

It should not be necessary to reject tappets due to an appearance of wear on the bottom face of the tappet. The only occasion when rejection may become necessary is if the cam peak on the camshaft is also badly worn.

It may cause problems to replace a mildly worn tappet with a new one unless the camshaft is also changed. For this reason only the tappets which are actually causing a problem should be renewed.

If it is found necessary to fit a new camshaft to an engine, a complete set of new tappets must also be fitted.

Hydraulic tappets – To remove (see fig. E7-1)

1. Carry out the usual workshop safety precautions.
2. Remove either the fuel injection system equipment or turbocharging equipment as applicable (refer to Engine Management Systems Manual – TSD 4737).
3. Drain the engine coolant (see Chapter L).
4. Depressurize the hydraulic systems (see Chapter G).
5. Remove the induction manifold.
6. Progressively unscrew the setscrews securing the tappet chest cover to the crankcase. The setscrews must be removed progressively. If the brake pump operating cams happen to be at their peak, distortion could occur to the tappet chest cover.
7. Remove the rocker covers.
8. Progressively unscrew the setscrews securing the rocker pedestals to each cylinder head. Then, remove the rocker shaft assemblies.
9. Remove the push rods.
10. Withdraw the hydraulic tappets from the tappet blocks (item 7).

Hydraulic tappets – To dismantle (see fig. E7-1)

1. Press down the spherical cap situated in the top of the tappet and remove the snap ring holding the cap in.

After gradually releasing the pressure from the spherical cap, the tappet can be dismantled (see inset C).

2. Remove the plunger and valve from the tappet barrel. Examine the tappet for any signs of wear on its base.

Hydraulic tappets – To assemble and prime
(see fig. E7-1)

In order to obtain the high degree of accuracy necessary for efficient operation of the hydraulic tappets, it is essential that extreme precautions are taken when assembling the components to ensure complete cleanliness.

It is therefore most important that particular attention is given to the following points before commencing the assembly procedure.

Due to the highly critical surfaces and dimensions of the hydraulic tappets, great care and cleanliness are of the utmost importance when handling tappet components. If a cloth has to be used, ensure that it is lint free.

Ensure that the assembly tank is perfectly clean before adding paraffin. Only clean fresh paraffin must be used.

Wash all tappet components in clean paraffin, taking care that the components of each tappet are retained as an assembly and are not interchanged with parts of another tappet.

1. Fit the spring washer (item 12) and valve (item 11) in the retainer (item 13).
2. Using 'finger' pressure, carefully press the retainer assembly onto the spigot of the plunger (item 10).
3. Fit the spring (item 14) onto the retainer assembly.
4. Fit the valve assembly (plunger, valve, spring washer, retainer, and spring), into the tappet barrel (item 15).
5. Fit the cap (item 9) into the top of the plunger.
6. Using an old push rod press the cap downwards until it is possible to fit the retaining snap ring (item 8) into the groove located inside the top of the barrel.
7. Release the pressure.
8. Submerge the tappet assembly in clean Esso TSD 1047 rust inhibiting paraffin.
9. Using a small probe push the valve off its seat. The probe should be carefully positioned through the small hole in the tappet cap and pushed down into the tappet until it contacts the valve. A slight increase in pressure will then be required to overcome the spring washer loading and open the valve.
10. Continue to hold the valve open and place a small screwdriver into the cap adjacent to the probe.
11. Apply pressure to both the probe and screwdriver. Press the cap downwards in the tappet barrel, compressing the spring. Note the air bubbles that are expelled from the tappet barrel oil inlet hole.
12. When the air bubbles cease, release the pressure from the cap and valve.
13. Repeat Operations 9 to 12 inclusive, until the air bubbles have ceased to appear throughout the cycle of operations.
14. Withdraw the probe from the small hole in the centre of the cap.
15. Again apply pressure to the cap with a small screwdriver. If the assembly feels solid it can be assumed that it is operating satisfactorily and can be

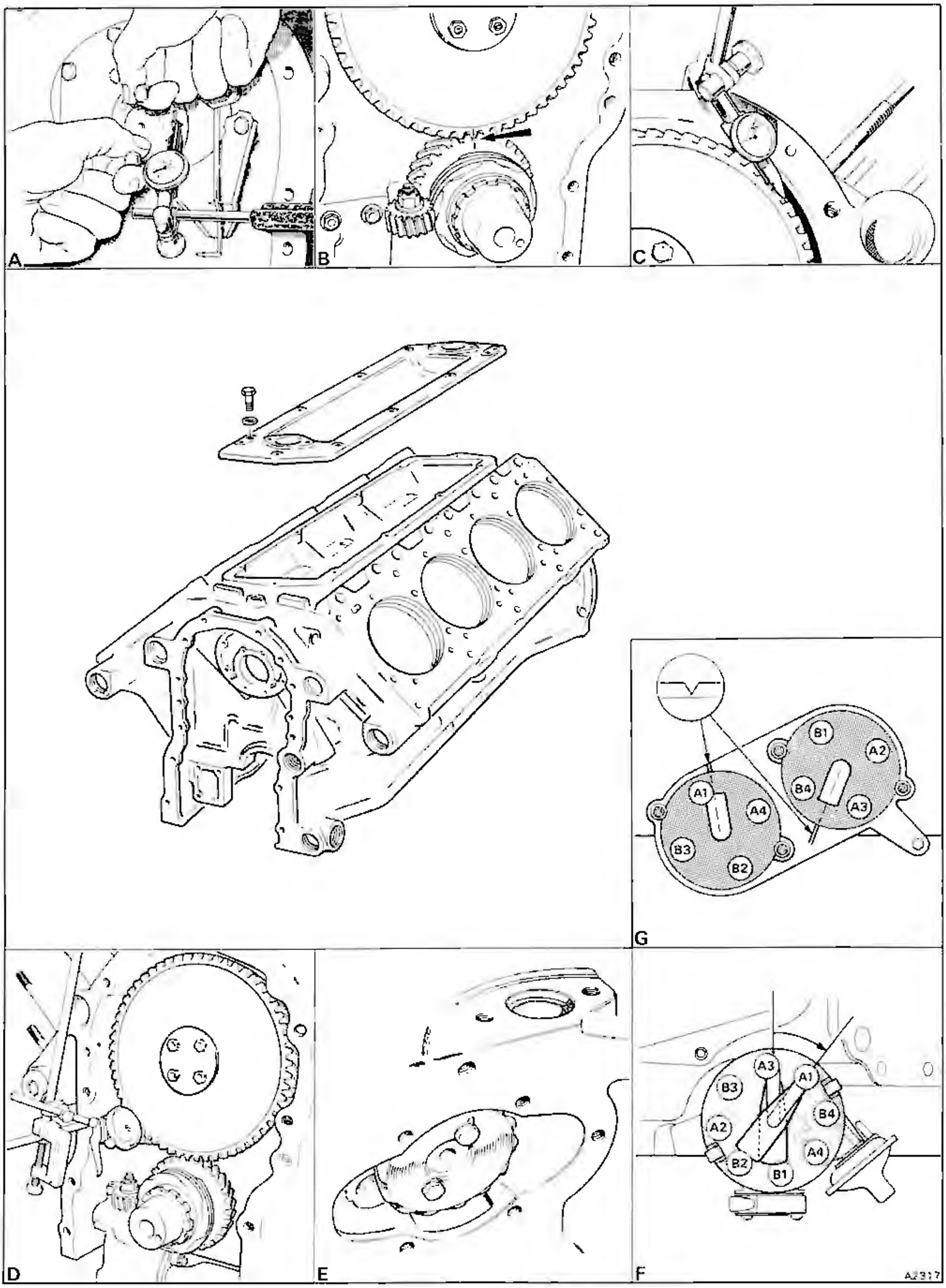


Fig. E7-2 Camshaft build sequence checks

removed from the paraffin.

When tappets are to be fitted immediately after overhaul, they should be primed with clean engine oil.

Hydraulic tappets – To fit (see fig. E7-1)
1. Oil the bores of the tappet blocks (item 7).
2. Fit the tappets.
3. Fit the push rods to the engine, into the same position from which they were removed.
4. Fit the rocker shafts. Then, progressively tighten the securing nuts.
5. Fit the tappet chest cover.

Tappet chest cover – To fit (see fig. E7-2)
1. Rotate the camshaft until the brake pump eccentrics are at approximately bottom dead centre (bdc).
2. To prevent the possibility of a hydraulic lock, ensure the brake pumps are drained of fluid.
3. If necessary, check that the position of the two brake pump rods is correct and fit the brake pumps (see Section E11).
4. Apply a 1,27 mm (0.050 in) wide bead of Loctite 573 sealing compound onto the crankcase tappet cover joint face, **so that it surrounds all the tapped holes.**
5. Complete the engine build by reversing the procedure given for dismantling, noting the following.
6. Fit new joints and sealing rings.
7. Refer to Chapter P and Section E15 for torque tightening figures.
8. Ensure that the brake pipes are not overtightened, otherwise damage to the conical seatings may occur.
9. Any hoses showing signs of deterioration should be renewed.
10. Ensure that the driving belts are adjusted to the correct tension (see Section E13).

Camshaft – To remove (see fig. E7-2)
Engines prior to 1989 model year
1. Remove the hydraulic tappets.
2. Remove the transmission (see Chapter T).
3. Remove the flexplate assembly.
4. Remove the distributor assembly.
5. Remove the cover from the rear end of the crankcase, to expose the distributor driving gear (see inset E).
6. Remove the skew gear from the end of the cemshaft.
7. Remove the radiator grille, refrigeration condenser, and radiator matrix.
8. Remove the coolant pump and lower front cover from the front of the engine.
9. Unscrew the setscrews from the camshaft and withdraw the cam gear.
10. Remove the camshaft thrust plate together with the timing gear lubricating oil pipe assembly (see fig. E7-1, inset B). Withdraw the camshaft through the front end of the crankcase. Take care that the bearing bores are not damaged by the cam lobes.

1989 model year engines
To remove the camshaft, it will be necessary to remove the engine from the car (see Section E12). Then, refer to the relevant Sections within this Chapter for detailed dismantling procedures.

Camshaft – To inspect
1. Inspect the cams for wear and pitting. The cam lift dimensions are given in Section E4, Dimensional data.
2. If wear is in excess of the figures given, the camshaft must be renewed.

Camshaft – To fit (see fig. E7-1)
1. Lightly smear the camshaft bearings with clean engine oil. Lubricate the camshaft lobes with EP (extreme pressure) oil such as Castrol Hypress SC 140. Fit the camshaft through the front end of the crankcase, taking care that the cam lobes do not damage the camshaft bearing bores.
2. Fit the timing gear lubricating jet assembly to the thrust plate and secure with a new tab-washer.
3. Fit and secure the camshaft thrust plate to the crankcase; use new tab-washers. Torque tighten the setscrews to the figures quoted in Chapter P; lock the tab-washers.

Camshaft end-float – To check (see fig. E7-2)
1. Fit a dial test indicator to the crankcase and position the indicator onto the end of the camshaft; set the scale to zero (see inset A).
2. Fit two setscrews to the end of the camshaft.
3. Grip the setscrews, then move the camshaft backward and forward and note the reading on the dial test indicator.
4. The camshaft end-float should be between the figures quoted in Section E4, Dimensional data.

Valve gear – To time (see fig. E7-2)
1. Rotate the crankshaft until the mark on the crankshaft timing gear is vertical and towards the top of the crankcase (see inset B).
2. Fit the camshaft timing gear to the camshaft so that the mark on the gear is aligned with the mark on the crankshaft timing gear; do not fit any setscrews at this stage.
3. Carefully rotate the camshaft until the holes in the camshaft timing gear align exactly with the threaded holes in the cemshaft (one hole is offset).
4. Fit the end plate cover and secure the timing gear and cover to the camshaft. Torque tighten the setscrews to the figures quoted in Section E15.

Camshaft timing gear backlash and run-out – To check (see fig. E7-2)
1. Fit a dial test indicator to the crankcase and position the indicator onto the timing geer (see inset C); set the scale to zero.
2. Rock the cam gear and check the backlash. The backlash should be between the figures quoted in Section E4, Dimensional data.

3. Check the backlash on various teeth around the circumference of the gear.
4. Check the timing gear run-out as follows (see inset D).
5. Move the indicator pointer so that it touches the front face of the cam gear.
6. Rotate the crankshaft and check the run-out shown on the indicator dial. The run-out should not exceed the figures quoted in Section E4.

Distributor and driving gear – To fit (see fig. E7-2)
1. Fit the camshaft distributor driving skew gear, noting that it will only fit one way due to the two holes being offset.
2. Rotate the crankshaft until the timing marks on the camshaft and crankshaft gears are in line (see inset B).
3. On naturally aspirated engines, the timing pointer should be on the 10° btdc mark on the damper.

Holding the distributor with the ignition module to the rear of the engine, position the rotor forward down the centre line of the engine.

As the distributor is fitted, the rotor will turn slightly (as it engages with the camshaft distributor driving gear) and point directly towards A1 cylinder and to A1 cylinder contact in the distributor cap (see inset F).

Fit the distributor clamp and tighten the setscrew fingertight, plus half a turn.
4. On turbocharged engines, the timing pointer should be on the 42° btdc mark on the damper.

Holding the distributor assembly as shown in inset G, with the twin rotors to the notches in the top face of the casting (caps removed), lower the distributor into position.

Seal the distributor adapter to the crankcase using Loctite 510. Tighten the securing setscrews to the figures quoted in Chapter P.
5. Using a dial test indicator in a similar manner to that shown in inset C, check the backlash of the distributor driving gear. This should be between the figures quoted in Section E4, Dimensional data.
6. Fit the camshaft rear cover (if fitted) using a new joint.

Engine assembly – To complete
Complete the engine assembly by reversing the procedure given for camshaft removal, noting the following.
1. All setscrews, nuts, and bolts must be torque tightened to the figures quoted in the appropriate section.
2. Renew all joints.
3. Fit a new Neoprene seal between the lower front casing and the coolant pump.
4. Ensure that the tappet cover is fitted correctly.
5. Check the ignition timing as described in the Engine Management Systems Manual – TSD 4737.
6. If a new camshaft is fitted to an engine, a complete set of new tappets must also be fitted.
7. On 1989 model year engines, apply a 1,3mm (0.050in) wide bead of Loctite 573 sealing compound onto the crankcase rear face so that it surrounds the tapped holes of the camshaft gear aperture, prior to fitting the transmission adapter plate to the engine.

Cylinder heads and valves

Cylinder heads – To remove (see fig. E8-1)
The operations listed form the basic procedure to be followed. In service, minor variations to this procedure will be encountered due to the specification of the vehicle.

1. Carry out the usual workshop safety precautions.
2. Drain the cooling system (see Chapter L).
3. Depressurize the hydraulic systems (see Chapter G).
4. Slacken the drive belts at the front of the engine.
5. Remove either the fuel injection system equipment or turbocharging equipment as described in the Engine Management Systems Manual – TSD 4737.

Induction manifold

6. Detach the refrigeration compressor from its mountings and move it from the vicinity of 'B' bank cylinder head.
7. Remove the alternator (see Electrical Manuals – TSD 4701 or TSD 4848).
8. Disconnect the throttle linkage at the ball joint located at the top of the long control rod. Then, detach the linkage trapeze mounting bracket from the body longeron.
9. Disconnect the coolant hose from the thermostat housing outlet connection.
10. Disconnect the heater feed pipe at the rear of 'B' bank cylinder head.
11. Detach all electrical connections from the thermostat housing switches. Label each one to facilitate assembly.
12. Remove the setscrews securing the thermostat by-pass pipe to the coolant pump.
13. Unscrew the transmission modulator pipe from the union situated at the rear of the induction manifold.
14. Disconnect the pipes from the hydraulic brake pumps.
15. Remove the induction manifold setscrews and collect the washers.
16. Carefully withdraw the induction manifold. Discard the gaskets.

Rocker covers

17. Remove the speed control actuator assembly from the rear of 'A' bank cylinder head (if not removed previously).
18. Unscrew both the cap and reach nuts from the rocker covers.
19. Disconnect the leads from the sparking plugs.
20. Remove the nut and bolt securing the engine dipstick tube to the harness shaft ('B' bank).
21. Withdraw the ignition harness from the mounting studs on the rocker covers.
22. Carefully free the seal and withdraw the rocker cover.
23. Repeat Operations 18 to 22 inclusive to the other rocker cover.
24. Remove the steering pump (see Chapter N).

Cylinder head

25. Unscrew the rocker shaft retaining setscrews but **ensure that they remain through the shaft.**
26. Withdraw the rocker shaft assembly.
27. Repeat Operations 25 and 26 on the other rocker shaft.
28. Withdraw the push rods.
29. Remove the exhaust manifolds (see Chapter Q).
30. Using box spanner RH 7126, unscrew the cylinder head nuts. Commence by unscrewing the nuts at each end of the assemblies and progressively work inwards.
31. Carefully free the cylinder head(s) and withdraw it from the engine. Take care to ensure that the studs do not damage the face of the cylinder head(s), or that the threads of the studs are not damaged as the cylinder head(s) is withdrawn.
32. Withdraw and discard the cylinder head gasket(s).

Cylinder head – To fit (see fig. E8-1)
Fit the cylinder head(s) by reversing the procedure given for removal, noting the following.

1. Always ensure that the cylinder head gasket(s) is fitted correctly. The word TOP is marked on one side.
2. Cylinder head gaskets should be fitted dry. **No jointing compound is necessary.**
3. If any core plugs are to be fitted, ensure that a new sealing washer is used and the thread of the plug is coated with Loctite Superfast 572. The core plug should then be torque tightened to the figures given in Section E15.
4. Before fitting the cylinder head nuts, ensure that the stud threads are clean and lubricated with clean engine oil. Screw the nuts onto the threads 'finger tight' and then torque tighten them in the correct sequence (refer to Section E15).

Valves – To remove (see fig. E8-1)
Label the parts as they are removed. This will ensure that they can be reassembled into their original position.

To remove the valves, special tool RH 7094 is required (see inset B).

1. Remove the cylinder heads.
2. Fit a valve tool pedestal at each end of the cylinder head. The pedestals locate in the recesses used for the rocker pedestals and are secured by nuts and bolts.
3. Place the cylinder head on a suitable base. Ensure that four wooden blocks fit into the combustion chambers. The blocks support the valves whilst the springs are compressed.
4. Insert the fulcrum bar through the holes in the pedestals.
5. Fit the valve spring compressing tool under the fulcrum bar and fit the stirrup over the valve top washer.
6. Compress the valve spring and remove the two collets.

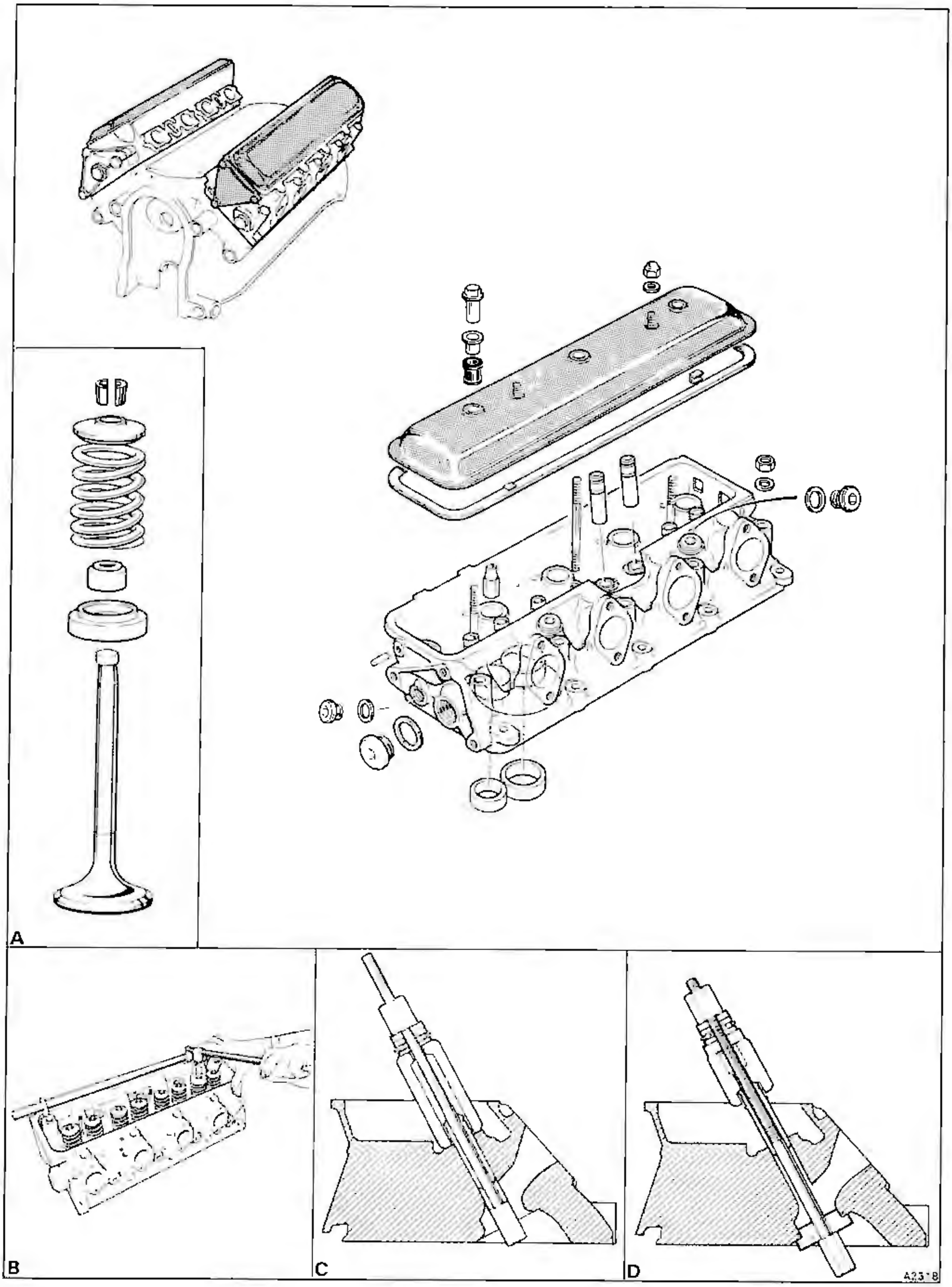


Fig. E8-1 Cylinder head assembly

7. Gradually release the pressure from the spring compressing tool.
8. Move the stirrup from the valve top washer.
9. Dismantle the assembly (see inset A) as follows.
Withdraw the top washer, valve spring, valve stem seal, and bottom washer.
10. Repeat Operations 5 to 9 inclusive to the remaining valves in the cylinder head.
11. Turn the cylinder head over and withdraw the valves.

Valves and valve seat inserts – To inspect and reface
1. Remove the valves from the engine. Note that each valve has its cylinder number etched onto the side of the tip.
2. Visually check that each valve head and seating area is serviceable. If a valve appears to be burnt away or cracked in the seating area, fit a new valve.
3. Clean all carbon from each valve head and cylinder head combustion area, using a wire brush.
4. Wash the valves and cylinder head in clean paraffin. Then, dry with compressed air.
5. Check that each valve seating area in the cylinder head (valve insert) is serviceable. Fit a new valve insert if any are badly worn, burnt, or cracked.
6. Ensure that the stem and head of each valve is not bent.
7. Reface the seating area on each valve and valve seat insert using the appropriate reconditioning equipment. The seat angle should be 45°.
When refacing the valve seats, remove the minimum amount of material possible to give a 'clean' seating.
Note If new valve guides have been fitted, they should be reamed before the valve seat inserts are faced.
8. If necessary, the exhaust valve seat inserts may be crowned with a 30° cutter to prevent pocketing.
9. Using a fine, good quality lapping paste, lightly lap each valve to its seat. Check the seating using Prussian blue.
10. Thoroughly wash the cylinder head(s) and valves in paraffin to remove all grinding dust and lapping paste. Dry using compressed air.

Valves – To fit (see fig. E8-1)
To fit the valves reverse the procedure given for removal, noting the following.
1. If any parts are serviceable, always ensure that they are fitted in their original positions.
2. Check that the valves operate smoothly in their respective guides and that they are seating correctly.
3. New valves are specially treated on the stems to aid running-in. The black appearance will wear off in service. However, this will not affect the surface hardness.
Under no circumstances must this coating be removed. However, if the coating has worn off or if new rubber valve stem seals are fitted, the valve stems and guides should be lubricated.
4. When lubrication of the valves is required, the valve stems should be lubricated with an assembly lubricant such as either Molykote G Rapid or Rocol MTS 1000. In addition, the valve guides should be lubricated with clean engine oil.

Valve guides – To inspect
The valve guides should be inspected whilst they are still fitted in the cylinder head.
1. Obtain a new valve guide. Examine the existing valve guides for wear, comparing them with the new guide.
2. The maximum permissable wear on the valve guides is given in Section E4, Dimensional data. If the wear tolerance is exceeded, the valve guides should be removed from the cylinder head and new ones fitted as described in Valve guides – To remove and fit.
3. 'Bellmouthing' at the bottom end of the valve guides is permissable within the tolerances specified in Section E4, Dimensional data.
4. Check the clearance in the bore between each valve stem and its respective guide (refer to Section E4, Dimensional data, for the permissable tolerance).

Valve springs – To inspect and test (see fig. E8-1)
1. Dismantle the valve arrangement, refer to Valves – To remove.
2. Wash the springs in clean paraffin and dry using compressed air.
3. Visually examine the valve springs for defects.
4. Check the poundage of each spring on a valve spring tester. Data for this poundage check can be found in Section E4.

Valve guides – To remove and fit (see fig. E8-1)
1. Remove the cylinder head(s).
2. Dismantle the valve assemblies.
3. Remove the valve guides using special tool RH 7207 (see inset C). Withdraw the guides from the top (rocker side) of the cylinder head.
4. Thoroughly clean the valve guide bores in the cylinder head and accurately measure the bore diameters.
5. Select a new set of oversize guides that will give the correct interference fit when installed in the cylinder head (see Section E4, Dimensional data).
6. Using the special tool RH 7207 (see inset D), draw the valve guides into the cylinder head from the top (rocker side). Ensure that the shoulder of the guide abuts the cylinder head.
7. Using the special reamer RH 7825, or the tungsten carbide tipped version RH 7827, ream both the inlet and exhaust valve guides to the finished size.

Valve seat inserts – To remove (see fig. E8-1)
1. The valve seat inserts should be machined out of the cylinder head, leaving a thin skin of the insert material approximately 0,25 mm (0.010 in) thick remaining in the cylinder head.
2. After machining, carefully remove the insert shell from the bore in the cylinder head.

Valve seat inserts – To fit (see fig. E8-1)
1. Compare the size of the insert bore in the cylinder head with the standard figures given in Section E4, Dimensional data.
2. If the bores do not conform to the size quoted, it will be necessary to machine them to a larger diameter and

to fit oversize seat inserts (refer to the Parts List).

3. Ensure that the correct interference fit is maintained when the inserts are fitted into the cylinder head (see Section E4, Dimensional data).

4. To fit the inserts, place the cylinder head in an oven, or heat evenly to a temperature of 150°C (302°F) for a period of one hour.

5. The cylinder head should be quickly removed from the oven and the insert(s) driven into position using a soft drift.

6. Ensure that the shoulder of each valve guide is in contact with the cylinder head (i.e. that it has not moved during the time that the cylinder head was in the oven or when the valve seat inserts were driven into position).

Note Do not finish machine the valve seats until after the valve guides have been reamed.

If the necessary service facilities are not available, it is recommended that the cylinder heads be returned to Rolls-Royce Motor Cars Limited for this work to be carried out.

Decarbonizing

Carbon deposits form in the combustion chambers and affect the cylinder heads, valves, and piston crowns.

To decarbonize the engine it will be necessary to remove and dismantle the cylinder heads, then proceed as follows.

1. Ensure that the piston is at tdc. Using a blunt tool carefully remove the carbon deposit from the piston crown and the top face of the liner. Do not use a wire brush.

2. Carry out a similar exercise with the blunt tool on the valves. Complete the removal of the carbon deposit using a wire brush.

Take care not to damage the valve seat or to make heavy score marks in the cylinder heads. Heavy score marks will quickly accumulate carbon and seriously impair engine performance.

3. Ensure that as the carbon is removed, it does not enter the coolant passages of the crankcase and cylinder heads.

4. Discard the sparking plugs for new ones.

5. Repeat Operations 1 to 4 inclusive on the remaining combustion chambers and their respective components.

6. Wash the cylinder heads and valves in paraffin and dry with compressed air.

7. Inspect the valve guides.

8. Inspect the valves, the valve seats, and the valve seat inserts.

9. Inspect the valve springs.

10. Assemble the engine by reversing the procedure given for dismantling, noting the following.

a. Use new gaskets and seals.

b. Torque tighten all nuts and setscrews to the figures quoted in either Section E15 or Chapter P.

Crankcase breather system

Crankcase breather housing – To remove and fit
(see fig. E9-1)
All engines
1. Withdraw the starter relay situated either;

a. Adjacent to the windscreen washer reservoir (Four door cars prior to 1989 model year, and all Corniche/Corniche II/Continental cars) **or**
b. Between the spring pot support brackets on the

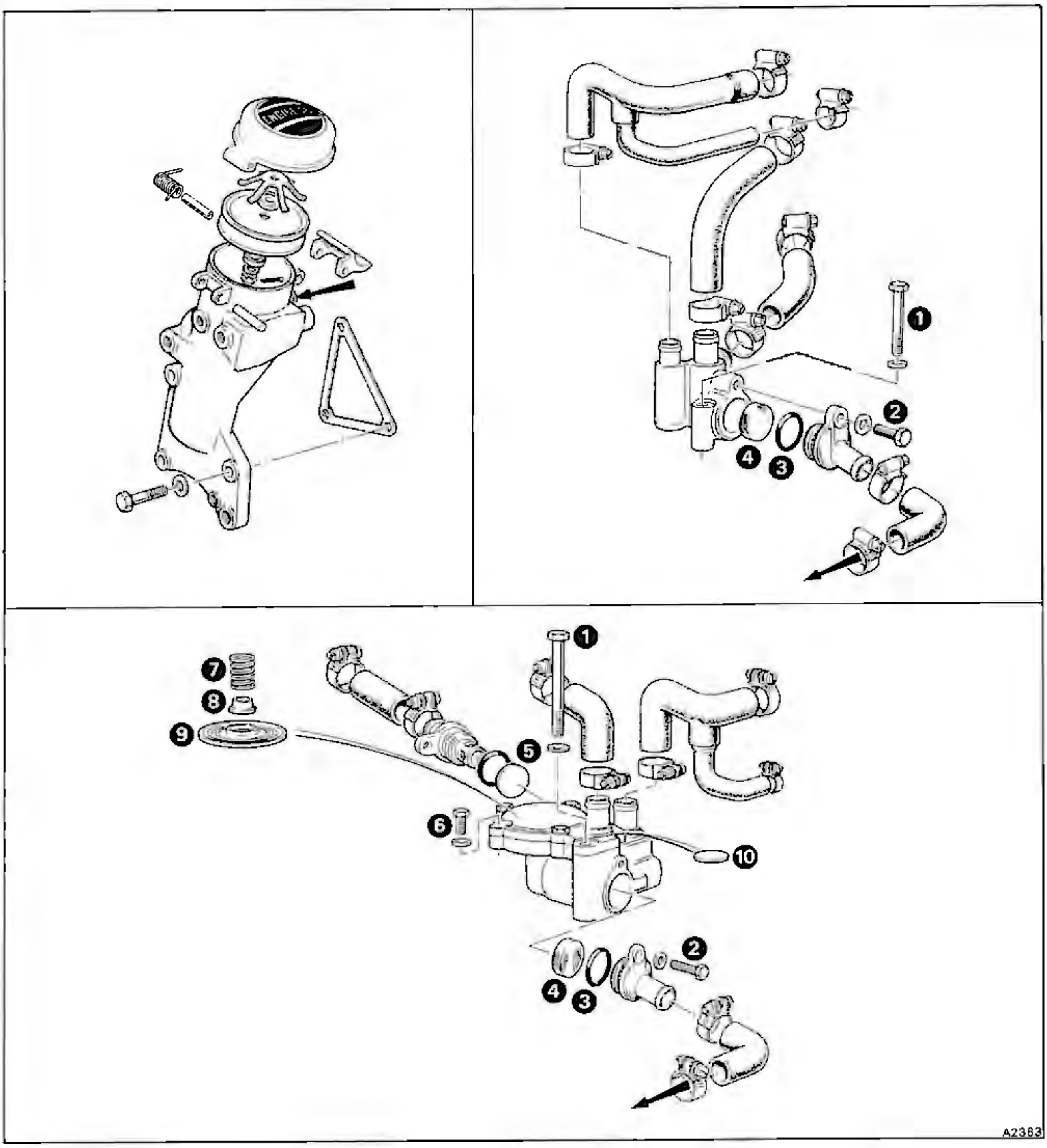


Fig. E9-1 Crankcase breather system

right-hand side of the engine compartment. To gain access to the relay, remove the cover panel (1989 model year – Four door cars).

2. Slacken the worm drive clips on the hoses leading to the breather housing. Label each hose for identification and then free each joint.

3. Remove the setscrews (item 1) securing the breather housing to the engine. Withdraw the assembly.

4. Slacken the worm drive clips securing the hoses to the housing and withdraw the hoses.

5. Remove the setscrew (item 2) retaining the inlet elbow to the housing. Ease the flange from the housing, noting that slight resistance may be encountered due to the rubber sealing ring (item 3) on the locating spigot.

6. Insert a small pointed instrument into the gauze and carefully lever the flame trap (item 4) from the housing.

Turbocharged engines

7. Repeat Operation 5 on the connection to the induction manifold.

8. Collect the metal disc valve (item 5) situated behind the flange.

9. Unscrew and remove the setscrews (item 6) situated around the top of the assembly.

10. Withdraw the top and collect the spring (item 7), guide washer (item 8), and diaphragm (item 9).

11. Collect the metal disc valve (item 10) from the smaller chamber located above the flame trap aperture.

All engines

12. Clean all parts and examine them for serviceability, particularly the rubber sealing ring(s) and diaphragm (if fitted).

If the rubber parts have covered a high mileage and/or show signs of deterioration, they should be renewed.

13. Assemble the breather housing and fit it to the engine by reversing the dismantling procedure.

Engine lubrication system

Oil pump – To remove (see fig. E10-1)
The operations listed form the basic procedure to be followed. However, minor variations may be encountered due to the specification of the engine.

All engines
1. Drive the vehicle onto a ramp and chock the road wheels.
2. Carry out the usual workshop safety precautions.
3. Drain the engine coolant (see Chapter L).
4. Drain the engine oil.
5. Remove the bonnet and radiator grille (see Chapter S).
6. Remove the engine drive belts (see Section E13).
7. Remove the alternator (see Electrical Manuals – TSD 4701 or TSD 4848).
8. Remove the oil cooler pipes (item 1) from the lower front cover.
9. Remove the auxiliary cooling fans (see Electrical Manuals – TSD 4701 or TSD 4848).
10. Remove the refrigeration condenser (see Chapter C), radiator matrix and cowl, viscous coupling, and cooling fan (see Chapter L).

Turbocharged engines
11. Remove the large exhaust downtake pipe between the turbocharger and the flexible bellows. Also, remove the large heatshield which is secured by setscrews to the turbocharger and the lower front cover.
12. Remove the exhaust crossover pipe and heatshield from beneath the sump.
13. Remove the turbocharger oil return pipe to the lower front cover.

All engines
14. Remove the setscrews retaining the refrigeration compressor mounting bracket to the engine (see Chapter C). Move the compressor and mounting bracket from the vicinity of the coolant pump.
15. Remove the air injection pump (if fitted) as described in the Engine Management Systems Manual – TSD 4737.
16. Remove the steering pump (see Chapter N).
17. Disconnect the engine coolant pipes (including the heater return pipe) from the coolant pump.
18. Remove the setscrews securing the thermostat housing to the coolant pump.
19. Remove the setscrews securing the coolant pump to the crankcase. Withdraw the coolant pump.
20. Discard the Neoprene seal which fits between the coolant pump and lower front cover.
21. Remove the setscrews from the centre of the crankshaft pulley/damper. Withdraw the pulley/damper assembly.
22. Remove the nut securing the drive flange to the crankshaft.
23. Using extractor RH 9765, withdraw the drive flange. The flange is dowelled to the crankshaft.
24. Ensure that all weight is removed from the engine front mounting foot. Then, remove the setscrews from the engine mounting situated below the lower front cover.
25. Disconnect the electrical cables from the pressure switch and oil pressure transmitter. Then, remove all the setscrews securing the lower front cover (see inset A).
26. Carefully slide any packing pieces from between the bottom of the lower front cover and the mounting foot. Slightly raise the engine if necessary. Take note of the packing pieces so that they can be returned to their correct positions.
27. Insert a feeler gauge or similar tool between the bottom of the lower cover and the sump gasket. Slowly work the feeler gauge around the joint to 'break' the seal.
28. Withdraw the front cover (the cover is dowelled to the crankcase). Discard the gasket. Remove the oil transfer pipes (item 2) between the front cover and crankcase. Discard the 'O' rings.
29. Remove the oil pipe retaining plug from 'B' bank side of the crankcase.
30. Push the oil pump outlet pipe (item 3) through the crankcase. Then, remove the setscrews securing the pump outlet elbow (item 4). Discard the gasket from the outlet elbow and the 'O' rings from the outlet pipe.
31. Remove the setscrews (item 5) securing the pump to the crankcase. Then, withdraw the pump together with the dowel inserts (item 6).
32. To remove the oil pump driving gear, refer to Section E5, Crankshaft – To dismantle.

Oil pump – To test
The pump must be tested on a rig which has a variable orifice so that the oil delivery pressure from the pump can be restricted. The rig should also be able to drive the pump at a controlled speed and be capable of maintaining a constant temperature of 80°C (176°F) for the duration of the test.

If these facilities are available, the pump should be tested as follows.
1. Drive the pump at 200 rev/min, then adjust the variable orifice until the pump is delivering oil at 1,03 bar (15 lbf/in^2). With the orifice at this setting the oil pump delivery should be at least 4,55 litres/min (1 gal/min).
2. Maintain the orifice at this setting. Then, increase the speed to 1500 rev/min, the pump should deliver no less than 9,0 litres/min (2 gal/min) at 2,89 bar (42 lbf/in^2).
3. The relief valve should blow at approximately 2,89 bar (42 lbf/in^2).

If the performance of the pump does not conform to these figures, proceed as follows.
4. Examine the working faces of the pump cover and if necessary, remove light wear marks by machining.

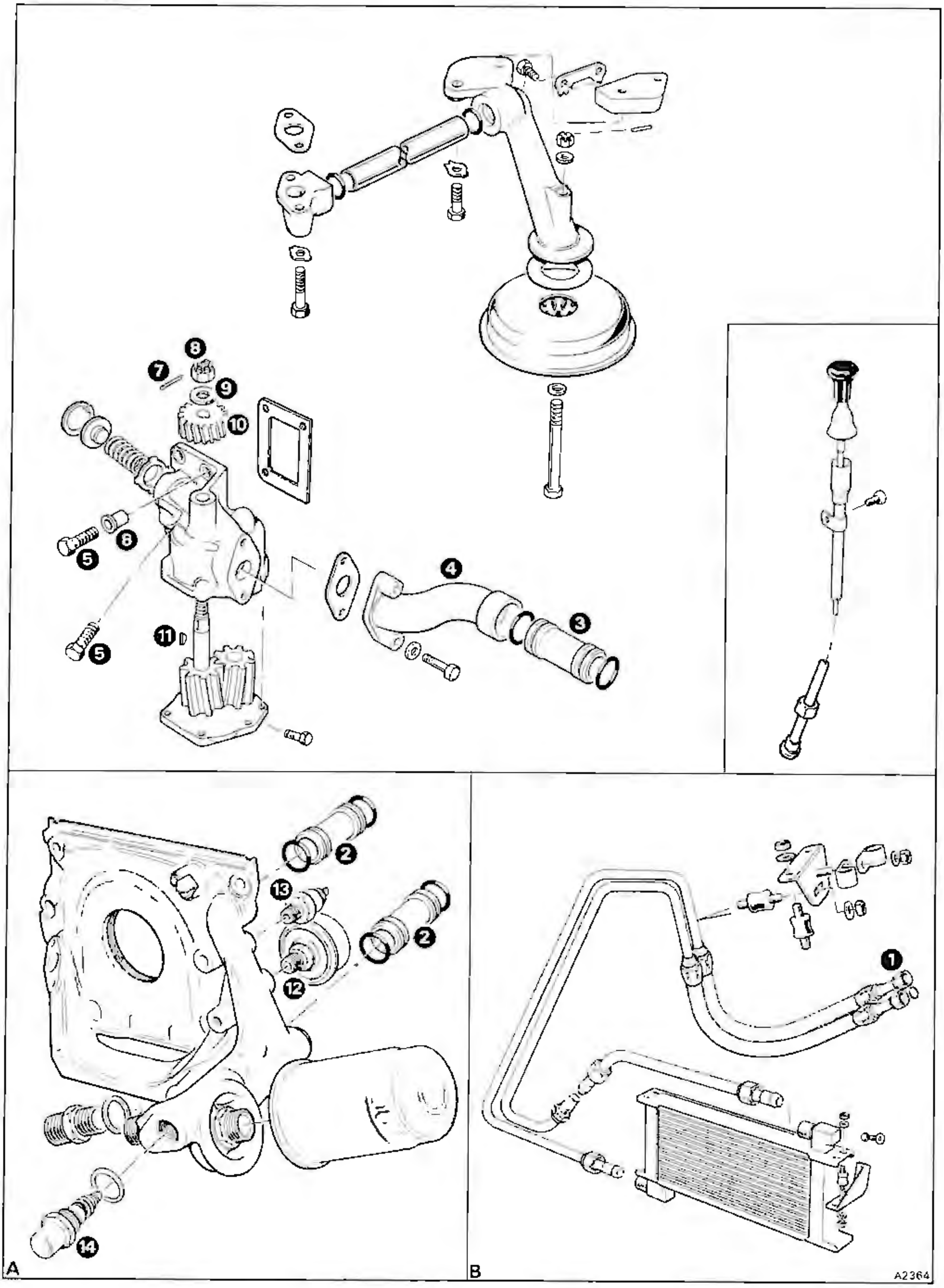


Fig. E10-1 Engine lubrication system components

5. Compare the pump clearance with the figures given in Section E4 – Dimensional data. If necessary renew the pump casing and fit a new matched set of gears.
6. If the condition of the pump is poor, the complete pump should be renewed.

Oil pump – To dismantle (see fig. E10-1)
1. Hold the external driving gear in a suitable fixture, taking care that sufficient protection is provided to ensure that the teeth of the gear are not damaged.
2. Remove the split pin (item 7), nut (item 8), and washer (item 9), securing the driving gear to the driving shaft; carefully withdraw the gear (item 10) using the extractor RH 8141. Remove the Woodruff key (item 11) from the shaft.
3. Unscrew the setscrews, remove the end cover and withdraw the two gears from the casing.

Oil pump – To assemble (see fig. E10-1)
1. Assemble the oil pump by reversing the procedure given for dismantling noting the following.
2. Examine all working parts for wear and inspect the end cover and casing for distortion; renew if necessary. If the end cover is lightly scored the marks may be removed by machining.
3. If the drive gear is serviceable, always ensure that it is fitted into position the same way around as it was removed.
4. Check that the end-float in the gears and the backlash between the pump driving gear and driven gear (internal gears) is correct (see Section E4, Dimensional data).
5. Torque tighten the setscrews, nuts, and bolts to the figures specified in Chapter P.

Oil pump – To fit (see fig. E10-1)
1. Fit the oil pump by reversing the procedure given for removal, noting the following.
2. Always ensure that the oil pump gear is of a different material to the mating gear on the crankshaft. The oil pump gear should be steel and the crankshaft gear bronze.

Under no circumstances should gears of like metals be fitted.

If a new oil pump driven gear is to be fitted, also fit a new oil pump driving gear to the crankshaft.
3. If the drive gear is serviceable, always ensure that it is fitted into position the same way around as it was removed.
4. Ensure that all setscrews, nuts, and bolts are torque tightened to the figures specified in Chapter P.
5. Ensure that the backlash between the driving gear on the crankshaft and the gear on the pump is correct (refer to Section E4, Dimensional data and figure E10-2).
6. When fitting the setscrews securing the pump to the engine, ensure that the dowel inserts are fitted to the holes from which they were removed.
7. Renew the 'O' rings on the oil transfer pipes.
8. Fit new joints to the lower front cover and the oil pump. If the front cover to sump joint is damaged or in poor condition it will be necessary to remove the sump to enable a new joint to be fitted.

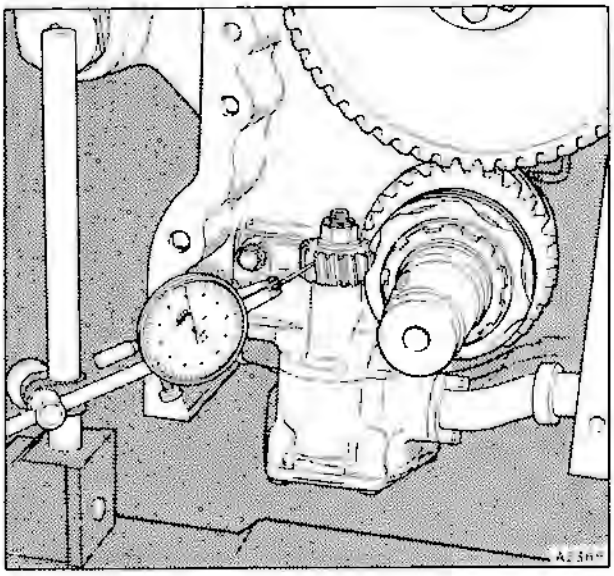


Fig. E10-2 Checking backlash of oil pump gears

9. Set the front engine mounting stop plate gap (refer to Section E12).
10. Fit a new Neoprene seal between the coolant pump casing and the lower front cover; also renew the coolant pump 'O' rings.
11. Examine all coolant hoses for deterioration and replace any that are considered unserviceable.
12. Ensure that the driving belts are fitted and adjusted correctly (refer to Section E13).
13. Fill the engine cooling system with the correct anti-freeze mixture (refer to Chapter L).
14. Fill the engine with an approved oil (refer to Engine oil, Sump – To fill).

Oil filter canister – To renew (see fig. E10-1)
1. Drain the oil from the engine by carrying out Operations 1 to 8 inclusive, under the heading Engine oil, Sump – To drain.
2. Position a suitable container beneath the oil filter.
3. Support the filter and unscrew, using a suitable strap spanner.
4. Discard the complete filter canister assembly.
5. Examine the new canister to ensure that it is a suitable approved replacement and that the rubber sealing ring is positioned correctly.
6. Lightly smear the sealing ring with clean engine oil.
7. Fit the new canister and tighten, using hand pressure.

Oil pressure gauge transmitter and/or pressure switch – To renew (see fig. E10-1)
1. Carry out the usual workshop safety precautions.
2. Disconnect the electrical cable at the Lucar connection on the transmitter (item 12) and/or pressure switch (item 13).
3. Using the appropriate size spanner, unscrew the unit anti-clockwise.
4. Fit the unit in the reverse order, ensuring the threads are coated with Loctite 572 prior to fitting.

Oil thermostat – To renew (see fig. E10-1)
The function of the thermostat (item 14) fitted into the oil filter elbow is to allow oil to flow through the engine oil cooler when it has reached a predetermined temperature.
1. Carry out the usual workshop safety precautions.
2. Unscrew the thermostat from the elbow.
3. Fit the assembly in the reverse order, noting that the sealing washer is in good condition and that the threads are coated with Loctite 572 prior to fitting.

Oil level sender unit – To renew
1. Carry out the usual workshop safety precautions.
2. Drain the engine oil (refer to Sump – To drain).
3. Locate the assembly situated in the side of the sump.
4. Remove the heatshield.
5. Disconnect the electrical connection.
6. Remove the setscrews securing the unit in position and collect the washers.
7. Carefully 'free' the joint and withdraw the sender unit.
8. Fit the assembly in the reverse order, noting that the joint faces must always be clean. Always fit a new gasket coated with Wellseal. Ensure that the word 'Top' stamped on the assembly is towards the top of the engine.
9. Fill the sump with oil (refer to Sump – To fill).

Engine oil

Sump – To drain
1. Position the car on a ramp and carry out the usual workshop safety precautions.
2. Raise the ramp.
3. Position a suitable container beneath the sump drain plug.
4. Clean the drain plug, sealing washer, and a small area of the sump around the drain hole.
5. Unscrew the drain plug, collect the aluminium sealing washer and allow the oil to drain into the container.
6. Examine the condition of the aluminium sealing washer and renew if necessary.
7. Ensure that the plug and washer seating area on the sump is both clean and dry.
8. Fit the sealing washer and plug to the sump and tighten.
9. Fit a new oil filter canister if necessary by carrying out Operations 2 to 7 inclusive, under the heading Oil filter canister – To renew.

Sump – To fill
It is most important that only engine oil of an approved grade and manufacture is used, refer to Chapter D.
1. Raise the bonnet and open the filler cap.
2. Pour 8,4 litres (14.7 Imp pt, 17.7 US pt) of fresh approved oil into the system via the filler, 9,4 litres (16.5 Imp pt, 19.8 US pt) if the filter has been changed.
3. Check the oil level.

Sump – Oil level to check and top-up
The vehicle must be standing on level ground and the engine switched off. It is most important that only engine oil of an approved grade and manufacture is used, refer to Chapter D.
1. If the sump has just been filled with fresh oil or if the engine has been switched off, allow at least four minutes for the oil to drain into the sump.
2. Withdraw the engine oil dipstick and wipe it clean.
3. Insert the dipstick into its position.
4. Withdraw the dipstick and read the oil level. Maximum and minimum oil level marks are indicated on the dipstick.
5. Top-up the oil level if necessary, by pouring a small quantity of fresh engine oil through the filler. **Do not overfill.**
6. After topping-up ensure that the filler cap and bonnet are properly closed.

Important Do not operate the engine if the oil level is below the minimum mark on the dipstick. Failure to observe this precaution could result in serious damage to the engine.
If the filter canister and/or the sump drain plug have been disturbed, check for oil leaks around the two components, immediately after the engine has been started.

Engine oils
Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation, and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities should be provided.
For full details on engine oil precautions, reference should be made to Chapter A.

Hydraulic pump push rod assemblies

Hydraulic pump push rod assembly – To remove
(see fig. E11-1)

1. Carry out the usual workshop safety precautions.
2. Remove either the fuel injection system equipment or turbocharging equipment as applicable (see Engine Management Systems Manual – TSD 4737).
3. Drain the engine coolant (see Chapter L).
4. Depressurize the hydraulic systems and remove the

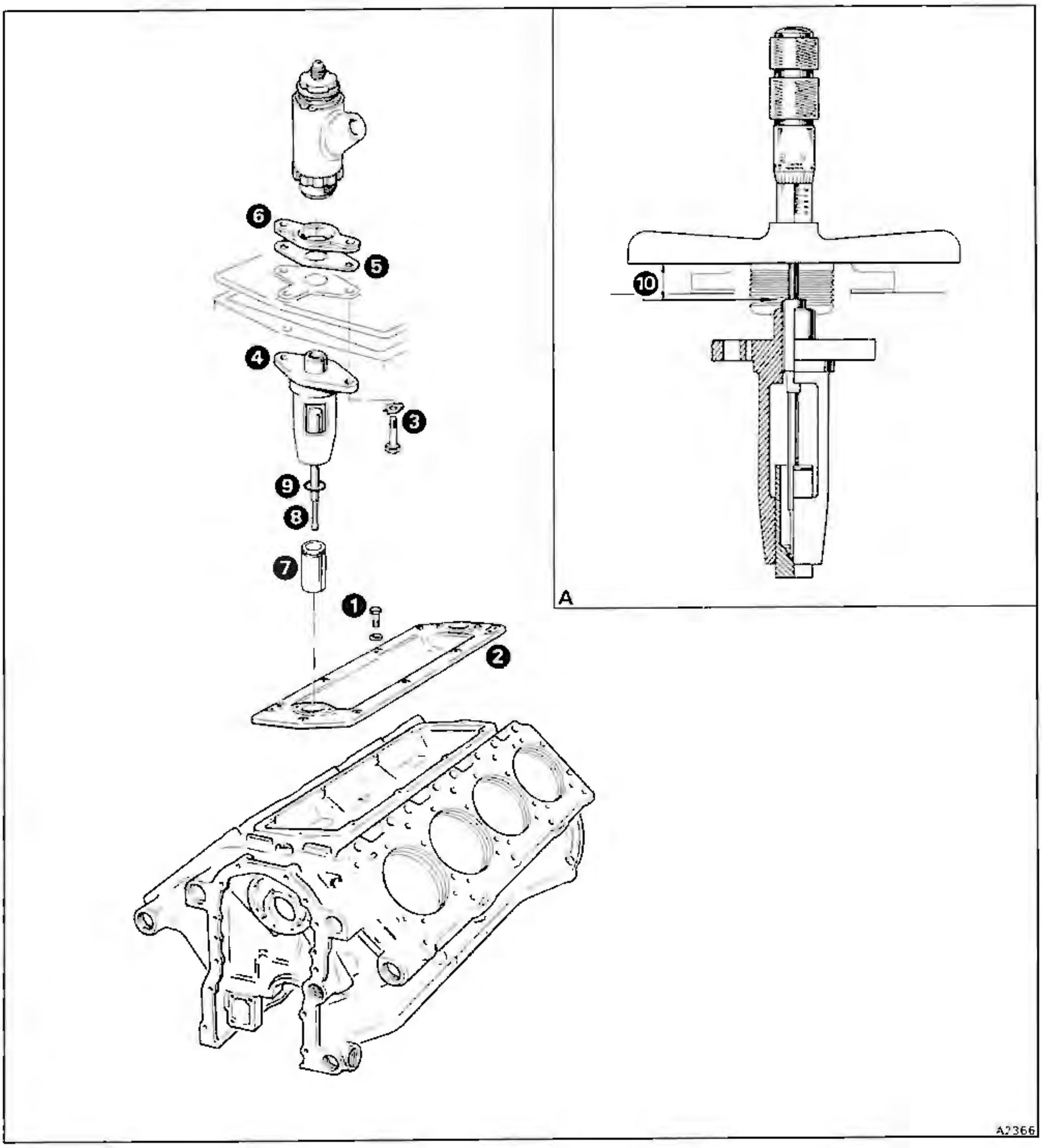


Fig. E11-1 Hydraulic pump push rod assemblies

hydraulic pumps (see Chapter G).
5. Remove the induction manifold.
6. Progressively unscrew the setscrews (item 1) securing the tappet chest cover to the crankcase. **The setscrews must be removed progressively,** otherwise if the brake pump operating cams are at their peak, distortion could occur to the tappet chest cover.
7. Withdraw the tappet chest cover (item 2).
8. From the underside of the tappet chest cover, bend back the tabs of the lock-washers (item 3).
9. Unscrew the setscrews securing the push rod housings (item 4) to the tappet chest cover.
10. Remove the housings. Collect the shims (item 5) if fitted, as the pump mounting flange (item 6) and push rod housing are detached.

Push rod housings – To dismantle and assemble
(see fig. E11-1)
1. Slide the push rod (item 8) through the hole in the push rod housing.
2. Press the cam follower (item 7) into the centre chamber of the housing (see inset A). Lift out the cam follower.
3. Discard the 'O' ring (item 9).
4. Examine the components for wear.
5. Clean the groove in the cam follower and fit a new 'O' ring.
6. Wash all components in clean paraffin.
7. Assemble the components by reversing the dismantling procedure.

Hydraulic pump push rod assembly – To fit
(see fig. E11-1)
1. Ensure that all components are clean, particularly the mating faces of the tappet chest cover and the crankcase.
2. Fit the push rod housing assemblies to the underside of the cover.
3. Fit the pump mounting flange and shim(s) on top of the cover and secure in position with setscrews and lock-washers.
4. To check that the push rods are correctly set, rotate the camshaft until both hydraulic pump eccentrics are at bottom dead centre (bdc).
5. Temporarily fit the tappet cover and progressively tighten the setscrews.
6. Rotate the engine to find the exact bdc position of the hydraulic pump push rod.
7. Using a depth micrometer placed across the pump mounting flange, measure the dimension to the top of the push rod (see item 10). This dimension should be between the figures quoted in Section E4, Dimensional data.
8. If the dimension is incorrect it will be necessary to alter the shims under the pump mounting flange. The shims are available in three sizes, refer to Section E4, Dimensional data.
9. To alter the number of shims, carry out the following operations.
10. Remove the tappet chest cover.
11. Remove the setscrews securing the push rod housing to the pump mounting flange. Remove the housing and flange, together with the shim(s).
12. Care should be taken to ensure that no dirt or other foreign matter is allowed to come into contact with the exposed components, especially the eccentrics or the cam face of the followers.
13. Add or subtract the necessary shim washers.
14. Fit the push rod housing, shims, and pump mounting flange to the tappet chest cover.
15. Fit the push rod.
16. Temporarily fit the tappet chest cover assembly to the crankcase. Using a depth micrometer, confirm that the dimension from the pump mounting flange to the top face of the push rod (item 10) is correct, refer to Section E4, Dimensional data.
17. When the dimension from the pump mounting flange to the top face of the push rod is correct, remove the tappet chest cover. Then, secure the retaining setscrews with the tabs of the lock-washers. Fit the cover as described in Section E7.
18. Fit the hydraulic pump(s) as described in Chapter G.

Engine removal and installation

This section describes the removal of the engine through the bonnet aperture. Details for the removal of the engine, torque converter transmission, and front sub-frame as one unit from beneath the car, are given in Chapter H.

The operations listed in this section are the basic steps to be followed when removing the engine. The sequence of operations may vary slightly dependent upon the specification of the vehicle. Therefore, it is always advisable to check that all cables, looms, pipes, etc., have been disconnected before lifting the engine out of the vehicle.

Engine – To remove (see figs. E12-1 and E12-2)

1. Drive the car onto a ramp.
2. Carry out the usual workshop safety precautions.
3. Chock both the front and rear road wheels.
4. Disconnect the battery.
5. Raise the bonnet and ensure that the wing covers RH 2684 and liners RH 2685 are fitted.
6. Remove the bonnet (see Chapter S).
7. Drain the engine cooling system (see Chapter L).
8. Depressurize the hydraulic systems (see Chapter G).
9. Drain the engine oil (see Section E10).

Disconnect the oil cooler pipes from the filter elbow. Allow any oil to drain into a container and then blank off the pipe ends.

10. Discharge the air conditioning system refrigerant (see Chapter C).
11. Remove the speed control system actuator.
12. Remove the top and bottom radiator hoses and blank the open connections.
13. Remove the engine fan assembly. Then, remove the radiator and cowl assembly (see Chapter L).
14. Disconnect the heater tap feed and return hoses from the engine. On 1989 model year cars, also disconnect the coolant expansion bottle return hose.
15. Disconnect the refrigerant pipes from the rear of the compressor.
16. Remove the air intake trunking. On cars fitted with an exhaust emission control system, also remove the air injection hose to the air filter housing. On 1989 model year turbocharged cars, disconnect the turbocharger to intercooler duct.
17. Fit a clamp to the feed hose from the steering system remote reservoir. Disconnect the steering pump and steering rack to oil cooler hoses. Allow the oil to drain into a container and then blank the connections.
18. Disconnect and remove the exhaust gas recirculation (EGR) feed pipe (if fitted).
19. Support the weight of the rear section of the exhaust system. Remove the front section of the exhaust system and downtake pipes (see Chapter Q).

    On turbocharged cars, remove the exhaust connecting pipe between 'A' and 'B' bank manifolds.
20. Depressurize the fuel system. Then, disconnect the body to engine fuel hoses. Also, the fuel evaporative control canister hose, if applicable.
21. Clamp the hydraulic system reservoir to brake pump hoses to prevent reservoir drainage. Then, disconnect the hoses from the pump inlet pipes.

    Fit blanks to the open connections.
22. Remove the starter motor (see Electrical Manuals – TSD 4701 or TSD 4848).
23. Position a jack under the rear of the engine sump. Place a piece of wood between the head of the jack and the sump. Take the weight of the engine.
24. On left-hand drive cars, remove the throttle linkage cross-shaft.
25. Remove the torque converter transmission (see Chapter T).
26. On four door cars only, disconnect the small dampers (adjacent to the engine rear mounts) from the transmission adapter plate.
27. Disconnect the accumulator to body hoses. On turbocharged cars, these hoses are situated on the left-hand side of the engine compartment.
28. Temporarily clamp the two accumulator low pressure return to reservoir hoses. Detach the hoses and suitably blank the open ends.
29. Disconnect the accelerator linkage at the long rod and detach the isolator trapeze from the body.
30. Disconnect all the relevant electrical connections and clipping points on either side of the engine (see figs. E12-1 and E12-2).

    On turbocharged cars, remove the left-hand front side/position lamp. Then, disconnect the boost control electronic control unit/knock sensor (ECU) (see inset C). Also, on cars prior to 1989 model year, disconnect the ignition and fuel injection electronic control units (ECU) situated beneath the facia in the right-hand footwell area. Remove the engine closing plate on the bulkhead and pull the two plugs removed, through to the engine compartment.
31. Detach the electrical connections to the ignition coil(s) and distributor(s).
32. To lift the engine, fit slings around the front and rear of the engine. Ensure that the front sling is not positioned under the front pulley. Using the special lifting sling RH 9732, connect the front and rear slings to an overhead hoist.
33. Take the weight of the engine.
34. Disconnect the front and rear engine mounts.
35. Check to ensure that no cables, pipes, etc., remain connected to the engine.
36. Carefully lift the engine and then move slightly forward, ensuring that it does not foul any point of the engine compartment.
37. Continue to lift the engine out of the vehicle. Once it is clear, lower it down onto a suitable stand and secure it in the upright position.

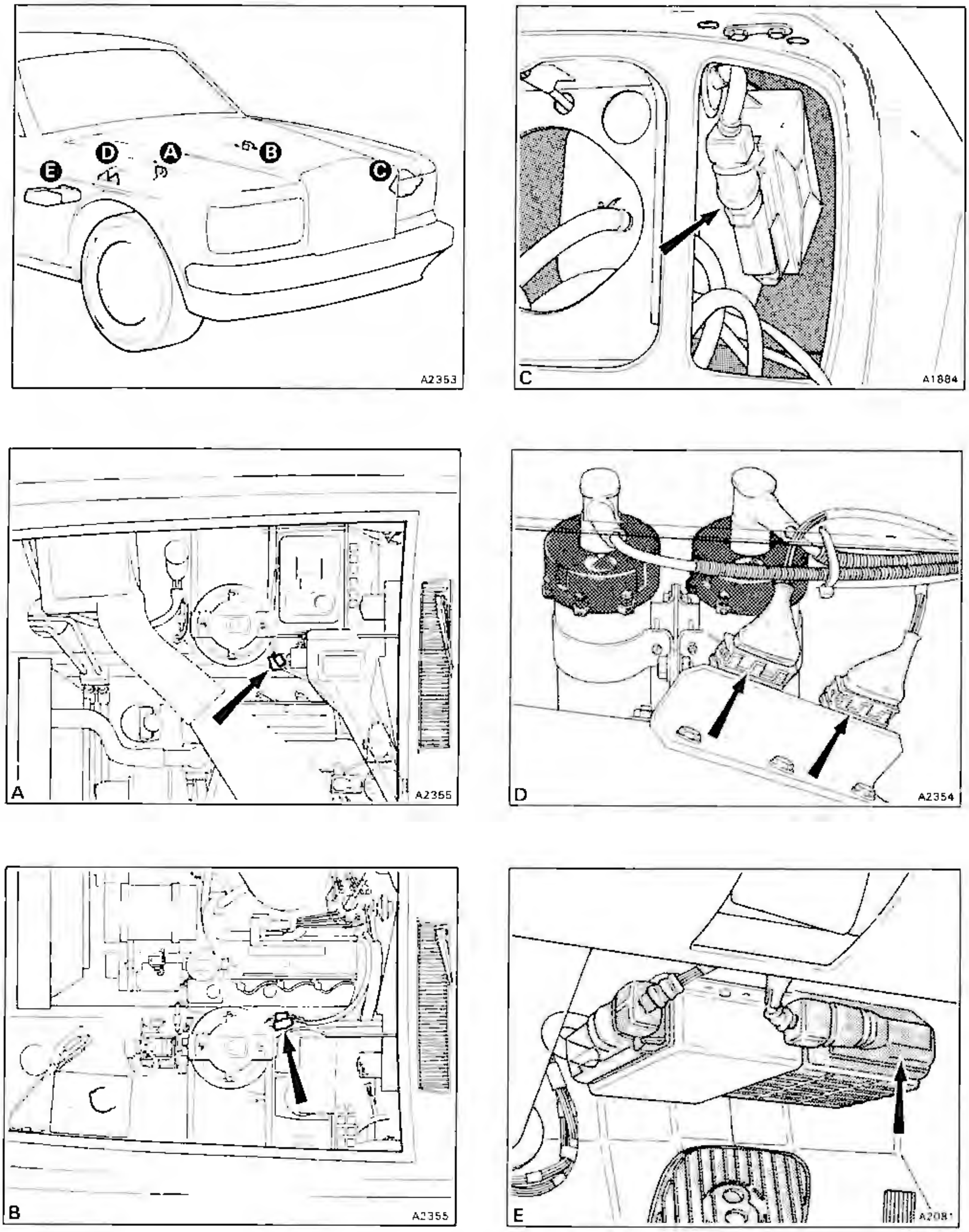


Fig. E12-1 Electrical disconnection points (Cars prior to 1989 model year)

A Valance to engine loom connections (All cars)
B Valance to engine loom connections (All cars)
C Boost control ECU (Turbocharged cars only)
D Ignition amplifier connections (Turbocharged cars only)
E Electronic control unit connections (Turbocharged cars only)

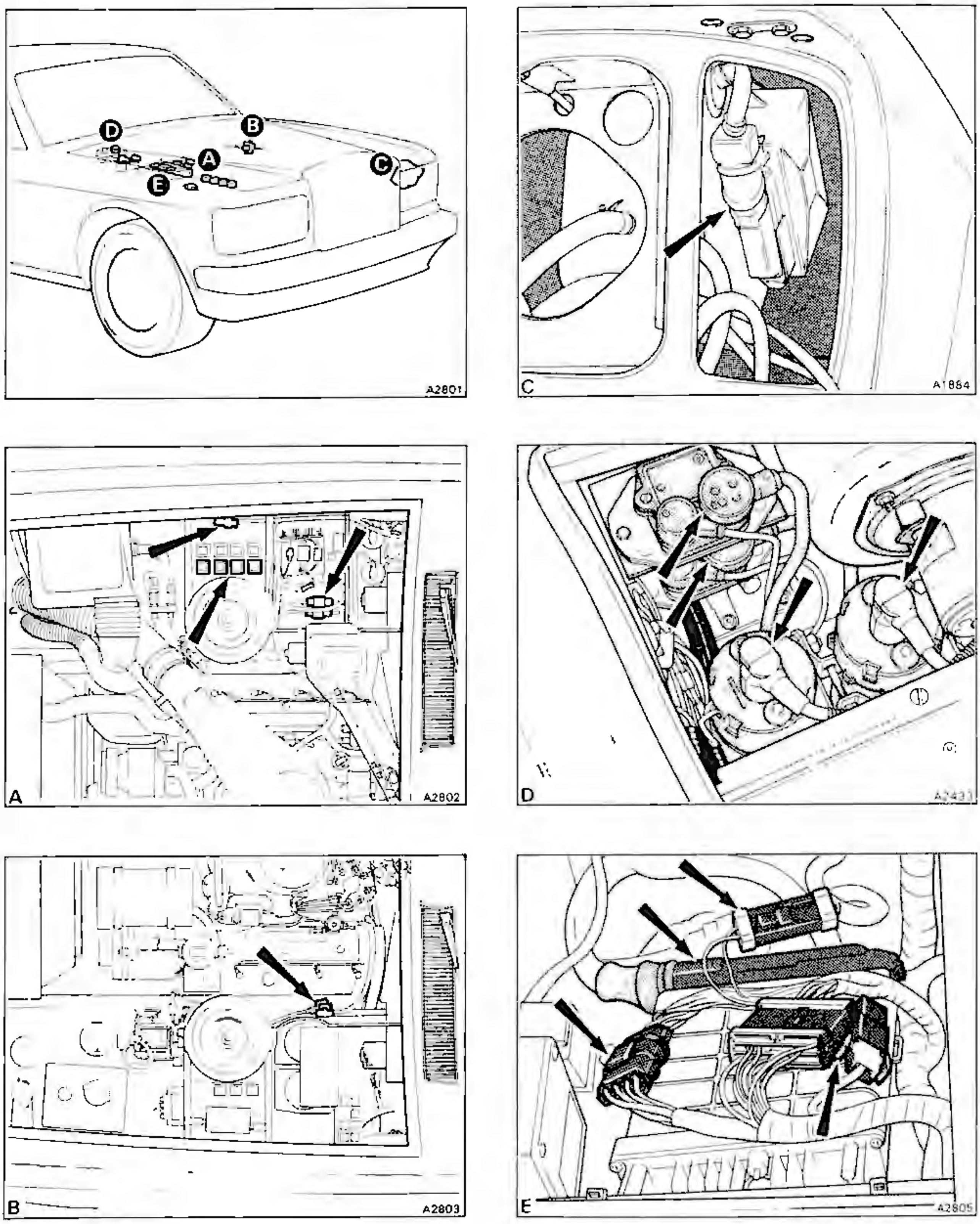


Fig. E12-2 Electrical disconnection points (1989 model year cars)

A Valance to engine loom connections and relay mounts (All cars)
B Valance to engine loom connections (All cars)
C Boost control ECU (Turbocharged cars only)
D Ignition amplifier and coil connections (Turbocharged cars only)
E Electronic control unit and valance to engine loom connections (Turbocharged cars only)

Engine – To fit (see figs. E12-1 and E12-2)
Fit the engine by reversing the procedure given for removal, noting the following.

1. When lowering the engine into position, ensure that the flywheel assembly and rear of the engine do not become trapped against the rear crossmember of the sub-frame.
2. With the front engine mounting setscrews slack, adjust the position of the engine mounting stop plate so that there is a gap of between 1,52 mm and 2,28 mm (0.060 in and 0.090 in), between the bonded rubber strip on the stop plate and the crossmember bracket (see fig. E12-3).

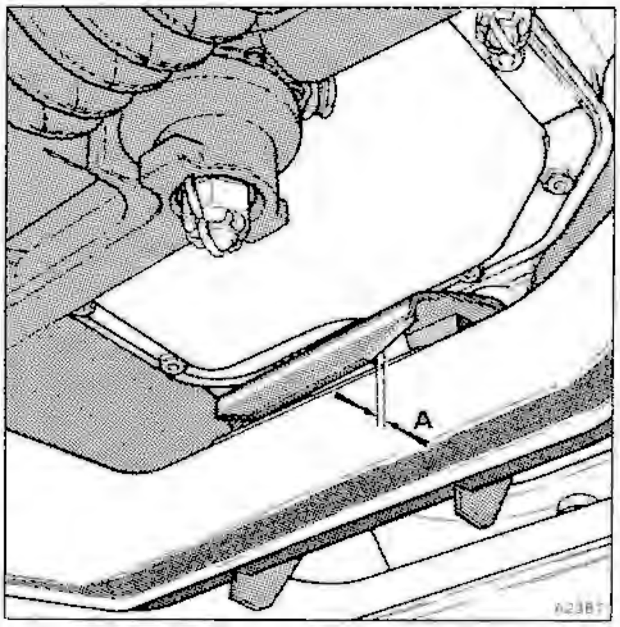


Fig. E12-3 Engine front mount stop plate gap

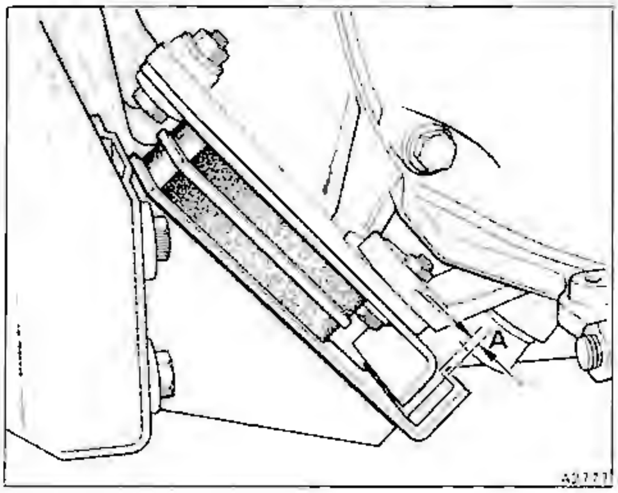


Fig. E12-4 Rear engine mount setting (1989 model year cars)
A 4,0 mm to 5,5 mm (0.158 in to 0.216 in)

The stop plate has elongated holes to allow adjustment.

On 1989 model year cars, the distance between the engine roll stop plate and buffer on each rear engine mount must be set to between 4,0 mm and 5,5 mm (0.158 in and 0.216 in). To carry out this operation, first slacken the top securing bolts on the mount to be adjusted. Using a soft metal drift, carefully tap the top plate of the mount until the correct setting is obtained (see fig. E12-4). Then, torque tighten the bolts.

3. On four door cars only, when fitting the small dampers adjacent to the rear engine mounts, the damper rods should point downwards. Fit the two tapered rubbers either side of the engine mounting plate bracket with the taper pointing downwards and the large cup washer on top. The two smaller cup washers and rubbers fit on each side of the sub-frame bracket.
4. On turbocharged cars prior to 1989 model year, reseal the bulkhead closing plates with Butyl strip sealant after the two ECU connections have been made in the right-hand footwell area.
5. Connect all pipes, hoses, and cables as described in the relevant chapters.
6. Fill all necessary systems as described in the relevant chapters.
7. Immediately the engine starts, inspect for obvious leaks. Then, whilst the engine is warming-up carry out a more detailed inspection for leaks.
8. When the engine is at normal operating temperature, check all fluid levels and correct as necessary.
9. Road test the car and carry out any adjustments as necessary.

Engine drive belts

Before commencing to adjust the drive belts, inspect them for signs of wear or cracking. Any belts found to be unsatisfactory, should be renewed.

If after adjustment, a matched pair of belts have a marked variation in tension, a new pair should be fitted. Always renew both belts in a matched pair, even if only one belt is faulty.

Three belt tension loads are specified; a new belt load for replacement (new) belts, a retensioning load for belts which are satisfactory for further service, and a minimum acceptable load, below which the belt should be retensioned.

The belt tension must be checked at a point midway between two pulleys (see fig. E13-1), using the Atlas Copco belt tensometer, RH 12211.

Belt dressing must not be applied to prevent belt slip.

Belt tension – To check

1. Ensure that the usual workshop safety precautions are carried out.
2. Ensure that the engine is cold (a warm engine will return a slightly higher belt tension reading).
3. Examine the back of the belt around the midway point of the span. If any irregularities are found, caused by a join in the fibres, etc., then rotate the engine until the area of belt is acceptable.
4. Belt tension readings should always be taken on one belt only. Therefore, when measuring twin belts the belt blocker should be fitted prior to using the tensometer (see fig. E13-2).
5. Open the jaws of the clamping unit by applying pressure at the two points indicated by the arrows in figure E13-2.
6. Position the clamping unit at a point midway between pulleys. Release the pressure from the unit.
7. Adjust the small Allen screw on the clamping unit until the unit will only just slide along the belt.
8. Squeeze the trigger on the hand held gauge. The reading displayed on the gauge when the red lamp illuminates, is the belt tension. Repeat this procedure until the readings are consistent. Note this final figure.
9. Remove the clamping unit from the belt.
10. Rotate the engine.
11. Repeat Operations 5 to 8 inclusive. The average of the two noted readings is the drive belt tension.

Note If the two readings vary by more than 45 N (10 lbf), take a third reading after again rotating the engine. Discard the exceptional value and average the two remaining readings.

12. If necessary, adjust the belt tension as described under the relevant heading.

Note Do not adjust the drive belt tension unless it has fallen below the **minimum acceptable load**.

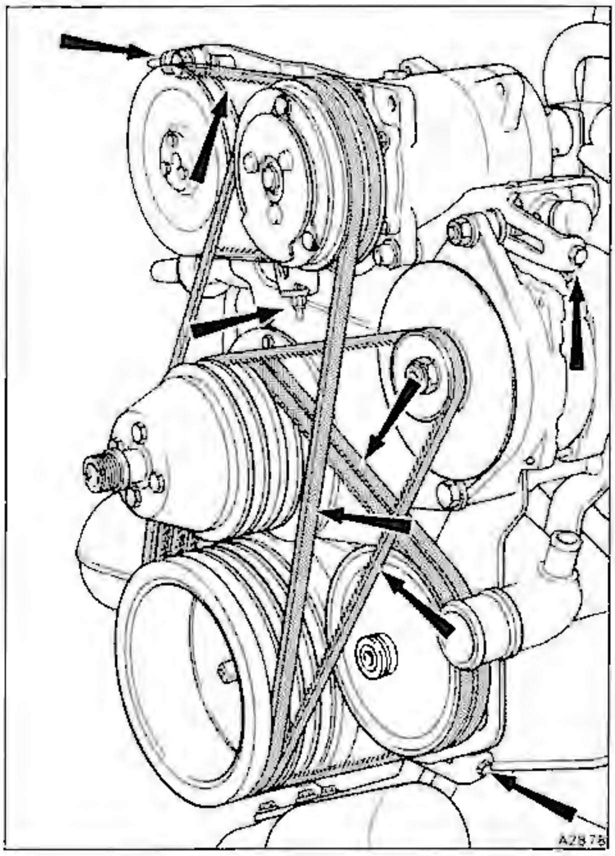


Fig. E13-1 Engine drive belt adjustment and tension checking points

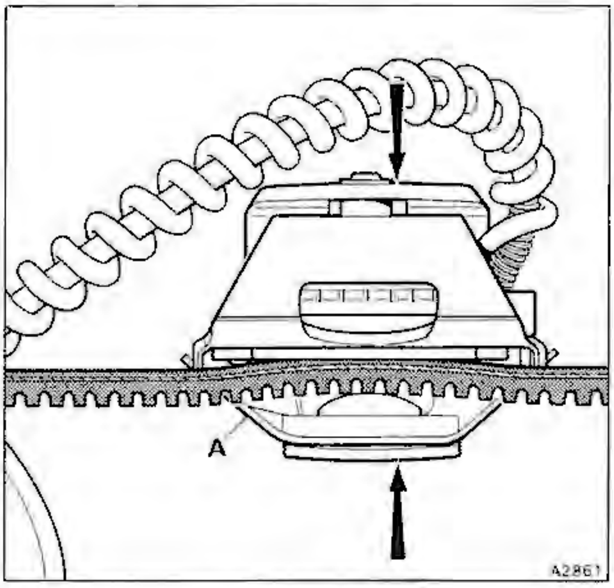


Fig. E13-2 Clamping unit in position
A Belt blocker

Drive belts – To renew

1. Release the tension from the particular belt(s) and remove the belt(s) from the pulleys.

   Always ensure that the correct approved replacement is obtained and fitted.
2. Inspect the pulleys and pulley grooves.
3. Before fitting the belts always ensure that they are in good condition with no marked variation in size.

Crankshaft to coolant pump/steering pump

The belt tension meter reading should be as follows

New belt load	400 N to 450 N (90 lbf to 100 lbf)
Retensioning load	360 N to 400 N (80 lbf to 90 lbf)
Minimum acceptable load	250 N (55 lbf)

1. The tension of this matched pair of belts is adjusted by altering the position of the steering pump.
2. Slacken the setscrew securing the steering pump mounting bracket pivot and the clamping setscrew on the belt tensioner situated below the steering pump.
3. Carefully adjust the tensioner until the correct belt tension is attained.
4. When the belt tension is correct, tighten the tensioner clamp and mounting bracket pivot setscrews.
5. If the alternator belt is to be adjusted the mounting bracket pivot setscrew can remain slack until adjustment has been carried out.
6. Ensure the belt tension is still correct when the steering pump is fully secured.

Crankshaft to coolant pump/alternator

The belt tension meter reading should be as follows

New belt load	400 N to 450 N (90 lbf to 100 lbf)
Retensioning load	360 N to 400 N (80 lbf to 90 lbf)
Minimum acceptable load	250 N (55 lbf)

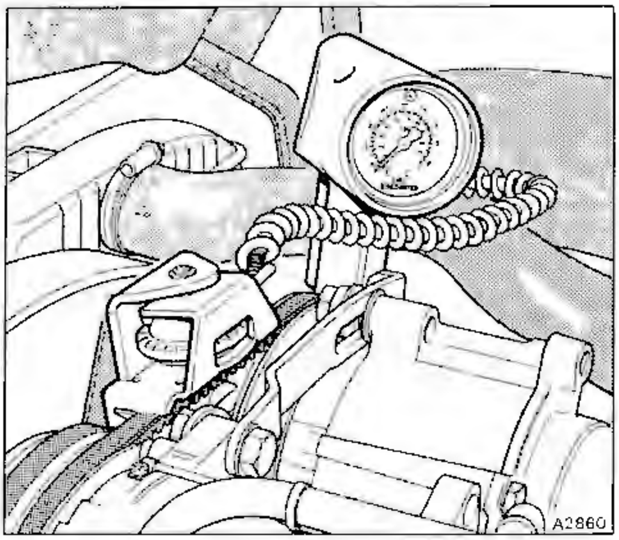


Fig. E13-3 Checking a belt tension

1. The belt tension is adjusted by altering the position of the alternator.
2. Slacken the alternator mounting setscrew and the clamping setscrew on the belt tensioner situated above the alternator.
3. Carefully adjust the tensioner until the correct belt tension is attained.
4. When the belt tension is correct, tighten the belt tensioner clamping setscrew and alternator mounting setscrew.
5. Ensure the belt tension is still correct when the alternator is fully secured.

Crankshaft to refrigeration compressor

The belt tension meter reading should be as follows

New belt load	400 N to 450 N (90 lbf to 100 lbf)
Retensioning load	360 N to 400 N (80 lbf to 90 lbf)
Minimum acceptable load	250 N (55 lbf)

1. The belt tension is adjusted by altering the position of the refrigeration compressor.
2. Slacken the compressor pivot bolts at the front and the rear of the compressor and the belt tensioner clamping setscrew.
3. Carefully adjust the tensioner until the correct belt tension is attained.
4. When the belt tension is correct, tighten the belt tensioner clamping setscrew and the compressor pivot bolts.
5. Ensure the belt tension is still correct when the compressor is fully secured.

Note If the engine is fitted with an air injection pump, it will be necessary to release the tension of its drive belt as the tension will be affected by the adjustment of the refrigeration compressor.

The belt should be retensioned as described under Air pump to refrigeration compressor, when adjustment of the refrigeration compressor belt has been completed.

Air pump to refrigeration compressor

The belt tension meter reading should be as follows

New belt load	250 N to 300 N (55 lbf to 65 lbf)
Retensioning load	250 N to 300 N (55 lbf to 65 lbf)
Minimum acceptable load	200 N (40 lbf)

1. The belt tension is adjusted by altering the position of the air pump.
2. Slacken the air pump pivot setscrew and the belt tensioner clamping setscrew.
3. Carefully adjust the tensioner until the correct belt tension is attained.
4. When the belt tension is correct, tighten the belt tensioner clamping setscrew and the air pump pivot setscrew.
5. Ensure the belt tension is still correct when the air pump is fully secured.

Fault diagnosis

Symptoms	Possible cause
1. Engine fails to start (starter motor inoperative)	1. (a) Battery master switch in OFF position *(cars other than those conforming to a West German specification).* (b) Gear range selector out of neutral or park position. (c) Ignition fuse blown. (d) Battery discharged. (e) Break or high resistance in battery connections and starter relay connections. (f) Auxiliary starter relay faulty (if fitted). (g) Faulty starter motor.
2. Engine fails to start (starter motor operates but fails to turn engine)	2. (a) Battery discharged. (b) Faulty starter motor circuit (refer to Electrical Manuals – TSD 4701 or TSD 4848). (c) Faulty starter motor. (d) Faulty starter solenoid (refer to Electrical Manuals – TSD 4701 or TSD 4848).
3. Engine fails to fire	3. (a) No fuel delivered to engine (refer to Engine Management Systems Manual – TSD 4737). (b) Faulty ignition system (refer to Engine Management Systems Manual – TSD 4737). (c) Excess fuel in engine (refer to Engine Management Systems Manual – TSD 4737). (d) Incorrect metering of fuel (refer to Engine Management Systems Manual – TSD 4737).
4. Poor engine idling	4. (a) Incorrect metering of fuel (refer to Engine Management Systems Manual – TSD 4737). (b) Incorrect ignition timing (refer to Engine Management Systems Manual – TSD 4737). (c) Air leaks in induction system (refer to Engine Management Systems Manual – TSD 4737). (d) Incorrect idle speed (refer to Engine Management Systems Manual – TSD 4737). (e) Air leaks in exhaust system (refer to Chapter Q and Engine Management Systems Manual – TSD 4737).
5. Incorrect engine idle speed	5. (a) Incorrect metering of fuel (refer to Engine Management Systems Manual – TSD 4737). (b) Throttle controls sticking (refer to Engine Management Systems Manual – TSD 4737). (c) Incorrect setting of throttle body air by-pass screw (refer to Engine Management Systems Manual – TSD 4737). (d) Air leaks in induction system (refer to Engine Management Systems Manual – TSD 4737). (e) Faulty idle speed control solenoid (refer to Engine Management Systems Manual – TSD 4737).

Symptoms	Possible cause
6. Irregular running	6. (a) Faulty sparking plug(s). (b) Faulty ignition system (refer to Engine Management Systems Manual – TSD 4737). (c) Air leaks in induction system (refer to Engine Management Systems Manual – TSD 4737). (d) Air leaks in exhaust system (refer to Chapter Q and Engine Management Systems Manual – TSD 4737). (e) Incorrect metering of fuel (refer to Engine Management Systems Manual – TSD 4737). (f) Inlet and exhaust valves not seating correctly (refer to Section E8). Examine valve seats and springs. (g) Defective cylinder head gasket(s) (refer to Section E8). Examine cylinder head gasket(s).
7. Loss of power	7. (a) Faulty sparking plug(s). (b) Faulty ignition system (refer to Engine Management Systems Manual – TSD 4737). (c) Air leaks in induction system (refer to Engine Management Systems Manual – TSD 4737). (d) Air leaks in exhaust system (refer to Chapter Q and Engine Management Systems Manual – TSD 4737). (e) Blocked or obstructed air intake filter (refer to Engine Management Systems Manual – TSD 4737). (f) Incorrect metering of fuel (refer to Engine Management Systems Manual – TSD 4737). (g) Throttle linkage sticking or incorrectly adjusted (refer to Engine Management Systems Manual – TSD 4737). (h) Worn, burnt, or sticking valves. Broken or weak valve springs (refer to Section E8). (i) Defective cylinder head gasket(s) (refer to Section E8).
8. Engine 'spits back'	8. (a) Incorrect metering of fuel (refer to Engine Management Systems Manual – TSD 4737). (b) Inlet valves not seating correctly (refer to Section E8). (c) Incorrect grade of fuel. (d) Air leaks in induction system (refer to Engine Management Systems Manual – TSD 4737). (e) Faulty ignition system (refer to Engine Management Systems Manual – TSD 4737). (f) Heavily carboned engine (refer to Section E8).
9. Engine 'runs on'	9 (a) Engine overheating. (b) Faulty ignition timing (refer to Engine Management Systems Manual – TSD 4737). (c) Incorrect metering of fuel (refer to Engine Management Systems Manual – TSD 4737). (d) Incorrect idle speed. (e) Throttle controls sticking (refer to Engine Management Systems Manual – TSD 4737).

Symptoms	Possible cause
10. Detonations in silencer	10. (a) Incorrect metering of fuel (refer to Engine Management Systems Manual – TSD 4737). (b) Faulty ignition system (refer to Engine Management Systems Manual – TSD 4737). (c) Air leaks in exhaust system (refer to Chapter Q and Engine Management Systems Manual – TSD 4737). (d) Exhaust valve(s) sticking (refer to Section E8).
11. Overheating	11. (a) Loss of coolant. (b) Faulty thermostat. (c) Broken or slipping drive belts. (d) Faulty coolant pump. (e) Weak fuel/air mixture. (f) Inadequate engine lubrication. (g) Faulty ignition system (refer to Engine Management Systems Manual – TSD 4737). (h) Blocked cooling system. (i) Restricted air flow through matrix.
12. Low oil pressure	12. (a) Inadequate oil supply. (b) Low oil level in sump (see Section E10). (c) Defective oil pressure gauge. (d) Worn or defective oil pump (see Section E10) (e) Blocked oil pick-up strainer. (f) Defective seal(s) on oil pick-up assembly. (g) Defective seal(s) in main oil galleries (core plugs). (h) Engine overheating. (i) Wrong specification oil (too thin), or water in oil.
13. Excessive fuel consumption	13. (a) Leaks from fuel system. (b) Incorrect metering of fuel (refer to Engine Management Systems Manual – TSD 4737). (c) Blocked air cleaner filter (refer to Engine Management Systems Manual – TSD 4737). (d) Faulty ignition system (refer to Engine Management Systems Manual – TSD 4737) (e) Loss of engine cylinder compression. (f) Cylinder head gasket(s) leaking.

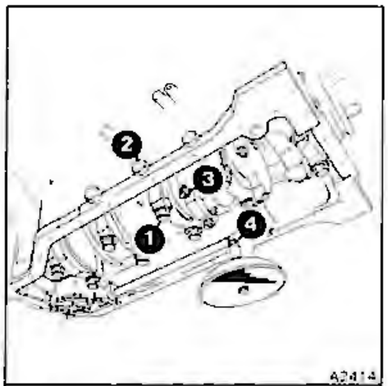
Special torque tightening figures

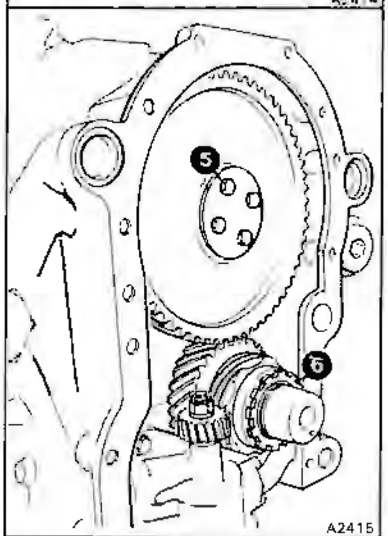
Introduction
This section contains the special torque tightening figures applicable to Chapter E.

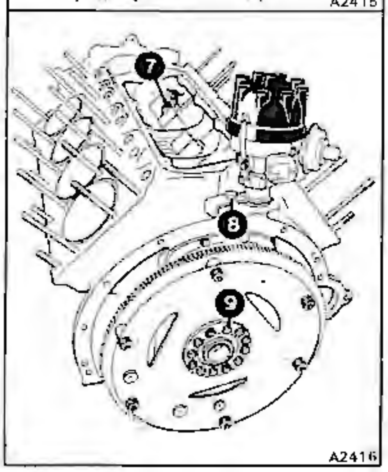
For the standard torque tightening figures refer to Chapter P.

Components used during the manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

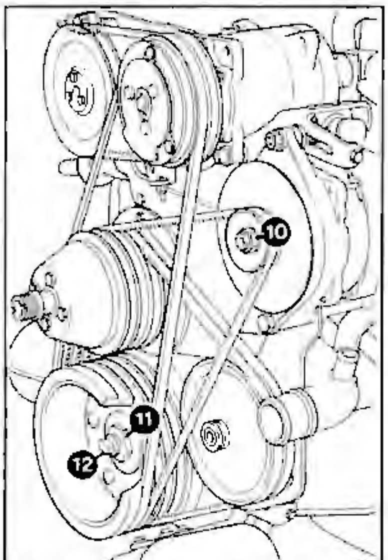
Section E5 to E10



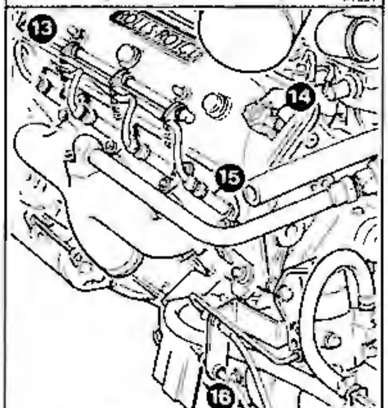




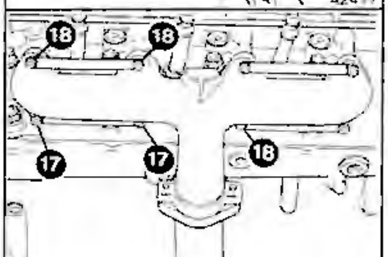
Ref.	Component	Nm	kgf m	lbf ft
1	Setscrew – Main bearing cap	79 – 84	8,0 – 8,5	58 – 62
2	Setscrew – Cross-bolting beam	52 – 56	5,3 – 5,8	38 – 42
3	Nut – Big end	See Section E6		
4	Castellated nut – Oil pump intake strainer	3	0,3	24 – 30 lbf in
5	Setscrew – Camshaft gear	22 – 24	2,3 – 2,4	16 – 18
6	Serrated nut – Crankshaft pinion (LH thread)	489 – 596	50 – 60	360 – 440
7	Setscrew – Tappet block	11 – 13	1,1 – 1,3	8 – 10
8	Setscrew – Distributor clamp plate Naturally aspirated engines	Finger tight, plus half a turn		
9	Setscrew – Drive plate to crankshaft	40 – 43	4,0 – 4,4	29 – 32


A1991

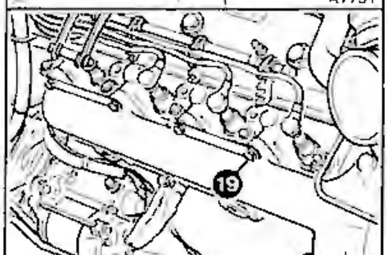
Ref.	Component	Nm	kgf m	lbf ft
10	Lock-nut – Alternator pulley	55 – 57	5,5 – 5,8	40 – 42
11	Nut – Crankshaft pulley/damper	489 – 596	50 – 60	360 – 440
12	Stud – Crankshaft	305 – 373	31 – 38	225 – 275


A2417

13	Cap nut – Rocker cover	4	0,4	30–35 lbf in
14	Setscrew – Rocker shaft pedestal	11 – 13	1,1 – 1,3	8 – 10
15	Sparking plug	25 – 30	2,5 – 3,0	18 – 22
16	Setscrew – Oil level indicator	2	0,2	20 – 22 lbf in


A1751

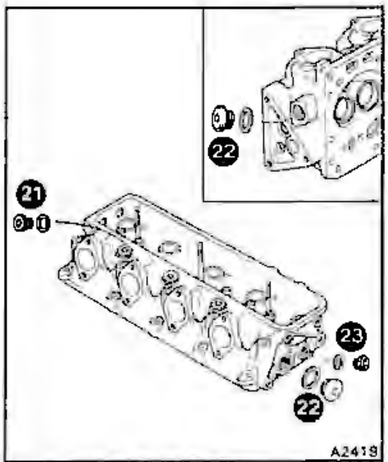
17	Setscrew (2 off) – Exhaust manifold (A3 and A4 lower) Naturally aspirated engines	19 – 21	2,0 – 2,2	14 – 16
18	Setscrew (14 off) – Exhaust manifold	32 – 33	3,2 – 3,4	23 – 25

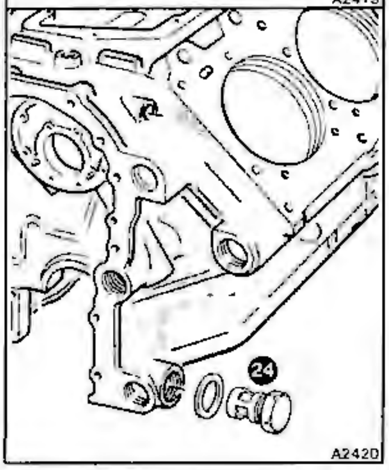

A1752

19	Setscrew (16 off) – Exhaust manifold Turbocharged engines	19 – 21	2,0 – 2,2	14 – 16


Tightening sequence A2418

20	Nut – Cylinder head Stage 1 Initial tightening	28 – 33	2,8 – 3,4	20 – 25
	Stage 2 Final tightening	68 – 74	7,0 – 7,6	50 – 55





Ref.	Component	Nm	kgf m	lbf ft
21	Core plug – brass	34 – 40	3,5 – 4,1	25 – 30
22	Core plug – aluminium	82 – 88	8,3 – 8,9	60 – 65
23	Core plug – aluminium	55 – 61	5,6 – 6,2	40 – 45
24	Plug – Bobbin retaining	68 – 74	7,0 – 7,6	50 – 55

Workshop tools

RH 2684	Wing cover set
RH 2685	Wing cover liners
RH 7094	Valve spring compressor
RH 7095	Extractor – cylinder liner
RH 7126	Spanner – cylinder head nuts
RH 7207	Extraction and insertion tool – inlet and exhaust valve guides
RH 7208	Extractor – main bearing caps (Cars prior to 1989 model year)
RH 7498	Extractor attachment – main bearing caps
RH 7825	Reamer – inlet and exhaust valve guides
RH 7827	Tipped reamer – inlet and exhaust valve guides
RH 8141	Extractor – oil pump driven gear
RH 9646	Insertion tool – crankshaft rear seal
RH 9655	Protective sleeve – crankshaft rear seal
RH 9732	Engine lifting sling
RH 9765	Extractor – front pulley driving flange
RH 12054	Extractor and fitting tool – crankshaft front end stud
RH 12055	Spanner – crankshaft serrated nut
RH 12211	Tensometer – engine drive belts

Propeller shaft

Contents

	Sections							
	Rolls-Royce				Bentley			
	Silver Spirit	Silver Spur	Corniche	Corniche II	Eight	Mulsanne	Turbo R	Continental
Contents and issue record sheet	F1	F1	F1	F1	F1	F1	F1	F1
Propeller shaft	F2	F2	F2	F2	F2	**F2**	**F2**	**F2**
Special torque tightening figures	F3	F3	F3	F3	F3	F3	F3	F3

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	F1	F2	F3							
1	3/87	3/87	3/87							
2		3/87								
3	3/87	3/87								
4		3/87								
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Propeller shaft

Introduction
Two types of propeller shaft are fitted dependent upon the specification of the car.

A single piece type is fitted to Bentley Turbo R cars, and a rubber jointed type is fitted to cars other than Bentley Turbo R.

The single piece propeller shaft incorporates universal joints, fitted onto each end of the shaft. The complete assembly is dynamically balanced to 0,14g mm (0.125 oz in) at a speed of 3000 rev/min.

If the propeller shaft assembly is dismantled and new universal joints fitted, the shaft should be rebalanced after assembly. If required, a fully balanced assembly can be obtained as a service exchange unit.

The rubber jointed type propeller shaft has a rubber flexible coupling fitted to each end of the shaft, together with a spigot flange. The spigot flange fits into a centralizing bush/lip seal. This seal is an interference fit in the shaft.

This propeller shaft is balanced prior to assembly to 0,14g mm (0.125 oz in) at a speed of 3000 rev/min, without the flexible rubber coupling arrangement fitted.

The transmission output flange and final drive pinion flange vary, dependent upon which type of propeller shaft is fitted.

Single piece propeller shaft
Propeller shaft – To remove
1. Drive the car onto a ramp and carry out the usual workshop safety precautions.
2. *On cars conforming to a Japanese specification,* remove the exhaust system grass-fire shields from around the catalyst area.
3. Support the weight of the exhaust system rearward of the front silencer/catalyst assembly. Remove the rubber hangers from the front support bracket.
4. Remove the mounting bolts securing the exhaust front mounting bracket to the centre crossmember.
5. Ensure that the parking brake is in the off position.
6. Unhook the parking brake return spring from the operating lever.
7. Remove the bolts securing the rear brake cables abutment bracket to the body.
8. On Corniche/Continental cars remove the nuts and bolts securing the transmission tunnel strengthening plate.
9. Remove the securing bolts from both sides of the centre body crossmember section and free the assembly. The centre section, together with the parking brake pivot mounting brackets and lever should be moved to the side of the car, but must be suitably supported to avoid strain or kinking of the parking brake cables. **Under no circumstances should the centre body crossmember be allowed to hang on the parking brake cables.**
10. Switch on the ignition and move the gear range selector lever to the neutral position. Switch off the ignition.
11. Raise a rear wheel of the car to enable the propeller shaft to be turned.
12. Correlate the propeller shaft flanges to the final drive pinion flange and the transmision output flange.
13. Support the propeller shaft and remove the nuts and bolts from the front and rear flanges.
14. Remove the propeller shaft by lowering the front end, and then lift the shaft forward and downward through the rear crossmember aperture.

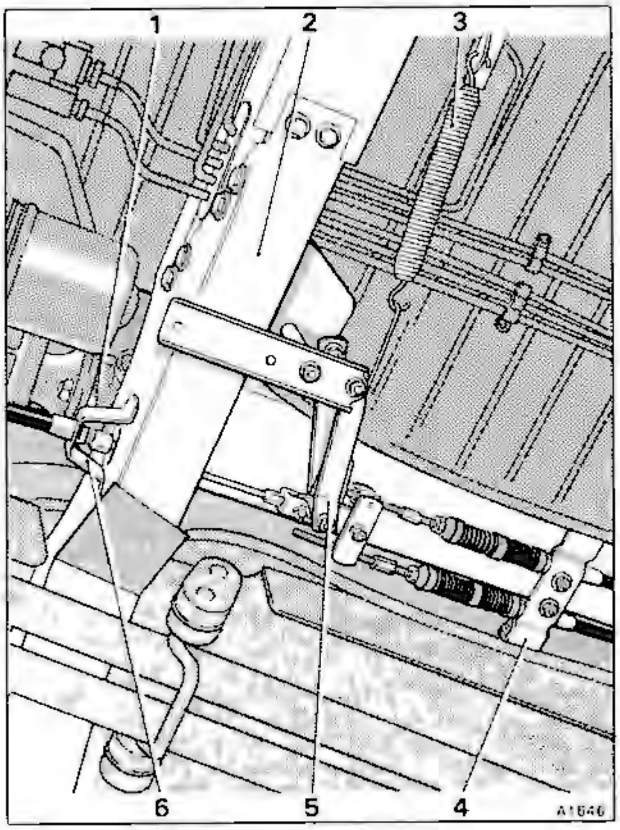


Fig. F2-1 Centre crossmember and parking brake linkage
1 Propeller shaft flange bolts
2 Removable centre body crossmember
3 Return spring
4 Abutment bracket – rear cables
5 Operating lever
6 Mounting bracket – front cable

Universal joint – To dismantle (see fig. F2-2)
If a universal joint cannot be serviced, it must be dismantled and a new joint fitted.

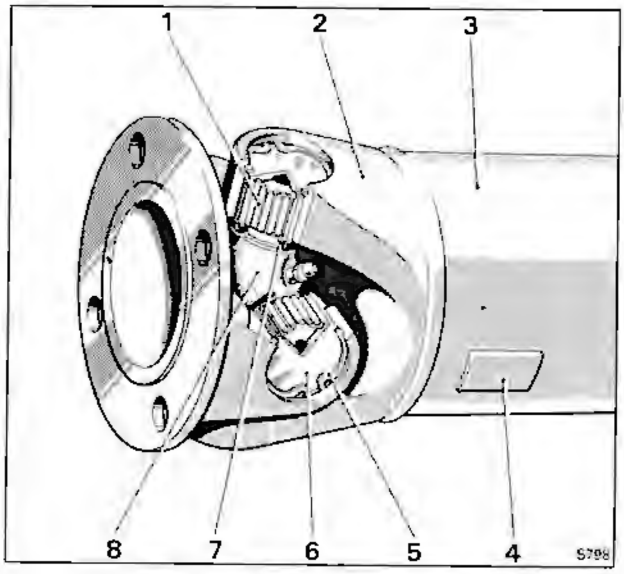


Fig. F2-2 Single piece propeller shaft universal joint
1 Needle roller bearings
2 Yoke
3 Centre tube
4 Balance weight
5 Circlip
6 Bearing retainer
7 Rubber seal
8 Cruciform

1. Clean and remove any paint, underseal, etc., from the yoke eyes.
2. Correlate the flanged yokes to the shaft.
3. Remove the circlips retaining the needle roller bearings.
4. Using a nylon mallet, tap the yoke until the bearing races are driven out of the yoke eyes.

Universal joint – To assemble
1. Insert the crosspiece and seals into the yoke eyes. Hold the crosspiece centrally, then carefully press the needle roller bearing assemblies into the yoke eyes, until it is possible to fit the circlips. If this is found difficult to accomplish due to pressurization, release the grease nipple situated between two of the crosspiece trunnions, thus allowing the trapped air to bleed.
2. Fit the circlips, ensuring that the end-float between the yoke and circlips is zero to 0,025mm (zero to 0.001 in).
3. If necessary, tighten the grease nipples.

Propeller shaft – To fit
Reverse the procedure given for removal noting the following.
1. The joint faces must be clean and free from damage.
Torque tighten the flange bolts to the figures quoted in Section F3.

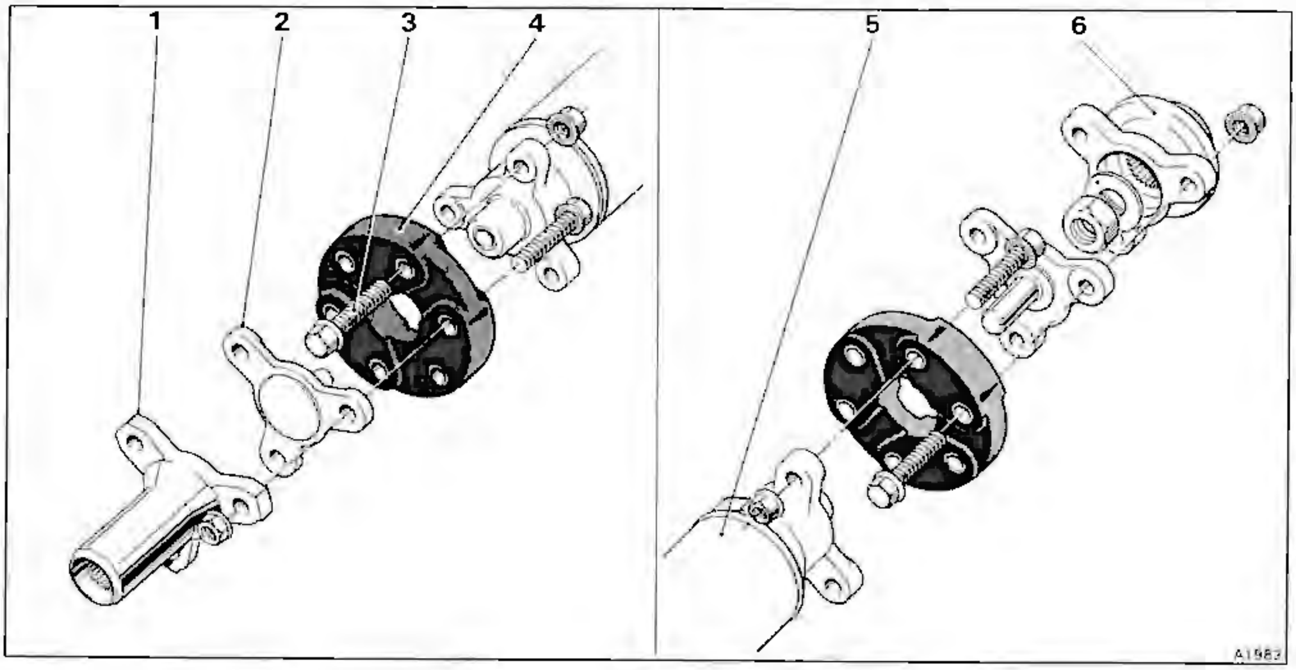


Fig. F2-3 Propeller shaft/rubber flexible couplings – Gearbox and final drive
1 Output flange – Gearbox
2 Spigot flange
3 Durlok bolt
4 Rubber flexible coupling
5 Propeller shaft
6 Pinion drive flange – Final drive

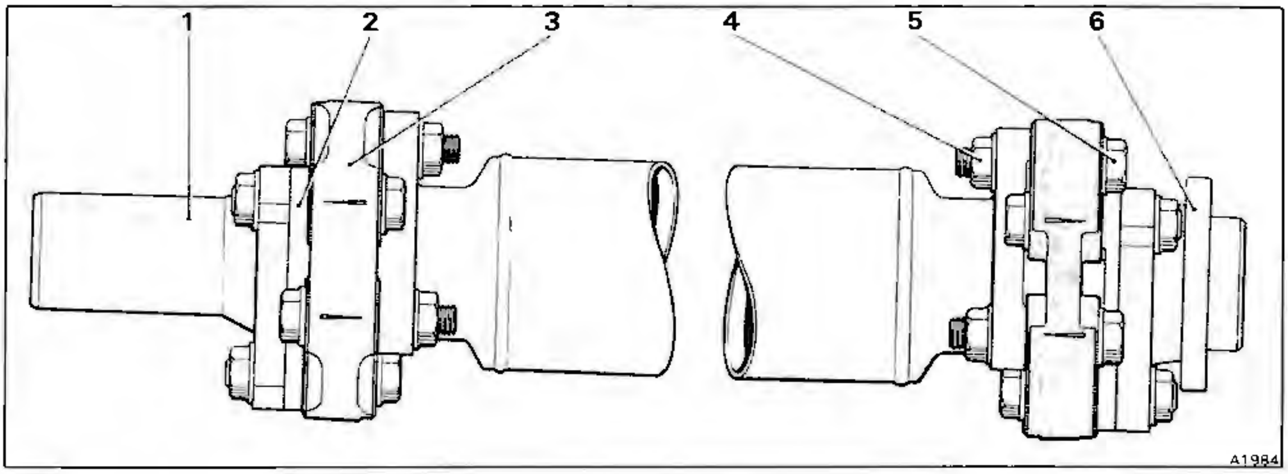


Fig. F2-4 Propeller shaft/rubber flexible couplings – Gearbox and final drive
1 Output flange – Gearbox
2 Spigot flange
3 Rubber flexible coupling
4 Durlok nut
5 Durlok bolt
6 Pinion drive flange – Final drive

Note Two types of securing bolts are fitted. The later type (Durlok) are black in colour and have serrations under the head to stop anti-clockwise rotation. Therefore, ensure that the correct torque tightening figures are used.

All other nuts and bolts must be torque tightened in accordance with the figures quoted in Chapter P.

2. Reference should be made to Chapter O, before fitting the exhaust system components.
3. Check the parking brake operation and adjust if necessary (see Chapter G).

Rubber jointed type propeller shaft

Propeller shaft – To remove

1. Carry out Operations 1 to 11 inclusive as described under the heading Propeller shaft - To remove (Single piece propeller shaft).
2. Correlate the propeller shaft rubber flexible couplings/spigot flanges to the final drive pinion flange and to the transmission output flange.
3. Support the propeller shaft and remove the Durlok nuts and bolts from the final drive and transmission coupling flanges.
4. Unscrew the Durlok nuts and bolts securing the rubber coupling to the rear end of the propeller shaft. Then, carefully remove the spigot flange and rubber coupling.
5. Remove the propeller shaft by lowering the front end. Then, lift the shaft forward and downward through the rear crossmember aperture.
6. If necessary, unscrew the nuts and bolts securing the rubber coupling to the front end of the propeller shaft and carefully remove the spigot flange and rubber coupling.

Centring bush/lip seal(s) – To renew

1. Remove the propeller shaft as described under the heading Propeller shaft - To remove (Rubber jointed type).

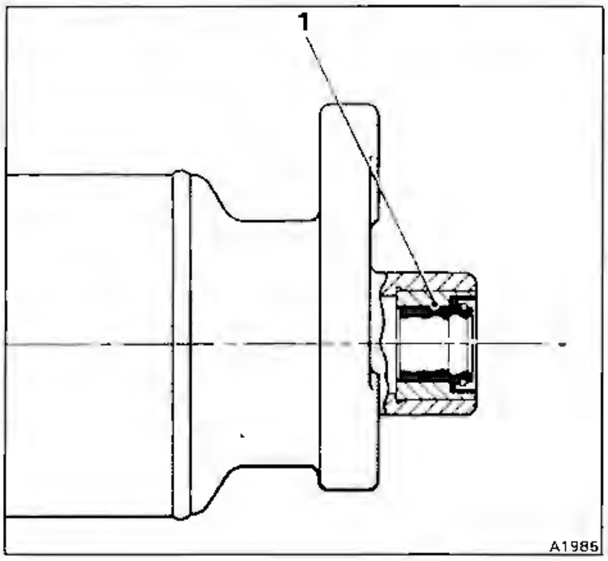


Fig. F2-5 Propeller shaft, centring bush/lip seal assembly (Flexible coupling)
1 Centring bush/lip seal

2. Fill the centring bush with as much grease as possible.
3. Using a soft headed mallet, drive the spigot flange into the centring bush. The grease will then force the centring bush from the end of the shaft.
4. Remove the grease from the end of the propeller shaft.
5. Fit a new centring bush/lip seal, noting that it must be an interference fit in the end of the propeller shaft.

When fitting the bush/seal ensure that the lip portion of the seal is on the outside of the shaft as shown in figure F2-5.

6. Apply 5 ml (0.175 fl oz) of Shell Retinax A grease or its equivalent to the bush/seal.
7. Fit the propeller shaft as described under the heading Propeller shaft - To fit (Rubber jointed type).

Propeller shaft – To fit
Reverse the procedure given for removal noting the following.
1. Durlok nuts and bolts have serrations under the heads which act as a ratchet to eliminate anti-clockwise rotation. Therefore, inspect all faces for damage and rectify as necessary.
2. If removed, fit the front spigot flange together with the rubber coupling to the propeller shaft, prior to fitting the shaft to the car.

Ensure that the spigot flange registers correctly in the mating flange counterbore.

Align the rubber coupling to the propeller shaft ensuring that the arrows moulded into the circumference of the coupling are positioned as shown in figure F2-4.

Fit the bolts through the rubber coupling into the propeller shaft ensuring that they are inserted in the direction of the arrows.

It is recommended that before securing the bolts to the propeller shaft that the remaining bolts are fitted through the rubber coupling. Ensure that these bolts are also fitted in the direction of the arrows.

Smear a small amount of grease onto the spigot locating pin prior to fitting the spigot flange to the propeller shaft.
3. When fitting the propeller shaft to the car, fit the rear spigot flange/rubber coupling in the same manner as that described for the front spigot flange/ rubber coupling (see Operation 2).
4. All joint faces must be clean and free from damage. Torque tighten the Durlok nuts and bolts to the figures quoted in Section F3.

All other nuts and bolts must be torque tightened in accordance with the figures quoted in Chapter P.
5. Reference should be made to Chapter O, before fitting the exhaust system components.
6. Check the parking brake operation and adjust if necessary (see Chapter G).

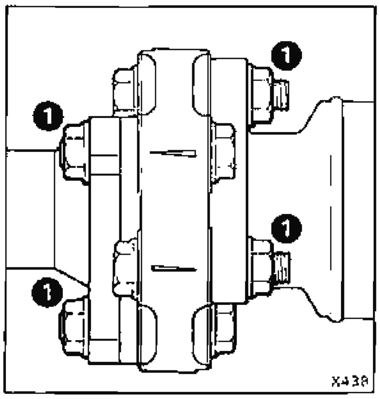
Special torque tightening figures

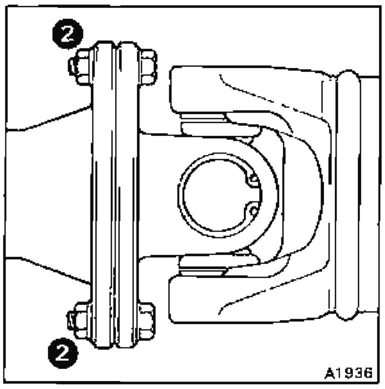
Introduction
This section contains the special torque tightening figures applicable to Chapter F.
For standard torque tightening figures refer to Chapter P.

Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

Section F2

Ref.	Component	Nm	kgf m	lbf ft
1	Flexible rubber coupling assembly – Durlok nut	89-94	8,9-9,6	65-70
2	Single piece propeller shaft coupling – nut (Early cars)	57-61	5,8-6,2	42-45
	Durlok nut – front	129-135	13,1-13,8	95-100
	– rear	82-88	8,3-8,9	60-65





Hydraulic systems

Contents

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10
1	6/87	6/88	9/86	9/86	6/88	6/87	9/86	9/86	9/86	9/86
2				6/88	6/88		9/86	9/86	9/86	9/86
3	4/89	6/87	9/86	6/88	6/88	6/87	1/87	9/86	9/86	
4		6/87	9/86		6/88	9/86			9/86	
5	6/88	9/86	9/86		6/88	9/86			9/86	
6		—	9/86			6/87				
7		9/86	9/86			1/87				
8		—								
9		9/86								
10		—								
11		9/86								
12		—								
13		9/86								
14		—								
15		9/86								
16		—								
17		9/86								
18		—								
19		9/86								
20		—								
21		6/88								
22		—								
23		6/88								
24		—								
25		6/88								
26		—								
27		6/88								
28		—								
29										
30										

Sections / Page No.	G11	G12	G13	G14	G15	G16	G17	G18	G19	G20
1	9/86	9/86	9/86	9/86	9/86	9/86	9/86	9/86	9/86	9/86
2	9/86		9/86		9/86		9/86	4/89	9/86	9/86
3		9/86						6/87	9/86	9/86
4		9/86						6/87	9/86	9/86
5		9/86							9/86	9/86
6		9/86								9/86
7		9/86								
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	G21	G22	G23							
1	11/86	11/86	6/88							
2	11/86	6/88								
3	6/87	11/86								
4		11/86								
5		11/86								
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Sections / Page No.										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections Page No.	G21	G22	G23							
1	11/86	11/86	11/86							
2	11/86	11/86								
3	11/86	11/86								
4		11/86								
5		11/86								
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Introduction

Contents

Pages

Introduction

WARNING

Use only hydraulic system mineral oil (LHM) to replenish the braking and levelling systems.

Do not use brake fluids (Castrol RR363, Universal, or any other type). The use of any type of brake fluid, even in very small amounts, will cause component failure necessitating extensive rectification to the braking and levelling systems of the car.

Always ensure before fitting any seals, hoses, pipes, etc., that they are suitable for a mineral oil system. For details of correct component identification reference should be made to Section G3 of this Workshop Manual.

Always ensure that two sealed containers of **hydraulic system mineral oil (LHM)** are fitted in the luggage compartment.

Always ensure that no foreign matter enters the systems when work is being carried out.

This Chapter covers the components for the two independently power operated braking systems, the levelling system, and the mechanically operated parking brake.

In order to protect against claims of liability for hydraulic system contamination, it is recommended that the hydraulic system mineral oil is tested for contamination prior to work being undertaken, preferably in the presence of the owner or his/her representative. The procedure for carrying out the test is described in Section G3.

It is important that the test is carried out even when the hydraulic system mineral oil is to be renewed as this will not prevent the deterioration of components which have been in contact with contaminated mineral oil.

Hydraulic systems

1. Cars fitted with an anti-lock braking system

The braking systems consist of two independent circuits. System 1 operates the rear brakes and levelling. System 2 operates the front brakes only.

The Bosch anti-lock brake control system, consists of a speed sensor fitted to each wheel, an electronic control unit (ECU), and a three channel hydraulic modulator.

The speed signals from the sensors are continually processed by the ECU. When the brakes are applied, the wheel deceleration, acceleration, and slip are determined by the ECU. Signals from the ECU are fed to the 3-way solenoid valves in the modulator.

The modulator then either increases pressure, holds pressure, or decreases pressure to the brake calipers.

The rear wheels are controlled jointly, using the 'select low' rear control principle.

Failure of the anti-lock braking system is indicated by an amber warning lamp on the facia, and does not affect normal braking performance.

2. Cars not fitted with an anti-lock braking system

The braking systems consist of two independent circuits. System 1 operates the front brake calipers on the front road wheels, the upper cylinders on the rear road wheel brake calipers, and the rear levelling. System 2 operates the rear brake calipers on the front road wheels and the lower cylinders on the rear road wheel brake calipers.

All cars

Disc brakes are fitted to all wheels.

Pressure for the systems is supplied by two hydraulic accumulators, mounted on the 'A' bank side of the engine, except for the Bentley Turbo R where the accumulators are mounted on the 'B' bank side of the engine. The accumulators are charged by engine operated hydraulic pumps. The hydraulic pump situated in front of the engine air intake manifold supplies hydraulic mineral oil to the front, vertically mounted accumulator (System 1). The hydraulic pump situated at the rear of the engine supplies hydraulic mineral oil to the rear, horizontally mounted accumulator (System 2).

Each accumulator sphere is divided into two chambers by a diaphragm, a charge of nitrogen gas being applied and retained in one chamber by the diaphragm.

As an accumulator commences to be charged with hydraulic system mineral oil from its hydraulic pump, only a small amount of hydraulic system mineral oil is required to be pumped into the other chamber to raise its pressure to that of the initial charge of nitrogen. Hydraulic system mineral oil will continue to be pumped into this chamber against steadily increasing pressure as the diaphragm is lifted, compressing the gas above it, until the pressure regulator in the accumulator valve housing operates and unloads the hydraulic pump by allowing the hydraulic system mineral oil to by-pass back to the reservoirs. The pressure of hydraulic system mineral oil stored in the sphere is maintained by the gas pressing against the diaphragm, the pressure reducing as hydraulic system mineral oil is used, until the regulator allows the pump to recharge the sphere.

Spheres similar to those used on the accumulator but with lower nitrogen gas pressure are incorporated into the rear suspension struts, the gas under pressure acting as a spring. Hydraulic system mineral oil fed from System 1 accumulator, flows into or out of the suspension strut spheres as varying loads are applied to the car. The quantity is controlled by the levelling valve, with hydraulic system mineral oil exhausted from the suspension spheres being returned to the reservoir.

To ensure that the braking system has priority over the rear suspension, a pressure priority valve is incorporated into System 1 high pressure line. If the pressure in the system falls unduly the priority valve will close and isolate the suspension system. This allows the available pressure to be utilised for braking purposes.

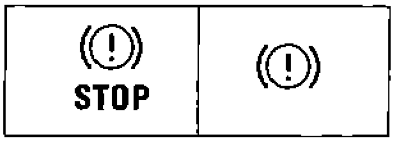
Also incorporated into System 1 is a minimum pressure valve. The purpose of this valve is to retain a predetermined pressure in the rear suspension strut spheres when the engine is switched off and the car unloaded. This retention of pressure reduces the time and amount of pressurized hydraulic system mineral oil required to fully charge the hydraulic systems upon the initial starting of the engine.

A pressure switch is incorporated into both System 1 and System 2 high pressure lines. The function of these switches is to illuminate the warning panels situated on the facia when the hydraulic system(s) pressure falls below acceptable working limits.

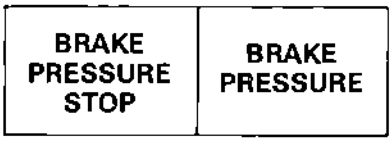
A seepage return hose is fitted between the minimum pressure valve and the levelling valve. This seepage return hose allows the designed seepage within the levelling valve to return to the reservoir.

Facia warning lamps

1. Cars fitted with an anti-lock braking system



or

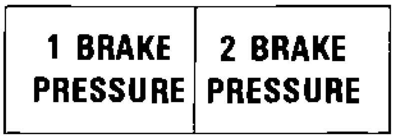


a. If there is a fault in the rear braking system only (System 1), the right-hand pressure panel will be illuminated. The car can be driven with care.

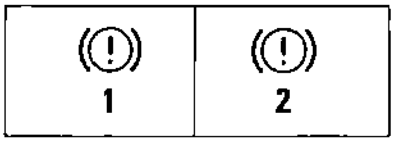
b. If there is a fault in the front braking system only (System 2), the STOP panel will flash and the right-hand pressure panel will be illuminated. **The car must not be driven.**

c. When both warning panels are **flashing**, there is a fault in both braking systems. **The car must not be driven.**

2. Cars not fitted with an anti-lock braking system



or

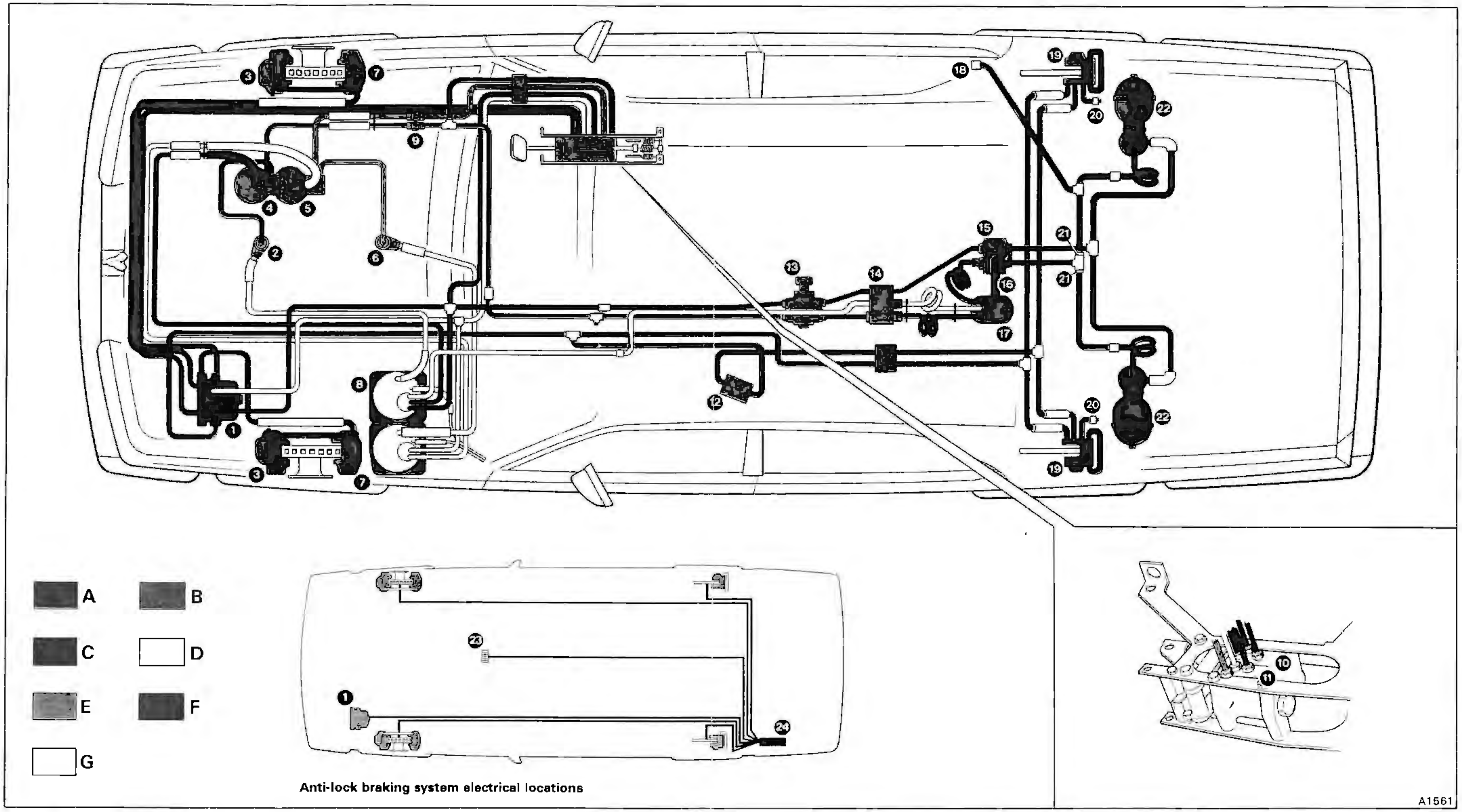


a. If only one warning panel is illuminated, the fault is in that particular system (either System 1 or System 2). The car can be driven with care.

b. When both warning panels are illuminated, there is a fault in both braking systems. **The car must not be driven.**

Figure G2-1

Mineral oil hydraulic system with anti-lock braking



Anti-lock braking system electrical locations

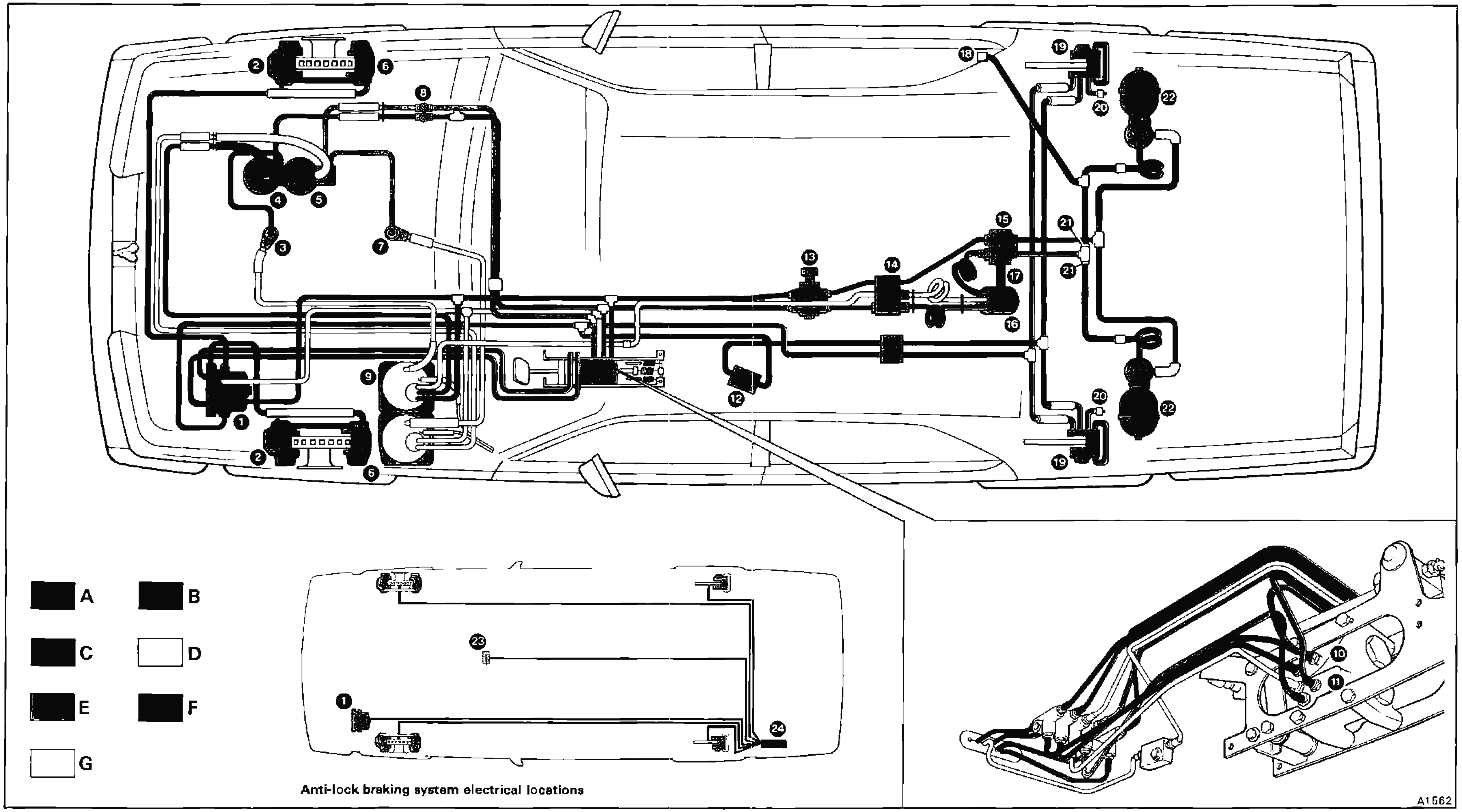
Mineral oil hydraulic system colour coding and component location – Right-hand drive cars

A Feed to rear brakes and levelling (System 1)
B Deceleration conscious pressure valve fed rear brakes (System 1)
C Low pressure return from levelling and rear brakes (System 1)
D Levelling return (System 1)
E Feed to front brakes (System 2)
F Front brakes and directly fed rear brakes (System 2)
G Low pressure return from front brakes (System 2)

1 Modulator (anti-locking brakes)
2 Front hydraulic pump
3 Front leading brake caliper (twin cylinder)
4 Front hydraulic accumulator
5 Rear hydraulic accumulator
6 Rear hydraulic pump
7 Front trailing brake caliper (twin cylinder)
8 Hydraulic mineral oil reservoirs
9 Hydraulic pressure warning switches
10 Upper distribution valve
11 Lower distribution valve
12 Deceleration conscious pressure limiting valve ('G' valve)
13 Priority valve
14 Filter block assembly
15 Minimum pressure valve
16 Seepage return hose
17 Levelling valve
18 Bleed point – Suspension struts
19 Rear brake caliper (four cylinder)
20 Rear brake caliper bleed point
21 Restrictor
22 Gas spring and Suspension strut
23 Anti-locking brakes warning panel
24 Anti-locking brakes electronic control unit (ECU)

Figure G2-2

Mineral oil hydraulic system with anti-lock braking



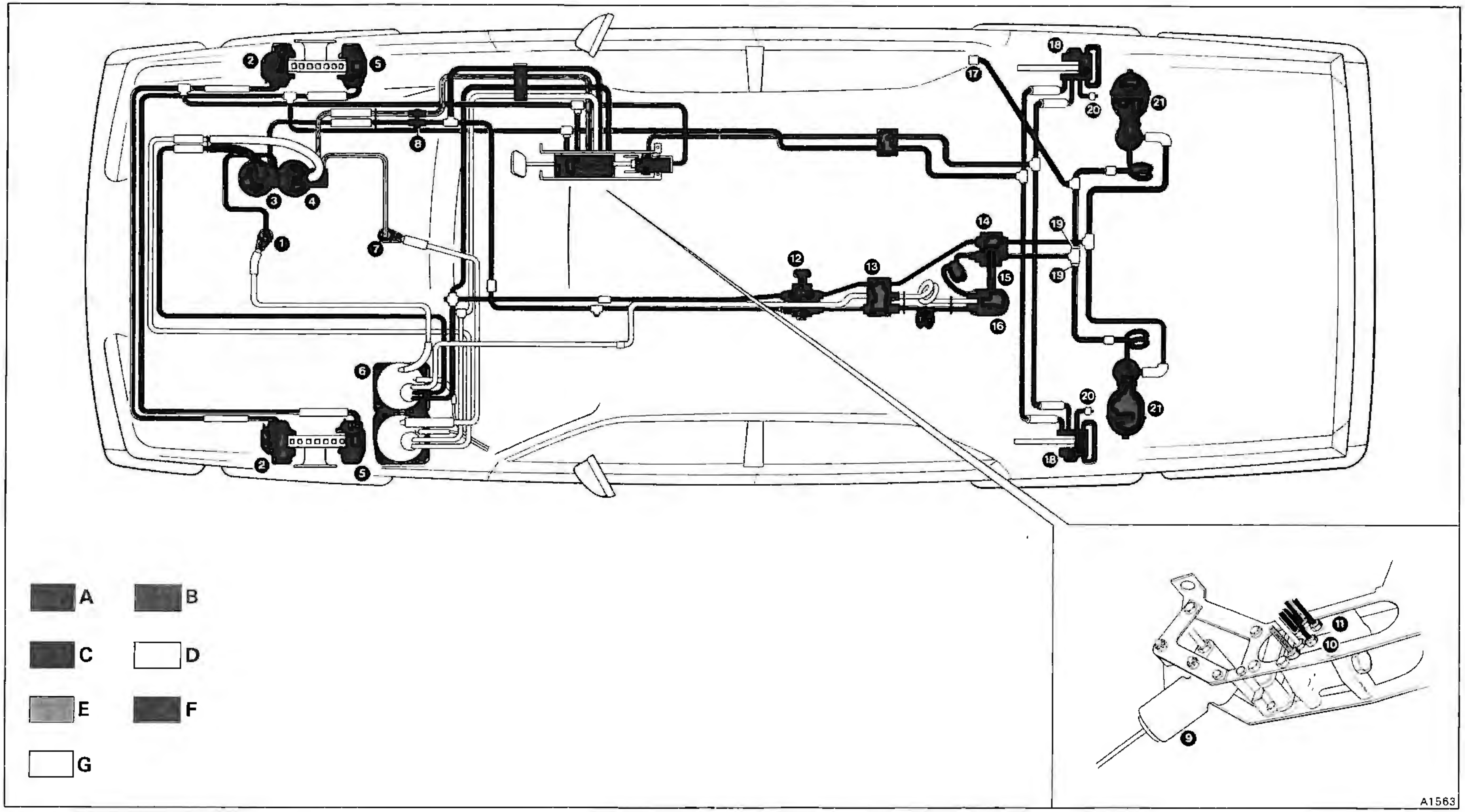
Mineral oil hydraulic system colour coding and component location – Left-hand drive cars

A Feed to rear brakes and levelling (System 1)
B Deceleration conscious pressure valve fed rear brakes (System 1)
C Low pressure return from levelling and rear brakes (System 1)
D Levelling return (System 1)
E Feed to front brakes (System 2)
F Front brakes and directly fed rear brakes (System 2)
G Low pressure return from front brakes (System 2)

1 Modulator (anti-locking brakes)
2 Front leading brake caliper (twin cylinder)
3 Front hydraulic pump
4 Front hydraulic accumulator
5 Rear hydraulic accumulator
6 Front trailing brake caliper (twin cylinder)
7 Rear hydraulic pump
8 Hydraulic pressure warning switches
9 Hydraulic mineral oil reservoirs
10 Upper distribution valve
11 Lower distribution valve
12 Deceleration conscious pressure limiting valve ('G' valve)
13 Priority valve
14 Filter block assembly
15 Minimum pressure valve
16 Height control levelling valve
17 Seepage return hose
18 Bleed point – Suspension struts
19 Rear brake caliper (four cylinder)
20 Rear brake caliper bleed point
21 Restrictor
22 Gas spring and Suspension strut
23 Anti-locking brakes warning panel
24 Anti-locking brakes electronic control unit (ECU)

Figure G2-3

Mineral oil hydraulic system



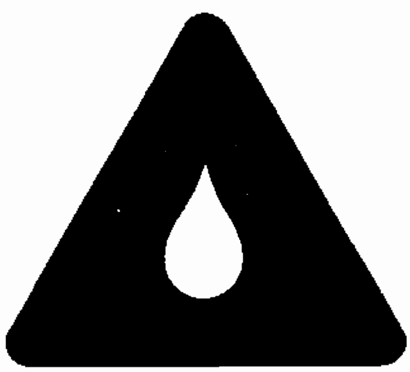
Mineral oil hydraulic system colour coding and component location – Right-hand drive cars

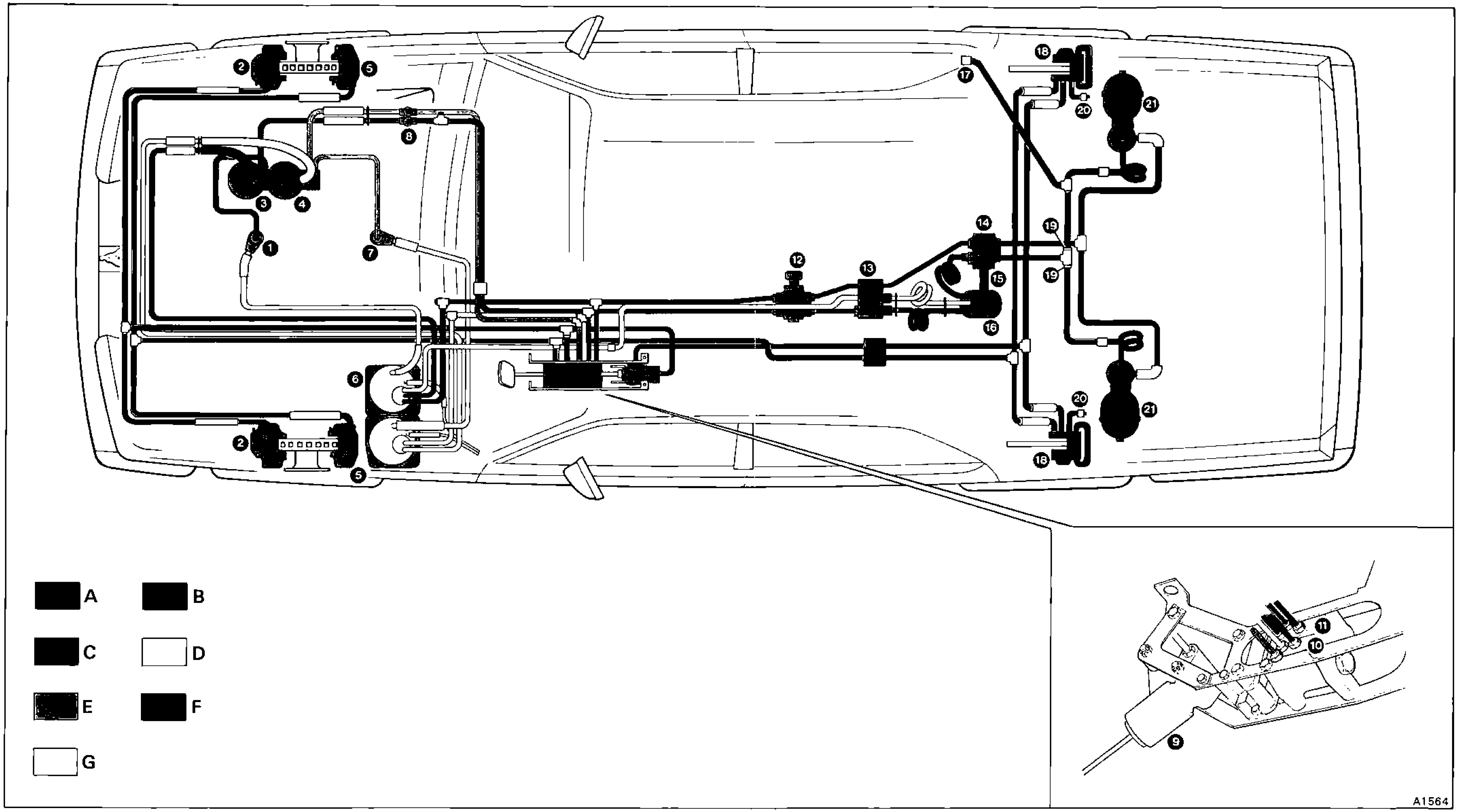
A Feed to rear brakes and levelling (System 1)
B Deceleration conscious pressure valve fed rear brakes and front leading brake calipers (System 1)
C Low pressure return from levelling and rear brakes (System 1)
D Levelling return (System 1)
E Feed to front brakes (System 2)
F Front trailing brake calipers and directly fed rear brakes (System 2)
G Low pressure return from front brakes (System 2)

1 Front hydraulic pump
2 Front leading brake caliper (twin cylinder)
3 Front hydraulic accumulator
4 Rear hydraulic accumulator
5 Front trailing brake caliper (twin cylinder)
6 Hydraulic mineral oil reservoirs
7 Rear hydraulic pump
8 Hydraulic pressure warning switches
9 Deceleration conscious pressure limiting valve ('G' valve)
10 Lower distribution valve
11 Upper distribution valve
12 Priority valve
13 Filter block assembly
14 Minimum pressure valve
15 Seepage return hose
16 Levelling valve
17 Bleed point – Suspension struts
18 Rear brake caliper (four cylinder)
19 Restrictor
20 Rear brake caliper bleed point
21 Gas spring and Suspension strut

Figure G2-4

Mineral oil hydraulic system





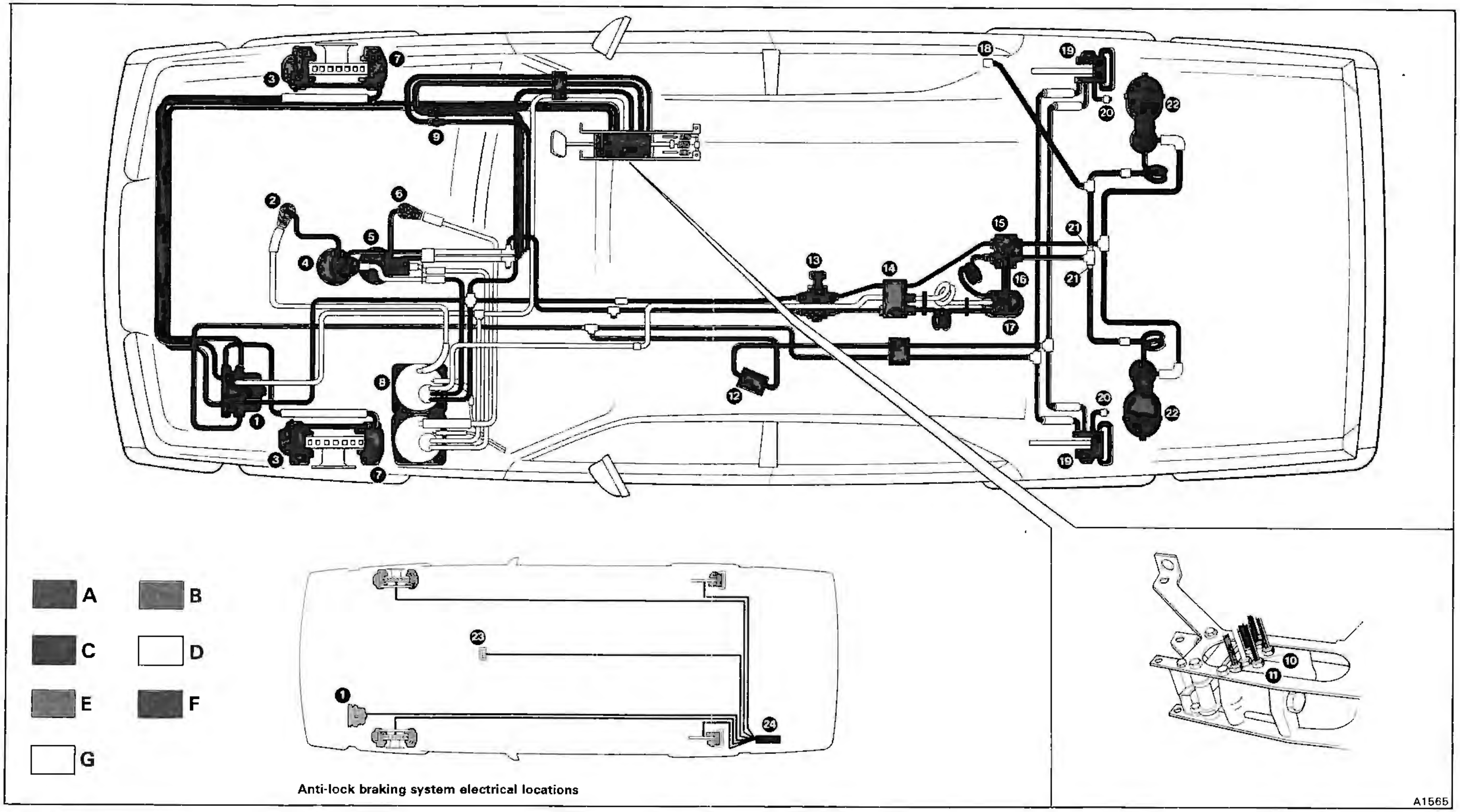
Mineral oil hydraulic system colour coding and component location – Left-hand drive cars

A Feed to rear brakes and levelling (System 1)
B Deceleration conscious pressure valve fed rear brakes and front leading brake calipers (System 1)
C Low pressure return from levelling and rear brakes (System 1)
D Levelling return (System 1)
E Feed to front brakes (System 2)
F Front trailing brake calipers and directly fed rear brakes (System 2)
G Low pressure return from front brakes (System 2)

1 Front hydraulic pump
2 Front leading brake caliper (twin cylinder)
3 Front hydraulic accumulator
4 Rear hydraulic accumulator
5 Front trailing brake caliper (twin cylinder)
6 Hydraulic mineral oil reservoirs
7 Rear hydraulic pump
8 Hydraulic pressure warning switches
9 Deceleration conscious pressure limiting valve ('G' valve)
10 Lower distribution valve
11 Upper distribution valve
12 Priority valve
13 Filter block assembly
14 Minimum pressure valve
15 Seepage return hose
16 Levelling valve
17 Bleed point – Suspension struts
18 Rear brake caliper (four cylinder)
19 Restrictor
20 Rear brake caliper bleed point
21 Gas spring and Suspension strut

Figure G2-5

Mineral oil hydraulic system with anti-lock braking



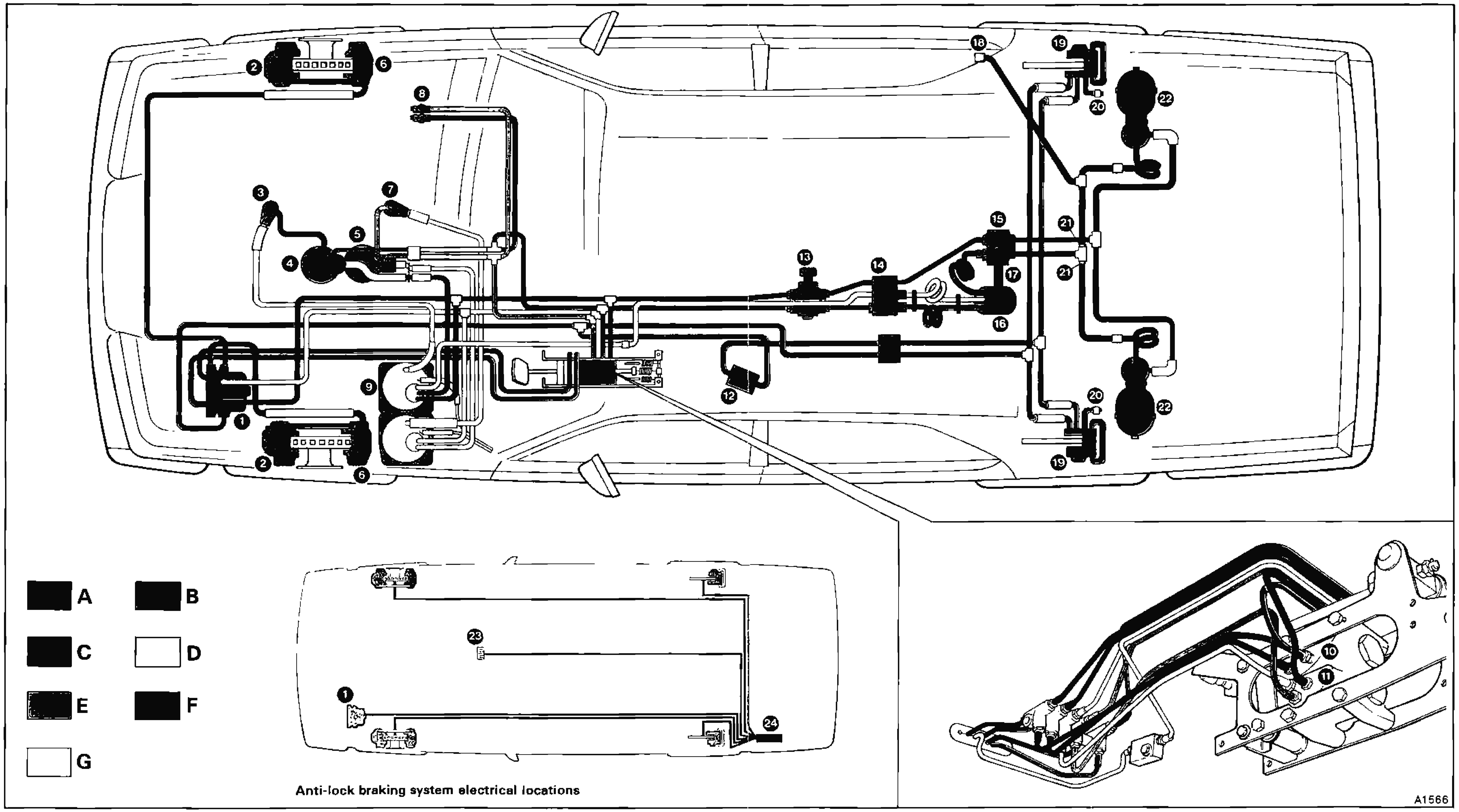
Mineral oil hydraulic system colour coding and component location – Right-hand drive cars

A Feed to rear brakes and levelling (System 1)
B Deceleration conscious pressure valve fed rear brakes (System 1)
C Low pressure return from levelling and rear brakes (System 1)
D Levelling return (System 1)
E Feed to front brakes (System 2)
F Front brakes and directly fed rear brakes (System 2)
G Low pressure return from front brakes (System 2)

1 Modulator (anti-locking brakes)
2 Front hydraulic pump
3 Front leading brake caliper (twin cylinder)
4 Front hydraulic accumulator
5 Rear hydraulic accumulator
6 Rear hydraulic pump
7 Front trailing brake caliper (twin cylinder)
8 Hydraulic mineral oil reservoirs
9 Hydraulic pressure warning switches
10 Upper distribution valve
11 Lower distribution valve
12 Deceleration conscious pressure limiting valve ('G' valve)
13 Priority valve
14 Filter block assembly
15 Minimum pressure valve
16 Seepage return hose
17 Levelling valve
18 Bleed point – Suspension struts
19 Rear brake caliper (four cylinder)
20 Rear brake caliper bleed point
21 Restrictor
22 Gas spring and Suspension strut
23 Anti-locking brakes warning panel
24 Anti-locking brakes electronic control unit (ECU)

Figure G2-6

Mineral oil hydraulic system with anti-lock braking



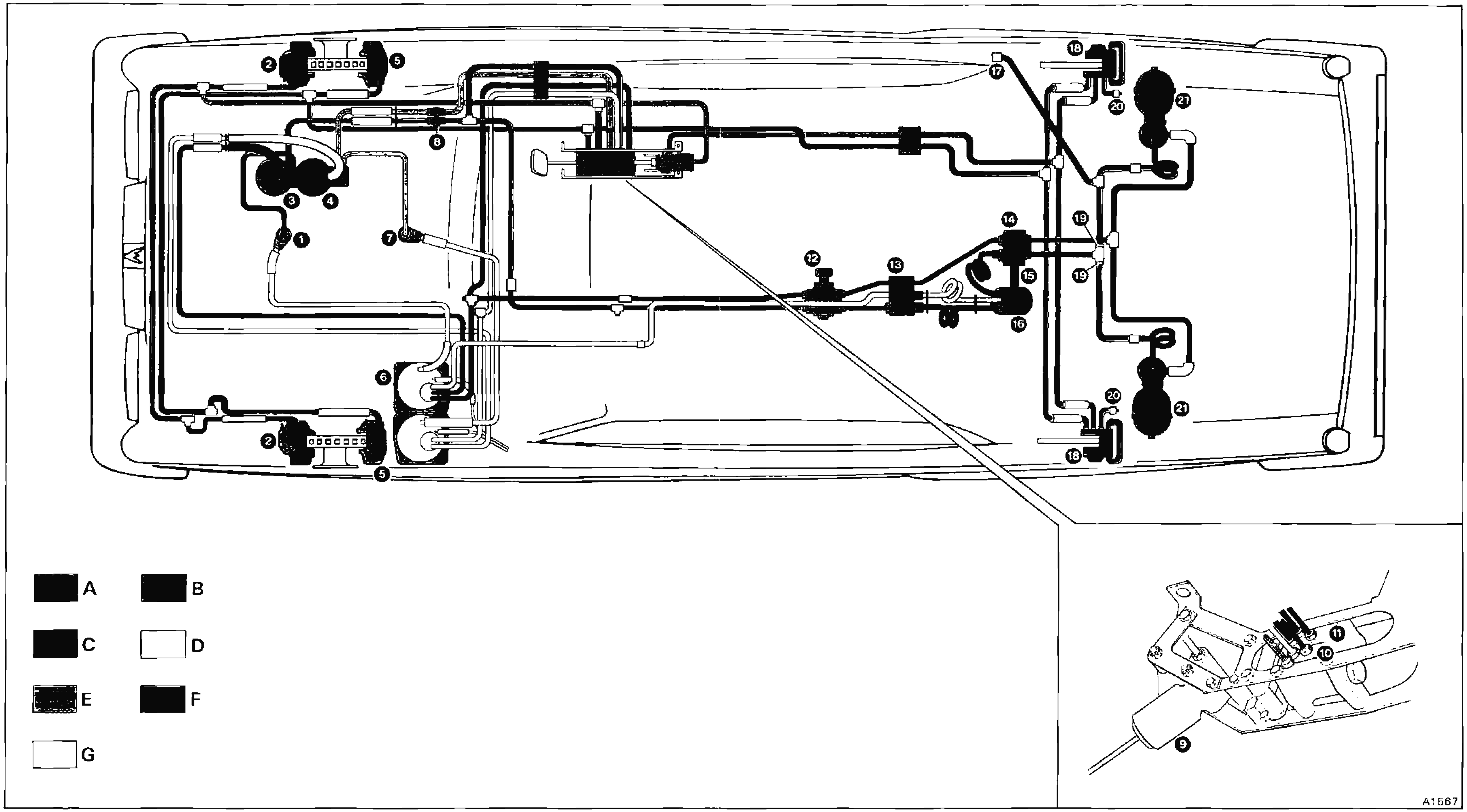
Mineral oil hydraulic system colour coding and component location – Left-hand drive cars

A Feed to rear brakes and levelling (System 1)
B Deceleration conscious pressure valve fed rear brakes (System 1)
C Low pressure return from levelling and rear brakes (System 1)
D Levelling return (System 1)
E Feed to front brakes (System 2)
F Front brakes and directly fed rear brakes (System 2)
G Low pressure return from front brakes (System 2)

1 Modulator (anti-locking brakes)
2 Front leading brake caliper (twin cylinder)
3 Front hydraulic pump
4 Front hydraulic accumulator
5 Rear hydraulic accumulator
6 Front trailing brake caliper (twin cylinder)
7 Rear hydraulic pump
8 Hydraulic pressure warning switches
9 Hydraulic mineral oil reservoirs
10 Upper distribution valve
11 Lower distribution valve
12 Deceleration conscious pressure limiting valve ('G' valve)
13 Priority valve
14 Filter block assembly
15 Minimum pressure valve
16 Height control levelling valve
17 Seepage return hose
18 Bleed point – Suspension struts
19 Rear brake caliper (four cylinder)
20 Rear brake caliper bleed point
21 Restrictor
22 Gas spring and Suspension strut
23 Anti-locking brakes warning panel
24 Anti-locking brakes electronic control unit (ECU)

Figure G2-7

Mineral oil hydraulic system



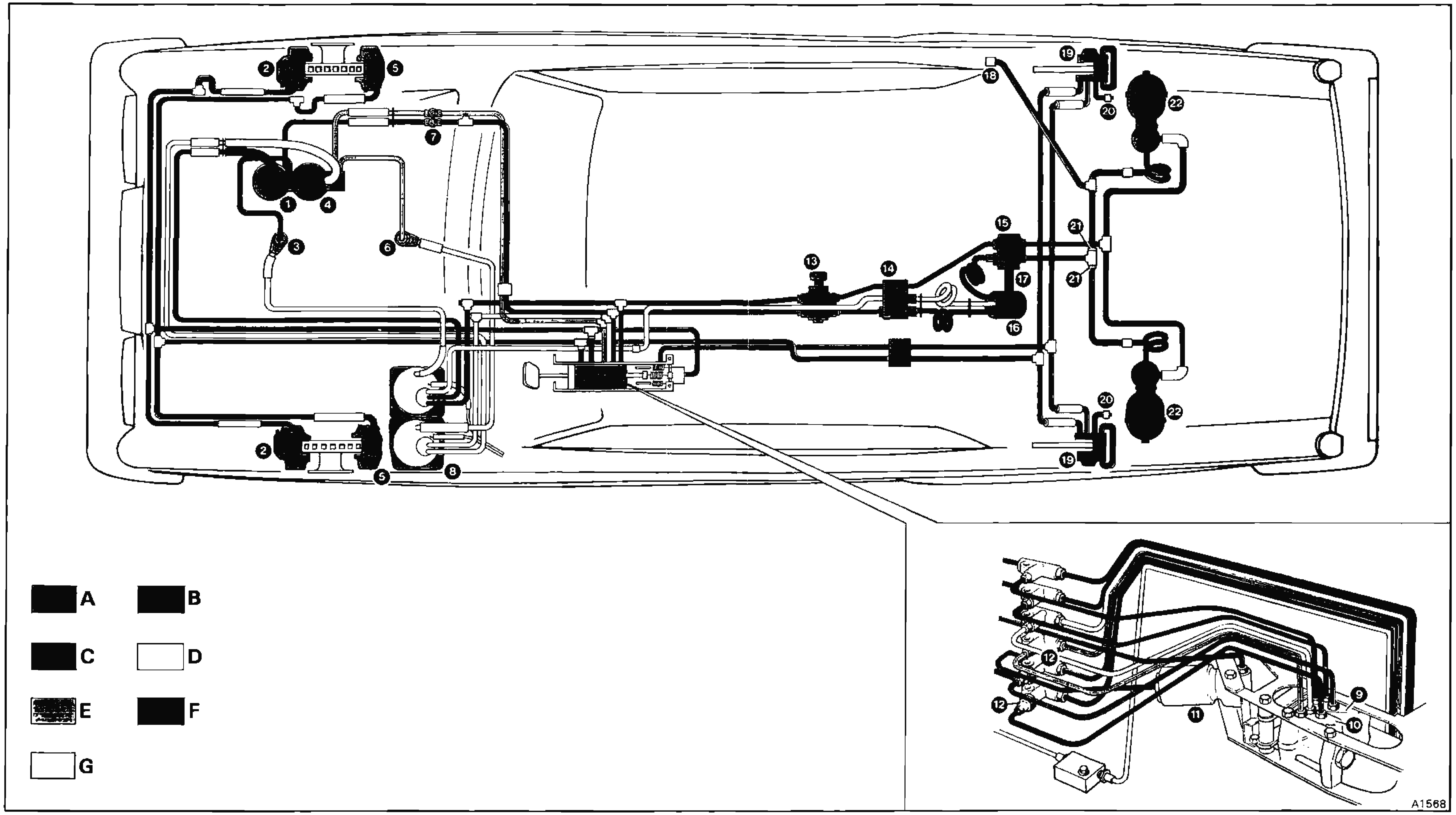
Mineral oil hydraulic system colour coding and component location – Right-hand drive cars

- A Feed to rear brakes and levelling (System 1)
- B Deceleration conscious pressure valve fed rear brakes and front leading brake calipers (System 1)
- C Low pressure return from levelling and rear brakes (System 1)
- D Levelling return (System 1)
- E Feed to front brakes (System 2)
- F Front trailing brake calipers and directly fed rear brakes (System 2)
- G Low pressure return from front brakes (System 2)

1. Front hydraulic pump
2. Front leading brake caliper (twin cylinder)
3. Front hydraulic accumulator
4. Rear hydraulic accumulator
5. Front trailing brake caliper (twin cylinder)
6. Hydraulic mineral oil reservoirs
7. Rear hydraulic pump
8. Hydraulic pressure warning switches
9. Deceleration conscious pressure limiting valve ('G' valve)
10. Lower distribution valve
11. Upper distribution valve
12. Priority valve
13. Filter block assembly
14. Minimum pressure valve
15. Seepage return hose
16. Levelling valve
17. Bleed point – Suspension struts
18. Rear brake caliper (four cylinder)
19. Restrictor
20. Rear brake caliper bleed point
21. Gas spring and Suspension strut

Figure G2-8

Mineral oil hydraulic system



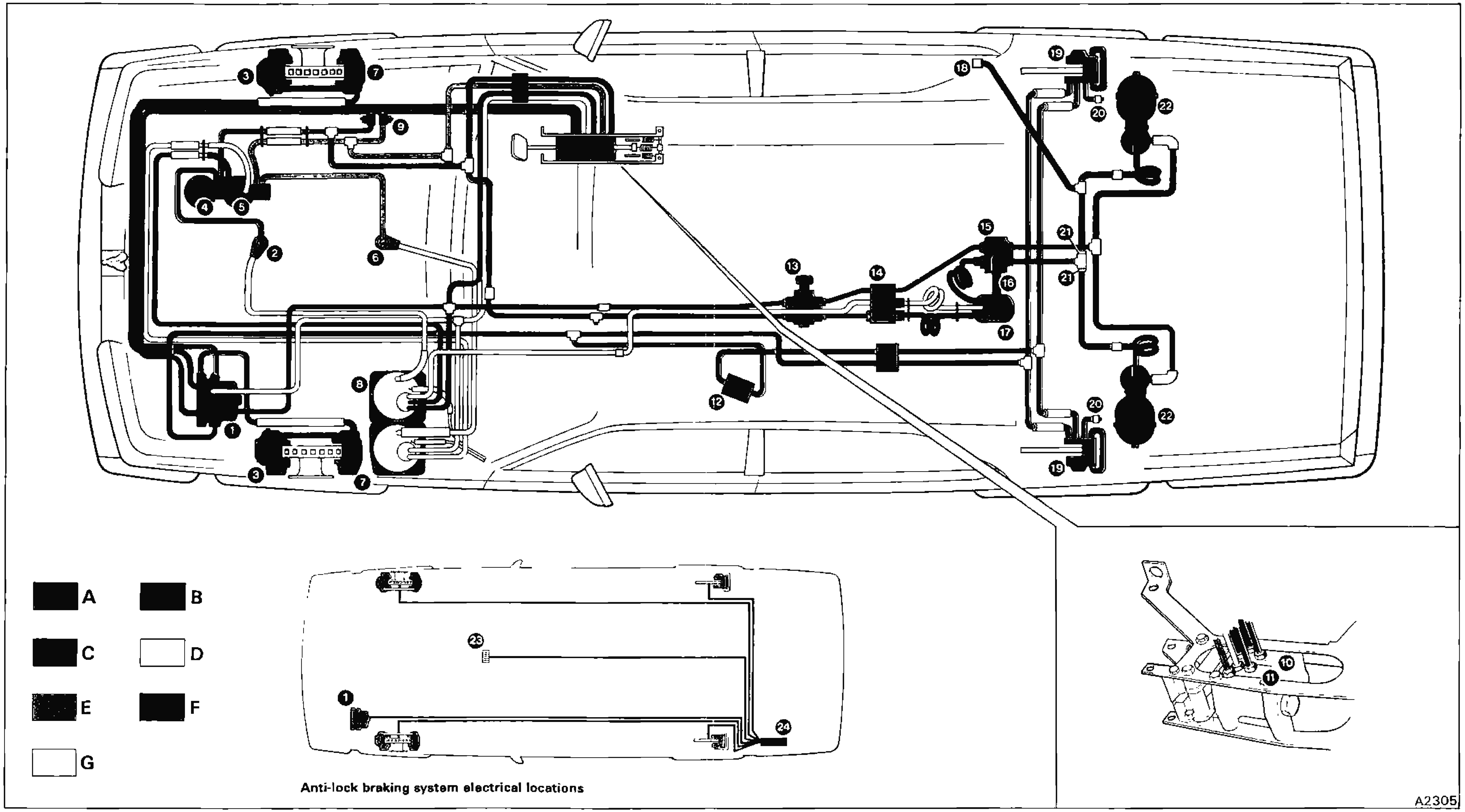
Mineral oil hydraulic system colour coding and component location – Left-hand drive cars

A Feed to rear brakes and levelling (System 1)
B Deceleration conscious pressure valve fed rear brakes and front leading brake calipers (System 1)
C Low pressure return from levelling and rear brakes (System 1)
D Levelling return (System 1)
E Feed to front brakes (System 2)
F Front trailing brake calipers and directly fed rear brakes (System 2)
G Low pressure return from front brakes (System 2)

1 Front hydraulic accumulator
2 Front leading brake caliper (twin cylinder)
3 Front hydraulic pump
4 Rear hydraulic accumulator
5 Front trailing brake caliper (twin cylinder)
6 Rear hydraulic pump
7 Hydraulic pressure warning switches
8 Hydraulic mineral oil reservoirs
9 Upper distribution valve
10 Lower distribution valve
11 Deceleration conscious pressure limiting valve ('G' valve)
12 Restrictor
13 Priority valve
14 Filter block assembly
15 Minimum pressure valve
16 Height control levelling valve
17 Seepage return hose
18 Bleed point – Suspension struts
19 Rear brake caliper (four cylinder)
20 Rear brake caliper bleed point
21 Restrictor
22 Gas spring and Suspension strut

Figure G2-9

Mineral oil hydraulic system with anti-lock braking



Anti-lock braking system electrical locations

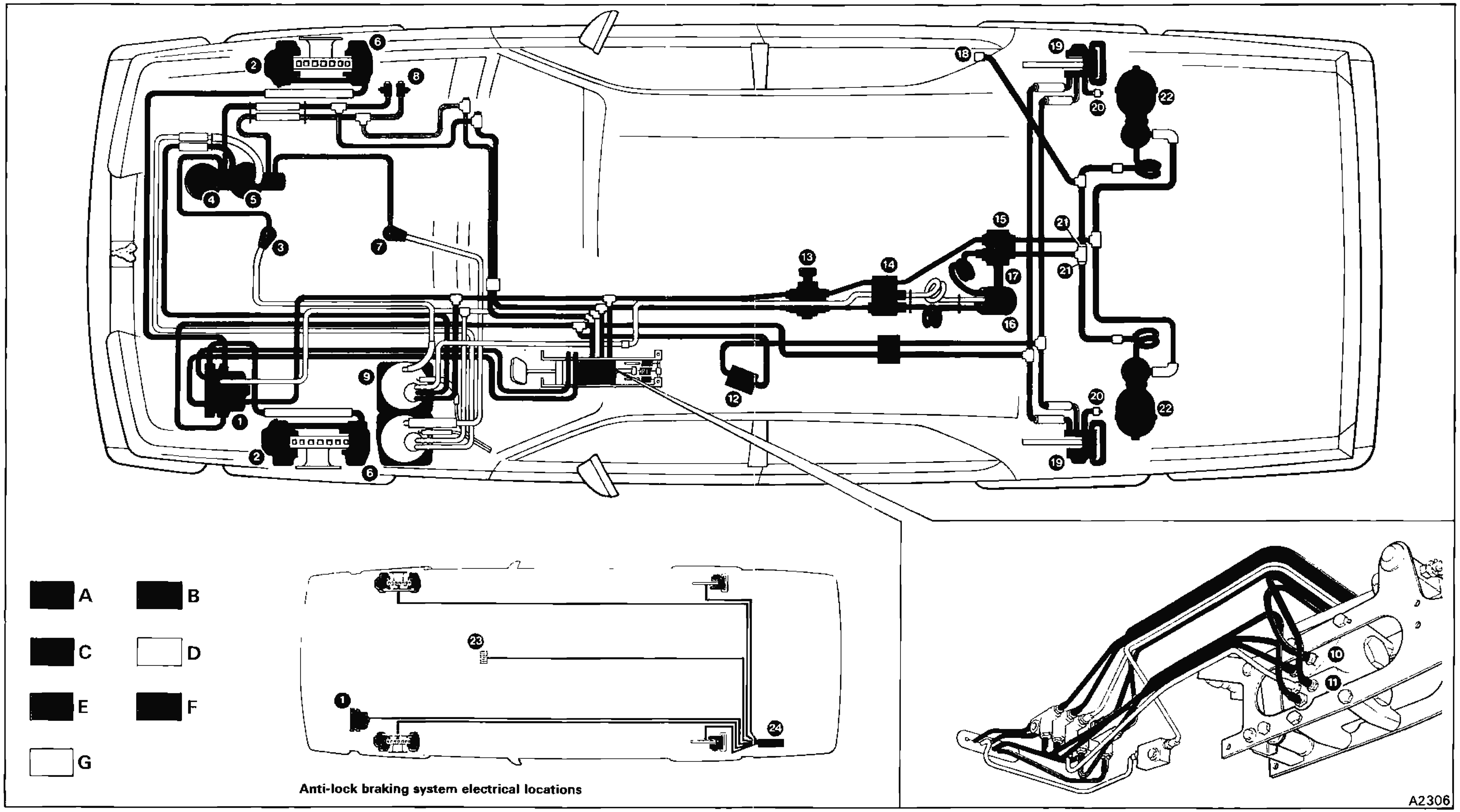
Mineral oil hydraulic system colour coding and component location – Right-hand drive cars

A Feed to rear brakes and levelling (System 1)
B Deceleration conscious pressure valve fed rear brakes (System 1)
C Low pressure return from levelling and rear brakes (System 1)
D Levelling return (System 1)
E Feed to front brakes (System 2)
F Front brakes (System 2) and directly fed rear brakes (System 1)
G Low pressure return from front brakes (System 2)

1 Modulator (anti-locking brakes)
2 Front hydraulic pump
3 Front leading brake caliper (twin cylinder)
4 Front hydraulic accumulator
5 Rear hydraulic accumulator
6 Rear hydraulic pump
7 Front trailing brake caliper (twin cylinder)
8 Hydraulic mineral oil reservoirs
9 Hydraulic pressure warning switches with bleed points
10 Upper distribution valve
11 Lower distribution valve
12 Deceleration conscious pressure limiting valve ('G' valve)
13 Priority valve
14 Filter block assembly
15 Minimum pressure valve
16 Seepage return hose
17 Levelling valve
18 Bleed point – Suspension struts
19 Rear brake caliper (four cylinder)
2D Rear brake caliper bleed point
21 Restrictor
22 Gas spring and Suspension strut
23 Anti-locking brakes warning panel
24 Anti-locking brakes electronic control unit (ECU)

Figure G2-10

Mineral oil hydraulic system with anti-lock braking



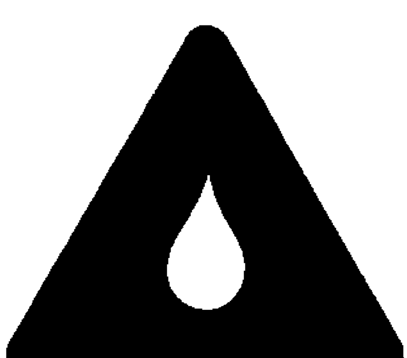
Mineral oil hydraulic system colour coding and component location – Left-hand drive cars

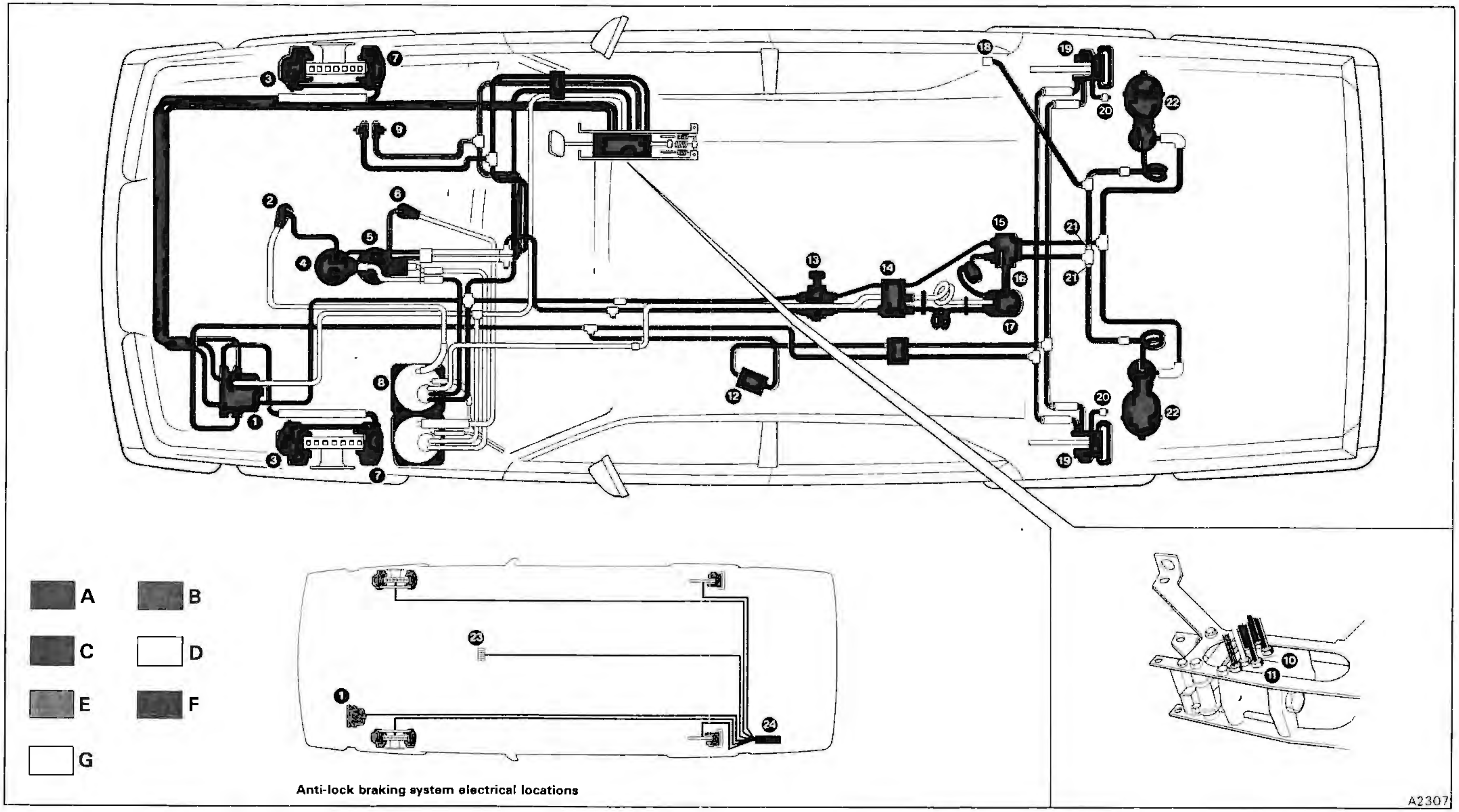
- A Feed to rear brakes and levelling (System 1)
- B Deceleration conscious pressure valve fed rear brakes (System 1)
- C Low pressure return from levelling and rear brakes (System 1)
- D Levelling return (System 1)
- E Feed to front brakes (System 2)
- F Front brakes (System 2) and directly fed rear brakes (System 1)
- G Low pressure return from front brakes (System 2)

1. Modulator (anti-locking brakes)
2. Front leading brake caliper (twin cylinder)
3. Front hydraulic pump
4. Front hydraulic accumulator
5. Rear hydraulic accumulator
6. Front trailing brake caliper (twin cylinder)
7. Rear hydraulic pump
8. Hydraulic pressure warning switches with bleed points
9. Hydraulic mineral oil reservoirs
10. Upper distribution valve
11. Lower distribution valve
12. Deceleration conscious pressure limiting valve ('G' valve)
13. Priority valve
14. Filter block assembly
15. Minimum pressure valve
16. Levelling valve
17. Seepage return hose
18. Bleed point – Suspension struts
19. Rear brake caliper (four cylinder)
20. Rear brake caliper bleed point
21. Restrictor
22. Gas spring and Suspension strut
23. Anti-locking brakes warning panel
24. Anti-locking brakes electronic control unit (ECU)

Figure G2-11

Mineral oil hydraulic system with anti-lock braking





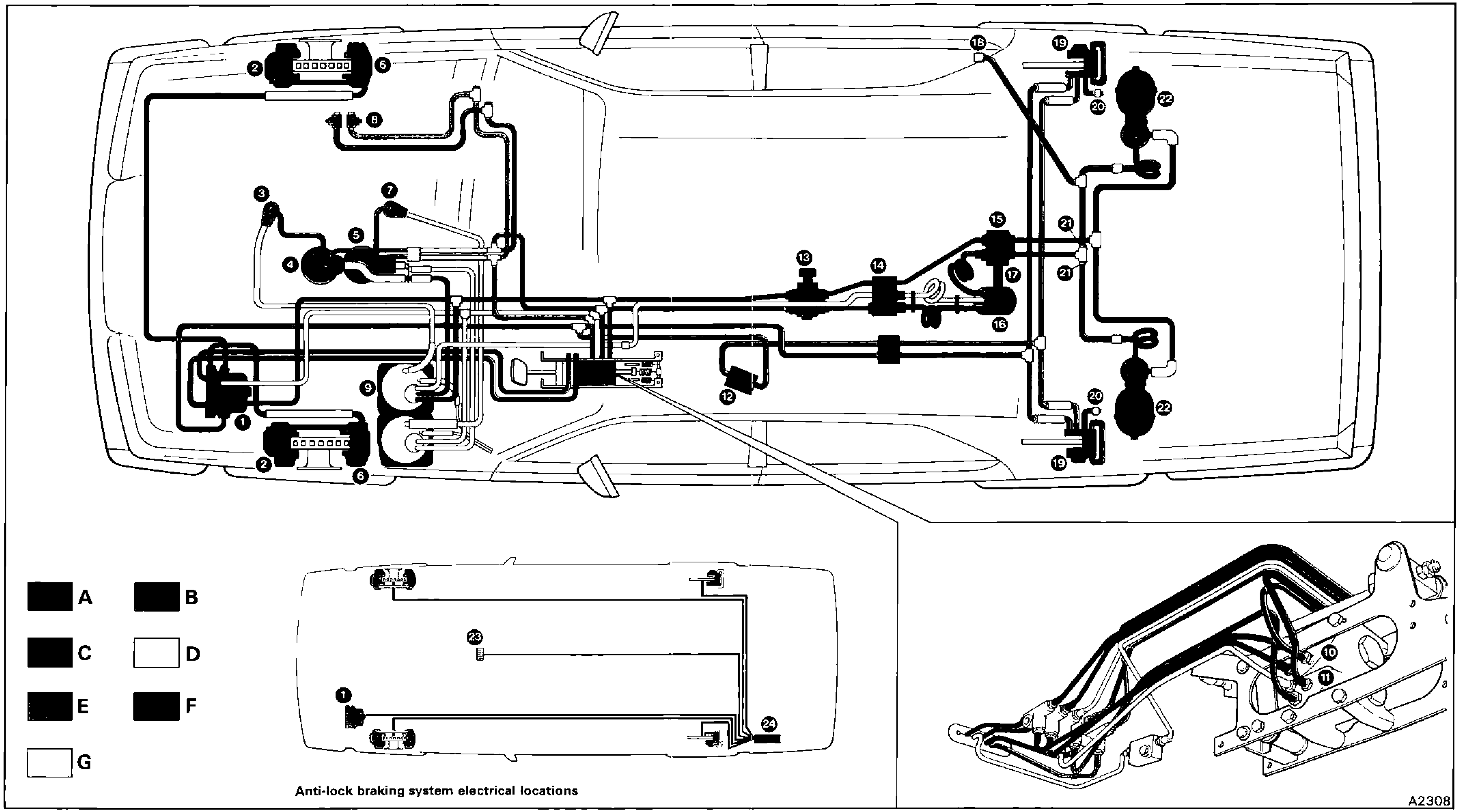
Mineral oil hydraulic system colour coding and component location – Right-hand drive cars

- A Feed to rear brakes and levelling (System 1)
- B Deceleration conscious pressure valve fed rear brakes (System 1)
- C Low pressure return from levelling and rear brakes (System 1)
- D Levelling return (System 1)
- E Feed to front brakes (System 2)
- F Front brakes (System 2) and directly fed rear brakes (System 1)
- G Low pressure return from front brakes (System 2)

1. Modulator (anti-locking brakes)
2. Front hydraulic pump
3. Front leading brake caliper (twin cylinder)
4. Front hydraulic accumulator
5. Rear hydraulic accumulator
6. Rear hydraulic pump
7. Front trailing brake caliper (twin cylinder)
8. Hydraulic mineral oil reservoirs
9. Hydraulic pressure warning switches with bleed points
10. Upper distribution valve
11. Lower distribution valve
12. Deceleration conscious pressure limiting valve ('G' valve)
13. Priority valve
14. Filter block assembly
15. Minimum pressure valve
16. Seepage return hose
17. Levelling valve
18. Bleed point – Suspension struts
19. Rear brake caliper (four cylinder)
20. Rear brake caliper bleed point
21. Restrictor
22. Gas spring and Suspension strut
23. Anti-locking brakes warning panel
24. Anti-locking brakes electronic control unit (ECU)

Figure G2-12

Mineral oil hydraulic system with anti-lock braking



Mineral oil hydraulic system colour coding and component location – Left-hand drive cars

A Feed to rear brakes and levelling (System 1)
B Deceleration conscious pressure valve fed rear brakes (System 1)
C Low pressure return from levelling and rear brakes (System 1)
D Levelling return (System 1)
E Feed to front brakes (System 2)
F Front brakes (System 2) and directly fed rear brakes (System 1)
G Low pressure return from front brakes (System 2)

1 Modulator (anti-locking brakes)
2 Front leading brake caliper (twin cylinder)
3 Front hydraulic pump
4 Front hydraulic accumulator
5 Rear hydraulic accumulator
6 Front trailing brake caliper (twin cylinder)
7 Rear hydraulic pump
8 Hydraulic pressure warning switches with bleed points
9 Hydraulic mineral oil reservoirs
10 Upper distribution valve
11 Lower distribution valve
12 Deceleration conscious pressure limiting valve ('G' valve)
13 Priority valve
14 Filter block assembly
15 Minimum pressure valve
16 Levelling valve
17 Seepage return hose
18 Bleed point – Suspension struts
19 Rear brake caliper (four cylinder)
20 Rear brake caliper bleed point
21 Restrictor
22 Gas spring and Suspension strut
23 Anti-locking brakes warning panel
24 Anti-locking brakes electronic control unit (ECU)

Special precautions (including system contamination test procedure)

Contents

Special precautions (including system contamination test procedure)

WARNING

Use only hydraulic system mineral oil (LHM) to replenish the braking and levelling systems.

Do not use brake fluids (Castrol RR363, Universal, or any other type). The use of any type of brake fluid, even in very small amounts, will cause component failure necessitating extensive rectification to the braking and levelling systems of the car.

Always ensure before fitting any seals, hoses, pipes, etc., that they are suitable for a mineral oil system. For details of correct component identification reference should be made to Section G3 of this Workshop Manual.

Always ensure that two sealed containers of **hydraulic system mineral oil (LHM)** are fitted in the luggage compartment.

Always ensure that no foreign matter enters the systems when work is being carried out.

Before attempting any work on the hydraulic systems of the car, service personnel must note carefully the contents of this Section and be fully conversant with the precautions required to ensure adequate safety and correct system operation. Also, before fitting any seals, hoses, pipes, etc., always ensure that they are suitable for use with a mineral oil hydraulic system.

The hydraulic systems operate at high pressure.

Pipes and components must never be removed when the hydraulic systems are in a charged state.

Before any work, except a specified test, is carried out on the hydraulic systems, they must be depressurized.

All items of hydraulic system equipment should carry identification to show that it is to be used only with hydraulic system mineral oil (colour reference green).

To assist in the identification marking of mineral oil components and equipment, self adhesive labels bearing the logo shown in figure G3-1 are available from the Parts Distribution Centre at Crewe.

If any work is carried out on either reservoir, ensure that the reservoir tops are retamperproofed. Refer to Section G7 for details.

Hydraulic system mineral oil (LHM)

Hydraulic system mineral oil is **Green** in colour. It is essential that only approved hydraulic system mineral oil is used (see Chapter D - Lubricants). Contamination of mineral oil hydraulic systems or components with any conventional vegetable or synthetic type of brake fluid will cause seals and hoses to deteriorate which could result in eventual brake faults.

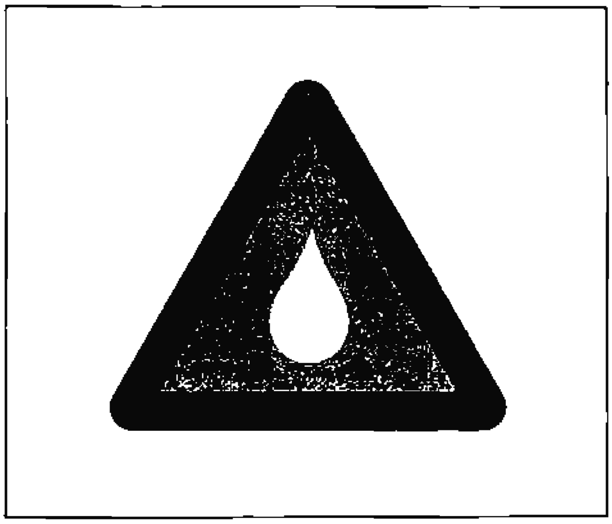


Fig. G3-1 Hydraulic system mineral oil logo

To avoid contamination all mineral oil containers and components should be stored in a clearly defined area away from that used for coventional brake fluid.

Hydraulic system mineral oil can cause damage to tyres. In the event of mineral oil coming into contact with a tyre, damage can be prevented if the mineral oil is removed immediately using a soap solution. Finally, wash the tyre with clean water.

Components identification

All components which are susceptible to damage from brake fluids are colour coded **Green** and have GMF prefix part numbers e.g. GMF 1062.

Other components in the system which are not susceptible to brake fluid damage (i.e. metal pipes and connectors) are neither colour coded nor do they have a GMF prefix part number. It must be stressed however that these parts must not become contaminated with brake fluid as this could circulate to other components in the hydraulic systems.

For details of individual component identification reference should be made to the relevant component Section within this Chapter.

Cleanliness

For the correct functioning of the hydraulic system, meticulous care should be taken to ensure complete cleanliness at all times.

Since both the braking system and levelling system have components with very fine manufacturing tolerances, the ingress of even very small particles of foreign matter could have very serious effects on the operation of the systems.

Care must be taken to ensure that at all times, only clean hydraulic system mineral oil is used in the system and that any overhauled units or components are not exposed to contamination during assembly or fitting.

Contact with conventional brake fluids must be avoided at all times as these fluids have a detrimental effect on the rubber seals and hoses used in hydraulic mineral oil systems.

Hydraulic system mineral oil (LHM) contamination test kit and procedure

The hydraulic reservoirs are considered to be contamination proof. However, if contamination is suspected the following procedure should be adopted.

Rolls-Royce Motors have developed a simple test kit and procedure which will allow Franchise Holders to quickly check the mineral oil (LHM) hydraulic system for contamination with conventional types of brake fluid i.e. Universal brake fluid, Castrol RR363.

Two test procedures have been established.

These simple methods of testing the hydraulic system mineral oil (LHM) for contamination have been developed to assist Franchise Holders in the following circumstances.

1. To determine the presence of a conventional type of brake fluid i.e. RR363, in hydraulic system mineral oil (LHM) prior to cars passing into the workshops. This is to help protect the Franchise Holder against claims of liability for contamination of the systems.
2. To determine the presence of contamination in cars that have been out in service, prior to the Franchise Holder accepting cars for part exchange or retailing.

The following tests do not guarantee that the system has not been contaminated with brake fluid (i.e. RR363, Universal, or any other type), it is only an indication that brake fluid does/does not appear within the system(s).

If brake fluid has been introduced into the system(s) no matter how briefly, **no** amount of corrective action (draining, flushing out, etc.) except for a complete hydraulic system(s) overhaul (i.e. replacement of seals, hoses), will ensure that damage has not occurred or will not occur at some future date.

Note Once the hydraulic system mineral oil has been tested and proved to be free from contamination, the reservoirs should be tamperproofed and the warning panel fitted. Cleanliness throughout the sampling and testing procedures is of vital importance.

Test kit

Hydraulic system mineral oil (LHM) test kit RH2841, can be obtained from the Parts Distribution Centre at Crewe. The kit consists of the following.

1 off Dropping bottle with dye solution.
1 off Test tube rack.
10 off Glass test tubes with corks.
1 off Photograph depicting the colour for varying degrees of contamination.
1 off Sampling tube.
1 off Set of instructions.

First procedure

1. Switch on the ignition and depressurize the hydraulic systems by pumping the brake pedal until both low pressure warning panels illuminate.

   Continue to pump the pedal for at least a further 20 applications to ensure that all the accumulator mineral oil is returned to the reservoir.
2. Clean the area around each hydraulic reservoir top and remove the warning panel. Remove the securing clips attaching the pipes from the reservoirs to the inner longeron.
3. Lift the pipes from the reservoir tops, noting their positions. Remove the setscrew from the circular cover in the top of each reservoir and lift out the covers.
4. Ensure that the components in the test kit are clean and dry. The sampling tubes should be thoroughly cleaned out with petroleum ether (120/160°C). Paraffin or petrol should **not** be used.
5. Using a small syringe, extract 50 ml of mineral oil from the top and bottom of each reservoir, through one of the small holes exposed.
6. Place the samples into individual clean dry containers.
7. Shake each sample taken to ensure it is well mixed.

   Pour 10 ml of each sample into clean test tubes (do not mix the samples together).
8. Using the dispenser, add two drops of the red dye solution contained in the kit into each 10 ml sample.

   Cork the test tubes and shake them thoroughly.
9. Leave the samples to settle for at least 30 minutes and then examine each sample (refer to Examination of results, in this Section).

Workshop procedure (to be carried out when contamination is suspected)

1. Depressurize both System 1 and System 2 accumulators by releasing the internal bleed screw (see Section G9). This procedure returns all high pressure fluid to the reservoirs.
2. Clean the area around each hydraulic reservoir top and remove the warning panel. Remove the securing clips attaching the pipes from the reservoirs to the inner longeron.
3. Lift the pipes from the reservoir tops, noting their positions. Remove the setscrew from the circular cover in the top of each reservoir and lift out the covers.
4. Ensure that the components in the test kit are clean and dry. The sampling tubes should be thoroughly cleaned out with petroleum ether (120/160°C). Paraffin or petrol should **not** be used.

5. Using a small syringe, extract 50 ml of mineral oil from the top and bottom of each reservoir, through one of the small holes exposed.
6. Place the samples into individual clean dry containers.
7. The procedure described in Operation 1 has depressurized all components forward of the minimum pressure valve. Therefore, the gas springs, struts, etc. are still pressurized.

To obtain a sample rearward of the minimum pressure valve carry out the following procedure.

8. Bleed off approximately 50 ml at the bleed point situated on the inner right-hand sill, forward of the rear road spring.
9. Ensure that each sample taken is tested.

Test procedure for determining hydraulic system mineral oil (LHM) contamination

Any cloudiness within a sample taken is an indication of mixed fluids. This is because hydraulic system mineral oil (LHM) and conventional types of brake fluid (Castrol RR363, Universal, etc.) **do not** mix to give a clear fluid.

The following procedure explains the sequence for testing a sample. It should be noted that a test must be carried out on each sample taken.

1. Shake the sample to ensure that it is well mixed.
2. Ensure that the test tube is clean and dry. Then, extract 10 ml from the sample and pour it into the test tube.
3. Using the dispenser, add two drops of the red dye solution.
4. Cork the test tube and shake well.

Examination of results

On adding the red dye solution and the subsequent mixing, it is possible that the green colour of the mineral oil will change to e reddish brown. **This does not indicate contamination of the hydraulic system mineral oil.**

Contamination can only be confirmed by the formation of a cloudy red mass which will begin to settle towards the bottom of the tube if left to stand for at least 30 minutes.

If the sample in the test tube on addition of the dye turns red but remains clear, it indicates that the sample is not contaminated.

The volume of red mass which will eventually settle to the bottom of the test tube indicates the amount of contamination within the hydraulic system mineral oil.

Complete separation of the two liquids may take a considerable amount of time, for example a very small percentage of contamination may take more than seven days to completely separate.

If contamination is suspected, but difficult to diagnose, due to the small amount of contamination that may be present, or any doubts exists, conformation should be obtained by sending a sample to Rolls-Royce Motors (if in the United Kingdom) or to a chemical analysis laboratory.

Very small percentages (less than 0.5%) of a conventional type of brake fluid contaminating the hydraulic system mineral oil is sufficient to cause seal and component failure.

Depressurizing the system

Method 1

Switch on the ignition and pump the brake pedal 50 to 60 times until resistance felt at the pedal reduces indicating that the systems are depressurized. The facia warning panels should be illuminated (see Section G2). Switch off the ignition.

To depressurize the rear suspension struts, attach a bleed tube to the struts bleed screw. Open the bleed screw and allow the hydraulic system mineral oil to bleed into a clean container until the flow ceases.

Method 2

Open the bleed screw on both accumulators and allow sufficient time for the mineral oil pressure to discharge back to the reservoir. These bleed screws are an integral part of the accumulator, the mineral oil being allowed to flow from the accumulator sphere back to the reservoir when the bleed screw is opened (see Section G9). Switch on the ignition and check that the facia warning panels are illuminated (see Section G2).

Depressurize the rear suspension struts as described in Method 1.

Accumulator and Gas spring spheres

The accumulator and gas spring spheres are charged on one side of their diaphragms with nitrogen gas to a pressure of 60 bar to 64 bar (870 lbf/in^2 to 928 lbf/in^2) and 10,35 bar to 18,63 bar (150 lbf/in^2 to 270 lbf/in^2) respectively, prior to despatch from the factory.

Each sphere is marked with a band of white paint or with a stick-on yellow label when charged. The charge pressure in bar is stamped on the non-return valve cap at the end of the sphere.

A date of manufacture is also marked on each sphere. It is recommended that spheres are stored and issued from stock in date sequence.

Bleeding the hydraulic systems

Remove fuse A6 from fuse panel F2 on the main fuseboard, to isolate the electric gearchange whilst the systems are bled.

Only use hydraulic system mineral oil bleed equipment when bleeding the hydraulic systems. **Never connect equipment that has been used for conventional brake fluids to the system.**

The bleed screws for the accumulators are an integral part of the accumulator valve housing and a bleed hose connection is not required.

Reference should be made to Section G5 for details of the complete bleeding procedure.

When bleeding the hydraulic system, any hydraulic system mineral oil that has been spilt onto the tyres must be removed. The use of a soap solution and a final rinse with clean water is recommended for this purpose.

Under no circumstances should hydraulic system mineral oil be allowed to remain on the tyres for prolonged periods as this will cause tyre damage.

General information

Removing components

Prior to disconnecting any pipes or removing hydraulic components from the car, the area around the pipes and components should be thoroughly cleaned. Particular attention should be given to the localized areas around the pipe unions and their corresponding ports.

Whenever units, pipes, or components are disconnected from the hydraulic systems all open ports and pipe ends must be blanked off immediately, to avoid contamination of the system.

It is stressed that the clean condition of any blanks used is equally as important as the clean condition of the components they seal.

Blanks which have been used on cars with conventional brake fluid systems should not be used, unless they have been thoroughly cleaned and all traces of brake fluid removed.

Note Masking tape or cork bungs do not constitute blanks.

Quantities of blanks may be obtained, on request from the Parts Distribution Centre at Crewe.

In addition, special pressure blanks are available, capable of withstanding full hydraulic system pressure. These blanks should be used during testing and fault diagnosis procedures where it may be necessary to blank off a pipe or component and then charge the systems. When fitted these blanks must be torque tightened to the figures quoted for the pipe unions which they replace.

Cleaning components

The recommended cleaner is petroleum ether (120/160°C).

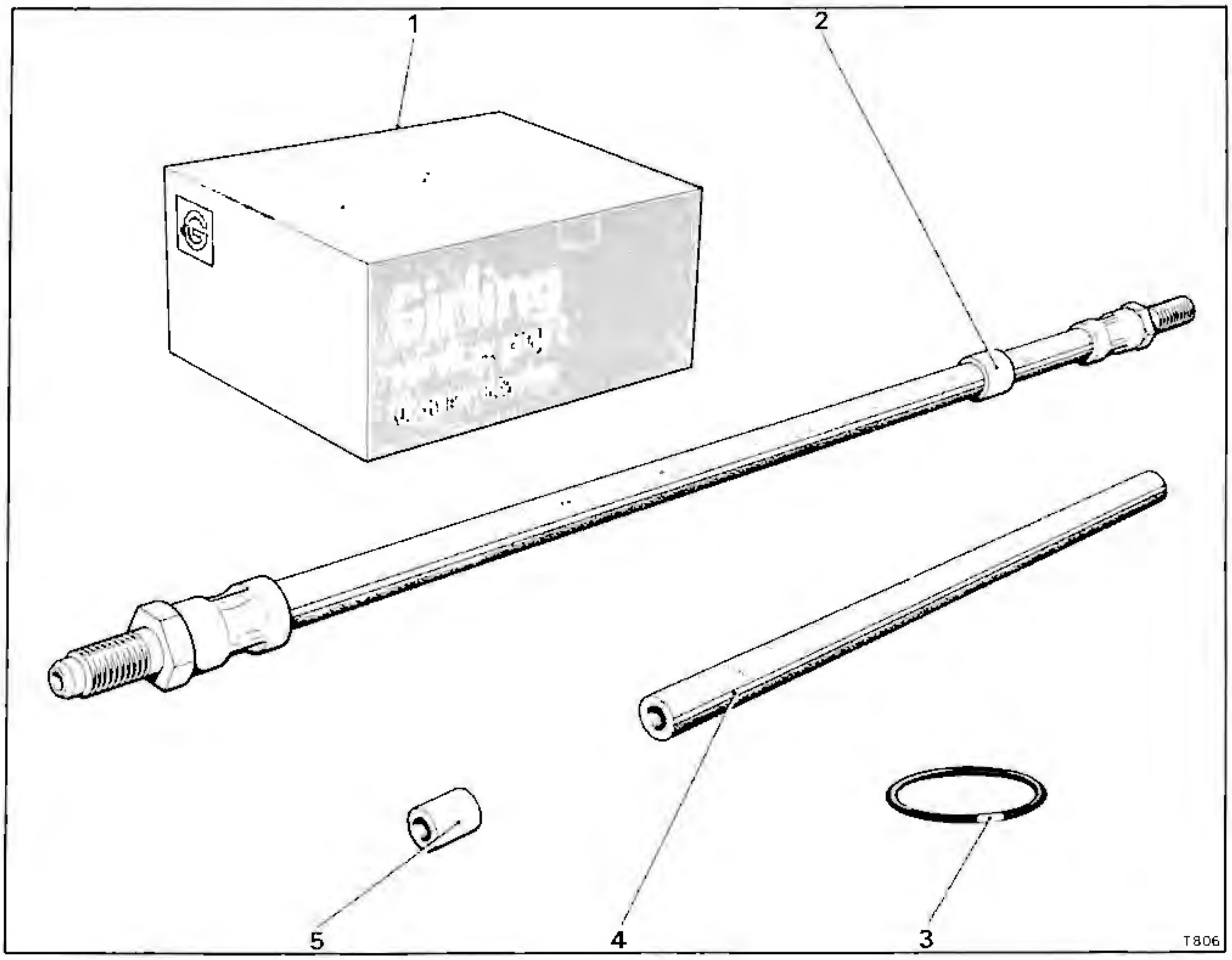


Fig. G3-2 Hydraulic system mineral oil component identification

1 Brake seal kit container
2 Flexible brake hose (green collar and stripe)
3 Sealing ring (green paint mark)
4 Brake hose (green stripe)
5 Pipe seal (green outer surface)

Components which have been removed should be thoroughly cleaned before replacement.

Rubber pipes, sealing rings, and other components should be washed in petroleum ether (120/160°C) and then dried with dry compressed air.

Metal pipes requiring the removal of underseal and road dirt from their outer surfaces, may be cleaned with trichlorethylene or paraffin. In such cases, a final cleaning procedure and flushing of the pipe internal bore using petroleum ether (120/160°C) should be carried out. Blow dry with clean compressed air.

Cloths, even the lint free types, should never be used to clean hydraulic components.

Servicing equipment

All servicing equipment should be clearly marked to indicate the type of hydraulic sytstem for which it is suitable.

Under no circumstances should equipment used for conventional brake fluids be used on a mineral oil hydraulic system or component.

Only pressure gauges, test, and bleed equipment bearing hydraulic system mineral oil identifications should be connected to a mineral oil system.

Hydraulic systems - Filling or topping-up

When the hydraulic reservoirs require topping-up or the systems are completely drained, always fill/top-up with fresh clean hydraulic system mineral oil of the specified type. Refer to Chapter D for the correct specification.

After filling the systems, bleed as described in Section G5.

Servicing rubber components

In the interest of safety, the rubber components used in the hydraulic systems have been allotted specific 'life' mileages at the completion of which or at the nearest service prior to completion it is recommended that the components are renewed. Reference should be made to the Service Schedule Manual publication number TSD 4702 for this information.

Only rubber components bearing mineral oil identification marks should be fitted to a mineral oil hydraulic system.

Under no circumstances must a rubber component for a conventional brake fluid system be substituted for the correct component.

Fitting replacement units

Replacement hydraulic units are tested and blanked off before being despatched from the factory.

It is advisable, when fitting a replacement unit, that when the unit has been placed in position and the blanks removed, the mineral oil in the unit is allowed to drain before the pipes are connected.

When drained, the pipes should be connected and the appropriate bleeding operations carried out.

Note The mineral oil should not be blown out, allowing it to drain is sufficient.

Storage and transportation

The care taken to prevent contamination of components during storage or transportation is extremely important.

All mineral oil components should be stored in a separate and clearly defined area from that used for conventional brake fluid components.

Replacement parts, pipes, and units must be clearly identified and securely sealed with the correct blanks. Blanks should not be removed until immediately prior to fitting; the replacement parts must also be protected from dust and damage.

Sealing rings and rubber pipes in storage should be protected from dust, light, and heat in order to reduce deterioration of the rubber.

Where mineral oil components are transported or returned to the manufacturer they should be clearly marked as being for use on mineral oil hydraulic systems.

Hydraulic system pipework

Bundy tubing is used to carry mineral oil around the hydraulic systems, except where flexible hoses are used to accommodate movement between two units. Flexible hoses are also used on several connections to the reservoirs, plus the levelling valve seepage return hose.

The bundy tubing pipework is almost entirely 4,76 mm (0.186 in) diameter, the exceptions being 6,35 mm (0.250 in) diameter and 9,52 mm (0.375 in) diameter.

To enable pipe identification, neoprene sleeves are fitted to each end of the metal pipes, except for the feeds from the reservoirs to the hydraulic pumps and the engine hydraulic pipes (pump to accumulator). A chart quoting the pipe colours and functions is given on page G4-2. This chart should be consulted to determine the function of each pipe i.e. high pressure, low pressure, and system.

Generally, pipework connections are effected by flared pipe ends and unions, either male or female as necessary. Conical seats are machined in the components or junctions to seat the flares and provide effective joints.

On the accumulators a different type of connection is used requiring the fitting of a small rubber sleeve (see fig. G4-1). Sealing is achieved by deformation of the rubber when the sleeve nut is tightened.

To fit this type of connection the procedure given at the end of this Section should be carried out.

In certain flexible pipe joints, face seals (aluminium) and copper washers are employed. A new copper washer and face seal must be fitted whenever the pipe is removed.

If hydraulic pipes are disturbed the following points should be noted.

The area around the pipe union and pipe end should be thoroughly cleaned before the union is unscrewed.

Pipe ends should always be blanked off immediately after removal. The blanks should not be removed until immediately prior to fitting.

Whenever pipes are removed, the flares should be inspected for serviceability. Pipes showing signs of damage, cracking, or collapse must be renewed.

Before fitting pipes and unions they should be cleaned thoroughly using petroleum ether (120/160°C), then blown through with clean dry compressed air. Particular attention should be made to the union and the exterior of the pipe immediately behind the flares.

Whenever any work is carried out which disturbs the anti-lock braking system components, the complete system must be checked with the ABS test box **before** the car is driven (see Section G6).

Special care must be exercised when removing or fitting any reservoir pipe connections. The pipes are a push-in fit into the reservoir manifold therefore, ensure the swaged end of the pipes engage with the nitrite seal.

Also, the levelling valve red and yellow coded pipes forming the double coiled pipe assembly, must be connected the correct way round. This is; red in the union nearest to the front of the car and yellow nearest to the levelling valve operating pivot. These red and yellow coded pipes are secured together using heatshrink ties to form the double coil assembly.

When fitting pipes, do not overtighten unions as this could cause damage to pipe flares.

If when a pipe is removed the coloured sleeves are in poor condition, they should be renewed. This is best achieved by expanding a new correctly coloured rubber sleeve sufficiently to clear the union, using a small three pronged expanding hand tool (i.e. Penguin pliers).

Identification sleeves are not fitted to the flexible hoses but the sleeves on the connecting pipes at either end may be used to identify the flexible pipe and its function.

The flexible and metal pipes can be readily identified by means of the colour coding and component location layouts (see Section G2).

Also refer to the function chart shown on page G4-2.

Note The two high pressure pipes from the hydraulic pumps to the hydraulic accumulators and the feeds from the reservoirs to the hydraulic pumps are not marked and do not connect to any other marked pipes. Since these pipes are the only ones without means of identification confusion should not arise.

Extreme caution should be taken when fitting or renewing flexible pipes to ensure that the correct type of pipe is fitted, in the correct location, and in accordance with the colour coding.

In the interest of safety, the flexible pipes fitted to the hydraulic systems have been allotted specific 'life' mileages at the completion of which or at the nearest service prior to completion, it is recommended that the flexible pipes are renewed.

For recommended 'life' mileages reference should be made to the Service Schedule Manual, publication number TSD 4702.

When renewing flexible pipes and hoses, only those conforming with hydraulic system mineral oil requirements and bearing mineral oil identification marks should be fitted (see fig. G3-2). Under no circumstances must any other type of flexible pipe or hose be fitted.

When removing rigid or flexible pipes, the positions of all clipping points and pipe routing should be noted to ensure that, when fitted, no chafing or vibration of the pipes can occur. Always ensure that the flexible hoses and rigid pipes are routed to clear other components and that clearance is maintained during the full range of steering and suspension movement.

In the event of replacement pipes being required, it is recommended that they are produced using 'Armco' 25 microns zinc plated, fully chromate passivated and/or green polymer coated bundy tubing. Care should be taken to avoid sharp bends when producing replacement pipes as this could cause the plating/coating to fracture. A hydraulic pipe manufacturing kit RH 12043 is available (see Section G23).

Note The pipe connection tappings on the front road wheel brake calipers, accumulators, modulator (if fitted), and levelling valve, have a metric thread form. Therefore, care should be taken when producing replacement pipes to ensure that the correct type and standard of pipe nut is fitted.

All pipes must be thoroughly cleaned using petroleum ether (120/160°C) and dried using clean compressed air. The ends should then be blanked until immediately prior to fitting.

Torque tighten all pipe unions and fittings, referring to either Section G22 or Chapter P.

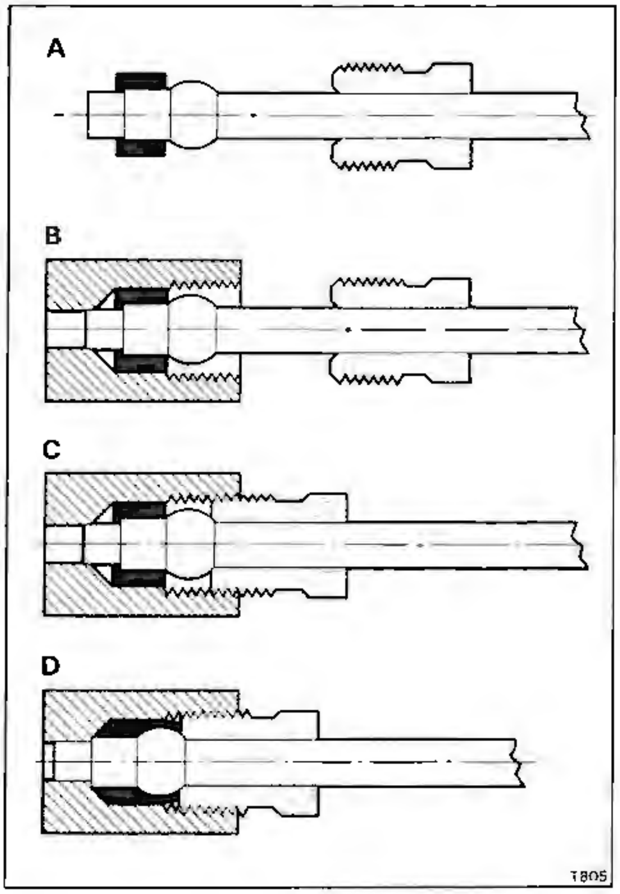


Fig. G4-1 Fitting a sleeved pipe connection

After fitting of replacement pipes they should be leak checked and then coated with underseal if they are in an exposed area.

Rubber sleeve pipe connection – To fit (see fig. G4-1)

A. Slide the rubber sleeve onto the pipe until it abuts the collar.

B. Insert the small end of the pipe into the close fitting bore at the bottom of the threaded connection port.

C. Carefully centralize the pipe in the bore and screw in the sleeve nut until it abuts the pipe collar.

D. Torque tighten the nut to the figures quoted in Section G22.

Note The rubber sleeve must be renewed each time the pipe is disconnected.

It is important that the torque figures quoted in Section G22 are not exceeded as damage to the pipe end could result. This will cause pipe restriction and difficulty in withdrawing the pipe end from the connection bore.

Pipework colour coding

(Refer to Section G2)

Colour	Function	Location
Red	High pressure No. 1 system	Rear brakes and levelling; pipes from the front hydraulic pump, to the front (vertically mounted) accumulator and from the front accumulator to the upper distribution valve. Also from the front accumulator to the rear levelling struts, passing through the priority valve, levelling valve, minimum pressure valve, and restrictors. Left-hand drive turbocharged cars have a pipe from the front accumulator to the pressure switch.
Blue	High pressure (with foot-brake applied) No. 1 system	**Anti-lock braking systems** Brake line; pipe from the upper distribution valve to the modulator. Pipe from the modulator to the upper cylinders on the rear wheel brake calipers, passing through the 'G' valve. **Non anti-lock braking systems** Brake line; pipes from the upper distribution valve to the front brake calipers on the front wheels and the upper cylinders on the rear wheel brake calipers.
Yellow	Low pressure No. 1 system	Levelling return; pipe from the levelling valve to the inboard reservoir.

Black	Low pressure return No. 1 system	Rear brakes and levelling; pipes from the upper distribution valve to the inboard reservoir and from the levelling struts through the minimum pressure valve and priority valve to the inboard reservoir. Also the return pipe from the front accumulator to the inboard reservoir. Anti-lock braking systems also have a return pipe from the modulator to the inboard reservoir.
Orange	High pressure No. 2 system	Brake line; pipes from the rear hydraulic pump, to the rear (horizontally mounted) accumulator and from the rear accumulator to the lower distribution valve. Left-hand drive turbocharged cars have a pipe from the rear accumulator to the pressure switch.
Mauve	High pressure (with foot-brake applied) No. 2 system	**Anti-lock braking systems** Brake line; pipe from the lower distribution valve to the modulator. Pipes from the modulator to the front brakes, including the caliper bridge pipes. (Pipe from 3-way connector forward of the 'G' valve to the lower cylinders on the rear wheel brake calipers, including the rear caliper bridge pipe, No. 1 system.) **Non anti-lock braking systems** Brake line; pipes from the lower distribution valve to the rear brake calipers on the front wheels and the lower cylinders on the rear wheel brake calipers, including the rear caliper bridge pipe.
White	Low pressure return No. 2 system	Brake line; pipe from the lower distribution valve to the outboard reservoir. Also the return pipe from the rear (horizontally mounted) accumulator to the outboard reservoir. Anti-lock braking systems also have a return pipe from the modulator to the outboard reservoir.

Bleeding the hydraulic systems

WARNING

Do not use equipment that has been used on cars utilizing synthetic brake fluid i.e. RR363, when carrying out bleeding operations on cars using hydraulic system mineral oil (LHM). Failure to observe this warning will result in contamination of the hydraulic systems, necessitating extensive and expensive rectification.

Introduction
In order to obtain optimum performance of the hydraulic systems, it is essential that they are free of air at all times. The two hydraulic systems are recirculatory and therefore, if air is allowed to enter them at any point it will reduce the efficiency.

Bleed screws are provided on the side of the accumulators, on the brake calipers, on the suspension struts, and on the deceleration conscious pressure limiting valve.

On 1989 model year cars, bleed screws are also incorporated at the pressure switches.

The accumulator bleed screws are an integral part of the valve housing and do not require the connection of a bleed pipe during the bleeding operation. The bleed screw for the suspension struts is situated on the right-hand sill forward of the rear road spring.

The accumulators are situated on the front right-hand ('A' bank) side of the engine except for the Bentley Turbo R, where the accumulators are mounted on the left-hand ('B' bank) side of the engine (see fig. G5-2). The accumulator for the number one system is vertically mounted and the number two system accumulator horizontally mounted.

The two hydraulic system mineral oil reservoirs are situated on the left-hand side of the engine compartment.

Anti-lock braking systems
The inboard hydraulic reservoir supplies hydraulic system mineral oil for the number one system. From the reservoir, mineral oil is supplied to the front brake pump, which in turn supplies hydraulic system mineral oil under pressure to the vertically mounted accumulator, upper distribution valve, and the rear brakes and levelling.

The outboard reservoir supplies hydraulic system mineral oil for the number two system. From the reservoir, mineral oil is supplied to the rear brake pump which in turn supplies hydraulic system mineral oil under pressure to the horizontally mounted accumulator, the lower distribution valve, and front brakes.

Non anti-lock braking systems
The inboard hydraulic reservoir supplies hydraulic system mineral oil for the number one system. From the reservoir, mineral oil is supplied to the front brake pump, which in turn supplies hydraulic system mineral oil under pressure to the vertically mounted accumulator, the upper distribution valve, the front brake calipers on the front wheels, the upper cylinders of the rear brake calipers, and the rear suspension struts.

The outboard reservoir supplies hydraulic system mineral oil for the number two system. From the reservoir, mineral oil is supplied to the rear brake pump which in turn supplies hydraulic system mineral oil under pressure to the horizontally mounted accumulator, the lower distribution valve, the rear brake calipers on the front wheels and the lower cylinders of the rear brake calipers.

When a rectification has been carried out between the brake pumps and the distribution valves, or levelling valve, it will be necessary to bleed at all the bleed points in that particular circuit.

However, if a rectification has been carried out between the distribution valves and the brake calipers, it should only be necessary to bleed at the bleed points between the distribution valve and the calipers in the faulty circuit.

Whenever in doubt it is advisable to bleed the complete system.

The power brake circuits should be bled at low pressure, ensuring that the systems are depressurized and the mineral oil levels in the reservoirs are kept up to the black line on the sight glass, at all stages of the bleeding operation.

To obtain low pressure bleeding of the system(s), depress the brake pedal and open the relevant bleed screw before starting the engine and running it at 1000 rev/min. This ensures the accumulator remains at low pressure. Throughout the bleeding operation, the brake pressure warning panels should be illuminated (see Section G2). Only when bleeding the suspension struts should the systems be fully pressurized and the warning panel lamps extinguished.

When bleeding the suspension struts, the interior of the car should be weighted to compress the suspension sufficiently for the levelling valve to actuate, thus allowing pressurized mineral oil to flow to the suspension struts and bleed screw. The engine should be allowed to run for four minutes prior to bleeding, to ensure the systems are fully charged. Bleed the suspension struts until all the bubbles have been expelled then allow fifteen seconds to elapse before fully tightening the bleed screw.

Bleeding the systems

The following information is a comprehensive bleeding operation which should be carried out to ensure removal of air from the complete hydraulic systems. However, as previously stated, each system can be bled separately at all points downstream of any replacements or pipe disconnections (refer to Sectional bleed requirements). However, if any doubt exists, it is advisable to bleed the complete system concerned.

Whilst bleeding is being carried out, it is essential that the mineral oil level in the two reservoirs is kept to the black line on the level indicator sight glass, using clean hydraulic system mineral oil. Reference should be made to Chapter D for approved types.

All bleed screws should be torque tightened in accordance with the figures quoted in Section G22.

When bleeding the hydraulic systems ensure that only equipment suitable for hydraulic system mineral oil is used. See **Warning** on page G5-1.

Anti-lock braking systems (see figs. G5-1 and G5-2)
Attach a length of bleed tube to each bleed screw prior to the bleed screw being opened. Immerse the free end of the tube in approximately 25 mm (1 in) of hydraulic system mineral oil contained in a clean bottle.

Bleed tube attachment is not necessary when bleeding the accumulators, as bleeding is effected internally through the accumulator valve housing, the mineral oil being allowed to flow back to its respective reservoir when the bleed screw is released approximately one revolution (see Section G9).

With the gear selector in the park position and the parking brake applied the following sequence of operations should be carried out, after first noting the following.

System 1 bleed points are A, C, F, H, G, I, and J (plus L for 1989 model year cars).

System 2 bleed points are B, D, and E (plus K for 1989 model year cars).

When bleeding the suspension struts extra care should be taken when slackening the bleed screw as the system will be operating at full pressure.

Any hydraulic system mineral oil that has been spilt onto the tyres must be removed. The use of a soap solution and a final rinse with clean water is recommended for this purpose.

Under no circumstances should hydraulic system

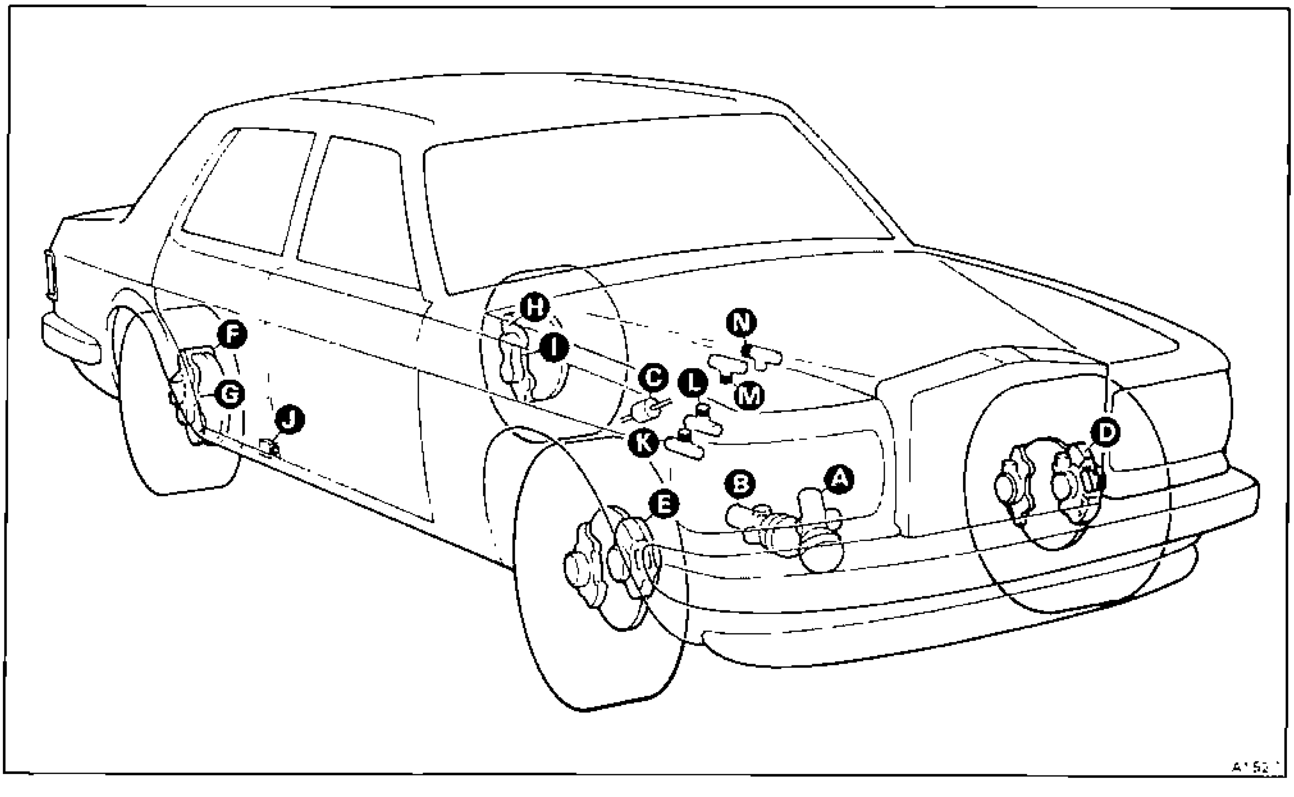


Fig. G5-1 Anti-lock braking system bleed points and accumulator test service points (Non-turbocharged cars)

- A Accumulator (No. 1 system)
- B Accumulator (No. 2 system)
- C Deceleration conscious pressure limiting valve
- D Front caliper left-hand front wheel
- E Front caliper right-hand front wheel
- F Right-hand rear caliper (upper cylinder)
- G Right-hand rear caliper (lower cylinder)
- H Left-hand rear caliper (upper cylinder)
- I Left-hand rear caliper (lower cylinder)
- J Rear suspension struts (right-hand side inner sill forward of rear road spring)
- K High pressure (pressure switch) (orange line No. 2 system)
- L High pressure (pressure switch) (red line No. 1 system)
- M High pressure (red line No. 1 system) right-hand drive cars
- N High pressure (orange line No. 2 system) left-hand drive cars

mineral oil be allowed to remain on the tyres for prolonged periods as this will cause tyre damage.

1. Remove fuse A6 from fuse panel F2 on the main fuseboard.
2. Depressurize the hydraulic systems as described in Section G3. Complete depressurization of the suspension struts is not necessary.
3. Open the accumulator bleed screws, points A and B.
4. Start and run the engine at 1500 rev/min for one minute. Ensure that the facia warning panels are illuminated (see Section G2).
5. Switch off the engine.
6. Close the accumulator bleed screws, points A and B.
7. Open the bleed screws at points C, D, and E (plus K and L for 1989 model year cars).
8. Depress the footbrake pedal.
9. Start and run the engine at 1000 rev/min.
10. Allow points C, D, and E (plus K and L, if applicable) to bleed until air free.
11. Open bleed screws F and G, allow bleeding to start.
12. Close the bleed screws at points C, D, and E (plus K and L, if applicable).
13. Bleed at points F and G until air free.
14. Open bleed screws at points H and I, allow bleeding to start. Close the bleed screws at points F and G.
15. Bleed at points H and I until air free.
16. Close the bleed screws at points H and I.
17. Release the footbrake pedal.
18. Add weight to the rear of the car to actuate the levelling valve.
19. Allow the systems to pressurize (facia warning panels extinguished).
20. Open the bleed screw at point J, bleed until air free.
21. Close the bleed screw at point J.
22. Check the hydraulic system mineral oil levels in the reservoirs and top-up as necessary.
23. Switch off the engine.
24. Fit a rubber dust cover to each bleed screw, and replace the fuse in the fuseboard.

Sectional bleed requirements

Red pipe line (No. 1 system)

Any pipe disturbed between the inboard hydraulic

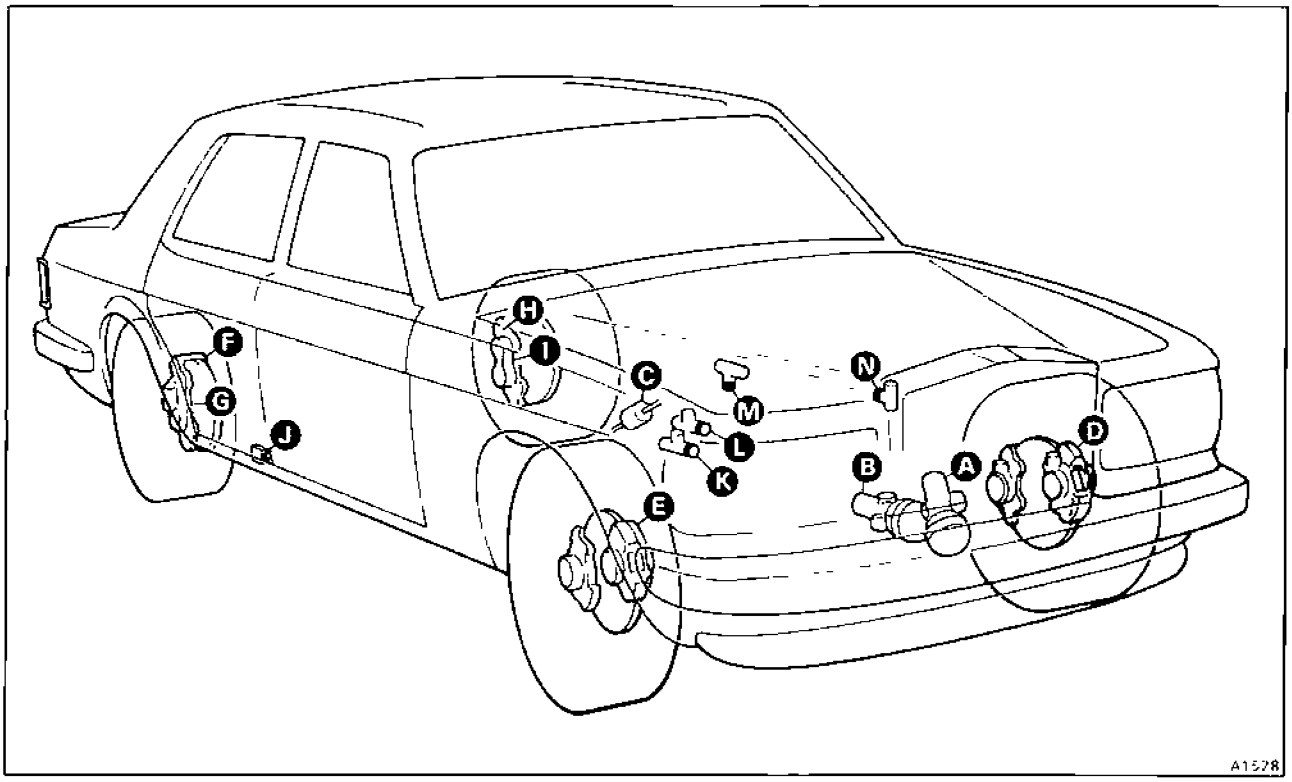


Fig. G5-2 Anti-lock braking system bleed points and accumulator test service points (Turbocharged cars)

- A Accumulator (No. 1 system)
- B Accumulator (No. 2 system)
- C Deceleration conscious pressure limiting valve
- D Front caliper left-hand front wheel
- E Front caliper right-hand front wheel
- F Right-hand rear caliper (upper cylinder)
- G Right-hand rear caliper (lower cylinder)
- H Left-hand rear caliper (upper cylinder)
- I Left-hand rear caliper (lower cylinder)
- J Rear suspension struts (right-hand side inner sill forward of rear road spring)
- K High pressure (pressure switch) (orange line No. 2 system)
- L High pressure (pressure switch) (red line No. 1 system)
- M High pressure (red line No. 1 system) right-hand drive cars
- N High pressure (orange line No. 2 system) right-hand drive cars

reservoir, front hydraulic pump, accumulator (vertically mounted), upper distribution valve, and rear suspension struts.

Bleed the complete system i.e. accumulator, deceleration conscious pressure limiting valve, the upper cylinders on the rear wheel calipers, and the rear suspension struts.

Orange pipe line (No. 2 system)
Any pipe disturbed between the outboard hydraulic reservoir, rear hydraulic pump, accumulator (horizontally mounted), and lower distribution valve.

Bleed the complete system i.e. accumulator and the front brake calipers.

Blue pipe line (No. 1 system)
Any pipe disturbed between the upper brake distribution valve, modulator, and the rear wheel calipers.

Bleed the deceleration conscious pressure limiting valve, and all the cylinders on the rear wheel calipers.

Mauve pipe line (No. 2 system)
Any pipe disturbed between the lower brake distribution valve, modulator, and front brakes.

Bleed the front brake calipers.

Checking the levels in the hydraulic reservoirs
After bleeding, the following procedure should be used when checking the levels in the hydraulic reservoirs.

1. Switch on the ignition.
2. Depressurize the system by using the bleed screws on both hydraulic accumulators until both brake pressure warning panels are illuminated.
3. Start the engine and allow to run at idle speed.
4. Allow the height to stabilize, then run the engine for a further four minutes.
5. Check the levels in each reservoir, adjust to the black line. **Do not overfill the reservoirs.**
6. Switch off the engine.
7. Replace the filler blanking plugs.

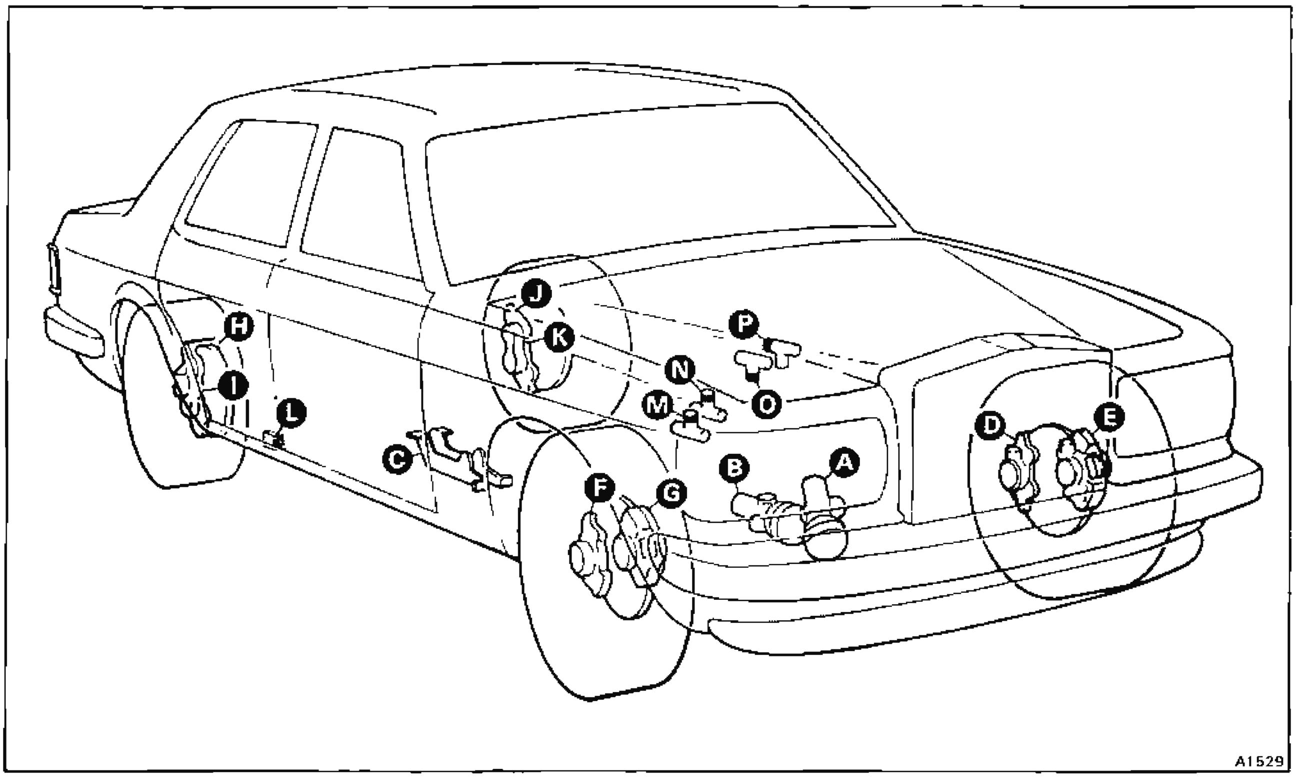


Fig. G5-3 Non anti-lock braking system bleed points and accumulator test service points

A Accumulator (No. 1 system)
B Accumulator (No. 2 system)
C Deceleration conscious pressure limiting valve
D Rear caliper left-hand front wheel
E Front caliper left-hand front wheel
F Rear caliper right-hand front wheel
G Front caliper right-hand front wheel
H Right-hand rear caliper (upper cylinder)
I Right-hand rear caliper (lower cylinder)
J Left-hand rear caliper (upper cylinder)
K Left-hand rear caliper (lower cylinder)
L Rear suspension struts (right-hand side inner sill forward of rear road spring)
M High pressure (orange line No. 2 system) right-hand drive cars
N High pressure (red line No. 1 system) left-hand drive cars
O High pressure (red line No. 1 system) right-hand drive cars
P High pressure (orange line No. 2 system) left-hand drive cars

Non anti-lock braking systems (see fig. G5-3)
Attach a length of bleed tube to each bleed screw prior to the bleed screw being opened. Immerse the free end of the tube in approximately 25 mm (1 in) of hydraulic system mineral oil contained in a clean bottle.

Bleed tube attachment is not necessary when bleeding the accumulators, as bleeding is effected internally through the accumulator valve housing, the mineral oil being allowed to flow back to its respective reservoir when the bleed screw is released approximately one revolution (see Section G9).

With the gear selector in the park position and the parking brake applied the following sequence of operations should be carried out, after first noting the following.

System 1 bleed points are A, C, E, G, H, J, and L. System 2 bleed points are B, D, F, I, and K.

When bleeding the suspension struts extra care should be taken when slackening the bleed screw as the system will be operating at full pressure.

Any hydraulic system mineral oil that has been spilt onto the tyres must be removed. The use of a soap solution and a final rinse with clean water is recommended for this purpose.

Under no circumstances should hydraulic system mineral oil be allowed to remain on the tyres for prolonged periods as this will cause tyre damage.

1. Remove fuse A6 from fuse panel F2 on the main fuseboard.
2. Depressurize the hydraulic systems as described in Section G3. Complete depressurization of the suspension struts is not necessary.
3. Open the accumulator bleed screws, points A and B.
4. Start and run the engine at 1500 rev/min for one minute. Ensure that the facia warning panels are illuminated (see Section G2).
5. Switch off the engine.
6. Close the accumulator bleed screws, points A and B.
7. Open the bleed screws at points C, D, and E.
8. Depress the footbrake pedal.
9. Start and run the engine at 1000 rev/min.
10. Allow points C, D, and E to bleed until air free.
11. Open bleed screws F and G, allow bleeding to start.
12. Close the bleed screws at points C, D, and E.
13. Bleed at points F and G until air free.
14. Open the bleed screws at points H and I, allow bleeding to start. Close the bleed screws at points F and G.
15. Bleed at points H and I until air free.
16. Open bleed screws J and K, allow bleeding to start.
17. Close the bleed screws at points H and I.
18. Bleed at points J and K until air free.
19. Close the bleed screws at points J and K.
20. Release the footbrake pedal.
21. Add weight to the rear of the car to actuate the levelling valve.
22. Allow the systems to pressurize (facia warning panels extinguished).
23. Open the bleed screw at point L, bleed until air free.
24. Close the bleed screw at point L.
25. Check the hydraulic system mineral oil levels in the reservoirs and top-up as necessary.
26. Switch off the engine.
27. Fit a rubber dust cover to each bleed screw, and replace the fuse in the fuseboard.

Sectional bleed requirements

Red pipe line (No. 1 system)
Any pipe disturbed between the inboard hydraulic reservoir, front hydraulic pump, accumulator (vertically mounted), upper distribution valve, and rear suspension struts.

Bleed the complete system i.e. accumulator, deceleration conscious pressure limiting valve, front calipers on the front wheels, upper cylinders on the rear wheel calipers, and the rear suspension struts.

Orange pipe line (No. 2 system)
Any pipe disturbed between the outboard hydraulic reservoir, rear hydraulic pump, accumulator (horizontally mounted), and lower distribution valve.

Bleed the complete system i.e. accumulator, rear brake calipers on the front wheels, and the lower cylinders on the rear wheel calipers.

Blue pipe line (No. 1 system)
Any pipe disturbed between the upper brake distribution valve and front calipers on the front wheels and the upper cylinders on the rear wheel calipers.

Bleed the deceleration conscious pressure limiting valve, the front calipers on the front wheels, and the upper cylinders on the rear wheel calipers.

Mauve pipe line (No. 2 system)
Any pipe disturbed between the lower brake distribution valve and rear calipers on the front wheels and lower cylinders on the rear wheel calipers.

Bleed the rear calipers on the front wheels and the lower cylinders on the rear wheel calipers.

Checking the levels in the hydraulic reservoirs
After bleeding, the following procedure should be used when checking the levels in the hydraulic reservoirs.

1. Switch on the ignition.
2. Depressurize the system by using the bleed screws on both hydraulic accumulators until both brake pressure warning panels are illuminated.
3. Start the engine and allow to run at idle speed.
4. Allow the height to stabilize, then run the engine for a further four minutes.
5. Check the levels in each reservoir, adjust to the black line. **Do not overfill the reservoirs.**
6. Switch off the engine.
7. Replace the filler blanking plugs.

Anti-lock braking system

Contents

6/87
Printed in England

Anti-lock braking system

Introduction
The anti-lock braking system consists of a speed sensor fitted to each wheel, an electronic control unit (ECU), and a three channel hydraulic modulator.

The speed signals from the sensors are continually processed by the ECU. When the brakes are applied, the wheel deceleration and slip is determined by the ECU. Signals from the ECU are fed to the 3-way solenoid valves in the modulator. The modulator then either holds pressure, decreases pressure, or allows pressure to increase to the brake calipers.

The rear wheels are controlled jointly, using the 'select low' control principle.

Failure of the anti-lock braking system is indicated by a warning lamp on the facia, and does not affect normal braking performance. A check for transient malfunctions of the system can be carried out by switching off the ignition and then restarting the engine. Continued illumination will need to be checked as described later in this Section.

Whenever any work is carried out which disturbs the anti-lock braking system components, the complete system must be checked with the ABS test box **before** the car is driven (see Anti-lock braking system – To test).

Wheel sensors
If any of the wheel speed sensors are found to be defective and need to be replaced, refer to either Chapter H (front hub) or Chapter J (rear hub) for the removal procedure.

Electronic control unit (ECU)
The electronic control unit situated in the luggage compartment, is mounted on the left-hand side rear wheel arch. Access to the ECU is gained by removing the left-hand side trim panel.

Hydraulic modulator
The hydraulic modulator is located in the engine compartment forward of the left-hand side suspension spring cover (see fig. G6-1).

The modulator consists of three solenoid valves (one for each front wheel, and one for the rear axle). These valves are actuated by the electronic control unit (ECU).

Whenever any work is carried out on the modulator, it is important to note the pipe connections and return them to the same positions (see fig. G6-2 and Section G2).

The modulator is a non-serviceable assembly, therefore if a fault is found, the complete assembly should be removed and a new one fitted.

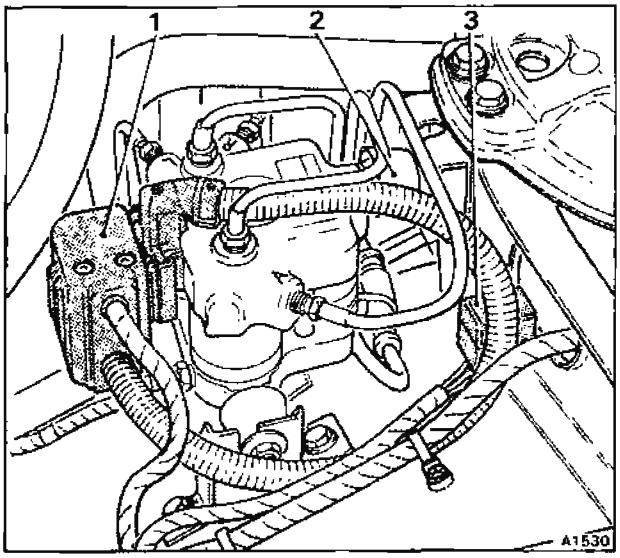


Fig. G6-1 Hydraulic modulator
1 Electrical plug
2 Flexible mount
3 Modulator relay – 1987 model year cars. From 1988 model year the modulator relay is repositioned in the luggage compartment

Precautions
If any work is carried out on a car equipped with an anti-lock braking system, the following points should be observed.

1. Before any welding is carried out on the car, the electrical connection to the ECU should be disconnected.
2. If force drying is to be used after spraying the car, remove the ECU.
3. Always ensure the battery connections are secure.
4. In the event of accident damage or failure of any part in the system, the only serviceable items are.

a. ECU
b. Relays (ABS and modulator)
c. Hydraulic modulator
d. Wheel speed sensors.

Hydraulic modulator – To remove
1. Depressurize the hydraulic systems as described in Section G3.
2. Disconnect the battery.
3. Ensure the modulator and surrounding area is thoroughly clean.
4. Disconnect the hydraulic pipes from the modulator and blank the open ports and pipes.
5. Slide the electrical plug upwards from the modulator. Disconnect the main loom connections

from the plug, noting the cable colours and positions.
6. Slacken the nuts securing the modulator to the mounting bracket. Lift the modulator clear of the bracket, taking care to avoid damaging the hydraulic pipes.

Hydraulic modulator – To fit
To fit the hydraulic modulator, reverse the procedure given for removal noting the following.
1. If a new modulator is to be fitted, the rubber mounts must be transposed from the modulator removed.
2. All nuts and setscrews must be torque tightened to the figures quoted in Section G22 and Chapter P.
3. Bleed the system (see Section G5).

Anti-lock braking system – To test
The anti-lock braking system electronic control unit (ECU) has a self-check programme which is activated whenever the car is operating. Any fault detected will cause the system to switch itself off, indicated by illumination of the ANTILOCK warning panel on the facia.

Before the system is checked with the test box (see fig. G6-3), switch off the ignition and then restart the engine. If the warning panel is still illuminated,

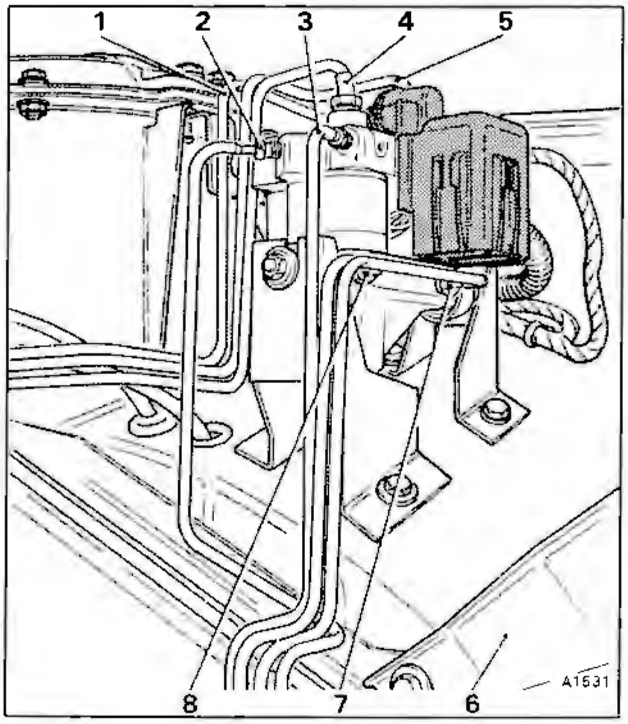


Fig. G6-2 Hydraulic modulator connections
1 Blue pipe to rear brakes
2 Mauve pipe to right-hand front calipers
3 Mauve pipe to left-hand front calipers
4 White pipe to outboard reservoir
5 Black pipe to inboard reservoir
6 Bonnet support bracket
7 Blue pipe to upper distribution valve
8 Mauve pipe to lower distribution valve

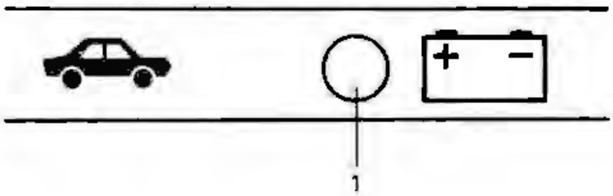
proceed as follows, referring also to the Electrical Manual TSD 4701, Section 9.
1. **Ensure the ignition is switched off** and then disconnect the electrical harness plug from the electronic control unit in the luggage compartment.
2. Connect the 35-way connector lead from the test box (Bosch ABS2 LED KDAS 0003), to the harness plug removed.

All tests are carried out with the ignition switch ON. The ignition must be switched off before removing or replacing the multi-pin plug to the ECU. **The car must not be driven with the test box connected.**

Note The electronic control unit is not checked. The test box checks the following system components.
a. Hydraulic modulator
b. Valve relay
c. Wheel speed sensors
d. Warning lamp
e. Cable harness
f. Connectors
g. Earth connections
h. Brake lamp switch signal
i. Alternator signal.

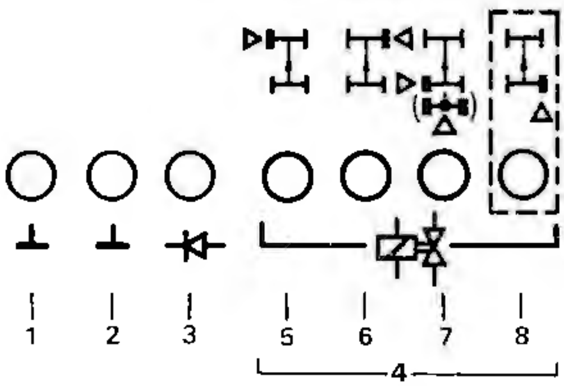
Description of test box symbols
The test box obtains supply voltage from the car's battery.

This supply voltage is monitored during the entire testing sequence and in all programme switch settings. One light emitting diode (LED) is constantly illuminated (1) to indicate that the voltage is sufficient.



Note When checking with the test box, the system(s) are correct when the LED indicators are illuminated (unless stated).

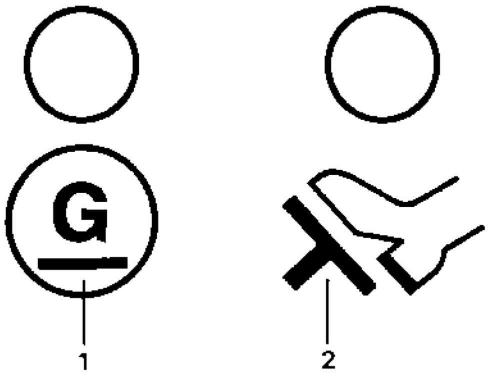
Programme switch position 1



1. LED indicator for earth connection 1.

2. LED indicator for earth connection 2.
3. LED indicator for warning lamp control diode.
4. LED indicators for internal resistances of the modulator solenoid valves and the off position of the valve relay.
5. LED indicator for front left-hand wheel.
6. LED indicator for front right-hand wheel.
7. LED indicator for rear axle (bracketed symbol).
8. Not applicable for 3-channel hydraulic modulator.

Programme switch position 2

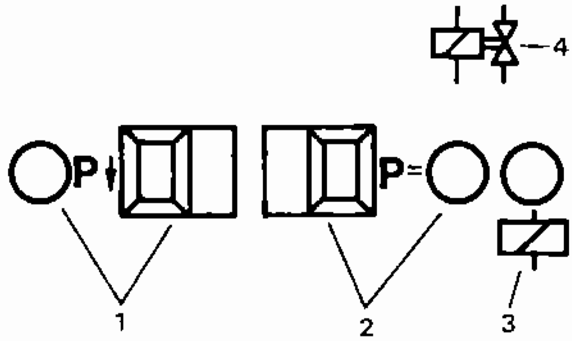


1. LED indicator for alternator connection.
2. LED indicator for stop lamp switch connection.

Programme switch positions 3 and 4

Positions 3 and 4 are not used with this type of anti-lock braking system.

Programme switch position 5



Functional tests of the solenoid valves and valve relay in the hydraulic modulator, and checking that the solenoid valves channel assignments are correct.

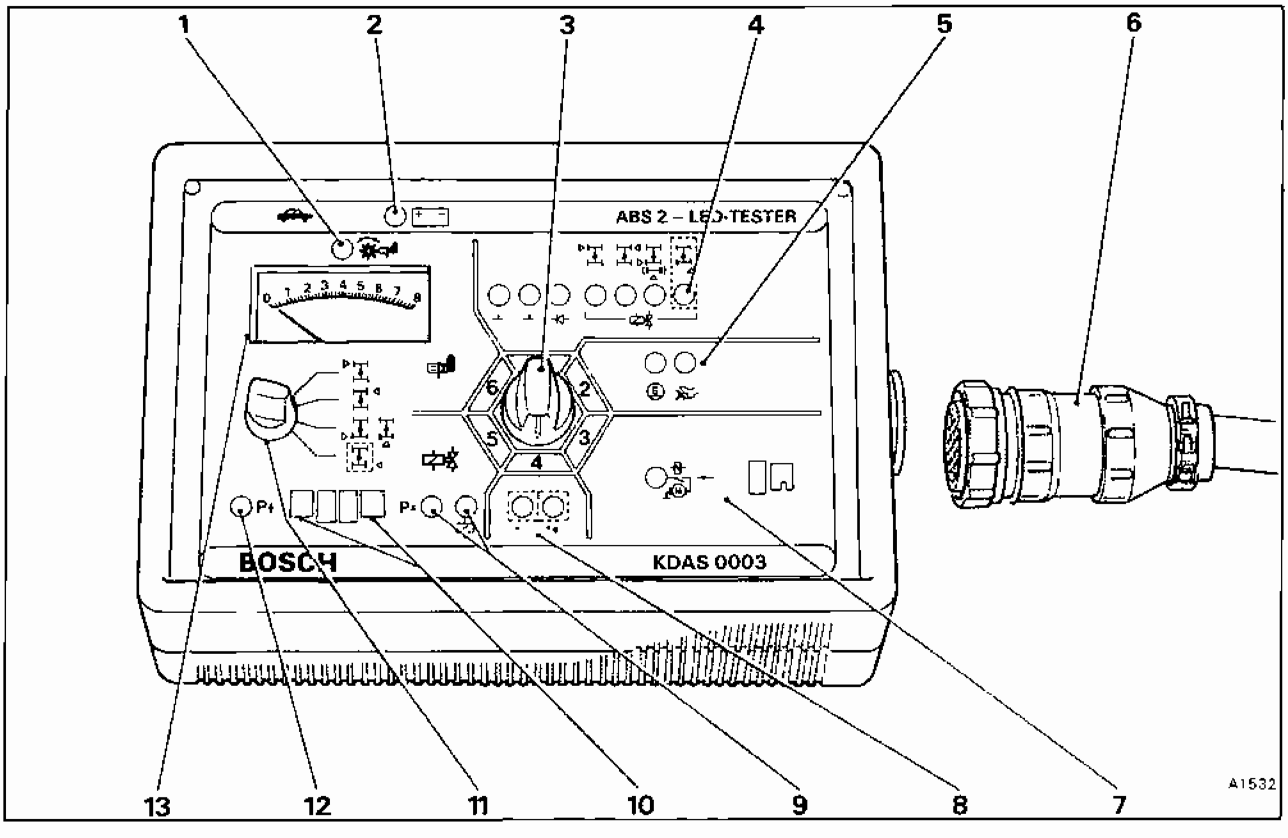
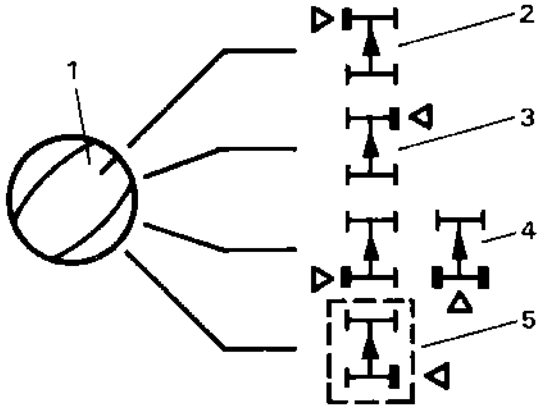


Fig. G6-3 Anti-lock braking system test box (Bosch ABS2 LED KDAS 0003)

1 LED indicator for wheel speed
2 LED indicator for battery voltage
3 Programme selection switch
4 LED indicators for switch position 1
5 LED indicators for switch position 2
6 Adapter lead to ABS wiring harness
7 Switch position 3 (not used)
8 Switch position 4 (not used)
9 LED indicators for switch position 5
10 Push buttons for 'Reduce pressure' and 'Maintain pressure' (switch position 5)
11 Wheel selection switch
12 LED indicator for switch position 5
13 Indicator gauge for switch position 6

1. Push button and LED indicator for the 'Reduce pressure' function. The LED must illuminate **after** operating the push button.
2. Push button and LED indicator for the 'Maintain pressure' function. The LED must illuminate **after** operating the push button.
3. LED indicator for correct functioning of the valve relay. This LED must illuminate continuously when the programme switch is set to position 5.
4. Solenoid valve symbol.

Wheel selection switch



When the programme switch is set to either position 5 or 6, the switch can be adjusted to the wheel to be tested.

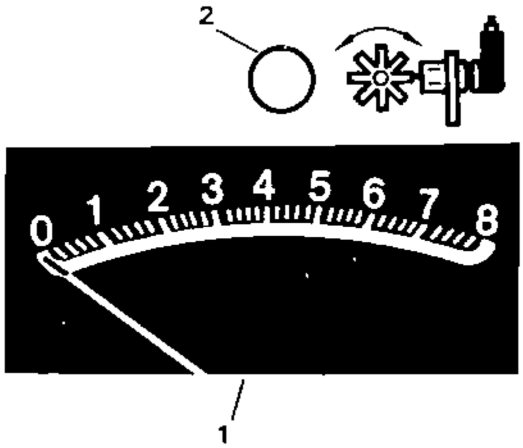
1. Rotary switch for wheel selection.
2. Front left-hand wheel.
3. Front right-hand wheel.
4. Left-hand symbol – Rear left-hand wheel for use with programme switch position 6 (i.e. rear left-hand wheel sensor).

Right-hand symbol – Rear axle for use with programme switch position 5 (i.e. rear axle modulator solenoid).

5. Rear right-hand wheel for use with programme switch position 6 (i.e. rear right-hand wheel sensor).

Not applicable for 3-channel hydraulic modulator when at programme switch position 5.

Programme switch position 6



Checking of the wheel speed sensor signals and for correct connections.

1. Instrument scale.
2. LED indicator for rotary motion of the wheels. This LED illuminates continuously when the test speed is adequate. Only then must the instrument indication be read.

Test procedure
Do not drive the car with the test box connected.

Programme switch position	Items to be tested	Additional requirements	Correct test box indication	Possible cause if incorrect
All settings	Power supply	Ignition on	LED [+ -] illuminates continuously	1. Battery voltage low. 2. Excessive voltage drops. 3. Fuse blown; check fuse on ABS relay, fuse B2 on fuseboard F1. In addition from 1988 model year, fuse in luggage compartment. 4. ABS relay defective.
1	Earth connections. Warning lamp control diode. Solenoid valves internal resistances. Off position and earth connection of valve relay.	Ignition on	All 6 LED indicators illuminate to the same extent	1. LED ⊥ does not illuminate. Check earth connections for discontinuity. 2. LED does not illuminate. ABS warning lamp defective, diode defective, check valve relay earth connections. 3. LED does not illuminate. Check corresponding connectors of solenoid valve and leads. 4. All LED indicators and do not illuminate. Check valve relay earth connection, valve relay defective. 5. Weaker illumination of the LED indicates a contact resistance in the corresponding current path.

Programme switch position	Items to be tested	Additional requirements	Correct test box indication	Possible cause if incorrect
2	Alternator voltage	Ignition on	LED illuminates	1. LED may not extinguish until after engine speed increase (test thus passed). 2. Check lead to alternator terminal. 3. Alternator defective.
		Start engine	LED is extinguished when engine running	
	Stop lamp switch	Ignition on	LED illuminates	1. Check lead to stop lamp switch. 2. Stop lamp switch defective. 3. Lead incorrectly connected to stop lamp switch.
		Operate brake pedal	LED is extinguished	
5	Solenoid valve relay operation (modulator)	Ignition on	LED illuminates	1. Modulator relay defective.
	Solenoid valves in hydraulic modulator functioning and correct connections. **Note** Test each wheel consecutively, keeping to operating sequence.	Jack up the vehicle. Ignition on. Wheel to be tested must be free to rotate by hand. Set the selection switch to the wheel to be tested.		1. Repeat the test with the engine running. 2. Modulator control leads transposed, short or open circuit. 3. Current value not reached (LED P↓ or P=extinguished) because battery voltage is low. Repeat the test with the engine running. 4. Hydraulic modulator defective. 5. Hydraulic modulator pipes transposed.
	'Maintain pressure' function	1. Operate push button P=	LED P= illuminates	
		2. Depress brake pedal	Wheel rotates by hand	
		3. Release push button P=	LED P= is extinguished, wheel locked	
	'Reduce pressure' function	4. Operate push button P↓	LED P↓ illuminates, wheel rotates by hand	
		5. Release push button P↓	LED P↓ is extinguished, wheel locked	
		6. Release brake pedal		
		It is only necessary to check one rear wheel, 'chock' the other wheel when testing		
6	Wheel speed sensors operating correctly and correct connections. **Note** Test each wheel consecutively	Jack up the vehicle. Ignition on. Wheel to be tested must be free to rotate by hand. When testing the rear axle, the wheel not being tested must be held. Set the wheel selection switch to the wheel to be tested.		1. Wheel speed sensor lead incorrectly connected. 2. Wheel speed sensor lead open circuit. 3. Excessive air gap between wheel speed sensor and toothed wheel. 4. Toothed wheel defective or loose. 5. Excessive wheel bearing play.
		Turn the wheel by hand until the LED above the instrument illuminates without flickering (speed approx. 1 rev/second). Then read the instrument indication.		
			Minimum indication must be greater than 4 divisions. Permissible fluctuation; 4% of the maximum indication.	

Hydraulic mineral oil reservoirs

WARNING

Use only hydraulic system mineral oil (LHM) to replenish the braking and levelling systems.

Do not use brake fluids (Castrol RR363, Universal, or any other type). The use of any type of brake fluid, even in very small amounts, will cause component failure necessitating extensive rectification to the braking and levelling systems of the car.

Always ensure before fitting any seals, hoses, pipes, etc., that they are suitable for a mineral oil system. For details of correct component identification reference should be made to Section G3 of this Workshop Manual.

Always ensure that two sealed containers of **hydraulic system mineral oil (LHM)** are fitted in the luggage compartment.

Always ensure that no foreign matter enters the systems when work is being carried out.

Introduction

The two hydraulic mineral oil reservoirs are situated on the left-hand valance of the engine compartment. Mineral oil for System 1 is contained in the inboard (large) reservoir and for System 2 in the outboard (small) reservoir.

To indicate a low mineral oil level, each reservoir contains a float actuated reed switch located inside the float pillar. This switch will cause a facia warning lamp to illuminate should the mineral oil in the reservoir fall below a preset level.

The reservoir filler device contains a spring loaded ball valve. The valve is opened by the filler nozzle situated on the purpose designed containers of hydraulic system mineral oil (LHM).

Two purpose designed containers, each containing 500 ml (17.5 fl oz) of mineral oil, are supplied with each new car. These containers are located within the luggage compartment, behind a trim panel. Before returning the car to a customer always ensure that two unused containers are supplied.

Important Do not refill an empty container.

Providing that the correct precautions are taken against the ingress of dirt into the systems and that perfectly clean hydraulic system mineral oil is always used when topping-up, the reservoirs will only require servicing at the intervals specified in the Service Schedule Manual, TSD 4702.

After any work is carried out on the reservoirs always ensure that the tamperproofing (wire and seal), and warning panel are fitted correctly.

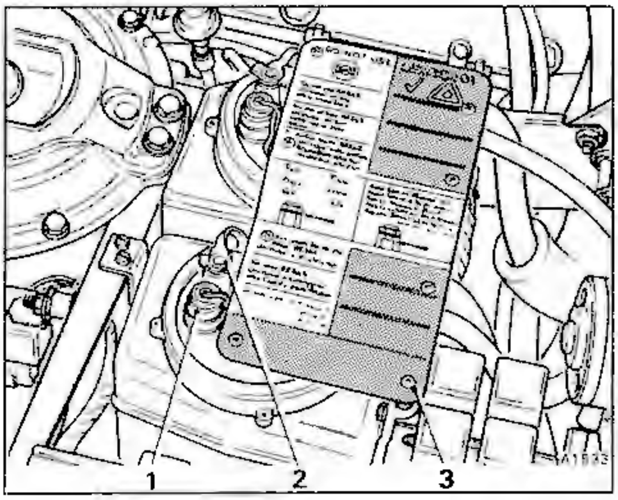


Fig. G7-1 Hydraulic system mineral oil reservoirs
1 Level indicator sight glass
2 Filler connection
3 Multi-lingual warning panel

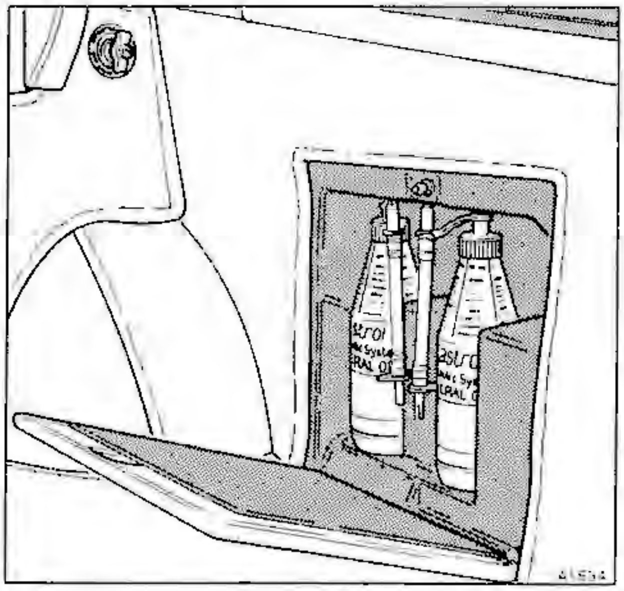


Fig. G7-2 Hydraulic system mineral oil bottle stowage (Four door cars)

Hydraulic mineral oil reservoirs – To remove
(see figs. G7-1 and G7-5)

The reservoirs must be removed from their support brackets together.

1. Depressurize the hydraulic systems as described in Section G3.
2. Disconnect the battery.

3. Remove the multi-lingual warning panel assembly from the top of the reservoirs. Ensure that the tops of the reservoirs are wiped clean.

4. Disconnect the electrical leads from the top of each reservoir.

5. Remove the clips securing the pipes to the inner longeron and then disconnect the pipes from the tops of the reservoirs. Four of the pipes have flexible rubber hose connections, the others lift directly from the reservoir manifold.

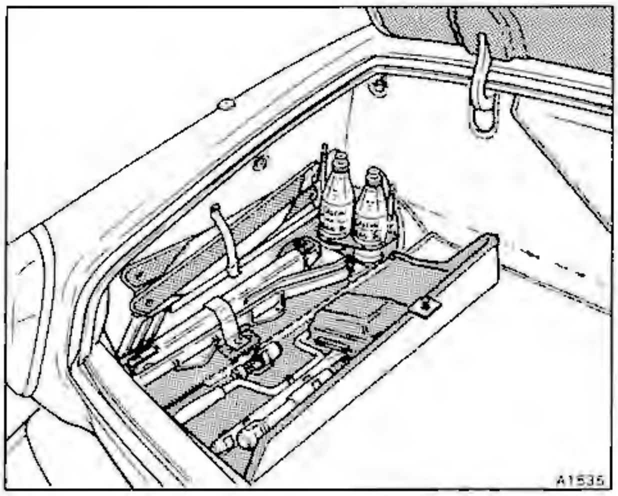


Fig. G7-3 Hydraulic system mineral oil bottle stowage (Corniche/Continental)

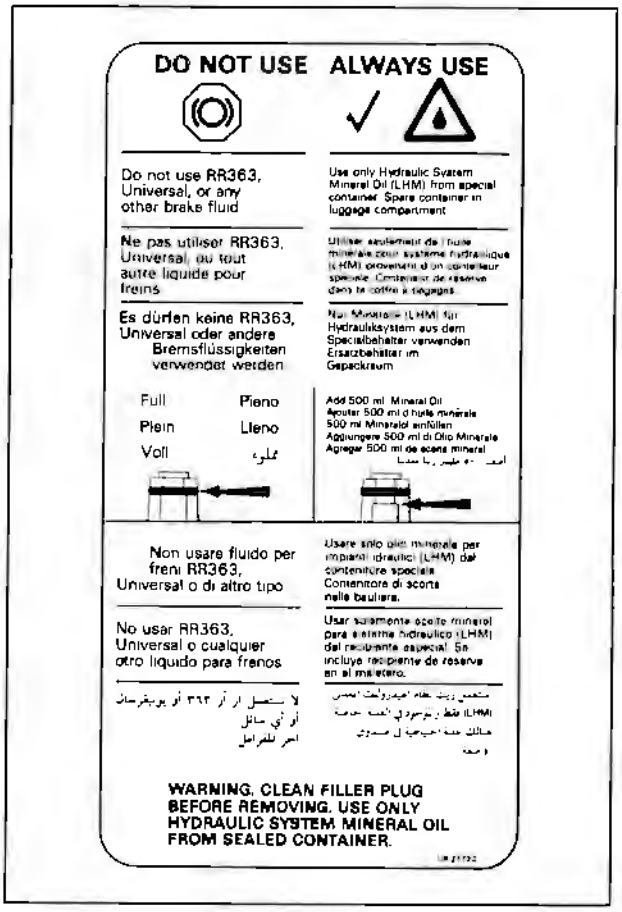


Fig. G7-4 Hydraulic system mineral oil multi-lingual warning panel

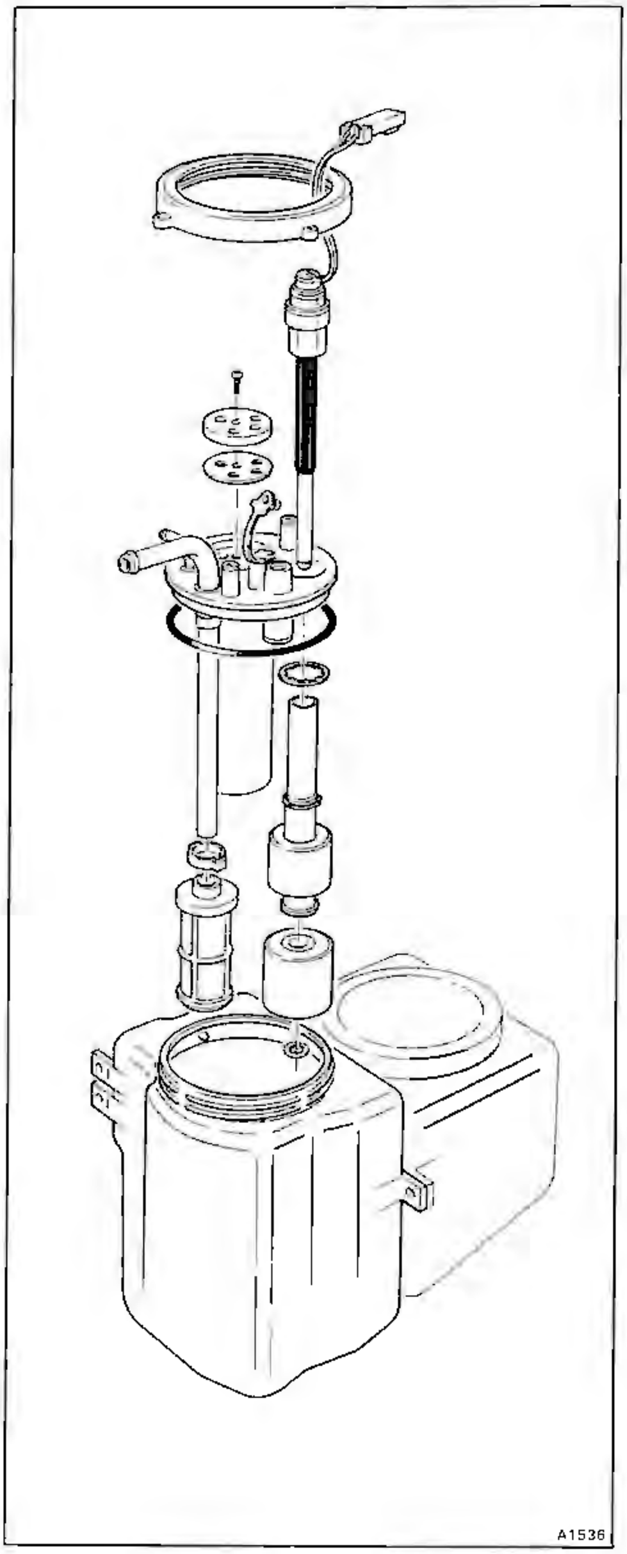


Fig. G7-5 Hydraulic system mineral oil reservoir

6. Blank off the pipe ends and the circular manifold covers in the reservoir lids.
7. Remove the two drill screws securing the reservoir bracket to the spring cover support bracket.
8. Remove the three setscrews securing the reservoirs to the side support brackets. Two setscrews secure the reservoirs to the bracket between the spring cover and the bulkhead, and one setscrew secures the small reservoir to the support bracket below the electrical relays.
9. Lift the reservoir assembly clear of the brackets, taking care not to damage any pipes.

Reservoirs – To dismantle, clean, and assemble
(see fig. G7-5)
1. Remove the reservoirs as described under Hydraulic mineral oil reservoirs – To remove.
2. Remove the tamperproofing wire and seal between the two reservoirs.
3. Remove the setscrew securing the two reservoirs together.
4. Turn each reservoir over and drain the mineral oil into a container.
5. Using tool RH 9885 remove the locking ring securing the reservoir lid.
6. Lift the lid from the reservoir, noting that it will only fit one way into the reservoir. Discard the sealing ring.
7. Remove the star washer from the base of the float assembly shaft. Withdraw the floats and green indicator stem.

Note The bottom float has a magnet in the **top** face. Ensure it is fitted correctly when assembling.

8. The sight glass/float pillar assembly is a serviceable item. The float pillar is bonded to the sight glass, which is an interference fit in the reservoir lid. Therefore, the float pillar assembly should only be removed from the reservoir lid in the event of the reed switch being inoperative.

To remove the float pillar, remove the star washer from the base of the sight glass on the underside of the reservoir lid. Push the sight glass/float pillar assembly out of the reservoir lid. Discard the sight glass/float pillar.

9. Remove the reservoir filter from the outlet pipe by removing the crimped securing clip.

Note When removing the outlet filter, care must be taken to ensure that the fine mesh of the filter is not torn or damaged.

Care must also be taken during dismantling and cleaning to ensure that the reed switch stem is not bent or damaged, as this will cause the switch to be inoperative.

10. Remove the screw securing the manifold in each reservoir lid. Pull out the manifold and rubber seal. Ensure the manifold and seal are kept with their respective reservoir.

Note The seals are not interchangeable between large and small reservoirs.

11. Thoroughly clean all parts with petroleum ether (120/160°C), drying them with dry compressed air.

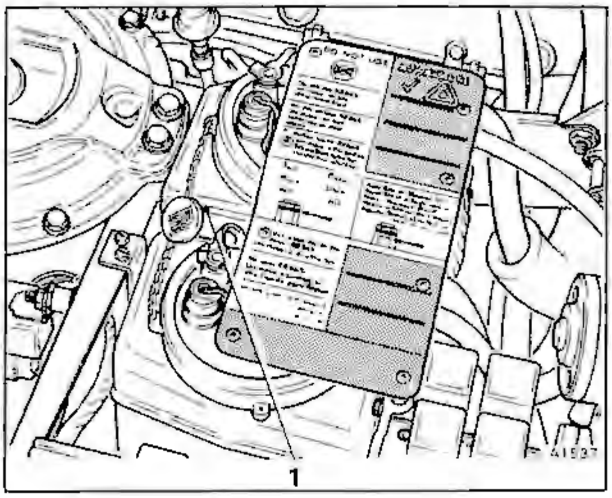


Fig. G7-6 Hydraulic reservoirs tamperproofing
1 Wire and seal

Ensure that all holes and pipe outlets are carefully cleaned and have blanks fitted.
12. Assemble the reservoirs by reversing the dismantling procedure noting the following.
13. Always use a new sealing ring on the reservoir lid, and new star washers.
14. Ensure the slot in the reservoir lid engages the locating spigot on the inside of the reservoir neck.
15. The reservoir lid requires **one full turn** of thread engagement. Ensure the ears on the lid of the small reservoir will not foul on the large reservoir when they are secured together.
16. Fit a new tamperproofing wire and seal between the reservoirs (see fig. G7-6).

Reservoirs – To fit and top-up
Fit the reservoirs by reversing the procedure given for removal noting the following.
1. When the reservoirs have been fitted, ensure that the bundy pipes are pushed fully into the reservoir manifold (e.g. the swaged part of the pipe engages with the rubber seal).
2. Ensure the multi-lingual warning panel is fitted.
3. Fill the reservoirs with clean hydraulic system mineral oil (see Chapter D), until the top of the green indicator tube is approximately 3 mm (0.125 in) below the bottom edge of the black ring on the indicator sight glass.
4. Run the engine for approximately four minutes with the car unladen, then top-up the reservoirs until the top of the green indicator tube is just **above** the top of the black ring on the indicator sight glass, [approximately 1 to 2 mm (0.040 to 0.080 in)]. Never allow the mineral oil level to fall below the minimum level (e.g. top of the green indicator tube **below** the bottom of the indicator sight glass).
5. Check for leaks, especially around all pipes, connections, etc., which have been disturbed.
6. The hydraulic systems must then be bled completely as described in Section G5.

Hydraulic pumps

Introduction
The mineral oil hydraulic pumps can be distinguished from those using conventional brake fluid, in that each pump has a green disc fitted beneath the top adapter (see figs. G8-1 and G8-2).

Internally the mineral oil pump has a larger diameter plunger than the pumps using RR 363 brake fluid. Also, the seals are made of material that meets mineral oil requirements.

The brake pump push rod has a collapsible section of increased diameter. The top edge of the push rod is chamfered for indentification purposes (see fig. G8-1).

Never fit a brake pump push rod from a conventional (RR 363) brake fluid system as a replacement.

When overhauling a mineral oil brake pump always ensure that sealing rings bearing mineral oil identification marks are fitted (see Section G3).

Hydraulic pump housing sealing rings – To renew (see fig. G8-2)
If hydraulic system mineral oil leakage occurs from a brake pump housing, it is possible to renew the two sealing rings with the pump in position.

1. Depressurize the hydraulic systems as described in Section G3.
2. Ensure that the pump and surrounding area is thoroughly cleaned.
3. Compress the rubber hose section of the hydraulic pump low pressure inlet pipe to prevent mineral oil flow. Remove the hose from the pump inlet pipe and blank the end of the hose.
4. Disconnect the high pressure outlet and low pressure inlet pipes from the hydraulic pump.
5. Remove the circlip from the top of the pump. Withdraw the outer housing upwards and off the pump.
6. Discard the two sealing rings. Fit new sealing rings after lubricating with clean hydraulic system mineral oil of the approved type.
7. Fit the pump outer housing with care, aligning the port with the inlet pipe. Press the housing firmly into position, then fit the circlip (see fig. G8-2).
8. Prime the pump with an approved hydraulic system mineral oil. Connect the low pressure feed and high pressure outlet pipe to the pump.
9. Top-up the reservoir(s) with an approved hydraulic system mineral oil (see Chapter D). Bleed the hydraulic systems as described in Section G5.

Hydraulic pump – To remove

1. Carry out Operations 1 to 5 inclusive of, Hydraulic pump housing sealing rings – To renew.
2. Using the special box spanner RH 8428, unscrew and remove the pump from its pedestal on the tappet chest cover. Blank off the pedestal against the ingress of dirt.

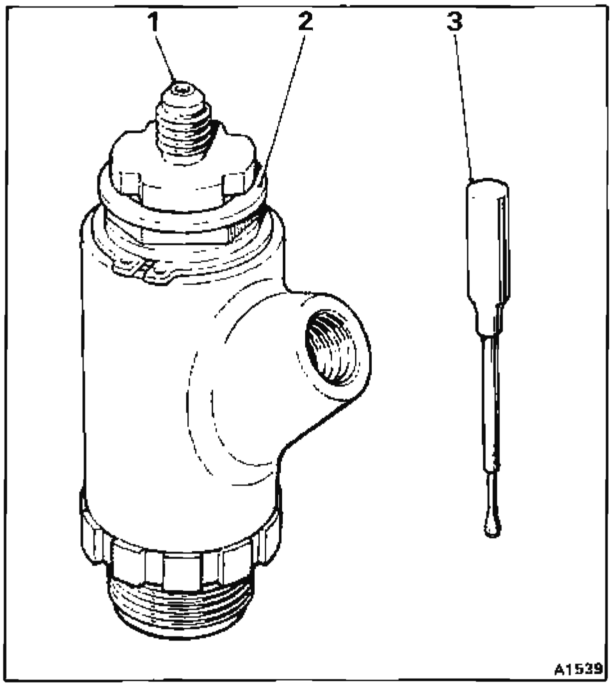


Fig. G8-1 Mineral oil hydraulic pump identification features
1 Smaller pipe connection
2 Green disc
3 Chamfered end face – Push rod

Note The pump must not be removed by using the top adapter as a spannering point.

Hydraulic pump – To dismantle (see fig. G8-2)
When two pumps are being dismantled the components from each pump must not be interchanged.

1. Release the lock-nut situated at the top of the brake pump.
2. Remove the adapter from the top of the pump and withdraw the non-return valve assembly from the bore.

Note Special tools RH 9814 and RH 9844 will be required.

Gentle use of a small screwdriver may be necessary to assist removal of the chamfered washer. The washer should be discarded and a new one fitted on assembly.

3. Remove the inlet valve ring, spacer ring, and conical valve spring.
4. From the lower end of the pump, remove the circlip. Withdraw the plunger and spring.

5. Carefully withdraw the plunger barrel from the pump body.

Note The barrel and plunger are matched ground components and are **not** interchangeable.

6. Remove and discard the three 'O' rings from the pump body.

7. To dismantle the non-return valve assembly, remove the circlip, push out the valve from the outer body and collect the spring, end stop, and valve.

Hydraulic pump components – To clean and inspect
Ensure that all tapped holes are free from foreign matter and slivers of thread which might break off during assembly and become entrapped in the hydraulic system. One method of achieving this is to screw slave adapters or pipe nuts down the threads before thoroughly cleaning the components in petroleum ether (120/160°C), and drying with dry compressed air, not with any type of cloth.

It is important that the seating of the valves is correct and that the finely machined barrel and plunger are not scored or damaged.

Under normal circumstances after a thorough cleaning and the introduction of a new set of sealing rings, the only parts that might need renewal are the small coil springs.

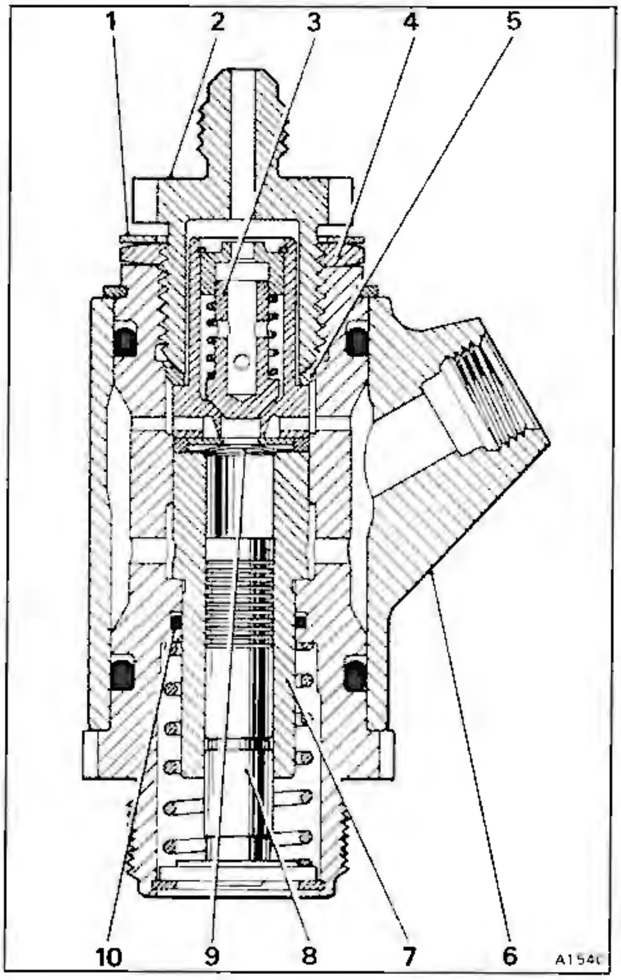


Fig. G8-2 Hydraulic pump
1 Identification disc
2 Adapter – high pressure outlet
3 Non-return valve
4 Lock-nut
5 Chamfered ring
6 Outer housing (reversed for front pump)
7 Pump barrel
8 Plunger
9 Inlet valve spring
10 Sealing ring

Hydraulic pump – To assemble (see fig. G8-2)
Ensure that all sealing rings used, are for use with hydraulic system mineral oil.

1. Lubricate all parts including the sealing rings with an approved hydraulic system mineral oil (see Chapter D), prior to fitting in their respective positions.
2. Fit the small 'O' ring into position in the centre bore of the pump body.
3. Insert the plunger barrel into the pump body, pressing it through the sealing ring until it abuts the shoulder.
4. Insert and locate the spacer ring; fit the valve spring (crowned face towards the inlet valve), and the inlet valve into position adjacent to the barrel head. Ensure that the seating face of the valve is free from damage marks, otherwise the efficiency of the pump will be reduced.
5. Assemble the non-return valve, by reversing the procedure given for dismantling. Ensure that the valve is fully seated and the circlip is correctly located in its groove. The end stop should be drawn upwards to abut the circlip.
6. Fit the non-return valve assembly, larger diameter leading, into the pump body adjacent to the spacer ring.
7. Fit a new chamfered sealing ring, small bore diameter leading, into the pump body bore so that it abuts the shoulder of the non-return valve assembly.
8. Fit the adapter, identification disc, and lock-nut to the top of the pump body. Torque tighten the adapter to the figures quoted in Section G22. Special tools RH 9814 and RH 9844 will be required. Blank off the adapter.
9. Fit the coil spring into the lower end of the pump body.
10. Fit the spring to the barrel plunger and carefully insert the plunger into the bore of the barrel.
11. Depress the plunger against spring pressure sufficiently to enable the circlip to be fitted into its location.
12. Fit the two 'O' rings to the outside of the pump body, after lubricating with suitable mineral oil (see Chapter D).
13. Fit the pump outer housing with care. Press the housing firmly into position, then fit the circlip.

Note The front pump outer housing inlet port faces downwards, the rear pump inlet port faces upwards.

Hydraulic pump – To fit

To fit the pumps to the tappet cover, reverse the procedure given for removal noting the following.

1. Using the special box spanner RH 8428, torque tighten the pumps to the figures given in Section G22.

Note The top adapter must not be used as a spannering point.

2. Bleed the hydraulic systems as described in Section G5. Check all disturbed pipe connections for leaks.

Hydraulic pumps – To test (on the car)

1. Depressurize the system as described in Section G3.
2. Disconnect the accumulator to reservoir return pipe from the appropriate reservoir. Attach a tube onto the end of the pipe and secure the other end of the tube in a clean measuring vessel.
3. Open the bleed screw on the accumulator.
4. Ensure that the appropriate reservoir is full and then start the engine.
5. Hydraulic system mineral oil should flow from the tube in a series of spurts, coinciding with each revolution of the camshaft. The rate of flow should be approximately 300 ml per minute, at an engine speed of 1000 rev/min.
6. If hydraulic system mineral oil does not flow, or the pumped quantity is below requirements, the pump should be removed and overhauled.

Hydraulic accumulators

Introduction
The hydraulic accumulators are mounted at the front of the crankcase, on the 'A' bank side of the engine.

The only exception being the Bentley Turbo R, where the accumulators are mounted at the rear of the crankcase, on the 'B' bank side of the engine.

The front accumulator (vertically mounted) supplies the No. 1 Hydraulic system; the rear accumulator (horizontally mounted) supplies the No. 2 Hydraulic system.

Both accumulators have an internal bleed screw incorporated into the valve housing. Bleeding or depressurizing an accumulator is achieved by slackening the bleed screw (see figs. G9-1 and G9-2), approximately one full turn. This allows the hydraulic system mineral oil to return internally through the valve housing to its respective reservoir.

In the event of an accumulator failure, a sphere, accumulator valve assembly, and 'O' rings can be obtained as individual items. Alternatively, a complete accumulator can be obtained.

Prior to despatch from the manufacturer, all spheres are charged to a pressure of between 60 bar and 64 bar (870 lbf/in^2 and 928 lbf/in^2). The charge pressure (in bar) is stamped on the screw head located at the top of the sphere. Whenever a sphere is found to be below a working pressure of 31 bar (450 lbf/in^2) a replacement sphere must be fitted. **Never attempt to recharge a sphere.**

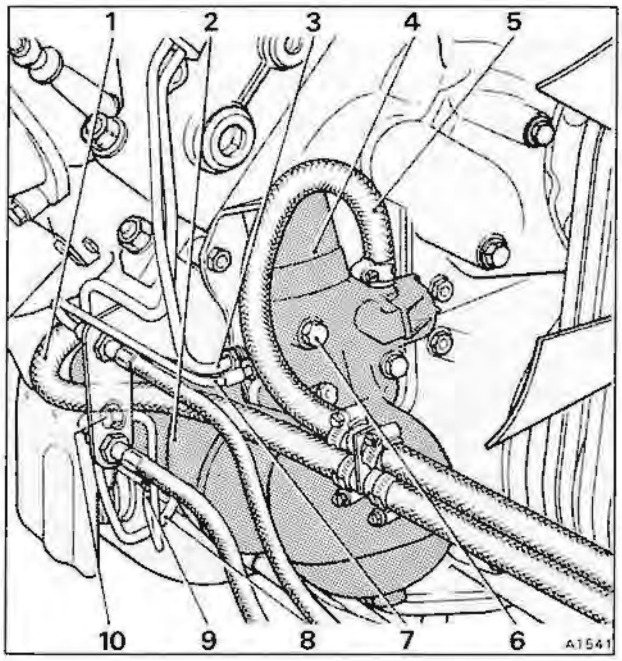


Fig. G9-1 Hydraulic accumulators (excluding Bentley Turbo R)
1 Low pressure return to reservoir
2 Accumulator (No. 2 system)
3 High pressure inlet from pump
4 Accumulator (No. 1 system)
5 Low pressure return to reservoir
6 Bleed screw
7 High pressure outlet to upper distribution valve and suspension struts
8 High pressure inlet from pump
9 High pressure outlet to lower distribution valve
10 Bleed screw

Hydraulic accumulator sphere – To renew whilst in position (see figs. G9-1 and G9-2)
On cars other than the Bentley Turbo R, to remove the sphere from No. 2 system the sphere from No. 1 system will have to be removed first. On Bentley Turbo R cars to remove the No. 2 system sphere, the **complete** accumulator of No. 1 system will have to be removed, refer to Hydraulic accumulator – To remove.
1. Depressurize the hydraulic system(s) as described in Section G3.
2. Carefully hold the valve body of the accumulator. Then, using a suitable chain wrench located around the circumference of the sphere, unscrew and remove the sphere from the valve housing. Discard the sealing ring (see fig. G9-3).
3. Locate a new sealing ring lubricated with clean hydraulic system mineral oil into the valve body.
4. Fit the new sphere to the valve body and torque tighten to the figures quoted in Section G22.
5. After fitting the sphere, top-up the reservoir(s) with a recommended hydraulic system mineral oil (see Chapter D). With the engine running, check for leaks.
6. Test the accumulator(s) as described in Hydraulic accumulator – To test.
7. Bleed the hydraulic system(s) as described in Section G5.

Hydraulic accumulator – To remove
It should be noted that the high pressure pipe connections on the accumulators are of the rubber sleeve type (see Section G4). All pipes and ports should have blanks fitted when disconnected.
1. Depressurize the hydraulic system as described in Section G3.
2. Disconnect the high pressure outlet pipe (red or orange) from the accumulator and connector block; remove the pipe.
3. Disconnect the high pressure inlet pipe from the accumulator.

Note On all cars except the Bentley Turbo R when removing a front accumulator it will be necessary to detach the outlet pipe from its mounting bracket. This allows the inlet pipe to be withdrawn from the accumulator port.

4. Fit a hose clamp to the hose of the accumulator return pipe. This prevents the flow of hydraulic system mineral oil from the reservoir.

5. Unscrew the worm drive clip on the accumulator return pipe connection and withdraw the hose from the accumulator.

6. Remove the setscrew from the mounting bracket at the end of the accumulator.

7. Support the accumulator, then remove the two remaining securing bolts. Lower the accumulator from the engine.

Hydraulic accumulator – To fit

Fit the accumulator to the engine by reversing the procedure given for removal, noting the following.

1. When fitting the high pressure pipe connections, new rubber sleeves must be fitted to the pipe ends.

2. All setscrews and pipe connections must be torque tightened in accordance with the figures quoted in Section G22 and Chapter P.

3. After fitting, top-up the reservoir(s) with a recommended hydraulic system mineral oil (see Chapter D). With the engine running, leak check all joints and unions which have been disturbed.

4. Test the accumulator as described in Hydraulic accumulator – To test.

5. Bleed the hydraulic system(s) as described in Section G5.

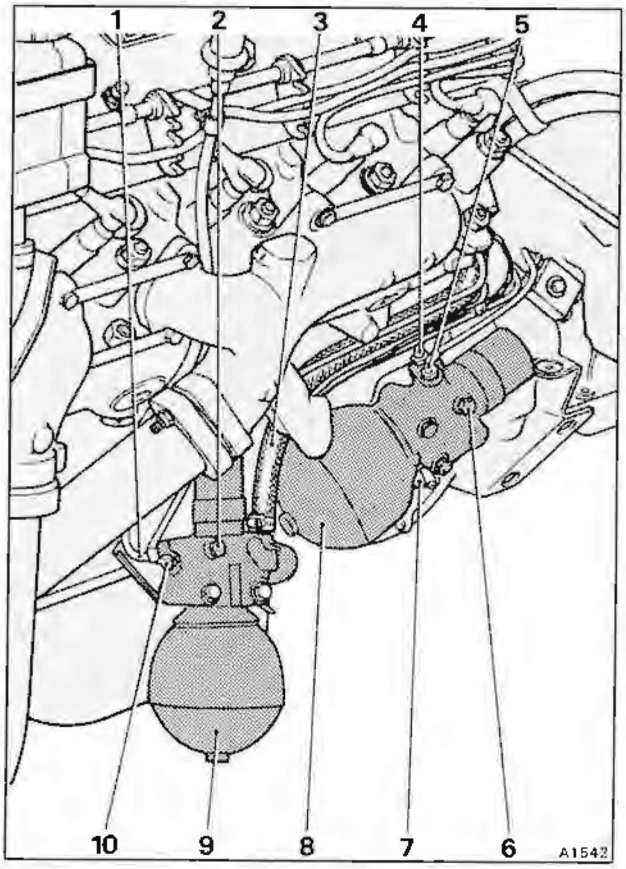


Fig. G9-2 Hydraulic accumulators (Bentley Turbo R)
1 High pressure inlet from pump
2 Bleed screw
3 Low pressure return to reservoir
4 High pressure inlet from pump
5 High pressure outlet to lower distribution valve
6 Bleed screw
7 Low pressure return to reservoir
8 Accumulator (No. 2 system)
9 Accumulator (No. 1 system)
10 High pressure outlet to upper distribution valve and suspension struts

Accumulator valve housing assembly – To dismantle (see fig. G9-4)

1. Remove the accumulator as described under Hydraulic accumulator – To remove.

2. Carefully hold the valve housing in a vice. Using a suitable strap spanner located around the circumference of the sphere, unscrew and remove the sphere from the valve housing. Discard the sealing ring (see fig. G9-3).

3. Remove the setscrew securing the connection valve retaining plate (see item 3). Remove the plate and valve ball.

4. Remove the bleed screw and ball (see item 1). Remove and discard the 'O' ring from the bleed screw.

5. Position the valve housing onto a press and depress the spring retaining plug (see item 2) sufficiently to allow the snap ring to be removed.

6. Release the pressure on the retaining plug and remove the plug, adjusting washers (if fitted), spring, and spring retainer. Remove and discard the 'O' ring from the retaining plug.

7. Remove the connection valve (see item 3). The valve can only be removed from the sphere end of the housing.

8. Position the housing onto a press with the cut-out spring housing (see item 4) located under the spindle. Apply sufficient pressure to retain the housing when the retaining screws are removed.

9. Remove the screws and carefully ease off the pressure.

10. Remove the spring housing, adjusting shims (if fitted), spring, spring seating, and the cut-out valve. The cut-out valve contains a stop ring and therefore can only be removed in the direction of the cut-out chamber. Remove and discard the sealing ring from the cut-out chamber.

11. Thoroughly clean all components with petroleum ether (120/160°C). Dry with dry compressed air. Do not use any type of cloth.

Accumulator valve housing assembly – To assemble (refer to fig. G9-4)

During assembly, ensure that all components are handled with care. Also, meticulous care must be taken during assembly to ensure that complete cleanliness is maintained.

1. Fit a new 'O' ring to the bleed screw (see item 1).

Inspect the ball and if not damaged, place the ball onto its seating. If the ball is damaged, replace with a new one. Screw in the bleed screw; do not overtighten.
2. Lubricate the connection valve (see item 3) with clean hydraulic system mineral oil and then fit the valve into the body ensuring that it slides into position.
3. Fit a new 'O' ring to the spring retaining plug (see item 2). Fit the spring retainer, spring, adjusting washers (if previously fitted), and the spring retaining plug. Position the retaining plug under a press and depress the plug sufficiently to enable the snap ring to be fitted. Remove the valve housing from the press.
4. Inspect the connection valve ball (see item 3) and if not damaged place the ball onto its seating. If the ball is damaged, replace with a new one. Fit the connection valve retaining plate (see item 3) and secure with the setscrew.
5. Inspect the cut-out valve (see item 4) to ensure that the stop ring is fitted. Lubricate the cut-out valve with clean hydraulic system mineral oil and then fit the valve into position.
6. Fit a new sealing ring (see item 4) into the cut-out chamber.

Position the valve housing onto a press and then fit the spring seating, spring, adjusting shims (if previously fitted) and spring housing. Apply sufficient pressure onto the spring housing to enable the two retaining screws to be fitted. After tightening the screws remove the valve housing from the press.
7. Lubricate a new sealing ring (see item 5) with clean hydraulic system mineral oil and then fit the ring into position.
8. Fit the sphere to the valve body and torque tighten to the figures quoted in Section G22.
9. Fit the accumulator(s) as described under Hydraulic accumulator – To fit.

Hydraulic accumulator – To test
1. Depressurize the hydraulic system as described in Section G3.
2. Fit the pressure gauge RH9727 into the service points of the relevant system by means of a suitable high pressure pipe. The service points are shown in Section G5.
3. Start the engine. The gauge needle should immediately rise to approximately 62 bar (900 lbf/in²) on a new sphere, indicating the nitrogen gas pressure in the accumulator sphere. The pressure should then slowly rise to between 165 bar and 180 bar (2393 lbf/in² and 2610 lbf/in²). At this pressure the accumulator cut-out valve should actuate and the pump cease to charge the accumulator.
4. After the cut-out pressure has been reached, note the pressure to which the gauge settles. This settling takes up to one minute and the pressure should not be more than 10 bar (150 lbf/in²) below the cut-out pressure. The pressure should then remain steady unless the brake pedal is applied or the levelling system actuated.
5. Fit a bleed tube onto the bleed screw of the gauge connecting pipe. Open the bleed screw and allow the pressure gauge reading to fall. When the pressure has fallen to between 140 bar and 155 bar (2030 lbf/in² and 2248 lbf/in²) the accumulator control valve should allow the hydraulic pump to recharge the accumulator.

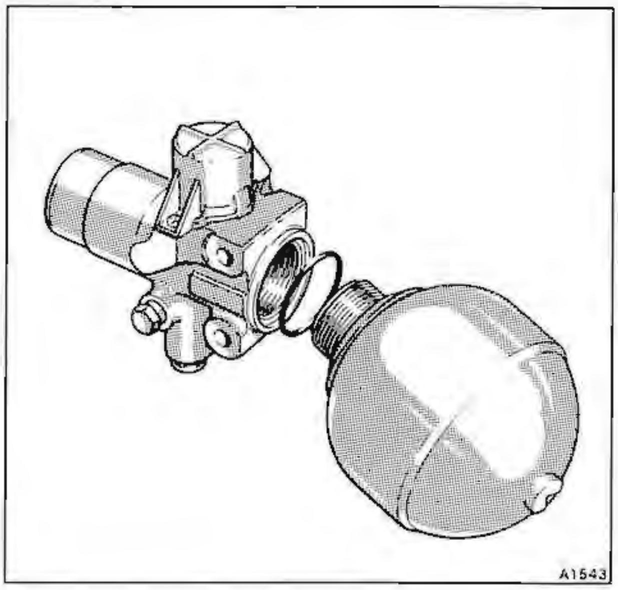


Fig. G9-3 Hydraulic accumulator with sphere removed

6. If, on first starting the engine, the pressure gauge needle fluctuates violently, rapidly climbs to 172 bar (2500 lbf/in²) and then immediately falls to zero on application of the brake pedal, complete loss of nitrogen gas pressure from the accumulator sphere is indicated.
7. In the event of the nitrogen gas pressure of the accumulator being less than 31 bar (450 lbf/in²) (refer to Operations 3 and 6) the accumulator sphere must be renewed.
8. If the cut-in and cut-out pressures of the accumulator are outside the limits quoted in Operations 3 and 5 the accumulator valve assembly must ba renewed.
9. If the pressure continues to fall after the accumulator has reached the cut-out pressure of between 165 bar and 180 bar (2393 lbf/in² and 2610 lbf/in²) and then settles, an internal leak is indicated.
10. If observations of the gauge show that the pump is still pumping (needle fluctuating with the pump pulses) without giving a rise in pressure, then there is a leak equal to the pump flow at that pressure. Pump 'cut-out' indicated by the change in the audible note of the pump, can be heard if the end of the engine dipstick is placed on top of the pump and used as a hearing aid.

To verify an accumulator internal leak, depressurize the system and remove the gauge from the service point. Secure the service point to withstand hydraulic pressure.

The following action separates the accumulator from the rest of the system and allows the

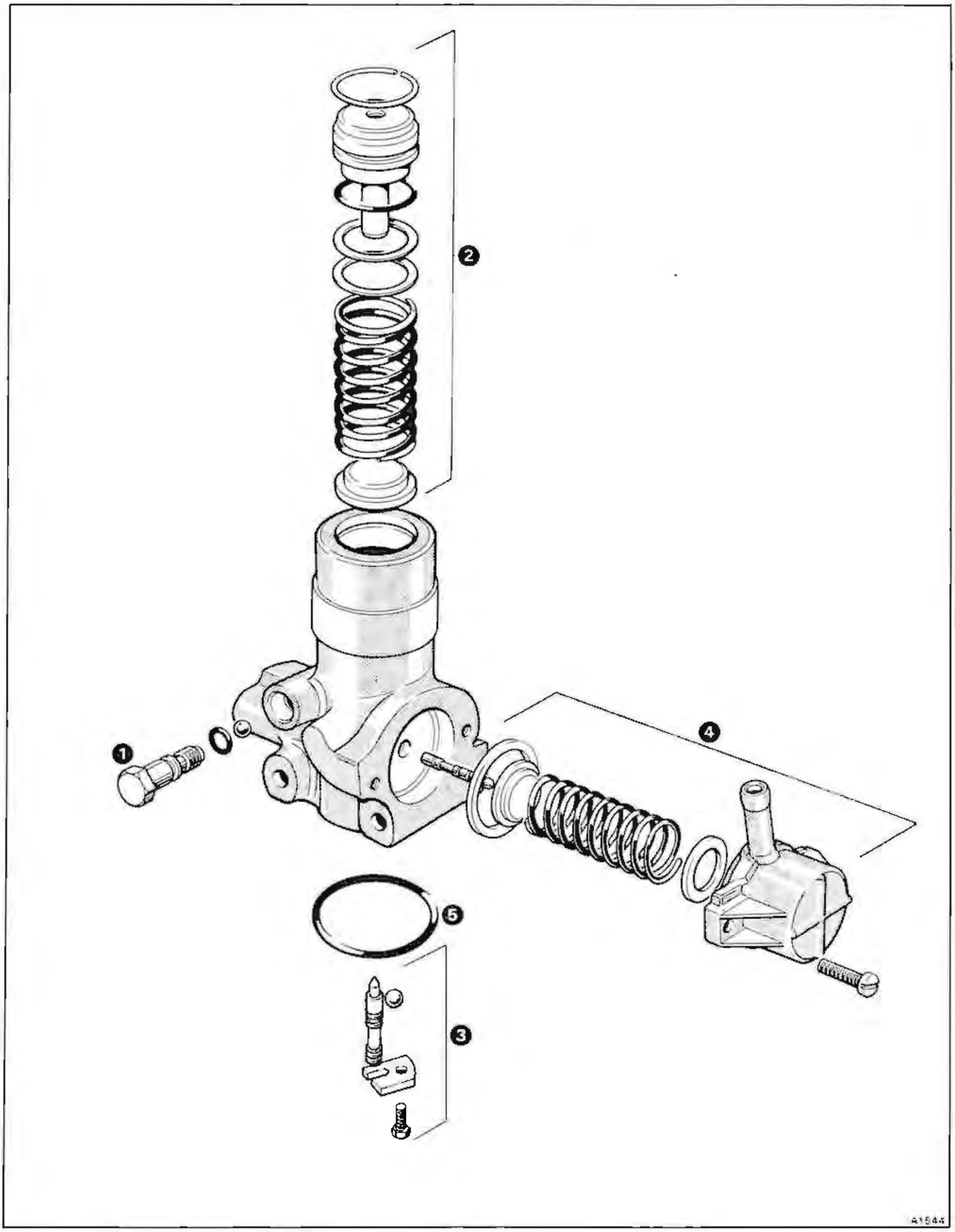


Fig. G9-4 Accumulator valve housing assembly

1 Bleed screw, 'O' ring, and seating ball
2 Valve housing, retaining plug, and associated components
3 Connection valve and associated components
4 Cut-out housing and associated components
5 'O' ring - Accumulator valve housing to sphere

accumulator and hydraulic pump to be checked thoroughly.

Disconnect the 'accumulator to frame' high pressure steel braided hydraulic hose from the junction block located at the engine end. Blank off the steel braided hydraulic hose.

Fit the pressure gauge RH9727 into the junction block. Start the engine and observe the pressure. If the symptoms persist (check that the accumulator bleed screw is sealing correctly), the accumulator valve assembly has an internal leak and the valve assembly should be renewed. If however, the gauge now behaves correctly and the pump can be heard to cut-out, the leakage is occurring downstream and a component isolating procedure should be undertaken.

The component isolating procedure necessary to locate the fault, consists of depressurizing the systems, then removing or blanking off the pressure feed to the various components in turn and repeating the test procedure.

The pressure feeds to the components can be readily identified from the colour coding chart (see Section G4).

Note Always ensure that the mineral oil in the reservoirs is just below the black line on the indicator sight glass at all times during the test procedure.

When a unit has been blanked off, before removing the blank, the systems must be depressurized either by continuous system operation with the engine switched off, or by bleeding the appropriate accumulator until it is depressurized.

After tests have been carried out involving blanking off of components, all blanks should be removed and the components reconnected. The systems should then be bled in accordance with the information given in Section G5.

Deceleration conscious pressure limiting valve

Introduction
The deceleration conscious pressure limiting valve is non-adjustable and must not be serviced other than for the renewal of valve seals.

If a valve is found to be faulty and renewal of the valve seals does not rectify the problem, it will be necessary to fit as a replacement, a complete deceleration conscious pressure limiting valve.

On cars fitted with an anti-lock braking system, the deceleration conscious pressure limiting valve is mounted on the left-hand side of the car, rearward of the central crossmember.

On cars not fitted with an anti-lock braking system, the valve assembly is mounted at the rear of the brake actuation assembly.

To enable the valve to be identified as a hydraulic system mineral oil component, the body of the valve is coloured green and a green identification tab is fitted to the valve bleed screw.

Under no circumstances should a complete valve assembly or seals for use with conventional brake fluid (i.e. RR363) systems be fitted, as a replacement.

During dismantling and assembly, cleanliness of components is of the utmost importance.

Deceleration conscious pressure limiting valve – To remove
1. Place the car on a ramp.
2. On cars not fitted with an anti-lock braking system, remove the undershield protecting the breke actuation linkage.
3. Depressurize the hydraulic systems as described in Section G3.
4. Disconnect the two pipes from the pressure limiting valve; blank off the pipe ends and valve ports.
5. On cars not fitted with an anti-lock braking system, remove the split pins and nuts from the two valve mounting bolts. Withdraw the bolts and remove the valve and distance pieces.

On left-hand drive cars the angular end plate must be removed from the mounting bolts.
6. On cars fitted with an anti-lock braking system, remove the two mounting bolts and withdraw the valve.

Deceleration conscious pressure limiting valve seals – To renew
1. Remove the valve from the car as described under

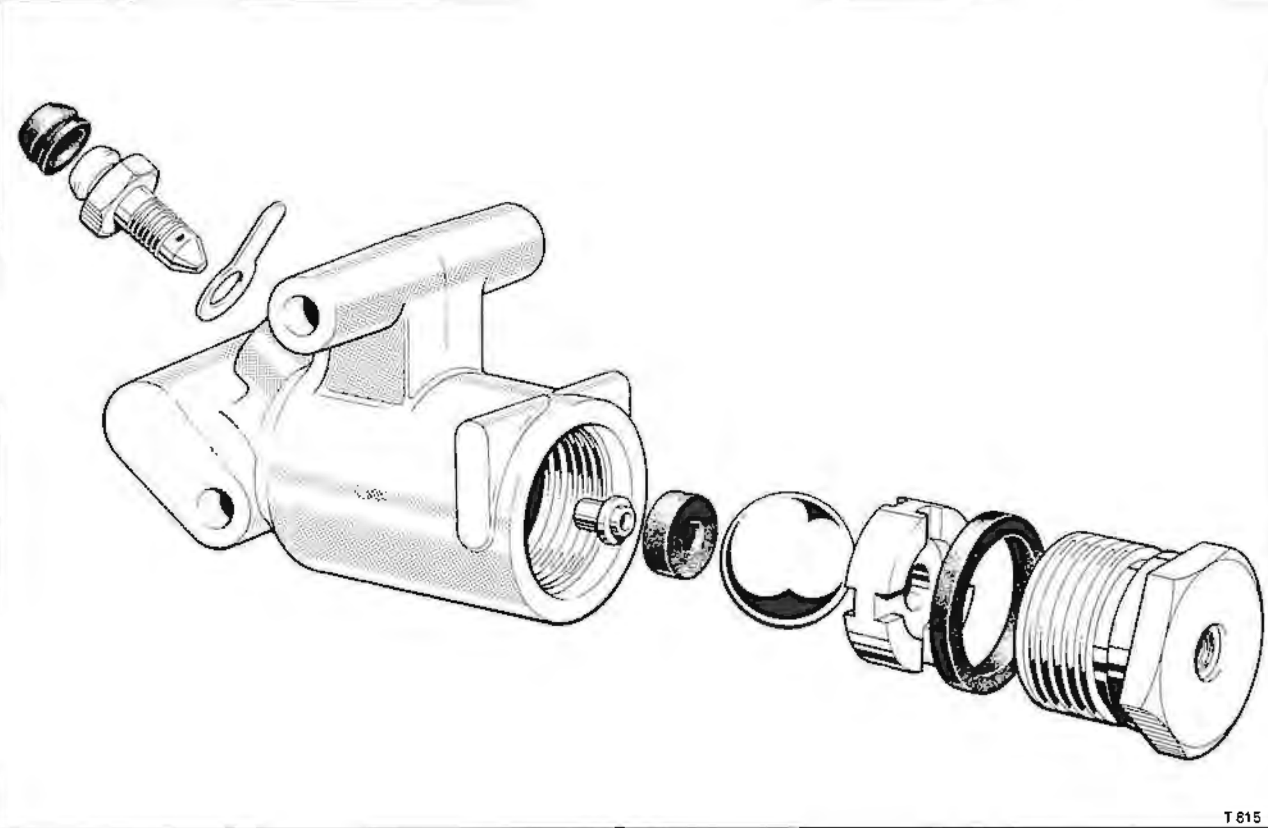


Fig. G10-1 Deceleration conscious pressure limiting valve

Deceleration conscious pressure limiting valve – To remove.

2. Unscrew the end plug from the valve. Remove the internal components and discard the two valve seals.
3. Thoroughly clean all the components in petroleum ether (120/160°C). Dry with dry compressed air, not with any type of cloth.
4. Ensure that all components are smooth and free from scratches, burrs, etc. Then, assemble the valve assembly using a new valve seal kit.
5. Fit the end plug and torque tighten to between 34 Nm and 47 Nm (3,5 kgf m and 4,8 kgf m; 25 lbf ft and 35 lbf ft).

Deceleration conscious pressure limiting valve – To fit

To fit the pressure limiting valve reverse the procedure given for removal noting the following.

1. All nuts must be torque tightened in accordance with the figures quoted in Section G22, prior to the split pins being fitted.
2. On completion the hydraulic system must be bled as described in Section G5.

Brake distribution valves

Introduction

The brake distribution valves fitted to cars with mineral oil hydraulic systems are identical in appearance to those fitted to cars using conventional brake fluid (i.e. RR363). In order to identify valves suitable for use with hydraulic system mineral oil the valve body and end plug are painted green.

Under no circumstances should a distribution valve designed for use with a conventional brake fluid system be fitted as a replacement.

The distribution valves are situated one above the other within the brake actuation linkage assembly. They operate when the footbrake is applied through a linkage and balance lever arrangement (see fig. G12-1).

Both valves are identical in operation but have differing mounting points and pipe arrangements. Corresponding valves on right-hand and left-hand drive cars are identical.

Complete distribution valve assemblies are available as service exchange units. Only the rubber end cover, return spring, and end plug sealing washer are available as separate items. The remaining working parts are subject to very fine limits and are therefore selectively assembled by the manufacturer.

Note The design of the valve is such that to provide adequate lubrication for the 0,0025 mm (0.0001 in) clearance between the operating valve and its bore, a small hydraulic system mineral oil 'leak-off' is permitted. This leakage is visible and takes the form of a small droplet of mineral oil hanging from the valve base. This is normal.

To determine if a valve is leaking excessively, thus requiring renewal, check that the 'leak-off' does not impair the braking efficiency of the car or cause a noticeable reduction in the level of hydraulic system mineral oil in the reservoir. If these conditions are satisfied the valve should be regarded as serviceable.

Brake distribution valve – To test (on the car)

1. Place the car on a ramp.
2. Remove fuse A6 from fuse panel F2 on the main fuseboard.
3. Depressurize the hydraulic systems as described in Section G3.
4. Remove the undershield from around the brake actuation linkage.
5. Connect pressure gauge RH9727 GMF (ensuring that a length of high pressure pipe is attached) into the high pressure outlet port of the distribution valve (blue or mauve pipe).

Alternatively, connect the gauge to any convenient junction between the valve and the brake calipers it supplies; for example the brake caliper bleed screw points.

Note Pressure gauge RH9727 GMF is capable of reading from zero to 207 bar (zero to 3000 lbf/in²).

6. Start the engine and depress the brake pedal. The brake line pressure shown on the gauge should be proportional to the load applied to the pedal, provided that the accumulators are fully charged. For a 200 N (45 lbf) load on the pedal, the line pressure should be approximately 69 bar (1000 lbf/in²). It should also be possible to achieve a line pressure of 138 bar (2000 lbf/in²) for a pedal pressure of approximately 333N (75 lbf).

When the load on the brake pedal is continuously varied, the brake line pressure should also vary accordingly, without any marked lag or jerkiness.

If the above effort/pressures are not obtainable or actuation shows marked lag or jerkiness on the gauge, the distribution valve may be considered faulty and must be renewed.

7. If a system internal leakage investigation, as described in Section G9, under Hydraulic accumulators – To test, shows a distribution valve to be the cause of a loss in accumulator pressure the actual leakage can be checked as follows.
8. Disconnect the low pressure return line from the distribution valve port (black or white pipe). Blank the end of the pipe to prevent drainage of the reservoir.
9. Insert a union and a length of pipe into the distribution valve low pressure return port and place the open end of the pipe into a clean container.
10. Start the engine but do not depress the footbrake pedal.
11. Top-up the reservoir continuously to keep the hydraulic system mineral oil level up to the black line on the indicator sight glass.

For the valve to be acceptable the hydraulic system mineral oil leakage should not exceed 25 ml (0.875 fl oz) per half hour with the valve in the 'off' position (i.e. brake pedal not applied) or 50 ml (1.75 fl oz) per minute with the brake pedal depressed and held steady under a load of 200 N (45 lbf). This load is equivalent to a brake line pressure of 69 bar (1000 lbf/in²). If the valve leakage exceeds these figures it must be renewed.

Brake distribution valves – To remove

1. Place the car on a ramp and depressurize the hydraulic systems as described in Section G3.
2. Remove the undershield from around the brake actuation linkage.
3. Remove the pipes from each valve. Blank off the pipe ends and valve ports.
4. Unlock and remove the securing bolts from each valve, draw the rubber boot seal off the valve. Taking care not to bend the valve actuation push rod, move each valve forward and downward, out of the actuation linkage assembly.

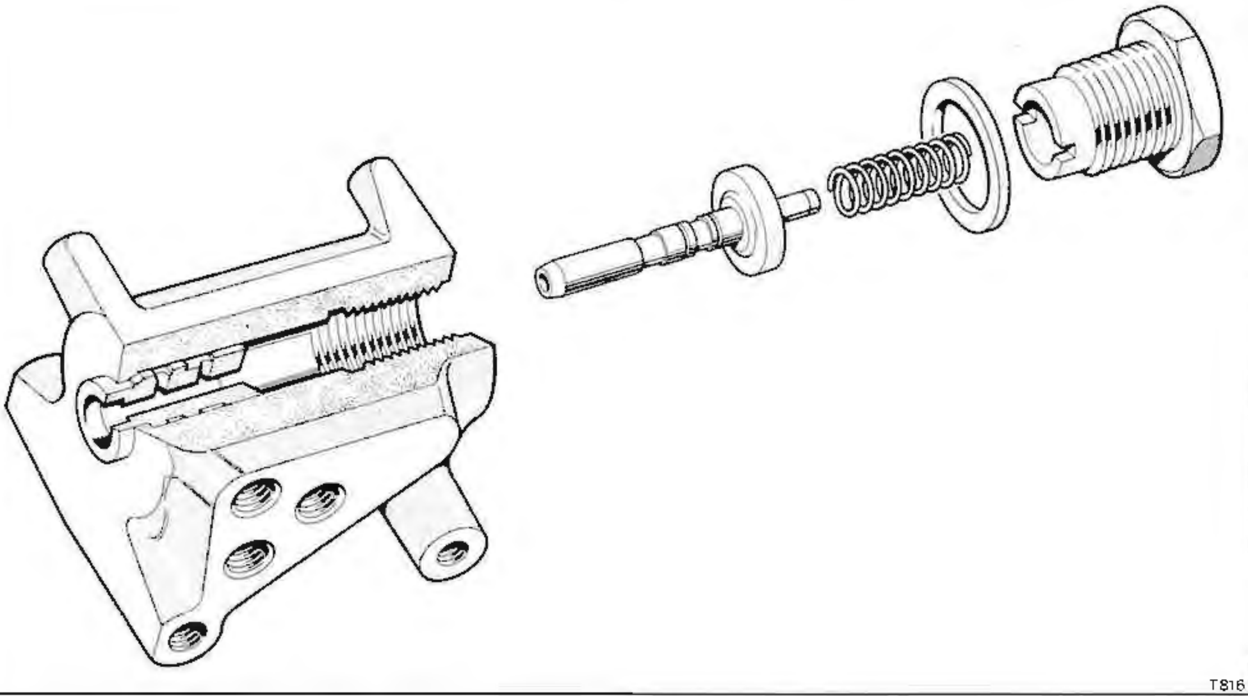


Fig. G11-1 Brake distribution valve

Brake distribution valve – To dismantle
(see fig. G11-1)
1. Remove the end plug and sealing washer; collect the return spring.
2. Carefully remove the valve stem. Extreme care should be taken to ensure that the valve stem and its operating bore do not become scratched or damaged.
3. Carefully wash all parts in petroleum ether (120/160°C). Dry with dry compressed air, not with any type of cloth.

Brake distribution valve – To inspect
1. Carefully examine the fine limit bore of the valve insert and the outside diameter of the valve stem. Each surface should be smooth and free from scratches.
2. Lubricate the bore of the valve insert and the valve stem with clean hydraulic system mineral oil. Carefully fit the valve stem into the valve insert bore and check for any axial wear. There should only be sufficient clearance to allow the valve stem to slide freely in the bore; the stem and bore having a clearance of 0,0025 mm (0.0001 in).
3. Wash the parts in petroleum ether (120/160°C). Dry with dry compressed air, not with any type of cloth.

Brake distribution valve – To assemble
1. Lubricate the bore of the valve insert and the valve stem with an approved hydraulic system mineral oil (see Chapter D).
2. Carefully insert the valve stem into the valve insert bore until fully seated. Fit a new return spring.
3. Fit a new sealing washer to the end plug. Fit and torque tighten the plug to between 82 Nm and 88 Nm (8,3 kgf m and 9,0 kgf m; 60 lbf ft and 65 lbf ft).
4. Ensure that the inward and return movement of the valve stem is smooth and does not bind or stick at any point along its travel.

Brake distribution valve – To fit
Fit the distribution valves by reversing the procedure given for removal noting the following.
1. If a replacement valve is being fitted, remove one of the blanking plugs and allow any hydraulic system mineral oil to drain from the valve. Fit the plug.
2. Torque tighten the mounting bolts and pipe connections in accordance with the figures quoted in Section G22 and Chapter P. Lock the securing bolt tab-washers.
3. On completion, the hydraulic systems must be bled as described in Section G5.

Brake actuation linkage assembly

Contents

Brake actuation linkage assembly

Introduction
The brake actuation linkage assembly is mounted just rearward of the toeboard. On right-hand drive cars the assembly is positioned just inboard of the body sill. On left-hand drive cars the assembly is fitted adjacent to the inner side of the body longeron.

The assembly houses the distribution valves, speed control switch, stop lamp switch, and on cars not fitted with an anti-lock braking system, the deceleration conscious pressure limiting valve. The assembly being the same for both right and left-hand drive cars.

Always ensure that replacement distribution valves and the deceleration conscious pressure limiting valve (if fitted) are for use with hydraulic system mineral oil and bear the relevant identification markings (see Sections G10 and G11).

Under no circumstances must valves for use with conventional brake fluid systems (i.e. RR363) be used for replacements.

Brake actuation linkage assembly – To remove
1. Place the car on a ramp; depressurize the hydraulic systems as described in Section G3.
2. Disconnect the battery.
3. Remove the undershield from around the linkage assembly.
4. Disconnect the Lucar connections, then remove the brake stop lamp switch, speed control switch, and mounting bracket.

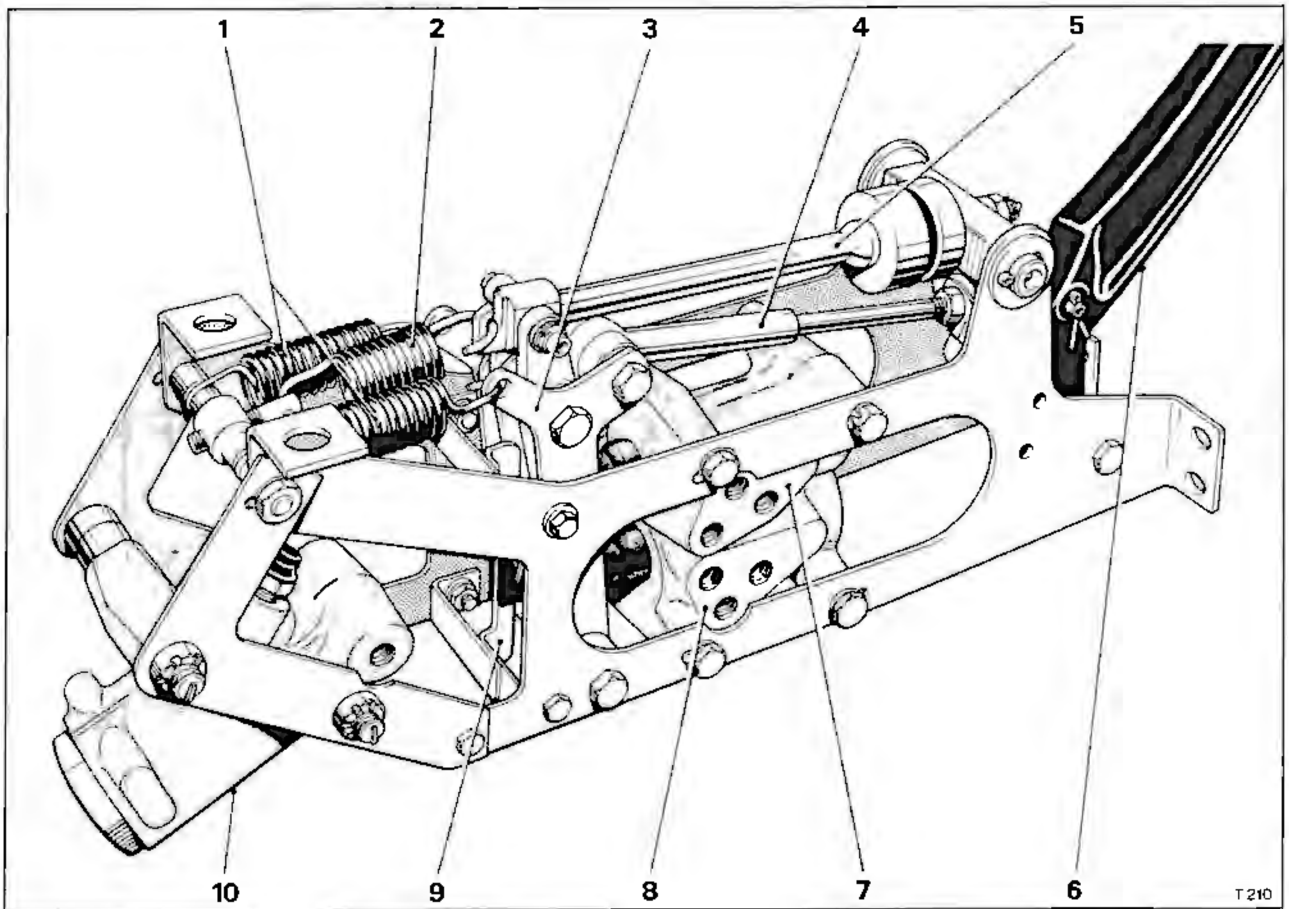


Fig. G12-1 Brake actuation linkage assembly
1 Return springs
2 Pedal 'feel' spring
3 Balance lever assembly
4 Brake actuation operating rod
5 Pedal 'feel' rod
6 Brake pedal lever
7 Upper distribution valve (No. 1 system)
8 Lower distribution valve (No. 2 system)
9 Off stop bracket
10 Deceleration conscious pressure limiting valve on cars not fitted with an anti-lock braking system

5. Remove the brake pedal pinch bolt from the upper end of the brake pedal lever and ease the pedal stem out of the lever. Collect the rubber seal.

6. Disconnect the pipes from the distribution valves and deceleration conscious pressure limiting valve (if fitted). Blank off all exposed pipe ends and valve ports.

7. Remove the setscrews (right-hand drive cars) or bolts and nuts (left-hand drive cars) securing the linkage assembly side plates at the forward end. Support the linkage assembly and remove the two rear securing setscrews. Lower the assembly from the car.

On left-hand drive cars, the brake pedal lever must be withdrawn from the rubber sealing boot when lowering the actuation linkage from the car.

Important Under no circumstances should the brake actuation assembly be allowed to hang from the brake pedal, supported by the actuation rod, as this may result in the rod being bent.

Brake actuation linkage – To dismantle

Prior to dismantling the linkage a note should be taken of the relative positions of the distance pieces and bolt direction (see figs. G12-1 and G12-2).

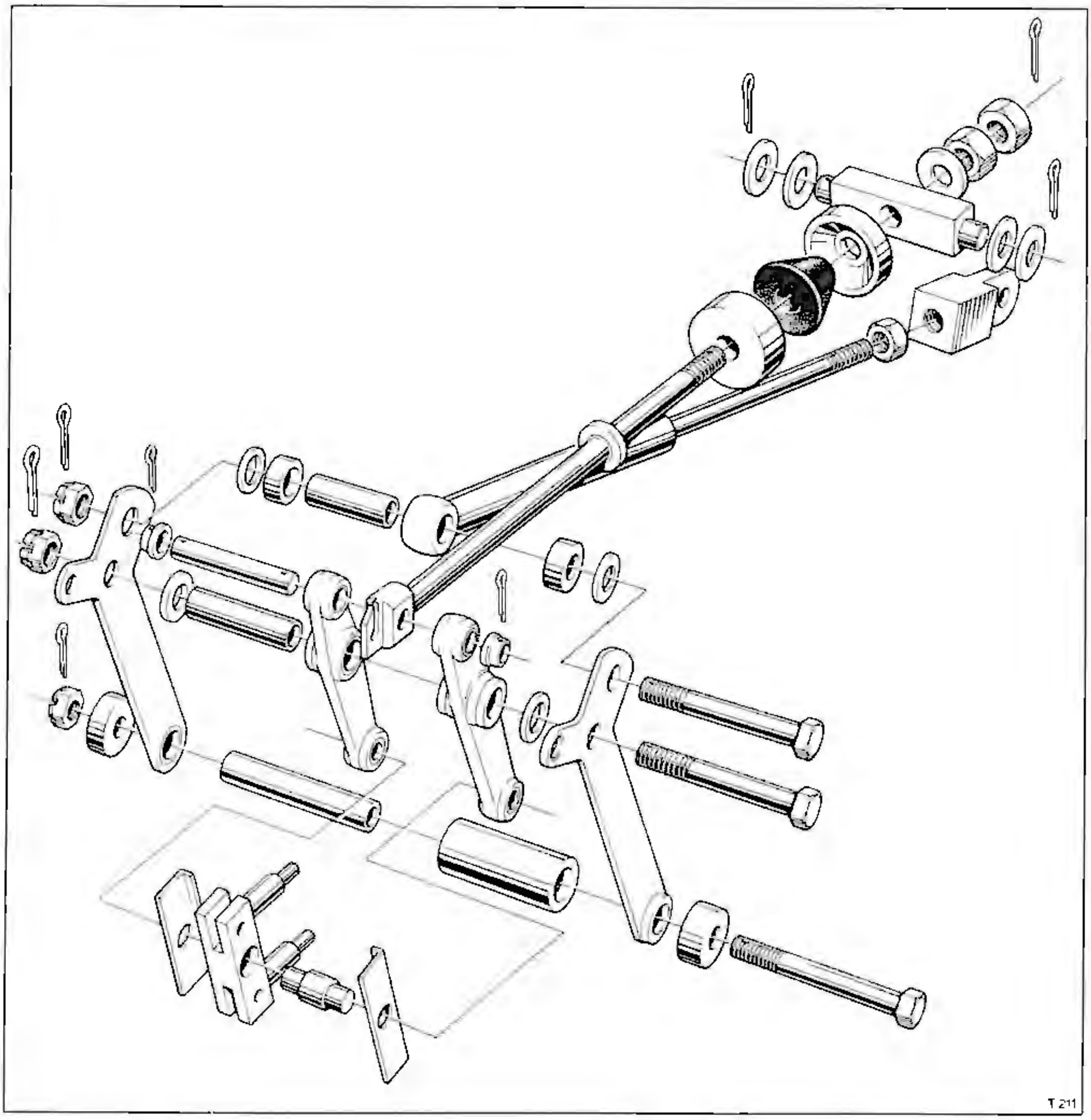


Fig. G12-2 Brake actuation linkage balance lever assembly

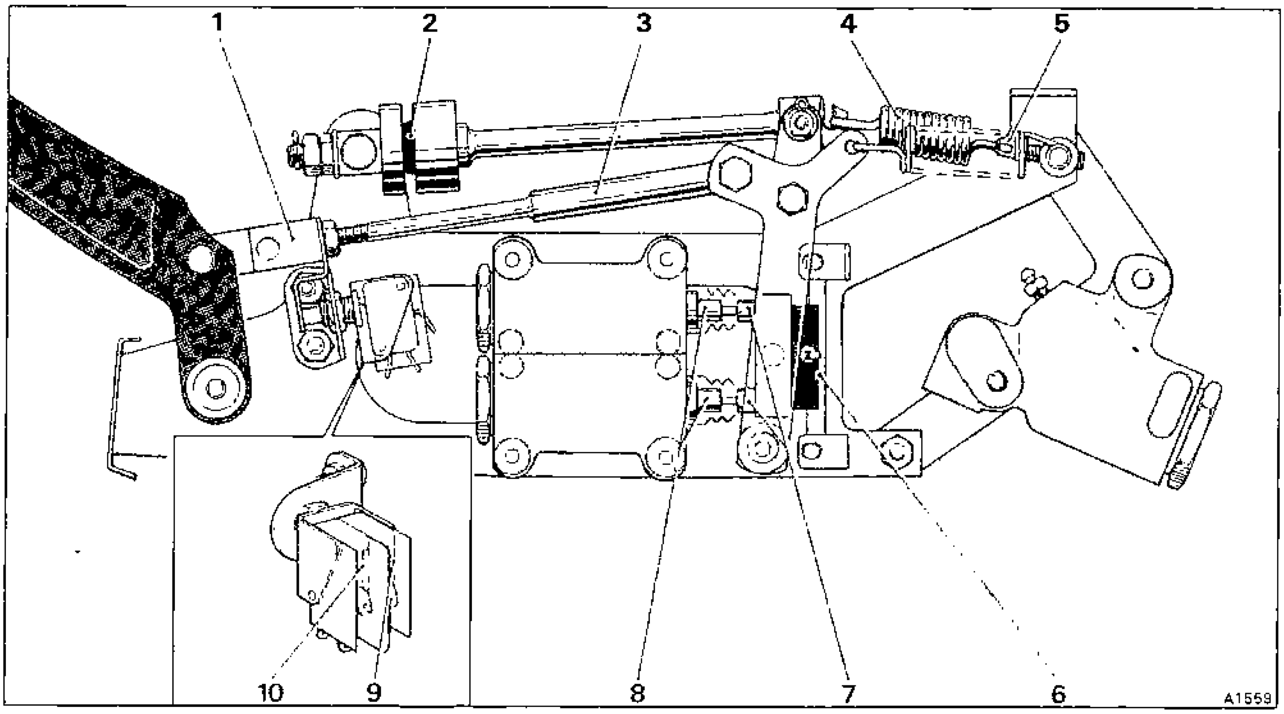


Fig. G12-3 Brake actuation linkage adjustment points

1 Brake pedal lever adjustment block
2 Rubber 'feel' cone
3 Brake actuation operating rod
4 Main 'feel' spring
5 Feel spring adjustment screw
6 Off stop bracket
7 Balance lever push rods
8 Distribution valve stems
9 Brake stop lamp switch
10 Speed control switch

1. Remove the brake actuation linkage from the car as described previously.
2. Remove the split pin and clevis pin from the operating rod pivot on the brake pedal lever.
3. Remove the three springs from the rear of the linkage.
4. Remove the split pin and nuts from the end of the pedal 'feel' rod.
5. Remove the 'off' stop bracket from behind the balance levers.
6. Remove the pivot bolt from the lower end of the balance levers. Ease the levers rearward and carefully withdraw the balance lever push rods from the distribution valves. Remove the distance pieces and pivot tube from the lower end of the balance levers.
7. Lift the levers clear of the side plates and withdraw the 'feel' rod from its retaining bar. Collect the conical rubber and abutment cups.
8. Remove the split pin from one side of the 'feel' rod pivot pin, withdraw the pin and collect the collar.
9. Remove the two bolts retaining the pivot arms to the balance levers. Noting their positions collect the washers, distance pieces, and pivot tubes.
10. Remove the balance levers from each side of the distribution valve push rod equalizing block, collect the pin retaining plates.

Note The levers and pivot pins are clearance fits and are easily removed.

Brake linkage assembly bushes and pivot pins – To renew

1. Remove and dismantle the brake linkage as described previously.
2. Carefully press the bushes requiring renewal out of their locations and fit new bushes. The bush bores are machined to final size, therefore no reaming or boring is necessary.
3. Any pivot pins that are worn or damaged must be renewed.

Brake actuation linkage – To assemble

Assemble the linkage by reversing the dismantling procedure, noting the following.

1. Clean all components prior to assembly. Lightly lubricate the linkage pivots, the protruding parts of the distribution valve stems, and the push rod location bores with Molytone 'C' grease or any approved alternative.
2. All bolts and nuts must be torque tightened to the figures quoted in Chapter P before split pins are fitted and tab-washers secured.
3. The linkage should operate freely when located between the assembly side mounting plates. All levers must be absolutely free to move with negligible friction on their pivots. Distance tubes must be similarly free in the Oilite bushes.

Note All bolts should be fitted in the directions shown in figure G12-1 in order that certain individual items may be removed without removing the complete assembly from the car.

Brake actuation linkage – To adjust
Adjustment of the actuation linkage should be carried out in the following sequence.
a. Distribution valve push rod clearance.
b. Rubber 'feel' cone setting.
c. Main 'feel' spring setting.
d. Brake pedal height setting.

Note Adjustment 'a', 'b', and 'c' can be carried out with the actuation linkage assembly removed from the car.

Distribution valve push rods – To set (see fig. G12-3)
1. Slacken and unscrew the brake 'feel' rod adjusting nuts until clearance is obtained between the 'feel' rod mounting block and the rubber cone seat.
2. Remove the 'feel' rod and return springs.
3. Slacken the four bolts securing the 'off' stop bracket to the actuation linkage side plate.
4. Slide the 'off' stop bracket forward on the elongated holes until a clearance of up to 0,25 mm (0.010 in) is obtained between the balance lever push rods and the distribution valve stems; with no pre-load being applied to the valve stems. Ensure that the setting is equal on each valve, then tighten the bracket securing bolts.

Note It will be necessary to draw back the two rubber dust covers on the distribution valves in order to check the push rod to distribution valve stem clearance.

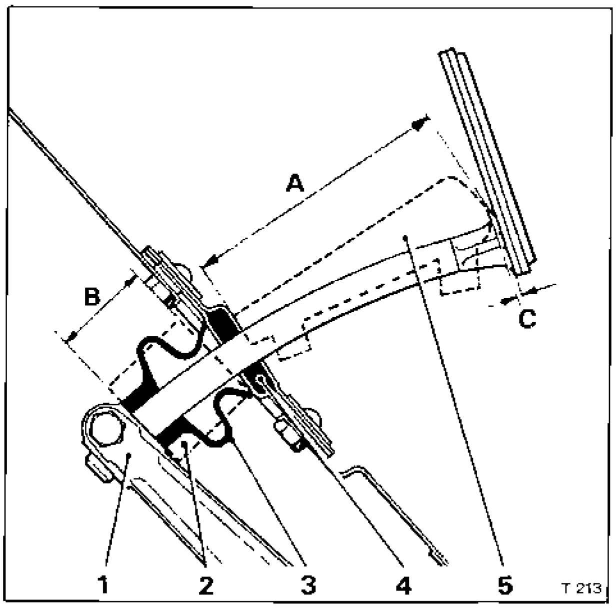


Fig. G12-4 Brake pedal height settings
1 Brake lever
2 Brake lever setting gauge
3 Rubber seal
4 Toeboard seal and housing
5 Pedal height checking template
A 99,06 mm to 98,30 mm (3.90 in to 3.870 in)
B 38,10 mm to 37,97 mm (1.50 in to 1.495 in)
C 0,38 mm to 5,08 mm (0.015 in to 0.20 in)

Rubber 'feel' cone – To set (see fig. G12-3)
1. Fit the two return springs to the linkage assembly. At this point the two abutment cups and the rubber 'feel' cone should be loose and free to slide on the shaft.
2. Tighten the adjusting nut until the clearance between the abutment cups and the rubber cone has been removed, without a pre-load being applied to the rubber cone.
3. Securely tighten the lock-nut onto the adjusting nut, then depress and release the brake pedal several times to ensure that the cone is seated correctly. Re-check the cone setting. Ensure that a security split pin is fitted to the end of the shaft.

Main 'feel' spring – To set (see fig. G12-3)
1. Ensure that the actuation assembly remains in the 'off' position.
2. Fit one end of the 'feel' spring into the adjusting screw located in the centre of the spring anchor rod.
3. Rotate the spring and screw half a turn at a time in the direction required until the spring can be fitted into the 'feel' rod hook. With no clearance between the spring and hook, ensure that there is no spring pre-load.

Note It is necessary to stretch the spring over the hook to obtain the correct position where clearance is determined.

4. Remove the spring from the hook and rotate the spring and screw 1½ turns clockwise, when viewed from the brake pedal end of the assembly (i.e. effectively tensioning the spring). Fit the spring onto the hook.

Note It is essential to follow both of the previous setting instructions accurately as deviations will completely alter the subjective feel and acceptability of brake control.

Clearance between the rubber 'feel' cone and its abutments will cause a spongy, long travel pedal feel at low decelerations. Any pre-load on this rubber will cause jerky initial braking under these conditions. Inadequate pre-load on the rear tension spring will produce unwanted free travel at the pedal followed by jerky initial braking. Too much pre-load will give jerky initial braking followed by a period of 'spongy' pedal travel.

Brake pedal height setting (see figs. G12-4 and G12-5)
This setting can only be carried out with the actuation linkage assembly fitted to the car.
1. Locate the setting gauge into the brake pedal stem hole in the end of the pedal lever (see fig. G12-4). Raise the pedal lever until the gauge touches the underside of the toeboard seal housing.

2. Adjust the block on the lever operating rod until the hole in the block aligns with the hole in the pedal lever.

Note Shortening the rod length reduces the gap between the pedal lever and seal plate, half a revolution of the block being equal to approximately 3,17 mm (0.125 in) of pedal lever movement.

3. Remove the setting gauge from the brake lever. Connect the rod to the lever by inserting the clevis pin. Fit the split pin.

4. Fit the rubber seal between the brake pedal lever and toeboard seal plate.

On left-hand drive cars slide the convoluted rubber seal over and down the brake pedal lever; fit the two retaining screws and washers. Ensure that the seal does not prevent the lever and linkage returning to the fully 'off' position.

5. Insert the brake pedal through the toeboard felt and rubber seals into the hole in the brake pedal lever.

6. Fit and tighten the pinch bolt to secure the brake pedal lever.

7. Check that the rubber seal does not prevent the actuation linkage returning to the 'off' position and that the brake pedal does not foul the seal housing at any point along its travel.

8. Fit the brake stop lamp and speed control switches. Adjust the setting as described under, Brake stop lamp and speed control switches – To adjust.

Brake pedal height – To check (see fig. G12-4)

1. Place the checking template between the underside of the brake pedal and the upper surface of the pedal seal housing with the two lugs of the gauge located under the pedal stem. Rest the flat base of the template on the seal housing. Ensure that both carpet and underlay are removed from the housing surface.

2. If the clearance between the top of the template and the underside of the pedal is less than 0,38 mm (0.015 in) or more than 5,08 mm (0.20 in) adjust the length of the pedal lever rod as described in Brake pedal height setting.

Brake pedal lever – To remove

1. Place the car on a ramp and remove the undershield from around the brake actuation linkage.
2. Disconnect the battery.
3. Disconnect the Lucar connections and remove the stop lamp and speed control switches.
4. Remove the brake pedal stem pinch bolt from the top of the pedal lever and withdraw the stem out of the lever. Collect the rubber seal from the pedal stem.
5. Remove the split pin and clevis pin from the operating rod pivot on the pedal lever.
6. Remove the bolt and nut from the pedal lever pivot. Remove the lever and collect the pivot tube. On left-hand drive cars it is necessary to withdraw the lever from the convoluted rubber seal during final removal.

Brake pedal lever – To fit

To fit the brake pedal lever reverse the procedure

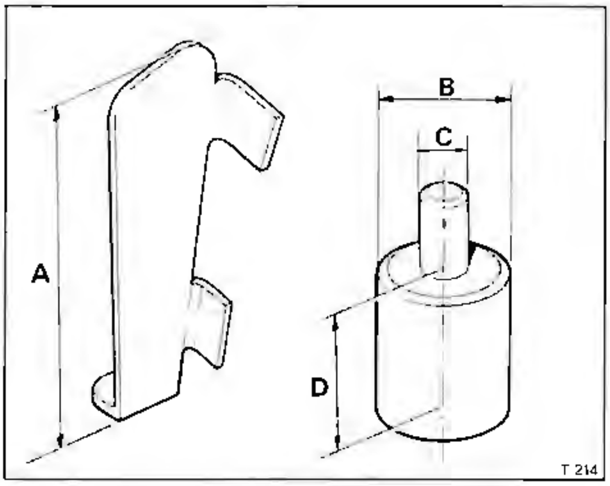


Fig. G12-5 Brake pedal setting and checking template

A 99,06 mm to 98,30 mm (3.90 in to 3.870 in)
B 34,92 mm to 34,29 mm (1.375 in to 1.350 in)
C 12,50 mm to 12,44 mm (0.492 in to 0.490 in)
D 38,10 mm to 37,97 mm (1.50 in to 1.495 in)

given for removal noting the following.

1. All nuts must be torque tightened to the figures quoted in Chapter P.
2. The pedal lever, stop lamp, and speed control switches must be checked for correct operation and adjusted if necessary, as described under the appropriate headings in this Section.

Brake stop lamp and speed control switches – To adjust

With all other adjustment to the brake actuation linkage and brake pedal completed, set the brake stop lamp and speed control switch as follows.

1. Ensure that the foot brake pedal is in the off position.
2. Slacken the nuts retaining the switch assembly. Allow the assembly sufficient movement to enable the push button to be depressed fully against the striker plate of the foot brake lever.
3. Position the switch assembly so that the push button is depressed against the foot brake striker plate, fully depressing the two switch contacts.

Note Care must be taken not to deflect the mounting bracket.

4. Tighten each lock-nut.
5. Check the efficiency of the stop lamp and speed control switches, using an ohmmeter. The stop lamps should operate and the speed control release, with less than 13 mm (0.50 in) of brake pedal travel.
6. Reset the switch assembly if the required setting is outside the specified tolerance.
7. Tighten each lock-nut.
8. Check that the whole mechanism operates smoothly.

Priority valve

Introduction
The priority valve is mounted on the underside of the body, rearward of the centre crossmember. It is incorporated into the supply line to the levelling valve (No. 1 system).

The function of the priority valve is to prevent the flow of hydraulic system mineral oil to the levelling valve until a pressure of between 86,2 bar and 120,7 bar (1250 lbf/in² and 1750 lbf/in²) is attained in the accumulator. This flow prevention ensures there is sufficient pressure in the hydraulic system to operate the rear levelling without jeopardising the braking efficiency of the car.

If the pressure in the hydraulic braking system falls unduly while the engine is running, the priority valve will close and isolate the rear levelling system. The reduced hydraulic pressure is then totally utilized for braking purposes.

The priority valve may be overhauled involving the replacement of the 'O' ring and the aluminium washer located on the small end plug.

It must be noted that the priority valve is for use with hydraulic system mineral oil only and can be identified by its green outer body.

Note If contamination of the hydraulic system has occurred, overhauling of the assembly is essential and a thorough cleaning of components in petroleum ether (120/160°C) is of the utmost importance. Also, dry with dry compressed air, not with any type of cloth.

Priority valve – To remove
1. Depressurize the hydraulic systems as described in Section G3.
2. Disconnect the inlet and outlet pipe connections from the valve.
3. Remove the bracket retaining screws (self-tapping), then lower the valve and bracket assembly.
4. Remove the priority valve from the bracket.

Priority valve – To dismantle (see fig. G13-2)
1. Unscrew and remove the switch housing cap. Remove the terminal post assembly, taking care not to lose the shim(s) from the terminal post. Discard the 'O' ring.
2. Unscrew and remove the switch housing from the valve body. Care must be taken with the spring and associated components.
3. Unscrew and remove the small end plug. Withdraw the plunger valve.
4. Thoroughly clean all components in petroleum ether (120/160°C). Dry with dry compressed air, not with any type of cloth.

Priority valve – To assemble (see fig. G13-2)
1. Reverse the procedure given for dismantling,

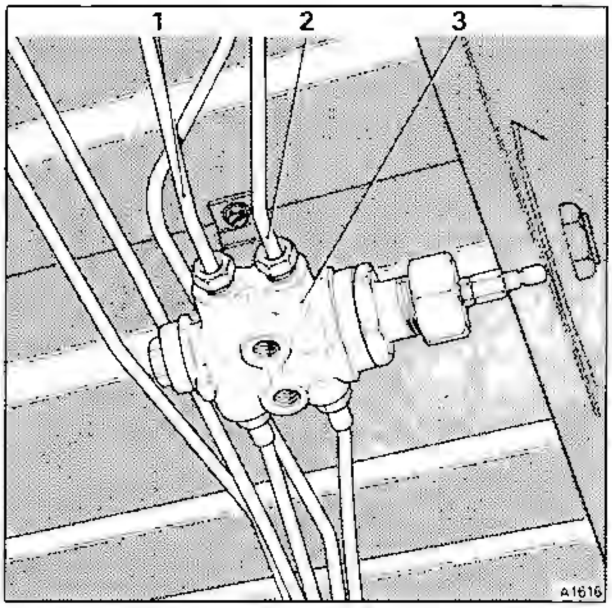


Fig. G13-1 Priority valve (No. 1 system)
1 High pressure line (Red No. 1 system)
2 Low pressure return (Black No. 1 system)
3 Priority valve body

ensuring that a new 'O' ring and aluminium washer are fitted.
2. Torque tighten the switch housing to the valve body to between 75 Nm and 81 Nm (7,7 kgf m and 8,2 kgf m; 55 lbf ft and 60 lbf ft). Finally, torque tighten the switch housing cap to between 17 Nm and 20 Nm (1,7 kgf m and 2,0 kgf m; 12 lbf ft and 15 lbf ft).

Priority valve – To fit (see fig. G13-1)
Reverse the procedure given for removal, ensuring that the pipe connections are torque tightened to between 7 Nm and 9 Nm (0,7 kgf m and 0,9 kgf m; 5 lbf ft and 7 lbf ft).

Priority valve – To test
1. Depressurize the hydraulic systems as described in Section G3.
2. Connect the pressure gauge RH9727 into the service point of No. 1 system (refer to Section G5).
3. Add weight to the luggage compartment of the car equal to 140 kg (300 lb).
4. Start and run the engine at approximately 1000 rev/min.
5. Note the pressure registered on the pressure gauge at the point that the car commences to level.

This pressure must not exceed 120,7 bar (1750 lbf/in²).

The pressure warning lamp will extinguish before the valve opens and the maximum pressure has been attained.

6. Switch off the ignition.

7. Attach a bleed pipe to the rear suspension struts bleed screw.

Carefully open the bleed screw and allow the hydraulic system mineral oil to flow into a clean container until the levelling system is fully exhausted, indicating that the priority valve has closed.

Whilst the pressure is decreasing the priority valve must close before the pressure warning lamp illuminates.

8. The pressure retained in the braking system (registered on the gauge) with the priority valve closed must not be less than 86,2 bar (1250 lbf/in^2).

9. If the priority valve operating pressures are not within the above limits the complete assembly must be renewed.

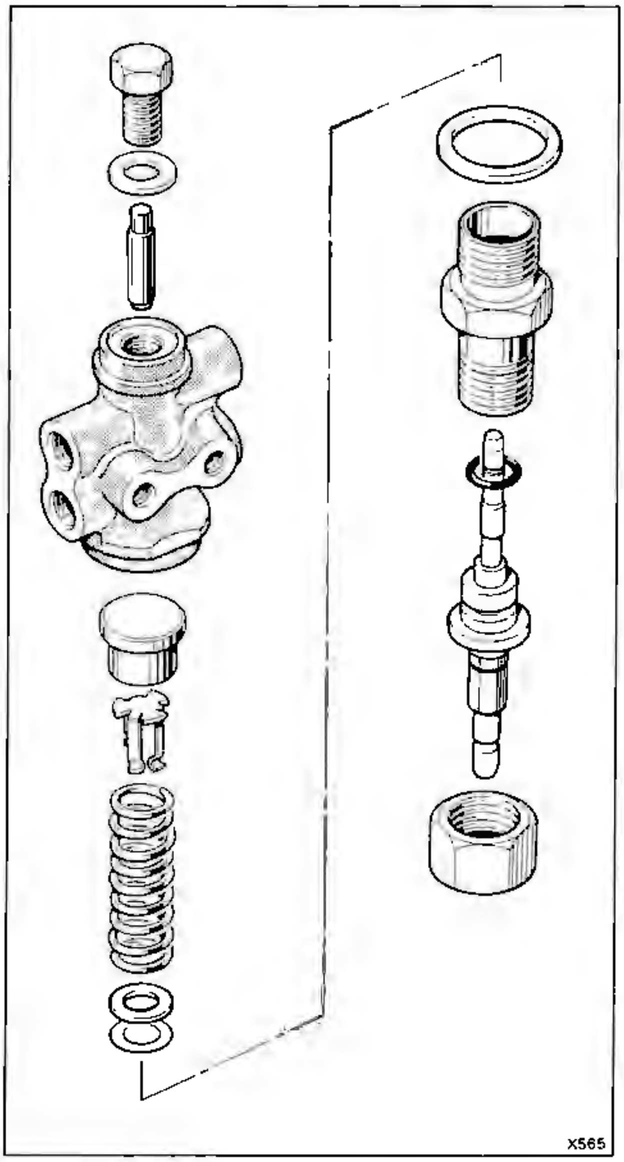


Fig. G13-2 Priority valve assembly

10. On completion of the test, top-up the reservoirs to the black line on the indicator sight glass, with clean hydraulic system mineral oil (see Chapter D).

Pressure switches

Introduction
A pressure switch is fitted into both System 1 (red) and System 2 (orange) high pressure lines. They are situated adjacent to each other on the right-hand valance in the engine compartment (see fig. G14-1).

The pressure switches are actuated by mineral oil in the hydraulic systems and will illuminate the warning panel(s) situated on the facia if the pressure in the hydraulic system(s) falls below acceptable working limits. It is important therefore that the switches operate correctly at all times.

The switches are for use with mineral oil only and have a green identification disc beneath the top contact housing.

In the event of a pressure switch failure, or if contamination of the hydraulic systems has occurred, the complete switch assembly must be renewed.

Pressure switch – To remove (see fig. G14-1)
1. Depressurize the hydraulic systems as described in Section G3.
2. Disconnect the battery, then remove the electrical connection from the switch.
3. Unscrew the pressure switch from the 3-way connector. Discard the copper washer.

Pressure switch – To fit
To fit the pressure switch, reverse the procedure given for removal noting the following.
1. Always fit a new copper washer to the pressure switch prior to fitting to the 3-way connector.
2. Torque tighten the pressure switch to between 7 Nm and 9 Nm (0,7 kgf m and 0,9 kgf m; 5 lbf ft and 7 lbf ft).

Pressure switch – To test
1 Depressurize the hydraulic systems as described in Section G3.
2. Connect the pressure gauge RH9727 into the service point of the relevant system (refer to Section G5).
3. Start and run the engine at approximately 1000 rev/min.
4. Note the pressure registered on the gauge at the point when the pressure warning lamp is extinguished. The pressure must not exceed 97/98 bar (1400/1425 lbf/in²).
5. Switch off the ignition.
6. Slowly open the bleed screw on the pressure gauge pipe and allow the hydraulic system mineral oil to flow into a clean container. Whilst bleeding, observe the pressure gauge needle descending. On reaching a pressure of between 83 bar and 76 bar (1200 lbf/in² and 1100 lbf/in²) the warning lamp should illuminate.

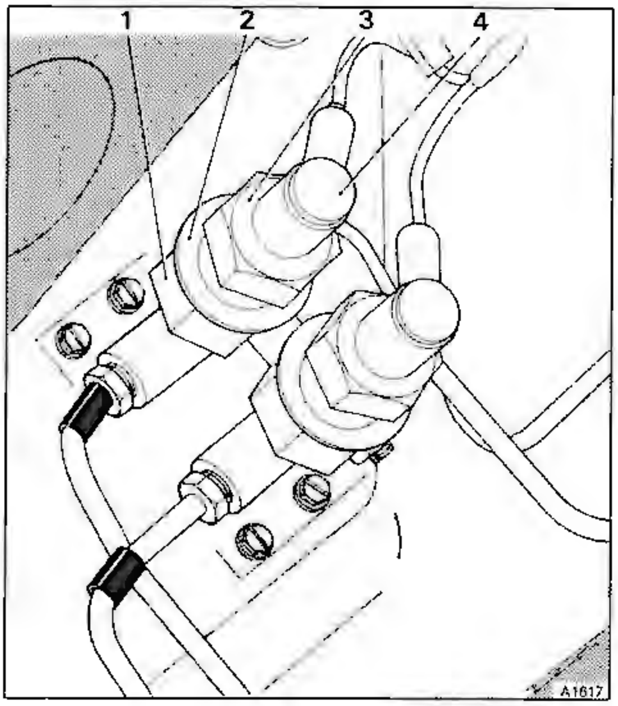


Fig. G14-1 Pressure switches
1 Switch body
2 Identification disc (green)
3 Contact housing
4 Electrical plug

7. If the pressure switch operating pressures are not within the above limits the complete pressure switch assembly must be renewed.
8. On completion of the test, top-up the reservoirs to the black line on the indicator sight glass, with clean hydraulic system mineral oil (see Chapter D).

Levelling valve

Introduction
The levelling valve is mounted on a bracket attached to the left-hand side of the rear sub-frame front crossmember.

Actuation of the levelling valve is controlled by a torsion rod. This rod is attached to the levelling valve ball pin lever at one end and to the rear anti-roll bar at the other (see fig. G15-1).

The levelling valve regulates the flow of hydraulic system mineral oil, either to or from the rear suspension struts, dependent on the variation in load applied to the rear suspension. Any sustained change in the ride height of the car operates the valve. Under conditions where extra load is applied (ride height low), pressurized hydraulic system mineral oil is allowed to pass from the accumulator, through the levelling valve to the rear suspension struts. When the load is reduced (ride height high), the levelling valve allows hydraulic system mineral oil to return from the rear suspension struts to the reservoir.

When work is being carried out on the levelling system, it should be noted that the levelling valve has a predetermined delay before it responds to movement of the ball pin operating lever. This delay period for 1 mm (0.040 in) movement of the valve is between 6.5 seconds and 12 seconds.

The levelling valve incorporates a seepage return hose. One end of the hose connects to the side of the levelling valve, the other end to the minimum pressure valve. This hose arrangement allows designed seepage within the levelling valve to return back to the reservoir.

The levelling valve is a non-serviceable unit. In the event of valve malfunction the complete valve assembly must be renewed. The outer diameter of the levelling valve is painted green for mineral oil identification purposes.

Levelling valve – To remove
1. Place the car on a ramp. Engage park position and chock the front wheels. Remove fuse A6 from fuse panel F2 on the main fuseboard.
2. Depressurize the hydraulic systems as described in Section G3.
3. Slacken the torsion bar 'U' bolt attached to the rear anti-roll bar.
4. Withdraw the torsion bar from the levelling valve ball pin lever and spherical bearing.
5. Disconnect the hydraulic pipes. Fit blanks to the pipe ends and ports. Also, fit a hose clamp to the seepage return hose and withdraw it from the levelling valve.
6. Support the valve assembly and remove the two mounting bolts. Remove the valve assembly from the car.

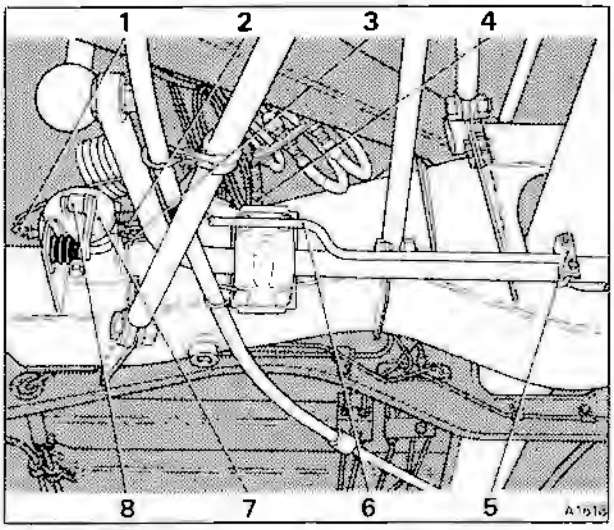


Fig. G15-1 Levelling valve assembly
1 High pressure feed to suspension struts
2 Low pressure return to reservoir
3 High pressure feed from accumulator
4 Seepage return hose
5 Torsion rod 'U' bolt
6 Torsion rod
7 Levelling valve
8 Levelling valve ball pin lever

Levelling valve – To fit
Fit the levelling valve by reversing the procedure given for removal noting the following.
1. When fitting a new levelling valve, ensure that it is filled with clean hydraulic system mineral oil before mounting on the car.
2. After positioning the valve on the bracket, torque tighten the bolts to between 21 Nm and 23 Nm (2,1 kgf m and 2,3 kgf m; 15 lbf ft and 17 lbf ft).
3. Ensure that new rubber sleeves are fitted to all pipe connections.
4. All pipe connections should be torque tightened to between 8 Nm and 9 Nm (0,8 kgf m and 0,9 kgf m; 6 lbf ft and 6.6 lbf ft).
5. Apply grease (Rocol MTS 1000) to the torsion bearing journal and lever fork. Connect the torsion bar to the levelling valve ball pin and spherical bearing. Ensure that neither the levelling valve ball pin bottoms in the operating jaw, or the torsion bar bearing journal contacts the spherical bearing rear cover.
6. Ensure that the area of contact between the torsion bar clamp and anti-roll bar is completely free of grease, oil, etc.

Levelled height – To set

1. Check that the fuel tank is full. However, if the tank is partially empty, weight equivalent to the amount of missing fuel should be positioned adjacent to the fuel tank. For each 4,5 litres (1 Imp gal, 1.2 US gal) of missing fuel add 3,4 kg (7.5 lb) of weight.
2. Ensure that the spare wheel, jack, tools etc., are fitted in their relevant positions.
3. Check the tyre pressures and adjust accordingly.
4. Drive the car onto a suitable level ramp. Chock the front road wheels.
5. Move the gear range selector lever to the park position. Remove fuse A6 from fuse panel F2 on the main fuseboard. Release the parking brake.
6. Depressurize the hydraulic systems by opening the bleed screw on the accumulators, allowing sufficient time for the mineral oil pressure to discharge back to the reservoirs.
7. Fit a pipe to the suspension struts bleed screw and slowly depressurize the struts by allowing the mineral oil to flow into a clean container. Remove the bleed screw and fit the pressure gauge RH 9727 GMF.
8. Start the engine and allow the hydraulic systems to fully pressurize (approximately four minutes).
9. Bleed the suspension struts and pressure gauge. Allow the car time to level (approximately one minute).
10. Slacken the 'U' bolt which clamps the torsion rod to the anti-roll bar.
11. Position an open ended spanner [maximum length not exceeding 152 mm (6.0 in)] onto the levelling valve operating lever. Then, push the lever towards the valve. Hold in this position until a pressure of approximately 34,5 bar (500 lbf/in²) is indicated on the pressure gauge.
12. Pull the lever away from the valve. The pressure will start to descend slowly.
13. Note the pressure on the gauge when it stops falling. This is the minimum pressure valve setting and should be between 24,1 bar and 26,2 bar (350 lbf/in² and 380 lbf/in²).
14. If the pressure is outside these limits, the minimum pressure valve should be adjusted as described in Section G17.

Note The adjustment procedure should then be repeated and approached from a higher pressure, approximately 34,5 bar (500 lbf/in²).

15. The correct levelling pressure is when the pressure gauge reads between 0,34 bar and 0,69 bar (5 lbf/in² and 10 lbf/in²) **higher** than the minimum pressure valve setting. Ensure that the levelling valve is in its 'dead area', then push the torsion bar as far as possible into the spherical bearing before withdrawing it between 0,50 mm and 0,75 mm (0.020 in and 0.030 in).
16. Torque tighten the torsion bar 'U' bolt clamp nuts to between 5,2 Nm and 6,2 Nm (0,53 kgf m and 0,63 kgf m; 3.8 lbf ft and 4.6 lbf ft).

    Ensure that the area of contact between the torsion bar clamp and the anti-roll is completely free of grease, oil, etc.
17. Depressurize the hydraulic systems and suspension struts.
18. Remove the pressure gauge.
19. Bleed the hydraulic systems as described in Section G5.
20. Top-up the reservoirs as described in Section G7.

Filter block assembly and restrictors

Introduction
A filter is incorporated into the No. 1 system high pressure line, positioned in a connector block assembly. The assembly is mounted on the underside of the car between the priority valve and levelling valve (see fig. G16-1). Its function being, to ensure that no foreign matter proceeds further into the system.

Two restrictors are situated into the No. 1 system high pressure line to the rear suspension struts.

On cars not fitted with an anti-lock braking system, a restrictor is also fitted into each brake line.

The function of a restrictor is to reduce the flow of hydraulic system mineral oil under certain operating conditions.

Filter – To renew (see fig. G16-1)
1. Depressurize the hydraulic system as described in Section G3.
2. Disconnect the No. 1 system hydraulic pipe from the adapter. Blank off the pipe. Remove the adapter and discard the washer. Carefully remove the filter components. Blank off the port in the connector block.
3. Obtain a new washer. Thoroughly clean all the components with petroleum ether (120/160°C). Dry with dry compressed air, not with any type of cloth.
4. Remove the blank from the connector block. Assemble the components, fitting the new washer to the adapter. Torque tighten the adapter to the figures given in Chapter P.
5. Remove the blank from the hydraulic pipe and connect the pipe to the adapter. Torque tighten the pipe nut to between 7 Nm and 9 Nm (0,7 kgf m and 0,9 kgf m; 5 lbf ft and 7 lbf ft).
6. Bleed the hydraulic system as described in Section G5.

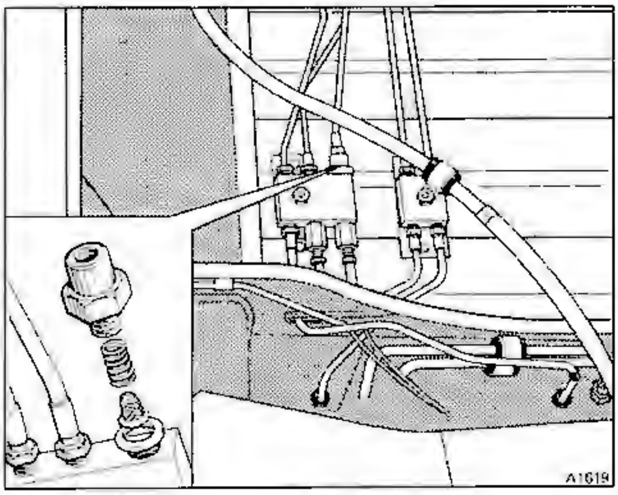


Fig. G16-1 Filter block assembly

Restrictor – To renew
1. Depressurize the hydraulic system(s) as described in Section G3.
2. Disconnect the hydraulic pipe from the restrictor and blank off the pipe.
3. Inspect the restrictor and renew if necessary.
4. Thoroughly clean all the components with petroleum ether (120/160°C). Dry with dry compressed air, not with any type of cloth.
5. Fit the washer and restrictor. Connect the hydraulic pipe. Torque tighten the restrictors to between 17 Nm and 20 Nm (1,7 kgf m and 2,0 kgf m; 12 lbf ft and 15 lbf ft). Torque tighten the pipe nuts to between 7 Nm and 9 Nm (0,7 kgf m and 0,9 kgf m; 5 lbf ft and 7 lbf ft).
6. Bleed the hydraulic system as described in Section G5.

Minimum pressure valve

Introduction

The minimum pressure valve is incorporated into the No. 1 hydraulic system between the levelling valve and the suspension struts (see fig. G17-1).

The purpose of the valve is to retain a predetermined hydraulic pressure in the suspension struts.

During normal system operation, the minimum pressure valve is held in the open position by hydraulic system pressure. This allows the uninterrupted flow of hydraulic system mineral oil between the levelling valve and the suspension struts.

However, if the supply of hydraulic system mineral oil to the suspension struts falls below a predetermined pressure, the minimum pressure valve will close and isolate the suspension struts from the system.

The minimum pressure valve is adjustable and it is important that the pressure is kept between the figures quoted later in this Section under the heading Minimum pressure valve – To test.

A leakage return hose is fitted between the minimum pressure valve and the levelling valve, to ensure that the designed leakage within the levelling valve is allowed to return back to the reservoir.

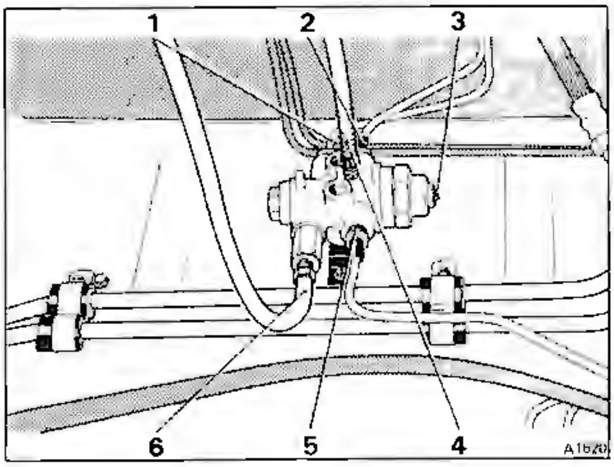


Fig. G17-1 Minimum pressure valve
1 Supply pipe to suspension struts
2 Leakage return pipe from suspension struts
3 Pressure adjuster
4 Leakage return pipe
5 Return pipe to reservoir
6 Supply pipe from levelling valve

Minimum pressure valve – To remove

1. Depressurize the hydraulic system as described in Section G3.
2. Disconnect the hydraulic pipe connections from the minimum pressure valve. Blank off all pipe ends and valve ports.
3. Remove the mounting screws. Lower the valve assembly and remove the setscrews securing it to the mounting bracket.

Minimum pressure valve – To dismantle

(see fig. G17-2)

1. Remove the adapter and sealing washer.
2. Remove the lock-nut and unscrew the adjusting socket setscrew.
3. Remove the large end cap, taking care not to lose the spring and internal components. Discard the 'O' ring.
4. Remove the small end plug and sealing washer.
5. Remove the valve stem from the valve housing. It may be necessary to use air pressure applied through the inlet port, to eject the valve.
6. Thoroughly clean all components using petroleum ether (120/160°C). Dry with dry compressed air, not with any type of cloth.

Minimum pressure valve – To assemble

(see fig. G17-2)

Assemble the minimum pressure valve by reversing the procedure given for dismantling, noting the following.

1. Ensure that the valve stem is fitted with the longer shoulder towards the small end plug.
2. Fit a new 'O' ring and sealing washers.
3. Torque tighten in accordance with the figures quoted in Section G22.

Minimum pressure valve – To fit

1. Fit the minimum pressure valve to the bracket. Secure the assembly to the underside of the car.
2. Remove the blanks and connect the hydraulic pipes.
3. Fit the leakage return hose between the minimum pressure valve and the levelling valve.
4. Bleed the hydraulic system as described in Section G5.
5. Torque tighten all bolts and pipe connections to the figures quoted in Section G22 and Chapter P.

Minimum pressure valve – To test

1. Place the car on a ramp. Engage park position and chock the front wheels. Remove fuse A6 from fuse panel F2 on the main fuseboard. Release the parking brake.
2. Depressurize the hydraulic system as described in Section G3.
3. Fit a pipe to the suspension struts bleed screw and slowly depressurize the struts by allowing the

mineral oil to flow into a clean container. Remove the bleed screw and fit the pressure gauge RH 9727 GMF.

4. Start the engine and allow the hydraulic systems to fully pressurize (approximately four minutes).

5. Bleed the suspension struts and pressure gauge.

6. Position an open ended spanner [maximum length not exceeding 152 mm (6.0 in)] onto the levelling valve operating lever. Then, push the lever towards the valve. Hold in this position until a pressure of approximately 34,5 bar (500 lbf/in²) is indicated on the pressure gauge.

7. Pull the lever away from the valve. The pressure will start to descend slowly.

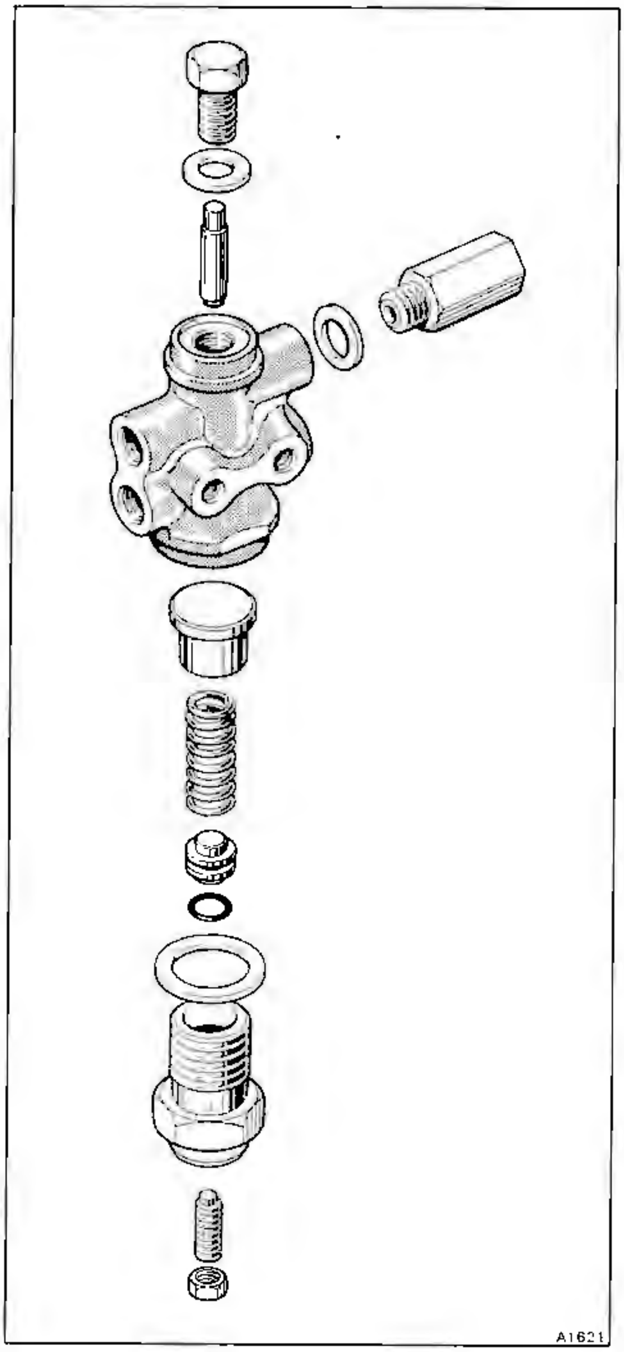


Fig. G17-2 Minimum pressure valve with adjuster

8. Note the pressure on the gauge when it stops falling. It is normal for the gauge needle to 'flick' and then settle. This final settled reading is the minimum pressure valve setting and should be between 24,1 bar and 26,2 bar (350 lbf/in² and 380 lbf/in²).

9. If the pressure is outside these limits, the minimum pressure valve should be adjusted as follows.

10. Slacken the lock-nut on the side of the minimum pressure valve. Then, turn the Allen socket screw clockwise to raise the setting, or anti-clockwise to reduce it. Torque tighten the lock-nut to the figures quoted in Chapter P.

11. Repeat Operations 4, 6, 7, and 8.

12. When the minimum pressure valve setting is correct, switch off the engine.

13. Depressurize the hydraulic systems and suspension struts.

14. Remove the pressure gauge.

15. Bleed the hydraulic systems as described in Section G5.

16. Top-up the reservoirs as described in Section G7.

Gas springs and Suspension struts

Introduction

The rear suspension struts situated beneath each rear wheel arch are mounted between the rear suspension trailing arms and the car body. A gas spring is attached to the top of each strut.

With the exception of Corniche/Continental cars, the gas springs and top mountings of the suspension struts are situated in the luggage compartment.

On Corniche/Continental cars the gas springs and top mountings are situated in the hood stowage well.

The gas spring and suspension strut combine to perform the functions of car levelling and suspension damper. The suspension strut is similar in design to a conventional damper, but is supplied with pressurized mineral oil from the No. 1 hydraulic system accumulator. The gas spring consists of a sphere, similar to that fitted to the hydraulic accumulator, divided into two chambers by a rubber diaphragm.

Nitrogen gas, under pressure, is retained on one side of the diaphragm. Hydraulic system mineral oil fills the other half of the sphere and suspension strut.

When a rear road wheel contacts a protrusion, the piston of the suspension strut is forced upwards. This action forces mineral oil into the gas spring sphere, compressing the gas behind the diaphragm. Conversely, when the rear road wheel travels over a hollow, the piston is forced downwards by the expansion of the gas.

Holes machined into the suspension strut piston, allow a restricted flow of mineral oil from one side of the piston to the other, thus acting as a shock damper.

Rear levelling control is achieved by increasing or decreasing the amount of mineral oil in the suspension strut and gas spring assembly. If extra load is applied to the car the levelling valve will actuate and allow extra mineral oil to flow into the suspension strut. This increase in the volume of mineral oil within the suspension strut, effectively raises the body height of the car to the correct levelled height position. When load is removed from the car, the levelling valve is actuated in the opposite direction, allowing the excess mineral oil to exhaust from the suspension strut back to the reservoir, thus lowering the height of the car body.

Gas spring spheres and suspension struts are both non-serviceable items. Therefore, in the event of a failure, a new component must be fitted.

No attempt should be made to charge a gas spring sphere. All spheres are charged to the correct pressure prior to despatch from the manufacturer.

Note Pressure gauge RH 9727 GMF is quoted for the testing of the gas spring spheres and suspension struts in this Section. The gauge gives a reading of between zero bar and 345 bar (zero lbf/in² and 5000 lbf/in²). However, it is essential that the gauge gives a correct reading in the 7 bar to 28 bar (100 lbf/in² to 400 lbf/in²) range.

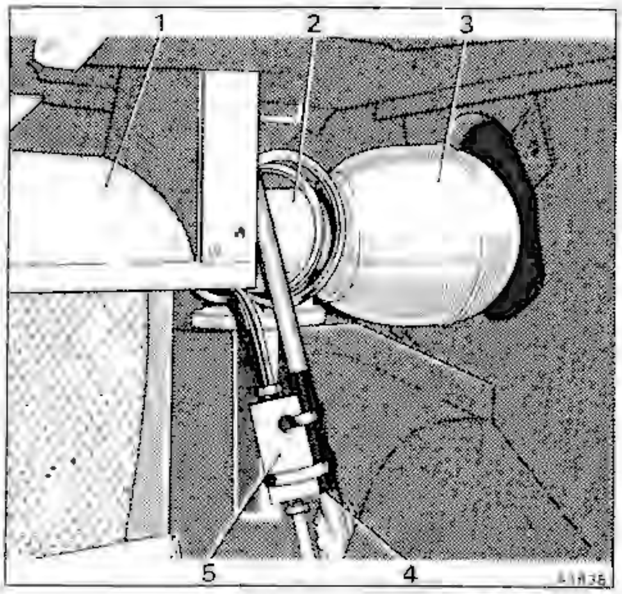


Fig. G18-1 Gas spring sphere
1 Fuel tank
2 Adapter
3 Sphere
4 Parcel shelf tie-bar
5 Connector block

Gas spring sphere – To remove (see fig. G18-1)

1. Depressurize the hydraulic system as described in Section G3.
2. Disconnect the battery.
3. Remove the Posidriv screws from the carpet covered sealing panel in the luggage compartment.
4. Remove the battery master switch knob and special ring nut from the right-hand side of the panel (if fitted).
5. On all cars except Corniche/Continental, release the press stud fastening straps adjacent to each luggage compartment hinge. Withdraw the panel to expose the fuel tank and gas spring spheres.
6. Remove the setscrews securing the battery master switch mounting bracket, to enable removal of the gas spring.

Operations 7 to 9 inclusive are applicable only to Corniche/Continental cars.

7. Carefully remove the rear seat cushion.
8. Remove the rear seat squab.
9. Release and remove the hood well trim to gain access to the rear suspension strut spheres.
10. Disconnect the coiled feed pipe from the gas spring adapter. Ensure protection is given to the carpet, trim, etc., in the luggage compartment.

11. Remove the three Allen screws from the adapter.
12. Carefully lift the adapter and sphere off the top of the suspension strut. Discard the sealing rings.
13. Secure the sphere adapter in a soft jawed vice. Using a suitable strap spanner, unscrew the sphere from the adapter. Discard the sealing ring.

Gas spring sphere – To fit (see fig. G18-2)
Fit the sphere by reversing the procedure given for removal, noting the following.
1. Ensure that all components are free from burrs, and then thoroughly clean them with petroleum ether (120/160°C). Dry with dry compressed air, not with any type of cloth.
2. Lubricate the new sealing rings with clean hydraulic system mineral oil.
3. If a replacement sphere is to be fitted, remove the blanking cover and allow any hydraulic system mineral oil to drain from the sphere.
4. When fitting the battery master switch, ensure sufficient clearance exists between the cable connections on the rear of the switch and the gas spring. **Never** allow a foul condition to exist in this area.
5. Torque tighten all setscrews and pipe connections in accordance with the figures quoted in Section G22 and Chapter P.
6. Bleed the hydraulic system as described in Section G5. Check all disturbed joints and pipe connections for leaks.

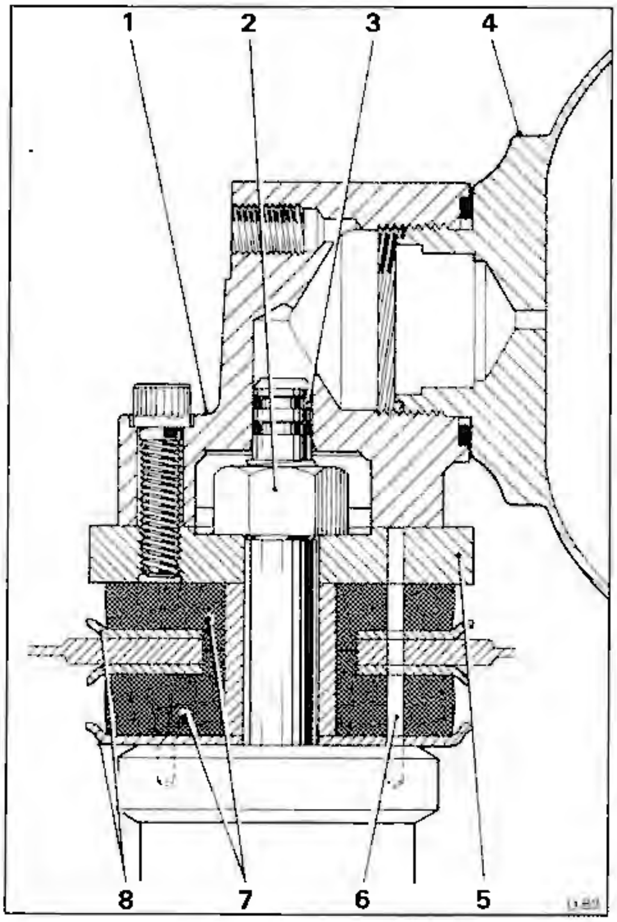


Fig. G18-2 Gas spring to suspension strut mounting
1 Adapter
2 Strut retaining nut
3 Sealing rings
4 Gas spring sphere
5 Gas spring mounting plate
6 Location peg holes
7 Rubber mounts
8 Cup-washer

Suspension strut – To remove
(see figs. G18-2 and G18-3)
1. Place the car on a ramp and securely chock the front wheels.
2. Depressurize the hydraulic system as described in Section G3.
3. Raise the rear of the car and place sill blocks under the rear end of the body sills. Support the trailing arms in the raised position, do not allow the suspension rebound struts to support the full suspension load.
4. Remove the relevant road wheel.
5. Remove the gas spring sphere as described under Gas spring sphere – To remove. Fit a protective blank to the top of the strut.
6. Disconnect the leakage return pipe from the lower end of the suspension strut. Hold the elbow of the pipe connection when unscrewing the nut, to ensure the pipe is not unscrewed from the strut. Blank off the pipe connections.
7. Remove the self-locking nut from the lower end of the suspension strut situated at the rear of the suspension trailing arm. Collect the rubber mounting bush, sleeve, and cup-washer.

Note In order to prevent rotation of the strut during removal of the retaining nut the location pin should be inserted through the mount. For details refer to Suspension strut – To fit.

8. Remove the retaining nut from the upper suspension strut mount. Collect the rubber mounting bush, gas spring mount, and cup-washers.
9. Support the suspension strut and lower the trailing arm. Lower the suspension strut from beneath the car, taking care not to damage the gas spring connection stem.

Suspension strut – To fit (see fig. G18-4)
In order to correctly locate the suspension strut, location holes are situated in the top face of the suspension strut and mount components. These location holes can be aligned by using a 76,20 mm (3.0 in) length of 4,75 mm (0.187 in) diameter bar.

The location peg can be fitted to either of two diametrically opposed holes in the strut, dependent on which side of the car the suspension strut is to be fitted. When positioned correctly the leakage drain pipe should point rearwards on both sides of the car.
Fit the suspension strut by reversing the procedure given for removal, noting the following.
1. Fit the upper strut mount, distance piece, cup-washers, and location peg into position on the strut stem.

2. Pass the strut stem through the hole in the body strut tower, using a peg to locate its angular position i.e. drain pipe to the rear of the car.
3. Fit the cup-washer, rubber mount, and gas spring mount onto the strut stem and location pin. Fit and torque tighten the stem nut to the figures quoted in Section G22.
4. Remove the location pin.
5. Connect the strut piston rod to the trailing arm using a self-locking nut. Torque tighten the nut to the figures quoted in Section G22.
6. Remove the protective cap from the strut stem. Lubricate the two stem sealing rings with clean hydraulic system mineral oil and fit them onto the strut stem.
7. Fit the gas spring sphere assembly onto the strut stem mount, taking care not to damage the stem or sealing rings (see Gas spring sphere – To fit).
8. All nuts, capscrews, and pipe connections should be torque tightened in accordance with the figures quoted in Section G22 and Chapter P. Ensure the elbow of the leakage drain pipe is pushed fully onto the drain pipe of the suspension strut. Hold the elbow in position when tightening the pipe nut.
9. On completion, bleed the hydraulic system as described in Section G5.

Gas spring sphere and Suspension strut operating pressures – To check

If a malfunction of the levelling system or ride deterioration is difficult to diagnose, the gas spring gas pressure and the suspension strut operating pressure should be checked as follows.
1. Place the car on a ramp and chock the front wheels.
2. Depressurize the hydraulic system as described in Section G3.
3. Fit the pressure gauge RH 9727 GMF into the suspension struts bleed screw port.

To check the right-hand side gas spring sphere

4. Disconnect the hydraulic pipe section from the 3-way connector to the left-hand side suspension strut.
5. Blank off the 3-way connector to withstand hydraulic system pressure. Blank off the hydraulic pipe removed.
6. Start the engine and allow the system to pressurize.
7. Bleed the right-hand strut and pressure gauge.
8. Position an open ended spanner [maximum length not exceeding 152 mm (6.0 in)] onto the levelling valve operating lever. Then, push the lever towards the valve. Hold in this position until a pressure of approximately 34,5 bar (500 lbf/in²) is indicated on the pressure gauge.

Switch off the engine.

9. Slowly open the bleed screw on the pressure gauge. The gauge needle will commence to descend slowly. Note the actual reading on the gauge when the needle drops sharply. This figure indicates the actual gas pressure within the sphere. The pressure must be between 10,35 bar and 18,62 bar (150 lbf/in² and 270 lbf/in²).
10. Depressurize the system as described in Section G3.
11. Remove the blanks from both the 3-way connector and the hydraulic pipe. Connect the hydraulic pipe to the connector. Ensure that the restrictor is fitted. Torque tighten the pipe connections to between 7 Nm and 9 Nm (0,7 kgf m and 0,9 kgf m; 5 lbf ft and 7 lbf ft).

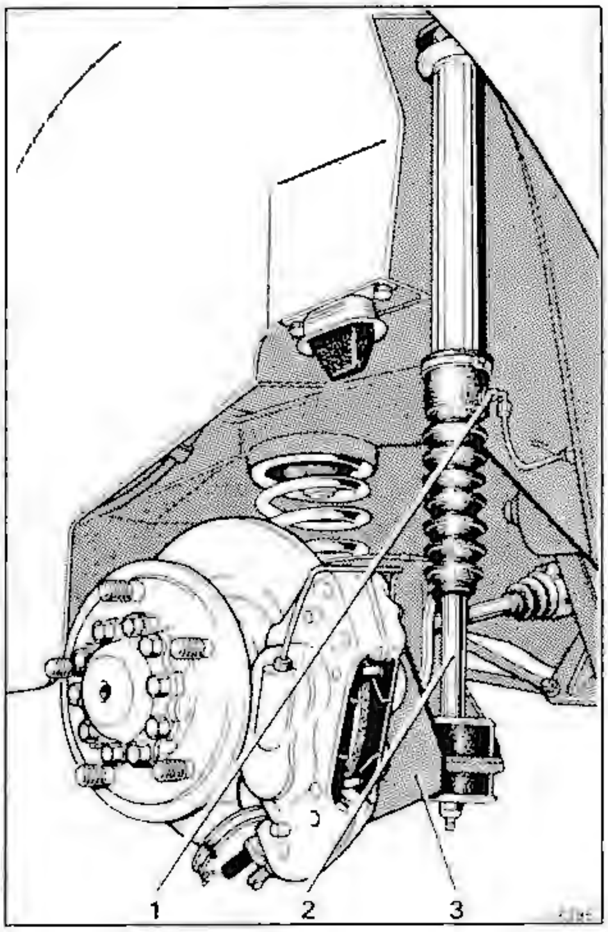


Fig. G18-3 Rear suspension strut
1 Leakage return pipe
2 Suspension strut
3 Trailing arm

To check the left-hand side gas spring sphere

12. Disconnect the hydraulic pipe section from the 3-way connector to the right-hand suspension strut.
13. Blank off the 3-way connector to withstand hydraulic system pressure. Blank off the hydraulic pipe removed.
14. Remove the pressure gauge RH 9727 GMF from the suspension struts bleed screw port. Then, replace and tighten the bleed screw.
15. Disconnect the hydraulic pipe section from the 3-way connector to the left-hand side suspension strut. Screw the pipe removed, and pressure gauge RH 9727 GMF into an **extra** 3-way connector.

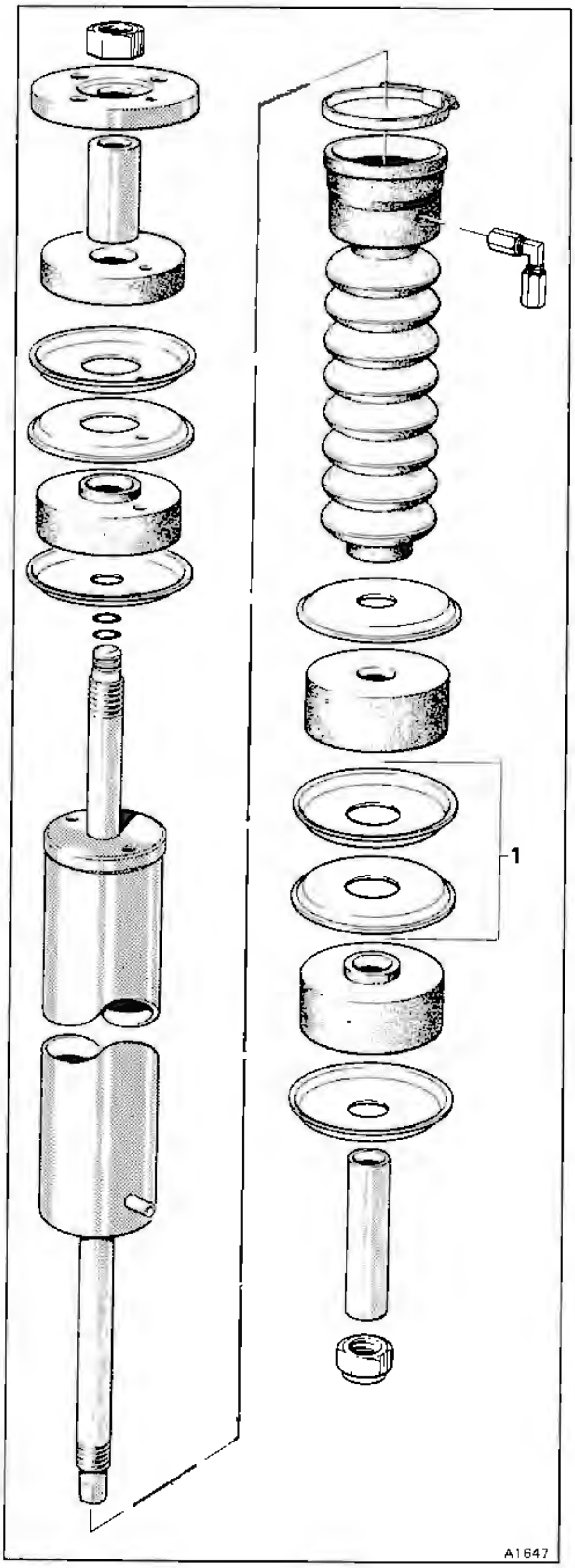


Fig. G18-4 Rear suspension strut mounts
1 Cup-washers (welded to the trailing arm)

16. Join the two 3-way connectors together with a flexible hose, capable of withstanding hydraulic pressure.
17. Start the engine and allow the system to pressurize.
18. Bleed the left-hand strut and pressure gauge.
19. Position an open ended spanner [maximum length not exceeding 152 mm (6.0 in)] onto the levelling valve operating lever. Then, push the lever towards the valve. Hold in this position until a pressure of approximately 34,5 bar (500 lbf/in^2) is indicated on the pressure gauge.

Switch off the engine.

20. Slowly open the bleed screw on the pressure gauge. The gauge needle will commence to descend slowly. Note the actual reading on the gauge when the needle drops sharply. This figure indicates the actual gas pressure within the sphere. The pressure must be between 10,35 bar and 18,62 bar (150 lbf/in^2 and 270 lbf/in^2).
21. Depressurize the system as described in Section G3.
22. Remove the blanks from both the 3-way connector and the hydraulic pipe.
23. Remove the pressure gauge and extra 3-way connector etc. Connect the hydraulic pipes to the connector. Torque tighten the pipe connections to between 7 Nm and 9Nm (0,7 kgf m and 0,9 kgf m; 5 lbf ft and 7 lbf ft).
24. Bleed the system as described in Section G5.
25. Top-up the reservoirs as described in Section G7.

Front and rear disc brakes

Introduction
Two twin cylinder calipers are fitted to each front wheel and a four cylinder caliper to each rear wheel.

On cars fitted with anti-lock braking, there are two independently operated hydraulic systems. System 1 operates the rear brakes and levelling. System 2 operates the front brakes only.

Bleed screws are fitted to the inner face of each front leading caliper and also to both rear calipers. These facilitate the bleeding of the two systems.

On cars not fitted with anti-lock braking, the calipers are divided between the two independently operated hydraulic systems. System 1 operates the front calipers on the front wheels and the upper cylinders on the rear wheel calipers. System 2 operates the rear calipers on the front wheels and the lower cylinders on the rear wheel calipers.

Bleed screws are fitted to the inner face of each caliper to facilitate bleeding of the two systems.

Brake calipers fitted to cars with mineral oil hydraulic systems are similar in appearance to those fitted to cars using conventional brake fluid (i.e. RR363). In order to distinguish calipers suitable for use with hydraulic system mineral oil, a section of the

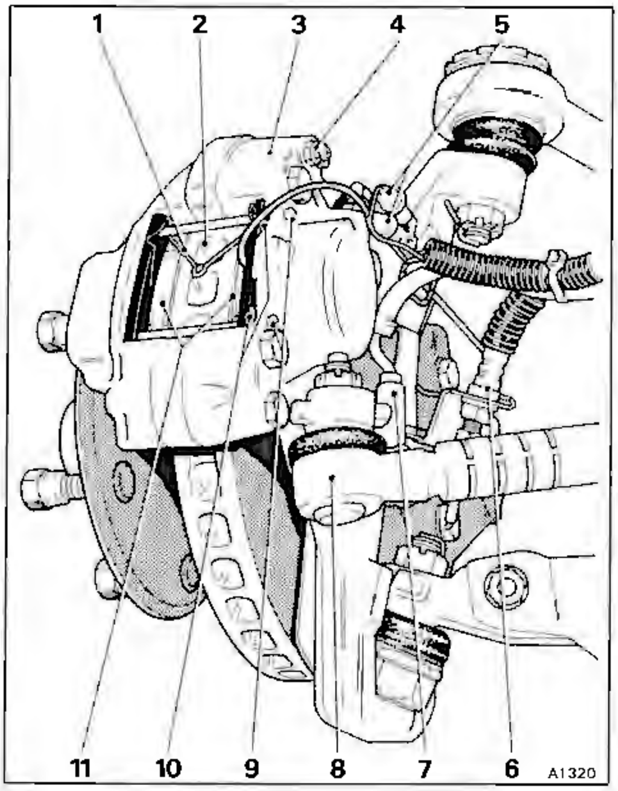


Fig. G19-1 Front wheel brake caliper (cars fitted with anti-lock braking)
1 'M' spring
2 Brake disc
3 Brake caliper
4 Bleed screw
5 Pad wear sensor connections
6 Brake pressure supply pipe
7 Anti-lock braking sensor
8 Track rod
9 Brake pad retaining pins
10 Pin retaining clips
11 Brake pads

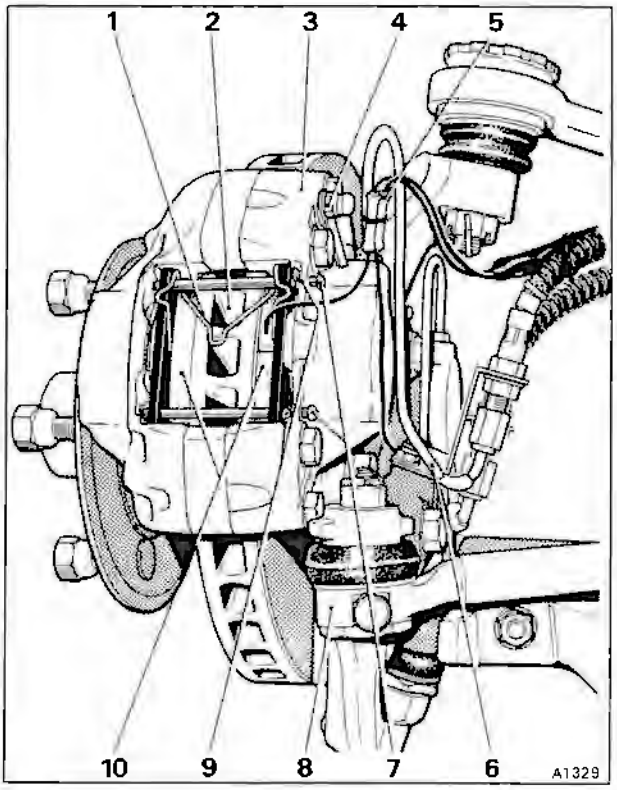


Fig. G19-2 Front wheel brake caliper (cars not fitted with anti-lock braking)
1 'M' spring
2 Brake disc
3 Brake caliper
4 Bleed screw
5 Pad wear sensor connections
6 Brake pressure supply pipe
7 Brake pad retaining pins
8 Track rod
9 Pin retaining clips
10 Brake pads

outer surface is painted green. The calipers are also fitted with a green identification tag around each bleed screw.

Under no circumstances should a caliper for use with a conventional brake fluid be used as a replacement.

Brake pad wear sensors are fitted to the front leading calipers only. If the warning panel on the facia illuminates, **all** the brake pads should be renewed.

In order to obtain maximum efficiency and safety from the braking systems, it is important that only replacement disc pads of an approved design and material specification are fitted.

Brake pads of a different specification or different manufacture vary in their friction, wear, and operating characteristics and if mixed could have an adverse effect on the braking performance.

It is important when changing the brake pads that the friction material of the new pads is of the same type and grade as that fitted to the other brake calipers, otherwise it will be necessary to renew all the brake pads.

Inspection of all brake pads must be carried out at the specified service intervals; for details reference should be made to the Service Schedule Manual, publication number TSD 4702.

The brake pads must be renewed if any of the pad linings are worn to within 3,18 mm (0.125 in) of the backplate.

After fitting new brake pads an initial running-in period of between 1100 kilometres and 1300 kilometres (700 miles and 800 miles) should be observed.

During this initial running-in period, the brakes should not be applied harshly or for prolonged periods from high speeds except in an emergency. The force with which the brakes are applied may be progressively increased towards the end of the running-in period.

Note If the brakes are to be relined with pads which have different recommended linings from those previously fitted, the disc faces should be cleaned prior to fitting the new pads. All traces of the old pad material should be removed by hand rotating the disc whilst applying fine emery cloth to the disc faces. Do not emery the disc radially. Always ensure that the same type and grade of pad lining is fitted to all six brake calipers.

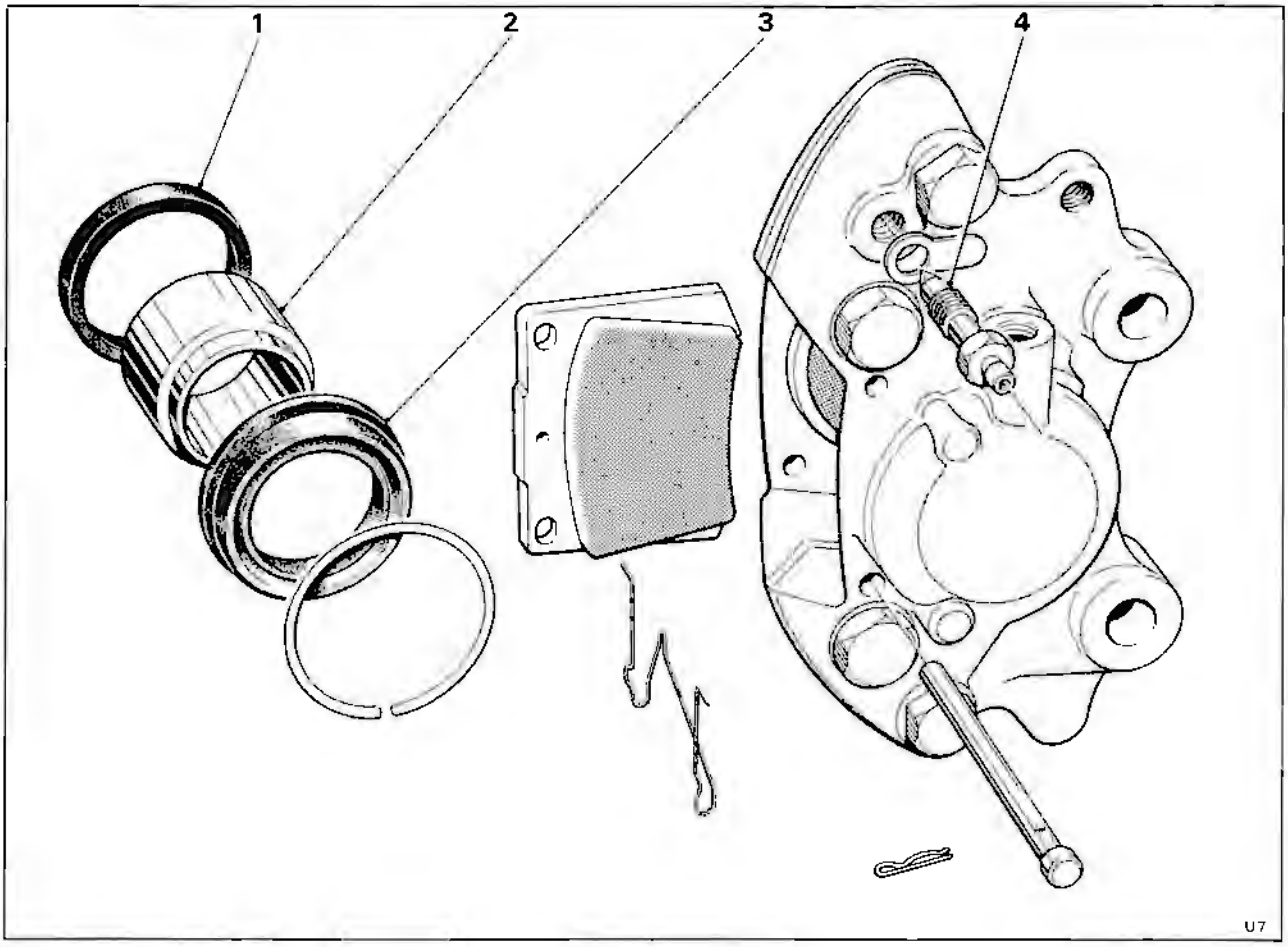


Fig. G19-3 Front wheel brake caliper (left-hand trailing caliper shown)

1 Piston seal
2 Piston
3 Dust seal
4 Bleed screw

Brake discs and pads

Periodically, the surfaces of the brake discs and pads should be cleaned during driving.

When driving at high speeds and when traffic conditions permit the car should be braked by applying the brake pedal very firmly two or three times. On cars not fitted with an anti-lock braking system take care when braking to avoid locking the wheels.

Similar applications should be carried out during long journeys in poor weather conditions, particularly in winter when salt may have been used on the roads. Care should be taken however, if the outside temperature is approaching freezing point.

On completion of a journey which has been undertaken during wet conditions, especially if salt has been used on the roads, apply the brakes lightly whilst parking the car until it is stationary. This will dry the brake discs and inhibit corrosion.

These procedures will not only test the efficiency of the brakes but will maintain them in a state of readiness for whatever conditions may be encountered.

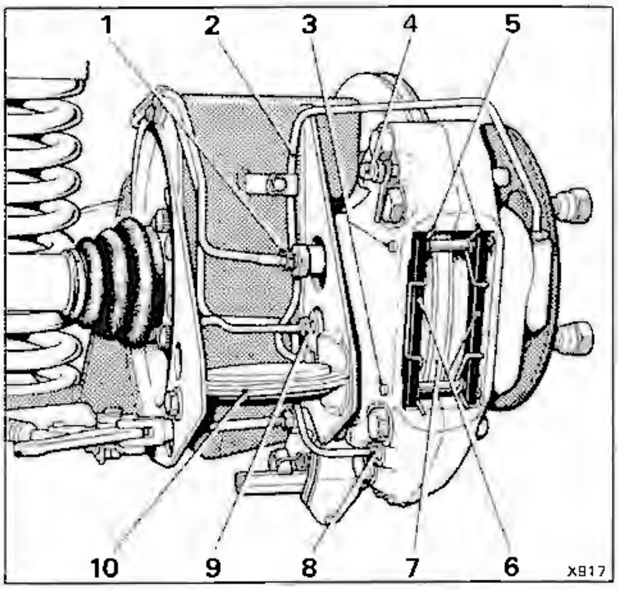


Fig. G19-4 Rear wheel brake caliper
1 Upper cylinder supply pipe
2 Lower cylinder supply pipe
3 Brake pad retaining pins
4 Upper cylinder bleed screw
5 Anti-rattle spring clips
6 Brake pads
7 Brake disc
8 Lower cylinder supply pipe
9 Lower cylinder bleed
10 Trailing arm suspension strut mount

Front wheel brake pads – To renew

(see figs. G19-1, G19-2, and G19-3)

1. Slacken but do not remove the front road wheel retaining nuts.
2. Securely chock the rear road wheels. Jack up the front of the car. Support the car with stands and sill blocks (see Chapter S).
3. Remove the front road wheels.
4. Remove the spring clips from the two brake pad retaining pins. Withdraw the pins from the caliper. Unclip the 'M' spring from the rear of each brake pad. Disconnect the pad wear sensor cable (front leading caliper only).
5. Withdraw the brake pads from the caliper.
6. Prior to fitting the new brake pads; inspect the caliper piston dust seals for signs of damage or heat hardening and renew as necessary.
7. Carefully press the caliper pistons back into their bores, taking care not to damage or trap the piston seals. Ensure that the piston seal retaining clips are correctly located.
8. Fit the new brake pads into position in the caliper. Ensure that the brake pad incorporating a sensor cable is fitted into the front leading caliper, inner position. Connect the cable to the connector.
9. Fit the trailing brake pad retaining pin through the caliper and brake pads. Secure the pin with the retaining clip. Ensure that the pads slide freely.
10. Locate the ends of the 'M' spring into the centre holes of the brake pad backplate. Ease the spring into position and secure with the leading pad retaining pin. Fit the pin retaining clip. When fitted the 'ears' of the 'M' spring must rest on the edge of the brake pad backing plate, with the bends at the top of the 'M' figuration butting against the caliper body.

Note The 'M' spring is only fitted onto the brake pad retaining pin at the leading end of the caliper, i.e. upper pin on the front brake caliper and lower pin on the rear brake caliper.

When fitting the 'M' spring do not compress the spring, more than the normal gap between the two brake pads, otherwise permanent distortion of the spring may occur.

Due to inherent distortion during pad wear, new 'M' springs should be fitted whenever the brake pads are renewed.

Rear wheel brake pads – To renew

(see figs. G19-4 and G19-5)

1. Securely chock the front road wheels. Jack up the rear of the car. Support the car with stands and sill blocks.
2. Remove the rear road wheels.
3. Remove the spring clips from the two brake pad retaining pins. Withdraw the pins. Collect the anti-rattle spring clips from the rear of each brake pad.
4. Withdraw the brake pads from the caliper.
5. Prior to fitting the new pads, inspect the caliper piston dust seals for signs of damage or heat hardening. Renew as necessary.
6. Carefully press the caliper pistons back into their bores, taking care not to damage or trap the seals. Ensure that the seal retaining clips are correctly located.

7. Fit the new pads by reversing the removal procedure, ensure that the pads slide freely. Ensure that the anti-rattle spring clips and pad retaining pin clips are correctly located; the heads of the retaining pins to be on the wheel side of the caliper.

Front brake caliper – To remove
(see figs. G19-1, G19-2, and G19-3)
1. Depressurize the hydraulic systems as described in Section G3.
2. Securely chock the rear road wheels.
3. Remove the wheel trim, then slacken but do not remove the wheel retaining nuts.
4. Raise the front of the car on a hydraulic jack. Securely support the car on stands and sill blocks (see Chapter S).
5. Remove the road wheels.
6. Disconnect the caliper feed pipe, blank off the pipe end and caliper port against the ingress of dirt.
7. Remove the bolts which secure the caliper to the axle yoke. Withdraw the caliper from the brake disc.
8. It is recommended that a distance piece is fitted between the caliper pads after removal, to prevent the pistons easing out of their bores.

Rear brake caliper – To remove
(see figs. G19-4 and G19-5)
1. Depressurize the hydraulic systems as described in Section G3.
2. Securely chock the front wheels of the car.
3. Remove the wheel trim, then slacken but do not remove the wheel retaining nuts.
4. Raise the rear of the car with a hydraulic jack. Securely support the car on stands and sill blocks (see Chapter S).
5. Remove the road wheels.
6. Disconnect the parking brake operating rod from the caliper lever.
7. Disconnect the two feed pipes from the caliper; fit blanks to the pipe ends and caliper ports.
8. Remove the caliper bridge pipe; fit blanks to the pipe ends and caliper ports.

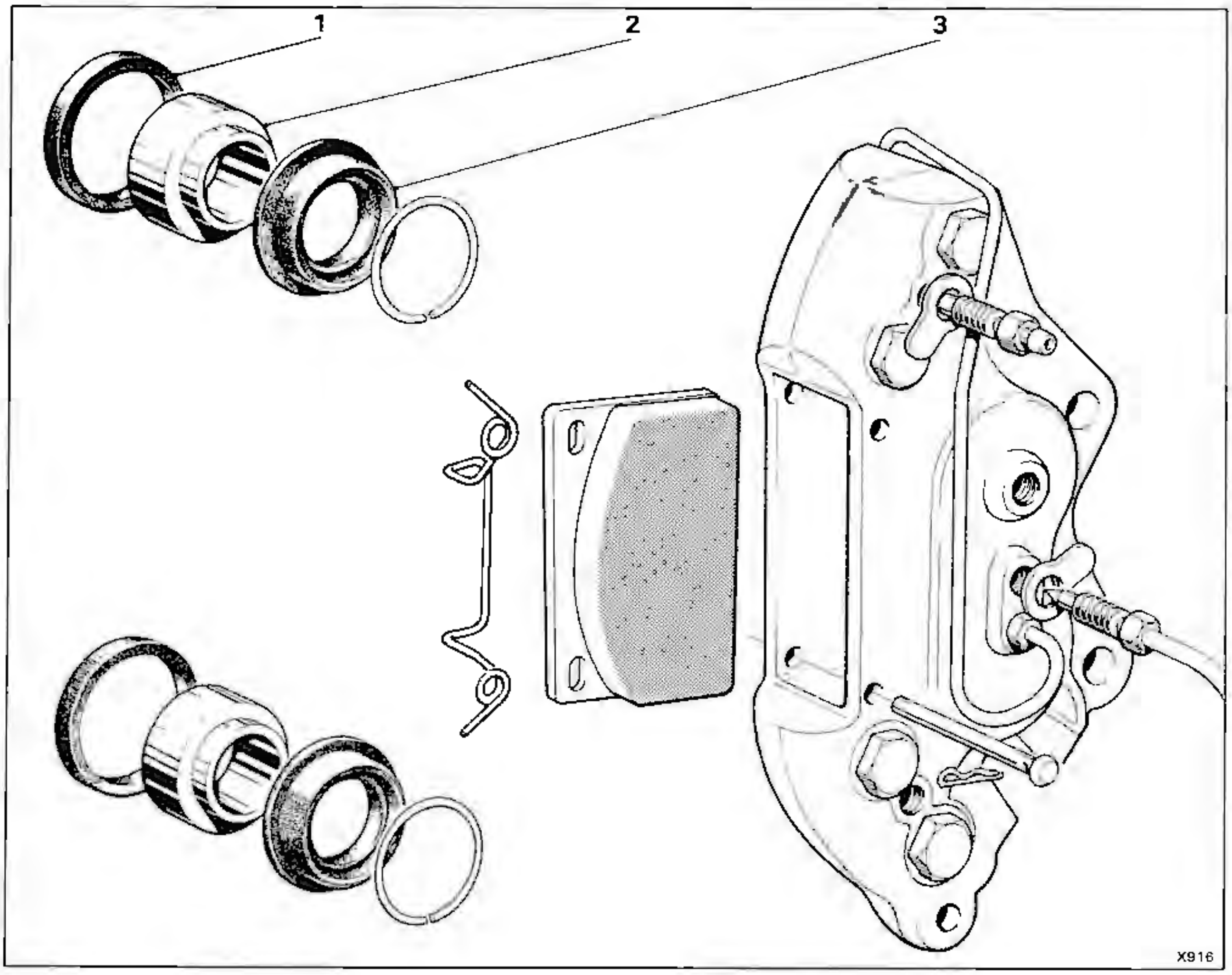


Fig. G19-5 Rear wheel brake caliper
1 Piston seal
2 Piston
3 Dust seal

9. Remove the pipe connection adapter and lower bleed screws from the inner face of the caliper.
10. Remove the bolts securing the caliper to the rear hub yoke.
11. Carefully withdraw the caliper from the brake disc.
12. Slacken the four bolts securing the hub yoke to the trailing arm, approximately four revolutions. Carefully draw the hub assembly away from the trailing arm until sufficient clearance is obtained to allow the removal of the caliper from the brake discs.

Brake caliper piston seals – To renew
The brake caliper seals should be renewed at the intervals specified in the Service Schedule Manual, publication number TSD 4702.

Only seals suitable for use with hydraulic system mineral oil must be fitted. Under no circumstances should seals for use with conventional brake fluid (i.e. RR363) be used.

1. Depressurize the hydraulic systems as described in Section G3.
2. Remove the brake caliper from the car and remove the brake pads as described previously.
3. Remove the spring clip retaining the caliper piston dust seal; remove the dust seal.
4. Ease the piston from its bore taking care not to damage the piston.
5. Remove the piston seal from the caliper bore.
6. Clean the caliper bore and piston with petroleum ether (120/160°C). Dry thoroughly, using dry compressed air, not any type of cloth.
7. Immerse the new piston seal in an approved hydraulic system mineral oil (refer to Chapter D). Then, carefully insert it into the groove in the caliper bore, ensuring that it is correctly seated.
8. Lubricate the piston outside diameter with a small quantity of an approved hydraulic system mineral oil, carefully fit the piston.
9. Fit a new dust seal around the piston top and over the caliper bore flange. Fit the spring ring taking care not to 'pinch' the seal with the ends of the ring.

Brake calipers – To fit
Fit the brake calipers by reversing the respective removal procedure noting the following.
1. All setscrews and pipe connections must be torque tightened in accordance with the figures quoted in Section G22 and Chapter P.
2. Ensure that a minimum clearance of 8,0 mm (0.312 in) is maintained between the caliper bridge pipe and the brake disc when fitting rear brake calipers.
3. When fitting is completed, bleed the hydraulic systems as described in Section G5.

Note The supply pipe connection ports on the front wheel brake calipers are a metric thread formation and only pipes fitted with the correct metric pipe nuts should be used.

Brake disc – To remove
1. Depressurize the hydraulic systems as described in Section G3.
2. Remove the front or rear hub as necessary, following the procedure described in Chapter H, Front hubs or Chapter J, Rear hubs.
3. To remove a front disc remove the setscrews securing the disc to the hub.
4. To remove a rear brake disc dismantle the rear hub as described in Chapter J, then unscrew the disc retaining setscrews.

Brake disc – To fit
Fit the brake disc by reversing the procedure for removal noting the following.
1. All setscrews must be torque tightened in accordance with the figures quoted in Section G22.
2. The hubs must be assembled and fitted as described in their respective Chapters H or J.
3. On completion the hydraulic systems must be bled as described in Section G5.

Note New brake discs are treated with a protective film. When a new disc has been fitted, the brakes should be applied gently until the protective film has been removed from the working surface of the disc by the first few brake applications.

If only one front brake disc has been replaced, the car will pull slightly to the side opposite the new disc until the protective film has been removed.

Parking brake linkage

Introduction
The parking brake is operated by a foot pedal application with a hand pull release.

The mechanism operates a caliper lever arrangement fitted beneath the two rear hydraulic brake calipers. These levers apply a wedge shaped friction pad to each side of the brake disc.

The parking brake should be inspected for wear and manually adjusted at the intervals specified in the Service Schedule Manual TSD 4702.

Pads must be renewed when the friction material has worn to within 3,18 mm (0.125 in) of the pad backplates.

Foot operated parking brake mechanism – To remove
1. Place the car on a ramp. Securely chock the road wheels. Release the parking brake.
2. At the intermediate linkage on the underside of the body, unhook the parking brake return spring from the operating lever. Remove the clevis pin attaching the front brake cable to the lever (see fig. G20-1).
3. Remove the lower trim panel from the parking brake area as described in Chapter S in order to gain access to the two setscrews and the two studs, which retain the foot pedal mechanism in position.
4. Disconnect the Lucar connectors from the micro-switch.
5. Disconnect the brake cable from the cable connector attached to the pedal lever.
6. Remove the two setscrews and two nuts that retain the mechanism in position. Lower the mechanism from beneath the facia.

Foot operated parking brake mechanism – To dismantle (see fig. G20-2)
1. Remove the foot operated parking brake mechanism as described previously.
2. Remove the side plates guard from the mechanism assembly, taking care not to damage the clipping tabs.
3. Remove the micro-switch.
4. Remove the cable connector from the pedal lever by removing a circlip from one end of the pin. Withdraw the pin.
5. Remove the sprag plate stop by removing the setscrew and the self-tapping screw.
6. Straighten the tension spring split pin. Withdraw the pin from the sprag plate to release the spring.
7. Remove the sprag plate by removing the circlips and washers from the pivot pin. Withdraw the pivot pin from the mechanism to release the sprag plate. Withdraw the sprag plate from the sprag rod.
8. Disconnect the sprag rod from the pedal lever by removing one of the retaining circlips from the pivot pin. Withdraw the pivot pin from the sprag rod and pedal lever.

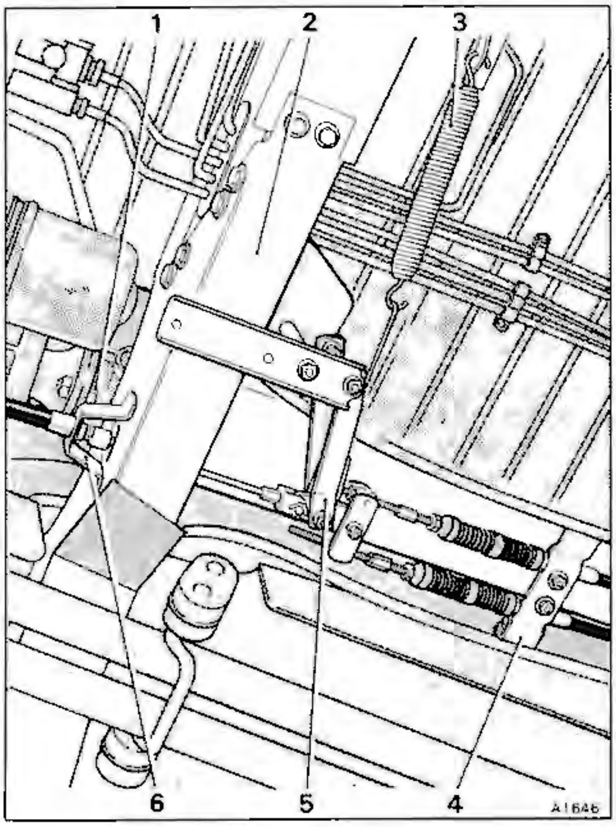


Fig. G20-1 Parking brake intermediate linkage
1 Propeller shaft
2 Centre body member
3 Return spring
4 Abutment bracket – rear brake cables
5 Operating lever
6 Mounting bracket – front brake cable

Note The following operation is only necessary if damage to the pedal lever is evident.

9. Carefully drill out the pedal lever pivot pin to release the pedal lever from the two side plates. Withdraw the pedal lever from the assembly.

Note If the release handle and rod are not damaged and operate correctly the following operations are not necessary.

10. Remove the Starlock fixing clip and spire linkage clip from the longest release handle slide rod.
11. Remove the split pin, washer, and spring from the shortest release handle slide rod. Carefully remove the release handle from the parking brake mechanism.

Foot operated parking brake mechanism – To assemble (see fig. G20-2)
Assemble the parking brake mechanism by reversing

the procedure given for dismantling, applying the following recommendations whilst noting that Operation 1 will only be necessary if the pedal lever needs to be replaced.

1. Position the pedal lever locating it with a new pin. Secure in place by rivetting over each end of the pin to grip the side plates.
2. Sparingly smear the inside of the sprag plate pivot hole with Retinax 'A' grease or any suitable equivalent.

Note The sprag rod must be clean, dry, and free from lubricant.

3. Fit the sprag plate onto the sprag rod, securing in position with a retaining pin and circlips.
4. Ensure that the cable connector cut-out is on the right-hand side when viewed from the front.
5. Adjust the mechanism as described under Foot operated parking brake mechanism – To adjust.

Foot operated parking brake mechanism – To adjust

The following operations can be carried out with the unit removed from the car.

1. Slowly depress the pedal from the 'off' position through its travel. The sprag plate will move forwards from its 'off' position for the first part of its travel and then move backwards towards the stop plate.
2. The sprag plate stop must be set with a clearance of 0,6 mm (0.025 in) between itself and the sprag plate when the pedal is in the full 'on' position. Torque tighten the locking setscrew on the stop in accordance with the figures quoted in Chapter P. Also tighten the self-tapping screw.
3. With the pedal mechanism in the 'off' position adjust the micro-switch so that it is depressed, tighten the setscrews.
4. To check that the micro-switch is functioning correctly move the pedal away from the 'off' position. The switch should be heard to 'click' on and then 'off' with the reverse movement, adjust as necessary.

Foot operated parking brake mechanism – To fit

Fit the foot operated parking brake unit by reversing the removal procedure noting the following.

1. All setscrews and nuts should be torque tightened to the figures quoted in Chapter P.
2. Care should be taken to ensure that the brake

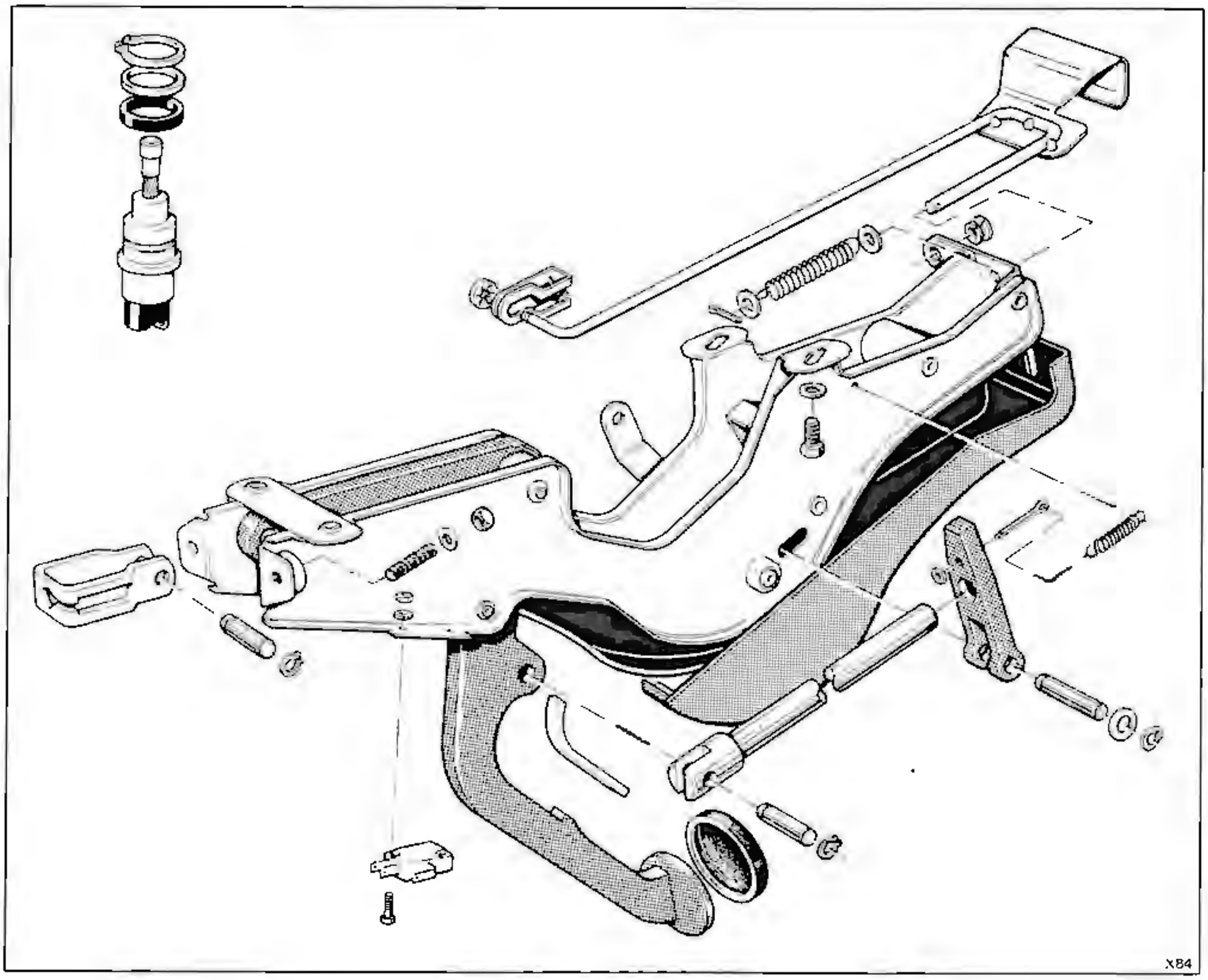


Fig. G20-2 Foot operated parking brake and cable connection

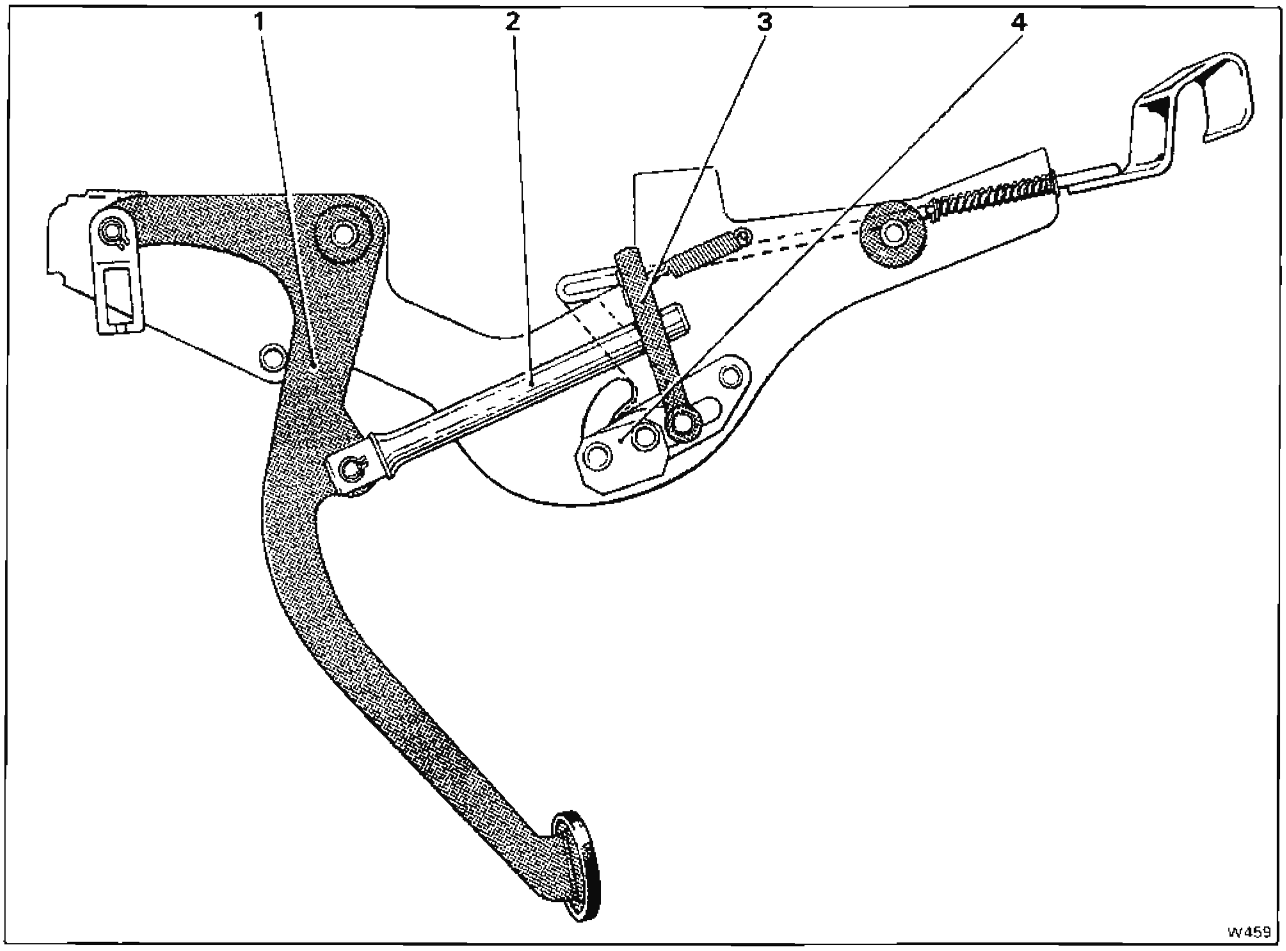


Fig. G20-3 Foot operated parking brake adjustment components
1 Foot pedal
2 Sprag rod
3 Sprag plate
4 Release mechanism

cable end is located correctly in the connector link of the unit.

Foot operated parking brake mechanism – To check
1. Check the movement of the release handle, as it should not foul the trim at any point during its full travel. If it does foul **do not** bend the slide rods, reposition the complete unit.

If the slide rods are bent, the handle slide rod assembly must be removed and a new one fitted. Refer to, Foot operated parking brake mechanism – To dismantle.
2. With the parking brake pads 'bedded-in', cables and linkages adjusted, depress the pedal fully and pull the release handle gently. If the pedal does not release check the sprag plate stop setting. Refer to, Foot operated parking brake mechanism – To adjust.

Parking brake front cable – To remove
1. Carry out Operations 1 and 2 of Foot operated parking brake mechanism – To remove.
2. Disconnect the front end of the brake cable from the cable connector which is attached to the pedal lever.
3. Remove the circlip retaining the outer cable to the body floor below the foot pedal mechanism.
4. Disconnect the rear end of the outer cable from the support bracket on the centre crossmember of the body.
5. Disconnect the clip securing the cable to the bracket on the transmission sump.

On left-hand drive cars disconnect the clip securing the cable to the throttle cross-shaft bracket.
6. Remove the cable from the car.

Parking brake front cable – To fit
Fit the parking brake front cable by reversing the procedure given for removal noting the following.
1. On right-hand drive cars ensure that the cable passes between the transmission casing and throttle lever.
2. All setscrews and nuts should be torque tightened in accordance with the figures quoted in Chapter P.
3. Lubricate the clevis pin with Rocol MTS 1000 grease or any suitable equivalent.
4. Check for freedom of operation during the application and release of the parking brake. The parking brake should operate freely without

roughness or binding throughout its entire operation.
5. Adjust the cables and calipers as described under Parking brake cables and calipers – To adjust.

Parking brake rear cables – To remove

1. Disconnect the rear cables at the equalizer fitted to the intermediate linkage on the centre body crossmember.
2. Disconnect the rear end of each cable from the parking brake caliper mechanism.
3. Remove the two centre bolts from the abutment bracket at the front end of the cables; collect the top clamping plate.
4. Disconnect the cable support clips.
5. Carefully withdraw the right-hand rear cable from beneath the heatshield and then remove the cables from the car.

Parking brake rear cables – To fit

Fit the parking brake rear cables by reversing the procedure given for removal noting the following.

1. All setscrews and nuts should be torque tightened in accordance with the figures quoted in Chapter P.
2. Lubricate the clevis pins and cable adjustment threads with Rocol MTS 1000 grease or any suitable equivalent, prior to fitting.

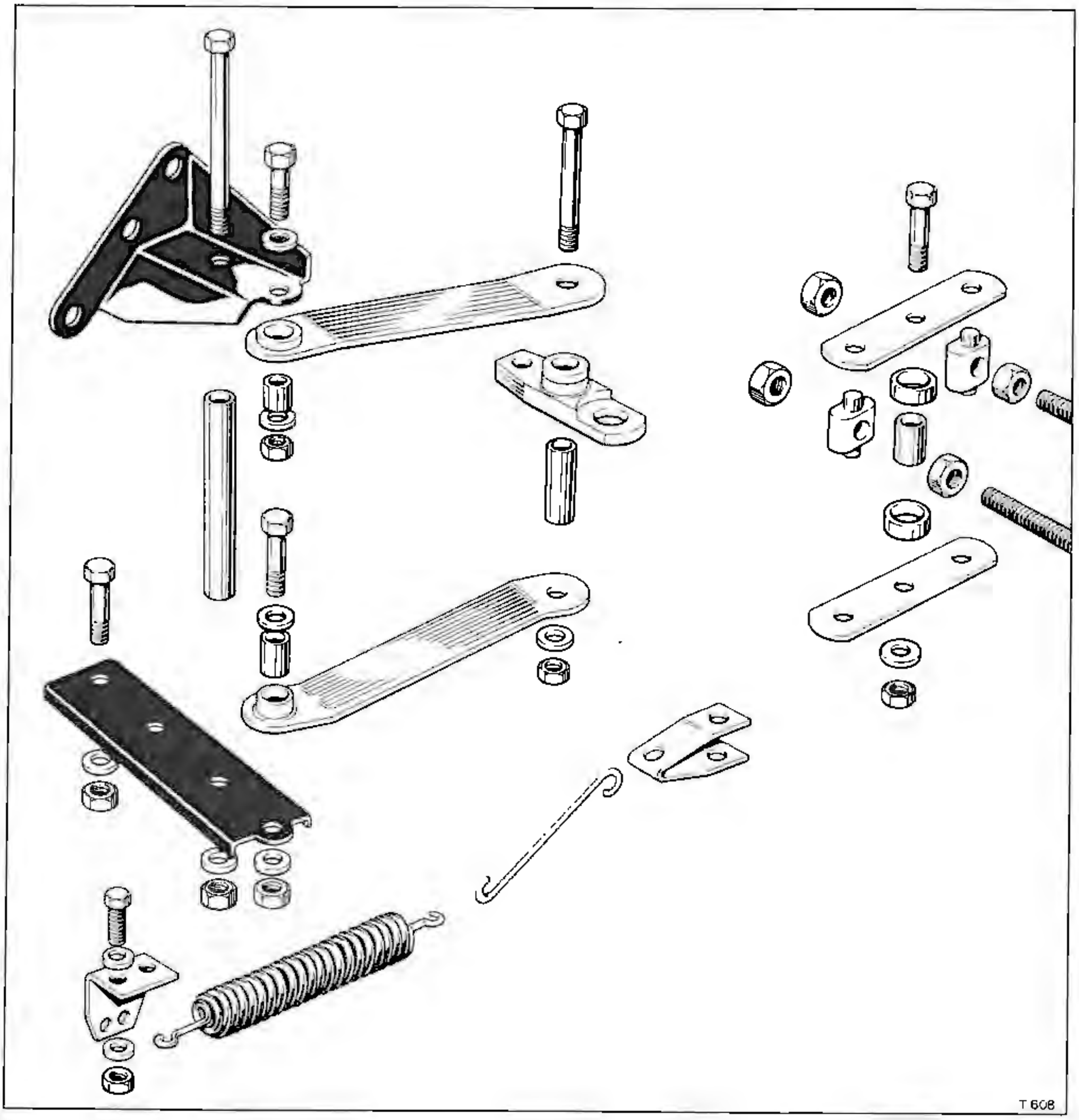


Fig. G20-4 Parking brake intermediate linkage

3. Check the freedom of operation during the application and release of the parking brake. The parking brake should operate freely without roughness or binding throughout its operation.
4. Ensure that the cables are correctly located in the cable support clips and can move freely through them. Also, ensure that the cables are routed above the lower tube of the rear suspension space frame.
5. Adjust the cables as described under Parking brake cables and calipers – To adjust.

Parking brake cables and calipers – To adjust
Before any adjustments are made to the parking brake rear cables the caliper on each rear wheel should be set as follows.
1. Remove the clevis pin connecting the brake cable to the actuation lever.
2. Disconnect the actuation rod from the actuation lever.
3. Check and adjust if necessary the length of the actuation rod, to obtain a measurement of 57 mm (2.250 in) between the exposed face of the jaw locknut and the face of the opposite jaw.
4. Position the rod onto the actuation lever; fit the clevis pin, waved washer, and split pin. Lubricate the clevis pin with Rocol MTS 1000 grease or any suitable equivalent.
5. Ensure that the parking brake caliper is on its 'off stop'. Check that the clearance (see fig. G20-5, point A) between the washer on the spring guide rod and the spring abutment bracket is approximately 6 mm (0.250 in) at the point of minimum clearance. Bend the abutment bracket as necessary.

Note The washer fitted to the end of the spring guide rod must not act as the parking brake 'off stop' as this will cause caliper pad misalignment.

6. Connect the rear brake cable to the actuation lever.
7. Ensure that the parking brake is in the fully 'off' position. Adjust the rear cables at the equalizer on the intermediate linkage until the caliper 'off stops' are just clear of the caliper. Measure the gap beneath each 'off stop' and lengthen the cables at the adjusters by this amount.

Note The cables must be adjusted so that the equalizer transverse link lies at right-angles to the centre line of the car with the parking brake in the 'off' position.

8. Raise each rear wheel in turn so that it is free to rotate. Turn the caliper adjuster clockwise until the parking brake pads grip the brake disc. At this point it should only just be possible to rotate the wheel by hand. Turn the adjuster anti-clockwise a quarter turn (three clicks on the nut) to obtain minimum clearance between the pads and disc.
9. Ensure that the centralizing straps are forcing the pads away from the disc when the parking brake is in the 'off' position. If not, remove the retaining bolt securing the straps; bend the straps outwards then re-assemble.
10. When new brake pads have been fitted carry out the pad bedding operation as described under Parking brake pads – To 'bed-in'.

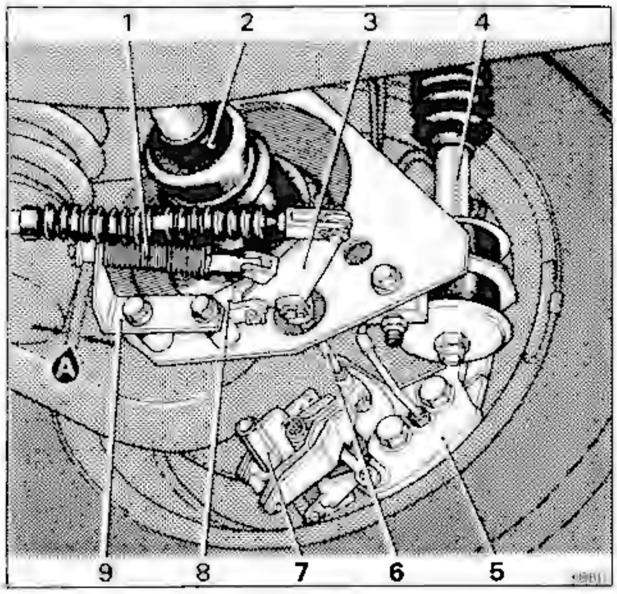


Fig. G20-5 Parking brake caliper and cable adjustment
1 Guide rod and return spring
2 Drive-shaft
3 Actuation lever
4 Suspension strut
5 Brake caliper
6 Actuation rod
7 Caliper adjuster
8 Mounting bracket
9 Spring abutment bracket

Parking brake pads – To renew (see fig. G20-6)
1. Securely chock the front wheels.
2. Raise the rear of the car. Place sill blocks under the rear end of the body sills. Support the trailing arms; do not allow the suspension struts to support the full suspension load.
3. Remove the rear wheels.
4. Release the parking brake to the 'off' position.
5. Disconnect the caliper actuation rod from the caliper lever.
6. Unscrew and remove the caliper adjuster. Collect the adjuster clicker block.
7. Unhook the pad retention springs from each brake pad; note that the larger spring is fitted to the inner parking brake pad.
8. Lift out the parking brake pads from the caliper and remove the retention springs.
9. Fit the springs to the new pads, then locate the pads in position. Hook the springs onto the caliper levers.
10. Complete the assembly by reversing the removal procedure. Adjust the calipers and cables as described under Parking brake cables and calipers – To adjust.

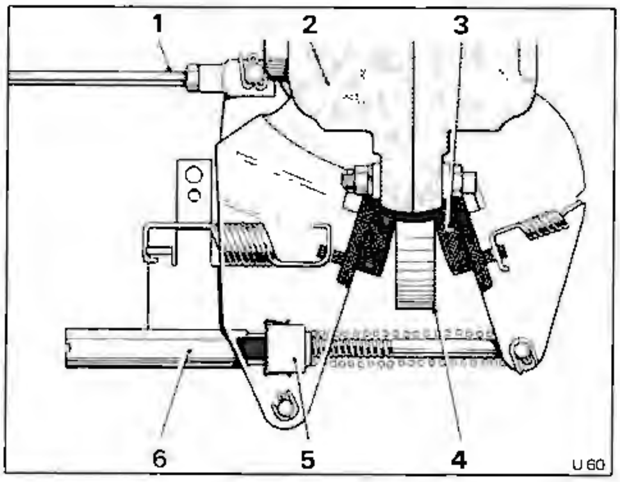


Fig. G20-6 Parking brake caliper
1 Actuation rod
2 Brake caliper
3 Parking brake pads
4 Brake disc
5 Adjuster clicker block
6 Adjuster

Parking brake pads – To 'bed-in'
When new parking brake pads are fitted to the car the following 'bedding-in' procedure should be carried out.

1. Drive the car at 48 km/h (30 mile/h) and apply the parking brake to bring the car to rest. The parking brake should be applied in such a way that the retardation of the car is constant without locking the wheels. This operation should be carried out nine times, allowing at least one minute to elapse between applications to prevent overheating.
2. Readjust the parking brake caliper as described in Operation 8 of Parking brake cables and calipers – To adjust.

Fault diagnosis

Hydraulic braking and levelling systems

Operation 1

Check the reservoir mineral oil level, after ensuring that the car is unladen.

Mineral oil level low.

Top-up the reservoirs to the correct level and bleed the hydraulic systems.

Check the hydraulic pipes and units for leakage.

Rectify any leakage as necessary and bleed the hydraulic systems.

If the warning lamp(s) remain illuminated carry out Operation 2.

Check the brake pads for wear.

Replace worn or defective brake pads.

Operation 2

Depressurize the system as described in Section G3.
Fit pressure gauge RH9727 GMF into each service point within the relevant system.
Start the engine and allow it to idle at approximately 1000 rev/min.
Carefully observe the pressure gauge.

If the pressure continues to fall after the accumulator has reached the cut-out pressure of between 165 bar and 180 bar (2393 lbf/in² and 2610 lbf/in²) and then settles, an internal leak is indicated.
If observation of the gauge shows that the pump is still pumping (needle fluctuating with the pump pulses) without giving a rise in pressure, then there is a leak equal to the pump flow at that pressure. Pump 'cut-out' indicated by the change of audible note of the pump can be heard, if the end of the engine dipstick is placed on top of the pump and used as a hearing aid.

Carry out Operation 3.
To verify an accumulator internal leak, or pump malfunction.

The correct behaviour of the gauge is as follows.
The gauge needle should immediately rise to between 31 bar and 62 bar (450 lbf/in² and 900 lbf/in²) indicating a satisfactory nitrogen gas pressure in the accumulator sphere. The pressure should then slowly rise to between 165 bar and 180 bar (2393 lbf/in² and 2610 lbf/in²). At this pressure the accumulator cut-out valve should actuate and the pump cease to charge the accumulator.
After the cut-out pressure has been reached note the pressure to which the gauge settles. This settling takes up to one minute and the pressure should not be more than 10 bar (150 lbf/in²) below the cut-out pressure. The pressure should then remain steady unless the brake pedal is applied or the levelling system actuated.
Fit a bleed tube onto the bleed screw of the gauge connecting pipe. Open the bleed screw and allow the pressure gauge reading to fall.
When the pressure has fallen to between 140 bar and 155 bar (2030 lbf/in² and 2248 lbf/in²) the accumulator control valve should allow the hydraulic pump to recharge the accumulator.
This indicates the correct build up and cut-out of the accumulator and that the system is functioning correctly.

If on first starting the engine, the pressure gauge needle fluctuates violently, rapidly climbs to 172 bar (2500 lbf/in²) and then immediately falls to zero on application of the brake pedal, a complete loss of nitrogen gas pressure from the accumulator sphere is indicated.
In the event of the nitrogen gas pressure of the accumulator being less than 31 bar (450 lbf/in²) the accumulator sphere must be renewed.

Renew the accumulator sphere (see Section G9). Carry out Operation 2 to check operation of accumulator.

The warning lamp(s) remain on.
The hydraulic pressure has built up normally, indicating a fault in the warning lamp circuit.

Check the warning lamp circuit and rectify as necessary (refer to the Electrical Manual TSD 4701, Section 20).

Operation 3

Depressurize the system.
Disconnect the 'accumulator to frame' high pressure hydraulic steel braided hose, from the accumulator of each relevant system.
Blank off the hydraulic hose.
Fit pressure gauge RH 9727 GMF to the accumulator junction block situated at the engine end of the hose.
Start the engine and observe the pressure.
This action separates the accumulator from the rest of the system and allows the accumulator and hydraulic pump to be checked thoroughly.

The pressure continues to fall after the accumulator has reached the cut-out pressure of between 165 bar and 180 bar (2393 lbf/in² and 2610 lbf/in²) and then settles.
Check that the internal bleed screw on the accumulator is tight.
The valve has an internal leak.

Renew the accumulator valve housing (see Section G9).
Carry out Operation 2 to check accumulator operation.

Pressure does not build up at all.
This indicates that the hydraulic pump is not functioning correctly because either the pump is air locked, there is dirt under the pump main delivery valve seat, the pump plunger has seized, or the pump push rod is bent.

Stop the engine.
Connect a bleed tube to the bleed screw on the gauge pipe. Open the bleed screw. Run the engine to see if mineral oil flows from the bleed tube.

Mineral oil does not flow.
Check that the hydraulic pump is not air locked.
Mineral oil still does not flow.
Close the bleed screw and stop the engine.
Disconnect the low pressure return hose from the accumulator and connect a bleed tube.
Start the engine.
If there is a low pressure return flow, the accumulator valve is faulty.
Renew the accumulator body (see Section G9).
If there is no low pressure return flow the hydraulic pump is faulty, or the pump push rod is bent.
Overhaul the hydraulic pump (see Section G8).
Bleed and test the system.

Mineral oil flows.
Close the bleed screw and check again. If pressure still does not build up the pump is faulty.
Overhaul the hydraulic pump (see Section G8).
Bleed and test the system.

Pressure builds up and cuts out correctly.

Carry out Operation 4.

Operation 4

Depressurize the hydraulic system.
Remove the gauge from the system. Reconnect the hydraulic steel braided hose to the junction block, situated at the engine end.

Blank off the feed to the relevant distribution valve.
Carry out Operation 2.

If pressure now builds up normally, overhaul the distribution valve as described in Section G11.
Bleed and test the system.

Isolating procedure – Single levelling rear suspension

Depressurize the system as described in Section G3. Fit pressure gauge RH 9727 GMF into the suspension struts service point.

To check the right-hand side gas spring sphere
Disconnect the hydraulic pipe from the 3-way connector to the left-hand side suspension strut. Fit a blanking plug in the 3-way connector to withstand hydraulic system pressure. Blank the hydraulic pipe removed.

To check the left-hand side gas spring sphere
Disconnect the hydraulic pipe from the 3-way connector to the right-hand side suspension strut. Fit a blanking plug in the 3-way connector to withstand hydraulic system pressure. Blank the hydraulic pipe removed. Remove pressure gauge RH 9727 GMF from the struts service point. Disconnect the hydraulic pipe from the 3-way connector to the left-hand side suspension strut. Screw the pipe removed, and pressure gauge RH 9727 GMF into an **extra** 3-way connector. Join the two 3-way connectors together with a flexible hose, capable of withstanding hydraulic pressure.

Start the engine and allow the system to pressurize. Bleed the strut and pressure gauge. Position an open ended spanner [maximum length not exceeding 152 mm (6.0 in)] onto the levelling valve operating lever. Then, push the lever towards the valve. Hold in this position until a pressure of approximately 34,5 bar (500 lbf/in²) is indicated on the pressure gauge.

Switch off the engine. Slowly open the bleed screw on the gauge. The gauge needle will commence to descend slowly. Note the actual reading on the pressure gauge when the needle drops sharply. This figure indicates the actual gas pressure within the sphere. The pressure must be between 10,35 bar and 18,62 bar (150 lbf/in² and 270 lbf/in²).

In the event of the nitrogen gas pressure in the sphere(s) being outside the limits, the sphere(s) must be renewed.

Renew the sphere(s) (see Section G18). Carry out the isolating procedure of the sphere(s) and check the gas pressure as described previously.

Special torque tightening figures

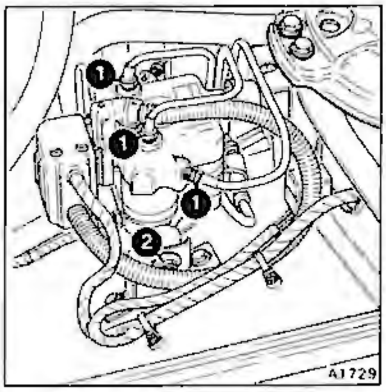
Introduction

This section contains the special torque tightening figures applicable to Chapter G.

For standard torque tightening figures refer to Chapter P.

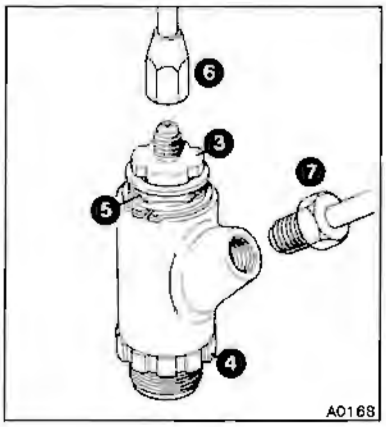
Components used during manufacture of the vehicle have different thread formation (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and screws it is important to ensure that the correct type and size of thread formation is used.

Section G6



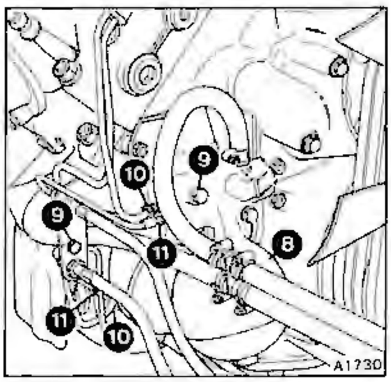
Ref.	Component	Nm	kgf m	lbf ft
1	Hydraulic pipes	13-16	1,3-1,6	9-12
2	Modulator mounts	6-8	0,6-0,8	4.5-6

Section G8



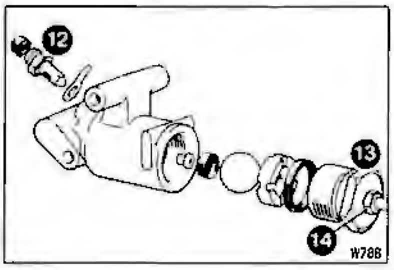
Ref.	Component	Nm	kgf m	lbf ft
3	Adapter – Brake pump	68-74	7,0-7,6	50-55
4	Castellated nut – Brake pump to engine	44-47	4,5-4,8	32-35
5	Lock-nut – Adapter to brake pump	21-33	2,1-3,4	15-25
6	Pipe nut – Brake pump to accumulator	11-13	1,2-1,3	8-10
7	Pipe nut – Brake pump inlet pipe	17-20	1,7-2,0	12-15

Section G9



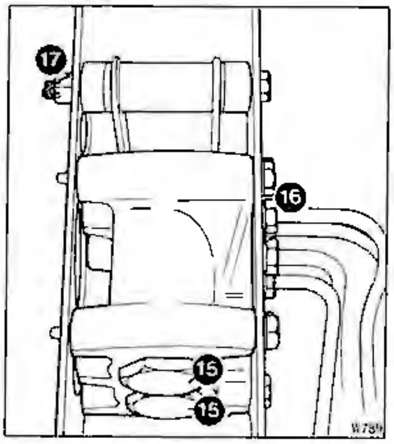
Ref.	Component	Nm	kgf m	lbf ft
8	Sphere to accumulator body	25-44	2,5-4,5	18-33
9	Bleed screws	8-9	0,85-0,9	6-6.6
10	Pipe nuts – High pressure inlet from pump (M12)	9-11	1,0-1,1	7-8
11	Pipe nuts – High pressure outlet (M9)	8-9	0,85-0,9	6-6.6

Section G10



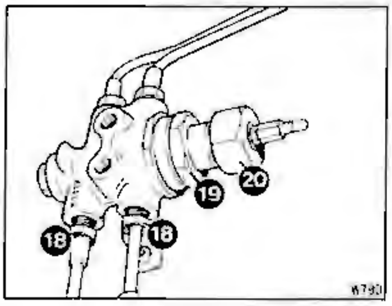
Ref.	Component	Nm	kgf m	lbf ft
12	Bleed screw	7-9	0,7-0,9	5-7
13	End plug	34-47	3,5-4,8	25-35
14	Pipe nuts (⅜ in dia. UNF)	7-9	0,7-0,9	5-7

Section G11



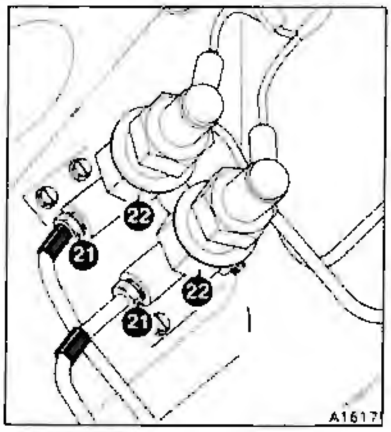
15	End plug	82-88	8,3-8,9	60-65
16	Pipe nuts (⅜ in dia. UNF)	7-9	0,7-0,9	5-7
17	Castellated nuts – Valve mounting	11-13	1,2-1,3	8-10

Section G13



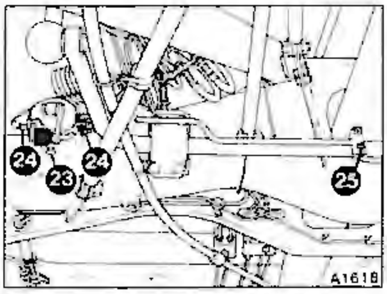
18	Pipe nuts (⅜ in dia. UNF)	7-9	0,7-0,9	5-7
19	Switch housing	75-81	7,7-8,2	55-60
20	Switch housing cap	17-20	1,7-2,0	12-15

Section G14



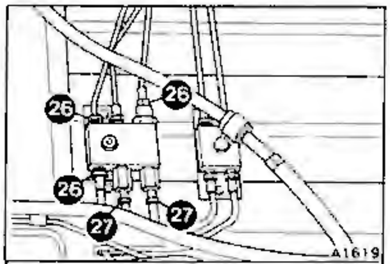
21	Pipe nuts (⅜ in dia. UNF)	7-9	0,7-0,9	5-7
22	Pressure switch to 3-way connector block	7-9	0,7-0,9	5-7

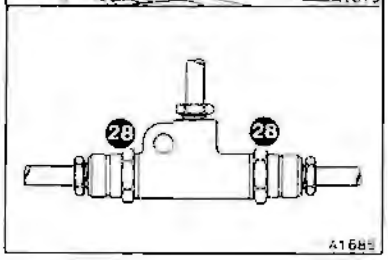
Section G15



Ref.	Component	Nm	kgf m	lbf ft
23	Setscrews – Levelling valve to bracket	21-23	2,1-2,3	15-17
24	Pipe nuts (M8)	8-9	0,85-0,9	6-6.6
25	Nuts – Torsion bar 'U' bolt clamp	5,2-6,2	0,53-0,63	3.8-4.6

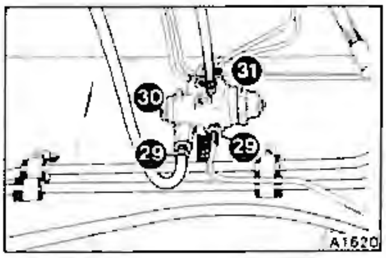
Section G16





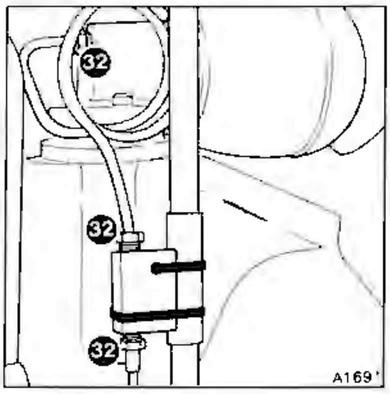
26	Pipe nuts (⅜ in dia. UNF)	7-9	0,7-0,9	5-7
27	Pipe nuts (M8)	8-9	0,85-0,9	6-6.6
28	Restrictors – To rear struts	17-20	1,7-2,0	12-15

Section G17



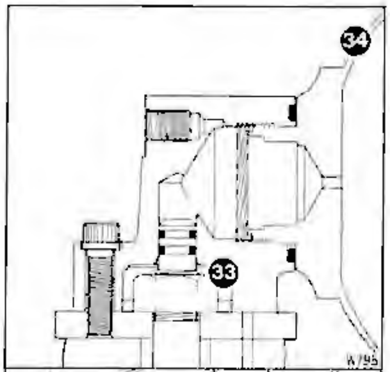
29	Pipe nuts (M8)	8-9	0,85-0,9	6-6.6
30	End plug – Minimum pressure valve	28-33	2,8-3,4	20-25
31	End cap – Minimum pressure valve	75-81	7,7-8,2	55-60

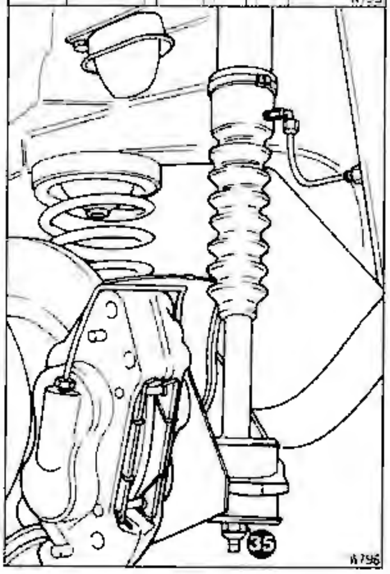
Section G18



32	Pipe nuts (⅜ in dia. UNF)	7-9	0,7-0,9	5-7

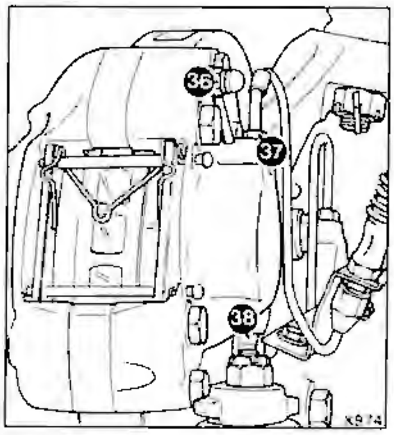
Section G18





Ref.	Component	Nm	kgf m	lbf ft
33	Strut retaining nut	55-58	5,6-5,9	40-43
34	Sphere – Gas spring	25-44	2,5-4,5	18-33
35	Self-locking nut – Strut piston rod to trailing arm	40-43	4,1-4,4	29-32

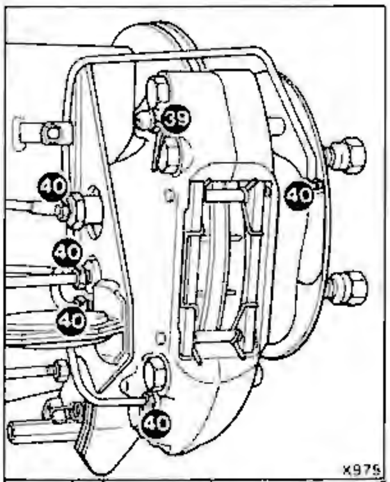
Section G19

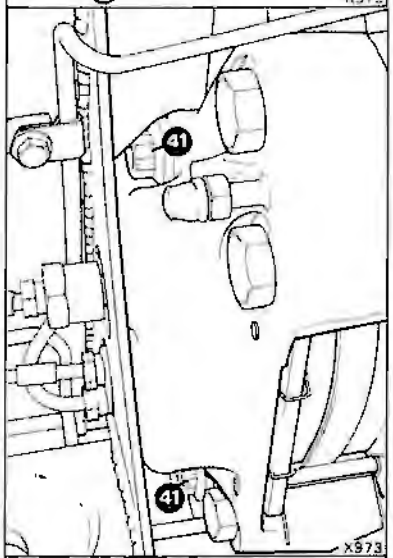


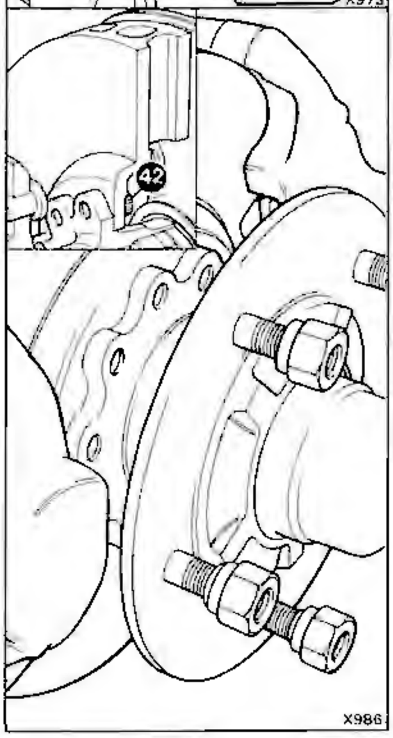
Ref.	Component	Nm	kgf m	lbf ft
36	Bleed screws – Front wheel caliper	7-9	0,7-0,9	5-7
37	Pipe nuts (⅜ in dia. UNF)	7-9	0,7-0,9	5-7
38	Setscrews – Front caliper to stub axle (7⁄16 in dia. UNF)	75-81	7,7-8,2	55-60

Section G19

Ref.	Component	Nm	kgf m	lbf ft
39	Bleed screws – Rear wheel caliper	7-9	0,7-0,9	5-7
40	Pipe nuts (⅜ in dia. UNF)	7-9	0,7-0,9	5-7
41	Setscrews – Rear caliper to stub axle (½ in dia. UNF)	109-115	11,1-11,5	80-85
42	Setscrews – Front brake disc to hub	44-48	4,5-4,9	32-36







Workshop tools

RH 2841	Contamination kit – Hydraulic system mineral oil
RH 8428	Special box spanner – Hydraulic pump
RH 9727GMF	Pressure gauge – Hydraulic system mineral oil
RH 9814	Spanner – Lock-nut – Hydraulic pump
RH 9844	Ring spanner – Adapter – Hydraulic pump
RH 9882	Anti-lock braking system test box
RH 9885	Removal and fitting tool – Reservoir lid
RH 12043	Hydraulic pipe manufacturing kit (comprising RH 12044, RH 12045, and RH 12046). Any tool obtainable separately
RH 12044	Double lap flaring tool
RH 12045	Pipe cutter
RH 12046	Pipe bender

Sub-frames and Suspension

Contents

12/87
Printed in England

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10
1	12/87	12/88	12/88	12/88	12/88	12/87	12/88	12/87	12/87	12/88
2			12/88	12/88	12/88	12/87	12/88	12/87	12/87	12/88
3	12/88		12/88	12/88	12/88	12/87		12/87	12/88	12/88
4			12/88	12/88	12/88			12/87		
5			12/88							
6			12/88							
7			12/88							
8			12/88							
9			12/88							
10			12/88							
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Sections / Page No.	H11	H12	H13	H14						
1	12/87	12/87	12/87	12/88						
2	12/88	12/88	12/87							
3	12/87	12/88	12/87							
4	12/87	12/87	12/87							
5		12/88								
6		12/87								
7		12/87								
8		12/87								
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Printed in England

Introduction

To enable the desired ride and handling characteristics of the respective models to be obtained, variations in the suspension components used are necessary. These variations fall mainly into three model groups.

Silver Spirit and Silver Spur.

Corniche, Corniche II, and Bentley Continental.

Mulsanne, Mulsanne S, Bentley Eight, and Turbo R.

In some instances the differences are not visibly evident and can only be confirmed by the component part number. The components affected are as follows.

Front suspension

Front sub-frame mounts

Visual appearances are identical but the rubber hardness differs.

Types identifiable by the part number moulded into the rubber of the mount.

Suspension dampers

Visual appearances are identical but the damping characteristic differs.

Types identifiable by the part number located at the base of the damper body.

Stabilizer and links

A visually larger diameter stabilizer is fitted to all Bentley models except the Bentley Continental. The rubber mounts for this stabilizer have a larger bore and are produced from a different hardness of rubber.

Different links and mounting bolts to those on the other models are also used (see fig. H5-5) when this larger stabilizer is fitted.

Rear engine mounts

Visual appearances of the rubber section of the mounts are identical but the rubber hardness differs. The harder rubber mounts are fitted to all Bentley and Corniche models. These mounts are also fitted to 1988 and 1989 model year Silver Spur and 1989 model year Silver Spirit cars *conforming to a Canadian and USA specification,* and to cars *conforming to Australian, Austrian, Japanese, Swedish, and Swiss specifications* from vehicle identification numbers (VIN)

Silver Spirit

* SCAZSO2A9KCX24804 *

Silver Spur

* SCAZNO2A3KCH24761 *

On all 1989 model year cars an engine roll stop plate and buffer is incorporated in the design of the mounts (see fig. H3-11).

Sub-frame tie-bars and stabilus dampers

On all cars other than the Corniche, Corniche II, and Continental models tie-bars are fitted between the sub-frame and the body longeron (see fig. H3-6). Small dampers are also fitted between the sub-frame and the engine to stabilize engine movement. Both of these items are situated at the rear of the sub-frame on each side of the engine.

Rear suspension

Rear crossmember mounts

The crossmember mounts are visually identifiable by the size of the voids in the rubber of the mounts.

Final drive crossmember mount

The mount used is the same for all models.

Rear stabilizer and links

A visually larger diameter stabilizer is fitted to all Bentley models except the Bentley Continental. The rubber mounts for this stabilizer have a larger bore.

Different links to those used on the other models are also used (see fig. H9-6) when this larger stabilizer is fitted.

Front sub-frame and suspension

Introduction
This section describes the removal of the front sub-frame, engine, and torque converter transmission as one unit. Details for removal of the engine only are given in Chapter E.

Before removal, reference should also be made to Chapter C and Chapter G. These chapters give details of the procedures necessary to discharge the air conditioning refrigeration system and depressurize the hydraulic braking and levelling systems. On cars fitted with an exhaust gas emission control system, reference should also be made to publication TSD 4737 Engine management systems.

The following operations are the basic requirements for removal of the sub-frame as a complete unit. It should be noted that the operations given relate to varying types of engine and car model. Modifications may also have been introduced as a result of improvements to the vehicle. Always ensure that all relevant looms, pipes, hoses, etc. are disconnected prior to raising the body from the sub-frame and engine unit.

When disconnecting hose and pipe connections, suitable blanks should always be fitted to prevent the ingress of foreign matter and the loss of lubricants and fuel. Ensure that hose and pipe routes and clipping positions are noted prior to removal.

Front sub-frame, engine, and torque converter transmission – To remove

1. Reverse the car onto a ramp and chock the rear road wheels.
2. Fit car protection kit RH2662, wing covers RH2684, and wing cover liners RH2685 onto the car.
3. Discharge the air conditioning refrigeration system as described in Chapter C.
4. Depressurize the hydraulic systems as described in Chapter G.
5. Drain the engine cooling system as described in Chapter L.
6. Switch on the ignition and move the gear range selector lever to the neutral position. Switch off the ignition.

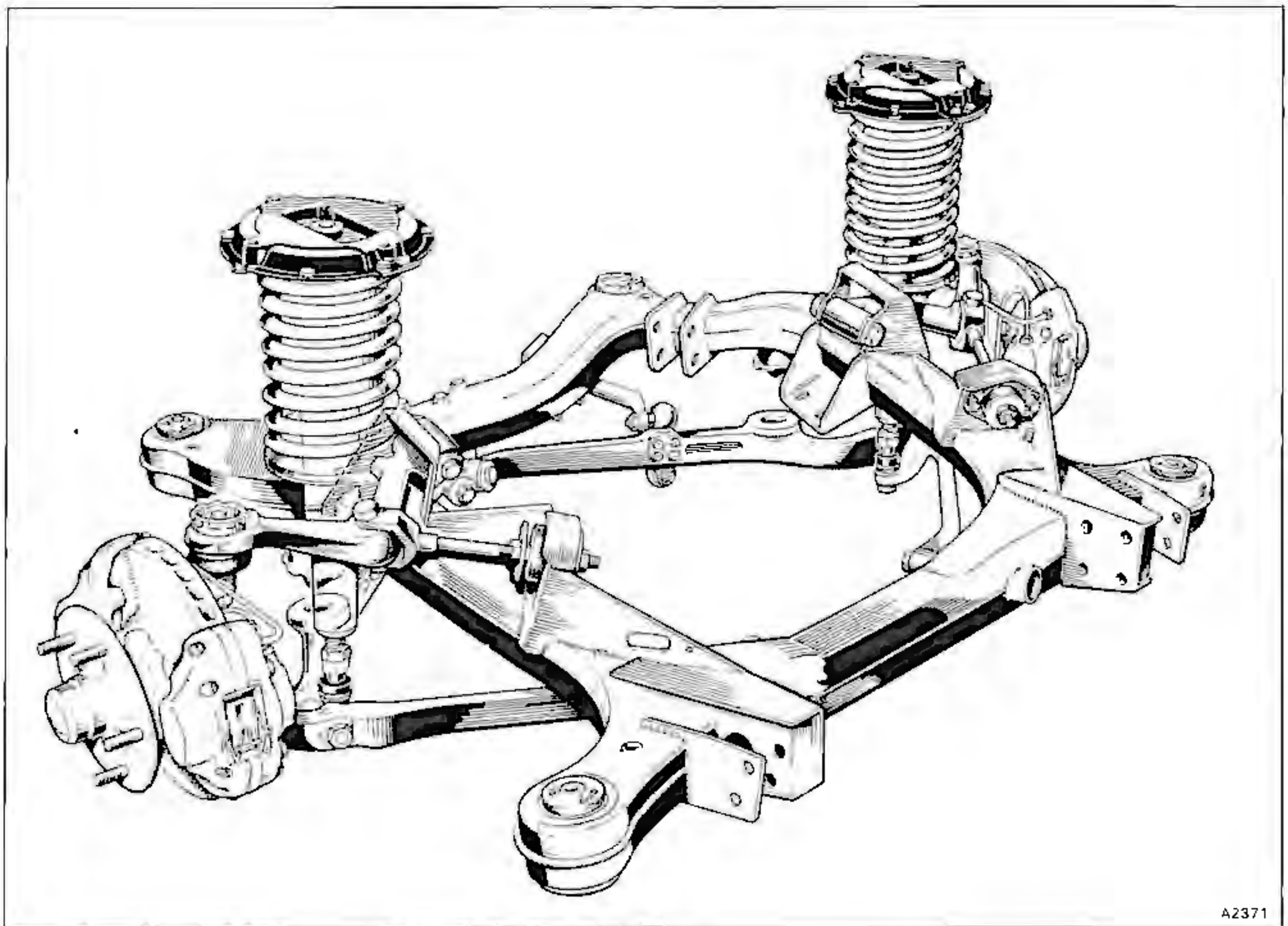


Fig. H3-1 Front sub-frame and suspension assembly

7. Disconnect the battery.
8. Remove the bonnet as described in Chapter S.
9. Remove the radiator top and bottom hoses.
10. Remove the engine fan as described in Chapter L.
11. Disconnect the heater tap feed and return hoses from the crankcase. On 1989 model year cars also disconnect the coolant expansion return hose.
12. Disconnect the two refrigeration pipes situated adjacent to the refrigerant compressor (see fig. H3-2).
13. Clamp the hydraulic system reservoir to brake pump hoses to prevent reservoir drainage, then disconnect the hoses from the pump inlet pipes. Fit blanks to the pipe ends.
14. Disconnect the steering pump and steering rack to oil cooler hoses. Allow the oil to drain into a container.
15. Remove the air intake duct. On cars fitted with an exhaust emission control system also remove the air pump feed hose.
16. On Bentley Turbo R cars remove the air dump (recirculation) pipe and the turbocharger intake adapter (see fig. H3-3). Blank off the turbocharger to prevent the ingress of foreign matter. On 1989 model year cars also disconnect the turbocharger to intercooler duct.
17. Disconnect the body to engine fuel hoses; also disconnect the evaporative loss canister hose if applicable.

Note The fuel supply line may contain pressurized fuel. When disconnecting this line an absorbent cloth should be placed around the joint and the pipe nut carefully slackened to release the pressure.

18. Disconnect the accumulator to body hoses. On Bentley Turbo R cars these hoses are situated on the left-hand side of the engine compartment adjacent to the rear engine mount.
19. Disconnect the accelerator down rod from the equalizer linkage. Remove the setscrews securing the equalizer bracket to the body, and the equalizer pivot bolt. Remove the equalizer bracket.
20. On Bentley Turbo R cars, disconnect the hydraulic mineral oil low pressure return hoses.
21. Disconnect the sub-frame to body hydraulic braking system hoses. On cars fitted with antilock braking, disconnect the electrical connections from the sensors

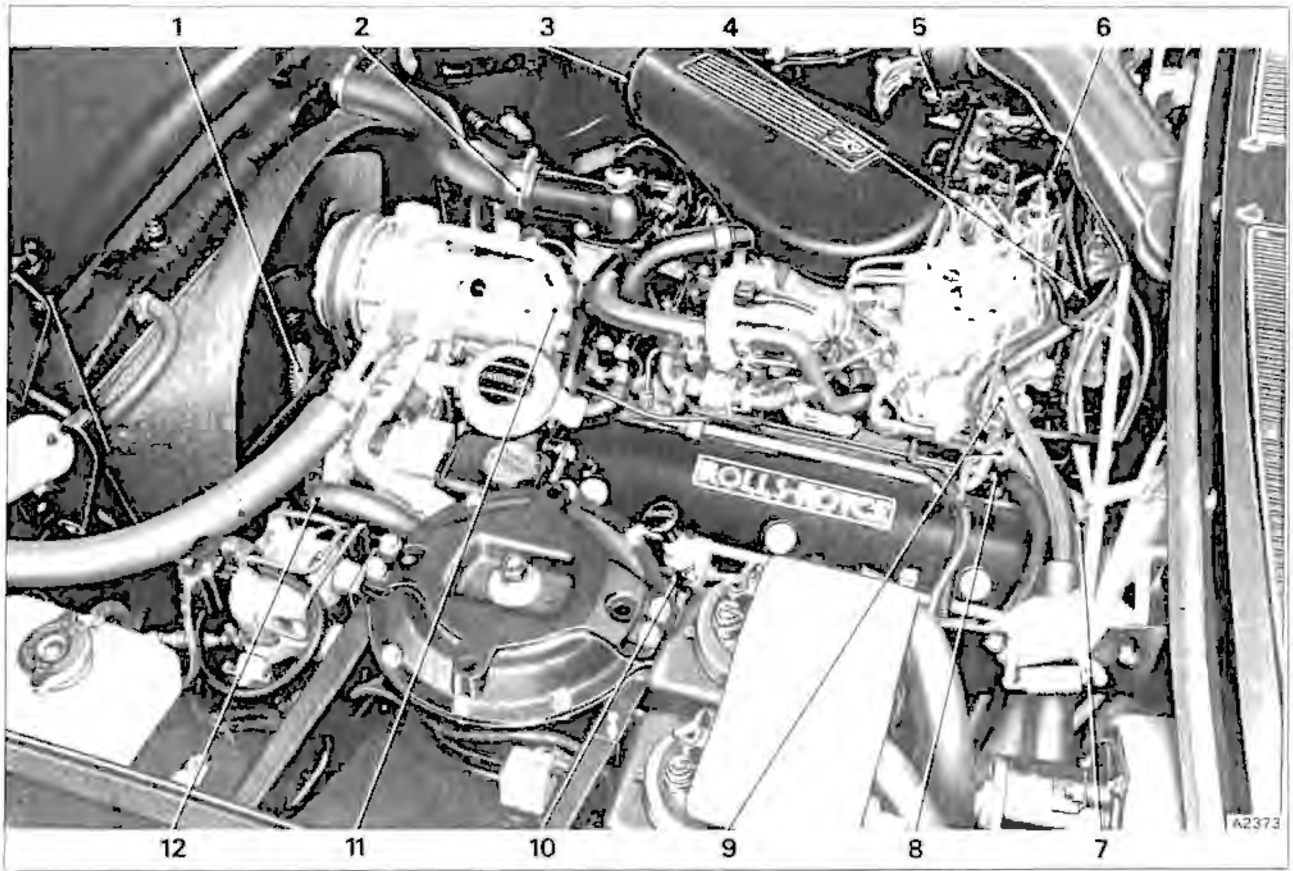


Fig. H3-2 Component disconnection points

1 Viscous fan
2 Radiator top hose
3 Air intake duct
4 H T lead
5 Electrical connections
6 Accelerator linkage
7 Heater hose
8 Fuel pipes
9 Front and rear brake pump supply pipes
10 Electrical connections
11 Refrigerant pipes
12 Heater hose, steering pump hose and radiator bottom hose

situated on each front yoke. The brake pad wear wires should also be disconnected.
22. Disconnect the two transmission oil cooler pipes from the bottom of the radiator assembly. Allow any transmission fluid to drain into a container.
23. Remove the two flexible engine oil filter to engine oil cooler pipes (see fig. H3-5). Allow any engine oil to drain into a container. On Bentley Turbo R cars remove the cooler pipes clamp situated on the right-hand longeron.
24. On cars fitted with an exhaust emission control system, disconnect the oxygen sensor electrical connection situated in the right-hand corner of the engine compartment.
25. Dependent on the type of exhaust system fitted, remove the section adjacent to the transmission unit together with any heat shields or grass fire shields. Refer to Chapter Q for details. On 1989 model year Bentley Turbo R cars also disconnect the compliance mount cooler duct situated behind the right-hand compliance assembly.
26. Disconnect the parking brake front cable from the equalizer assembly. Release the outer cable from its securing bracket on the centre body member. Detach the cable clip and move the cable away from the transmission.
27. Disconnect the propeller shaft from the transmission unit as described in Chapter F.
28. On left-hand drive cars, remove the accelerator cross-shaft.
29. On right-hand drive cars, remove the accelerator lever securing bolt and slide the lever along the pivot shaft; away from the transmission.
30. Disconnect the body to sub-frame earth braid situated adjacent to the right-hand rear sub-frame mount.
31. On cars fitted with tie-bars at the rear of the sub-frame (see fig. H3-6), disconnect the tie-bars from the body.
32. Remove the two bolts securing the steering link to the steering column.
33. Remove the gear change actuator from the transmission unit. Move the actuator to a suitable position and tie it to the underside of the car body.
34. Disconnect all the relevant electrical connectors and clipping points to release the engine looms. Refer to figures H3-7 and H3-8 for details.
35. Remove the front road springs as described in Section H4. Fit the wooden support blocks (see fig. H3-9) between the bump stops and the lower triangle levers. Lower the car onto its wheels, ensuring that the wooden blocks remain in position.
36. Ensure that all the relevant components have been disconnected and that any component that will prevent the raising of the car body off the sub-frame and engine unit has been removed. The sub-frame mounting bolts should not be removed at this stage.
37. Lower the ramp to the ground. Carefully push the car forward off the ramp, until the front of the car overhangs the ramp sufficiently to allow the ramp to be raised without any crossbeam or part of the ramp fouling the transmission unit (see fig. H3-10). Place

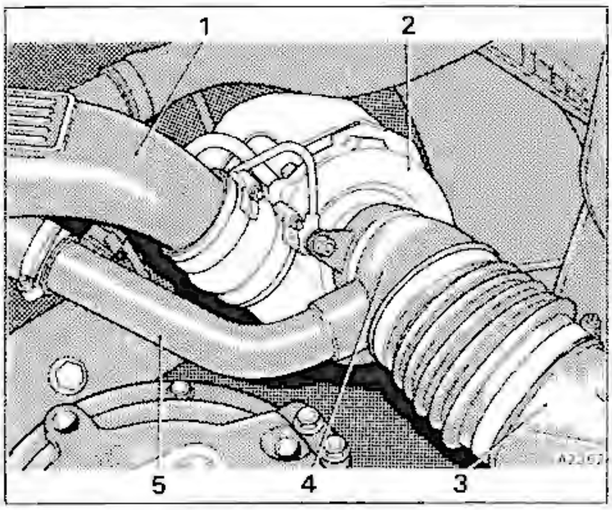


Fig. H3-3 **Air intake** (Bentley Turbo R prior to 1989 model year)
1 Air intake elbow
2 Turbocharger
3 Air intake filter housing
4 Turbocharger intake adapter
5 Dump pipe

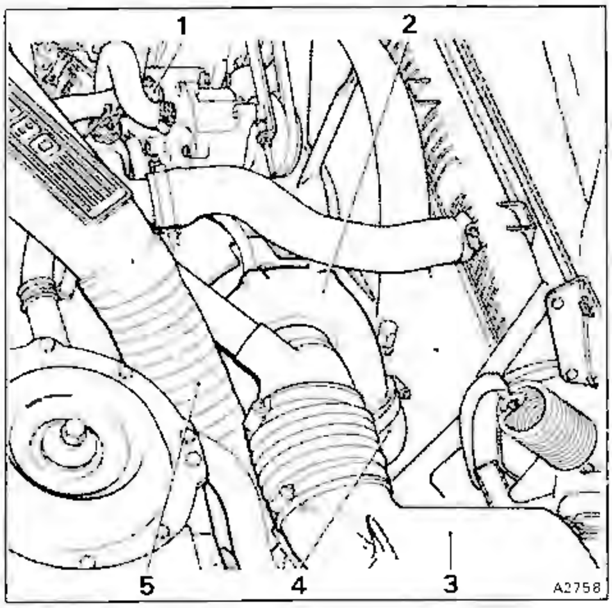


Fig. H3-4 **Air intake** (Bentley Turbo R 1989 model year)
1 Air pump feed hose
2 Turbocharger
3 Air intake filter housing
4 Air duct to intercooler
5 Air intake from intercooler

blocks beneath the front road wheels to maintain the car in a horizontal plane.
38. Position sill blocks beneath the car body sills as far forward as possible to maintain the body on the ramp in the horizontal position (see fig. H3-10).
39. To prevent any possibility of the body pivoting forward when the ramp is raised, secure the rear of the

Printed in England

car to the ramp by passing ropes over the final drive crossmember. Position the ropes on each side of the axle case and suitably secure them to the ramp. This can be achieved for example, by placing a suitable steel bar across the underside of the ramp and securing the ropes to the bar. **Do not use** the rear sub-frame tubes to secure the car.

40. Place a jack beneath the rear crossmember of the front sub-frame and also beneath the front triangle lever mounting bracket (see fig. H3-10).

41. Carefully remove the bolts and setscrews securing the front sub-frame mounts to the body.

42. Ensure that all relevant components have been disconnected or removed and that clearance between the sub-frame and engine unit, and the car body has been obtained.

43. Slowly raise the ramp, thus lifting the body off the sub-frame and engine unit. During this operation, continuous observations should be made to ensure that clearance is maintained and that hose and loom connections between the body and the sub-frame and engine unit have not been overlooked. When the body is clear of the engine, raise the ramp and carefully wheel the sub-frame and engine unit from beneath the car.

44. Lift the sub-frame and engine unit onto a suitable stand.

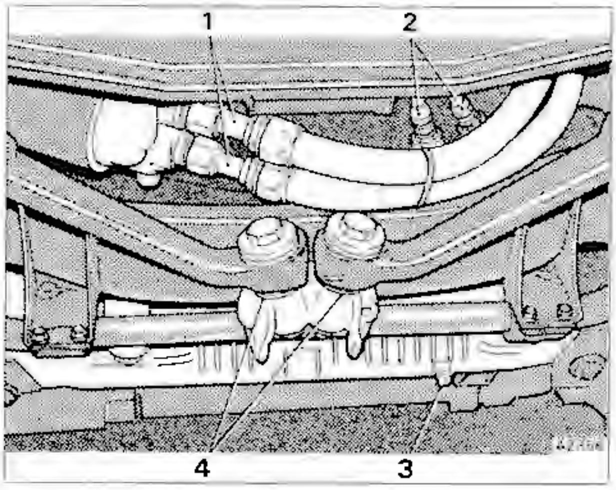


Fig. H3-5 Engine and transmission oil cooler pipes
1 Engine oil filter to cooler pipes
2 Transmission unit oil cooler pipes
3 Radiator drain plug
4 Lower triangle lever shims

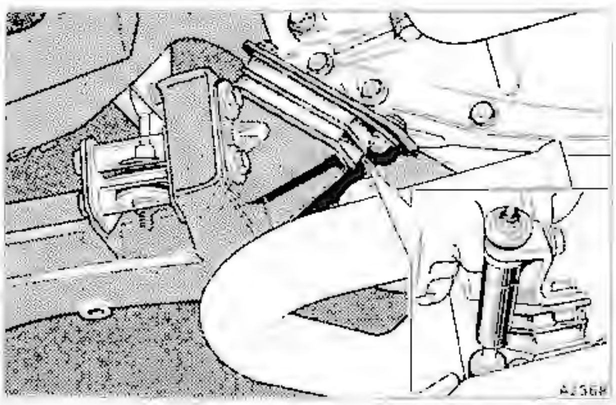


Fig. H3-6 Sub-frame to longeron tie-bar
Inset – Engine stabilus damper

Engine and torque converter transmission – To remove from the sub-frame

1. Remove the exhaust system downtake pipes from the engine exhaust manifolds.
2. Disconnect the steering pumps supply hose from the steering rack. Allow any oil to drain into a container.
3. On cars fitted with the small dampers adjacent to the rear engine mounts, disconnect the top of the dampers from the transmission adapter plate.
4. To lift the engine and transmission unit from the sub-frame, utilize the lifting eyes provided. One eye is situated in the refrigerant compressor mounting bracket at the front of the engine and two eyes on the engine mounting plate at the rear of the engine.
5. Using an overhead hoist, take the weight of the engine and transmission on the slings. Always ensure before taking the full load that the slings are not in positions that may cause damage to the engine components.
6. Disconnect the front and rear engine mounts.
7. Carefully check that nothing will impede the removal of the engine, then, lift the engine and transmission unit from the sub-frame. Note the position and quantity of all packing plates that may be fitted to the engine mounts.
8. If the front engine mount crossmember or the rear engine mount brackets are to be removed, co-relation marks should be made between the components and the sub-frame. These marks will enable the crossmember and mounting brackets to be correctly positioned and the engine to be centralized in the sub-frame when assembly is carried out. The location and thickness of the washers should also be noted before they are removed.

Engine and torque converter transmission – To fit into the sub-frame

Fit the engine and transmission unit by reversing the removal procedure noting the following.

1. If new rear engine mounts are fitted, always ensure they are of the correct type. Two types of rubber are used and although they are visually the same the hardness rating of the rubber used is different. Always identify the mounts by the part number. For further information refer to Section H2.
2. Attach the front and rear engine mounts, together with any packing plates that may have been removed, to the engine. Do not tighten the bolts at this stage.
3. Lower the engine and transmission unit into position and fit the bolts securing the engine mounts to the sub-frame. Tighten all the engine mount bolts.
4. As shown in figure H3-11 the distance between the front engine mount stop plate and the bracket must be set at between 1,5 mm and 2,2 mm (0.060 in and 0.090 in) when all the operations are completed.

On 1989 model year cars the distance between the

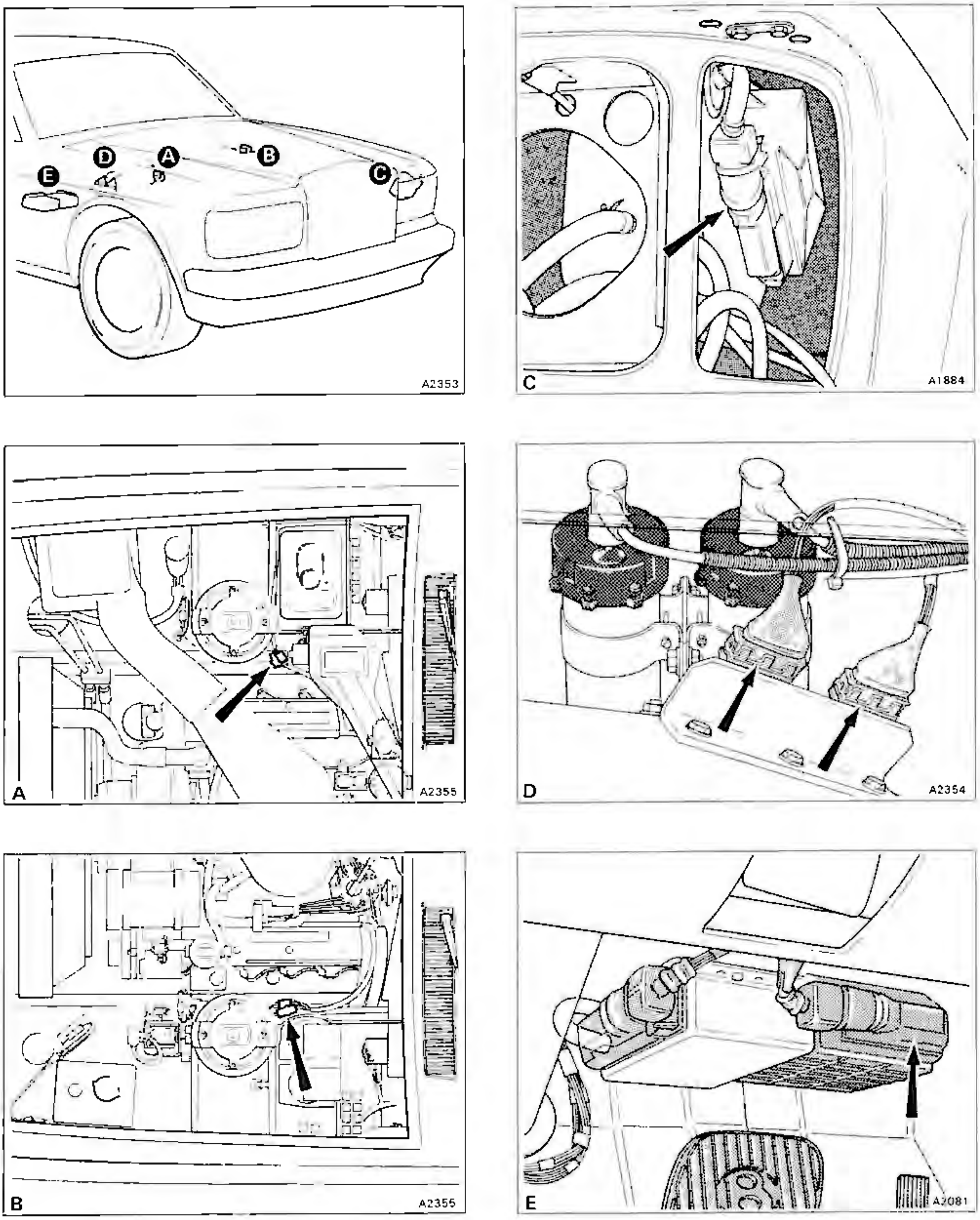


Fig. H3-7 Electrical disconnection points (Cars prior to 1989 model year)

A Loom block and end connectors
B Loom block and end connectors
C Boost control ECU (Bentley Turbo R only)
D Ignition amplifier connectors (Bentley Turbo R only)
E Electronic control unit connectors (Bentley Turbo R only)

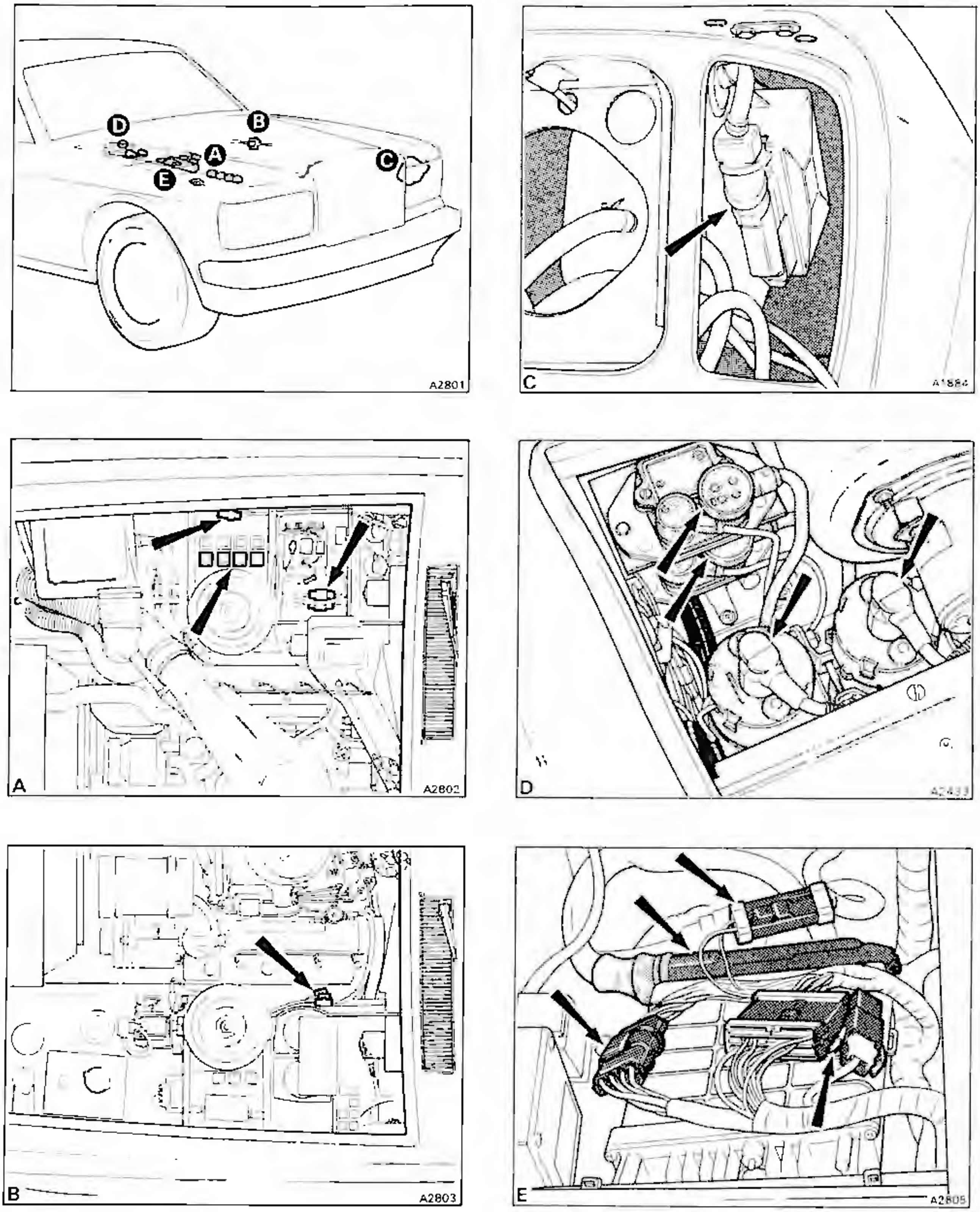


Fig. H3-8 Electrical disconnection points (1989 model year cars)

A Loom block, end connectors, and relay mounts
B Loom block and end connectors
C Boost control ECU (Bentley Turbo R only)
D Ignition amplifier and coil connectors (Bentley Turbo R only)
E Electronic control unit and loom block connectors (Bentley Turbo R only)

engine roll stop plate and buffer on each rear engine mount must be set to between 4,0 mm and 5,5 mm (0.158 in and 0.216 in). To carry out this operation, first slacken the top securing bolts on the mount to be adjusted. Using a soft metal drift, carefully tap the top plate of the mount until the correct setting is obtained then torque tighten the bolts.

5. When fitting the small dampers adjacent to the rear engine mount, the dampers should be fitted with the rod downwards. Fit the two tapered rubbers either side of the bracket on the rear engine mounting plate. Ensure the taper points downwards with the large cup washer on top. The two smaller cup washers and rubbers fit on each side of the sub-frame bracket.

Note These dampers are not fitted to two door models.

Engine, torque converter transmission, and sub-frame – To fit into the car

Fit the engine, torque converter transmission, and sub-frame to the body by reversing the removal procedure noting the following.

1. If new sub-frame mounts are fitted, ensure they are of the correct type. Two types of mount are used and although they are visually the same, the hardness rating of the rubber used is different. Always identify the mounts by the part number which is moulded into the rubber of the mount. For further information refer to Section H2.

2. The sub-frame mounting points in the body have a limited amount of movement to allow the sub-frame to be centralized. Ensure that the plain bobbin (front mounts) and the threaded bobbin (rear mounts) are free in the longeron prior to fitting the sub-frame.

3. Inspect all relevant pipes and hoses prior to fitting the sub-frame into the body. Renew any that show signs of deterioration or damage.

4. When fitting the sub-frame to the body mounting points, ensure that the main bearing washer for each mount is in position. Any additional washers that may have been fitted in order to correct individual variations of the mounting points should also be fitted in their respective positions.

5. With the engine and sub-frame positioned in the engine compartment, assemble the rear steady brackets onto the rear mount centre setscrews together with any washers previously removed. Pass the setscrews through the sub-frame mounts and screw them into the threaded body mount bobbins. Fit the bolts, nuts, and washers which secure the steady brackets to the body. Fit the front mounting bolts and steady brackets in a similar manner. Do not tighten the mounting bolts at this stage.

Note If during dismantling, the upper nut from the front mounting stud is removed, it must be torque tightened onto the stud to the standard torque figure quoted in Chapter P before locating the stud through the body longeron.

6. Centralize the sub-frame by utilizing the movement in the body mounting bobbins. To check the sub-frame position, diagonal and parallel measurements should be taken between the jig location points situated on the front and rear sub-frames (see fig. H3-14). With the sub-frame centralized torque tighten the sub-frame mount bolts and setscrews.

7. Assemble the sub-frame to body tie-rods and set them to the length shown in figure H3-13. Four compression washers are fitted to each tie-rod on Rolls-Royce cars and six compression washers to Bentley cars.

Note Tie-rods are not fitted to two door models.

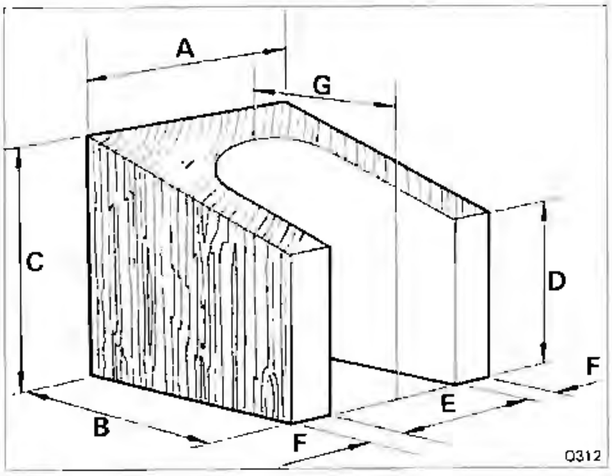


Fig H3-9 Wooden support block

A 76 mm (3.0 in)
B 76 mm (3.0 in)
C 76 mm (3.0 in)
D 51 mm (2.0 in)
E 38 mm (1.5 in)
F 19 mm (0.75 in)
G 57 mm (2.25 in)

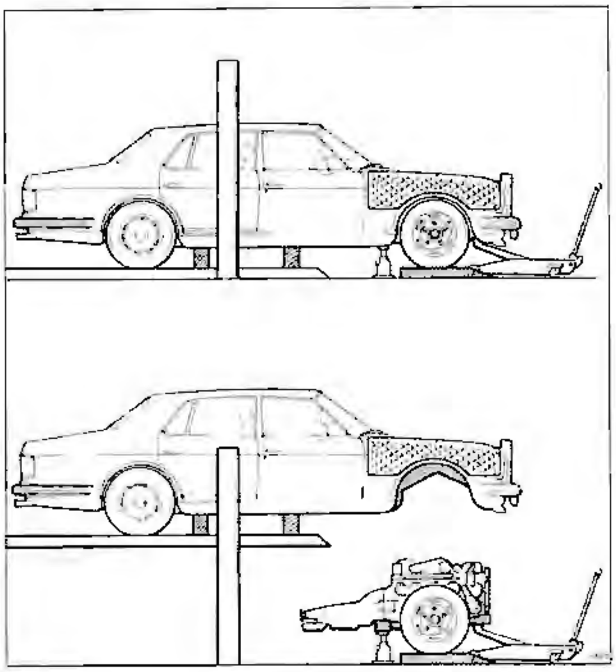


Fig. H3-10 Sub-frame, engine and transmission unit removal

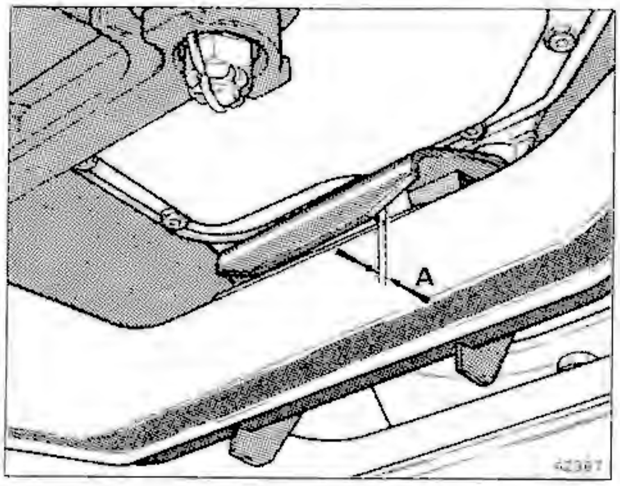


Fig. H3-11 Front engine mount setting
A 1,5 mm to 2,2 mm (0.060 in to 0.090 in)

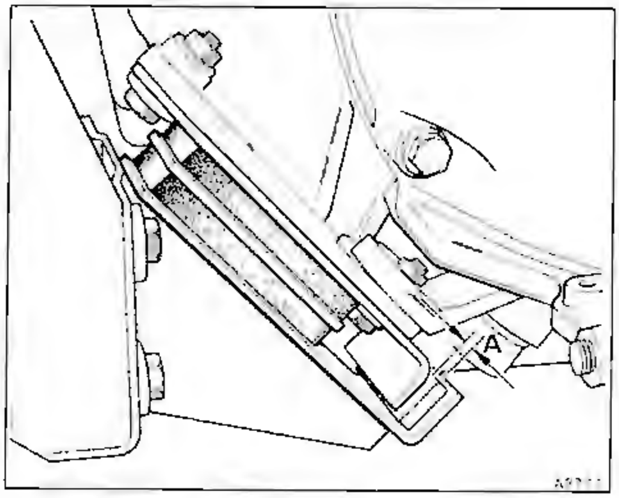


Fig H3-12 Rear engine mount setting
(1989 model year cars)
A 4,0 mm to 5,5 mm (0.158 in to 0.216 in)

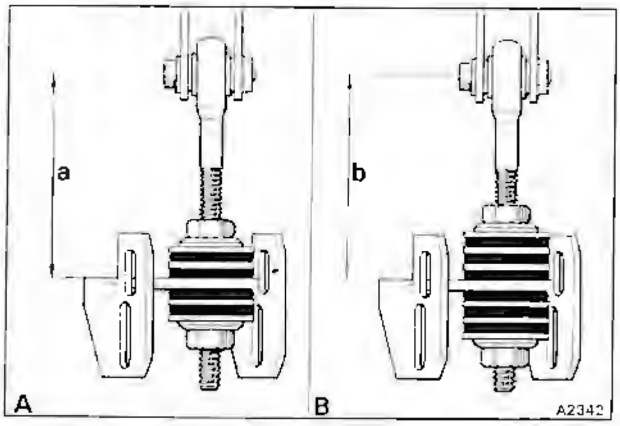


Fig H3-13 Sub-frame to longeron tie-bar setting
A 81,8 mm to 82,9 mm (3.22 in to 3.26 in) (Rolls-Royce four door cars)
B 78,8 mm to 80,0 mm (3.10 in to 3.15 in) (Bentley four door cars)

8. Connect the tie-bar assemblies to the longerons and sub-frame. Do not tighten the bolts and setscrews at this stage.
9. Connect the steering column ensuring that the road wheels and the steering wheel are in the straight ahead position. Refer to Chapter N for details.
10. Fit the exhaust system components as described in Chapter Q.
11. Torque tighten all the relevant nuts, bolts, and setscrews, except those on the tie-rods. Always refer to the special torque figure section of the respective component chapter and to Chapter P for the correct torque requirements.
12. Ensure that all hose connections have been completed and that they are routed and clipped correctly.
13. Fill the engine coolant system and check the engine, torque converter transmission, and steering pump oil levels as described in their respective chapter.
14. Bleed the hydraulic systems as described in Chapter G.
15. Charge the refrigeration system as described in Chapter C.
16. Check all components for leaks and ensure that the necessary clearances have been obtained.
17. Ensure the ride height of the car is correct as described in Section H7.
18. With the car height correct torque tighten the bolts and setscrews securing the sub-frame to longeron tie-rods (see Operations 7 and 8) to the figures quoted in Section H13.
19. Check that the distance between the front engine mount stop plate and the bracket is between 1,5 mm and 2,2 mm (0.060 in and 0.090 in). Adjust if necessary. On 1989 model year cars, also check that the rear engine mounts are set at between 4,0 mm and 5,5 mm (0.158 in and 0.216 in) as shown in Figure H3-12.

Sub-frame mount – To remove

The sub-frame mounts can be renewed with the sub-frame in position.

1. Position the car on a ramp.
2. Apply the parking brake and chock the rear wheels.
3. Support the car body with sill blocks.
4. Fit spring retention tool RH8809 onto the road spring nearest to the mount being renewed. Adjust the tool until sufficient pressure is applied to support the road spring pressure.

Warning Always examine the spring retention tool components for signs of thread wear or damage prior to its use. Renew any part of the tool that may be liable to fail under spring load.
It is recommended that the use of the tool is restricted to a maximum of 200 applications.

5. Position a jack to support the sub-frame as near as possible to the mount being renewed.
6. Disconnect the tie-rod (if fitted) from the longeron when renewing a rear mount.
7. Remove the bolts securing the mounting point steady bracket to the body.
8. Remove the centre setscrew or bolt (dependent upon whether it is a front or rear mount) from the mount.

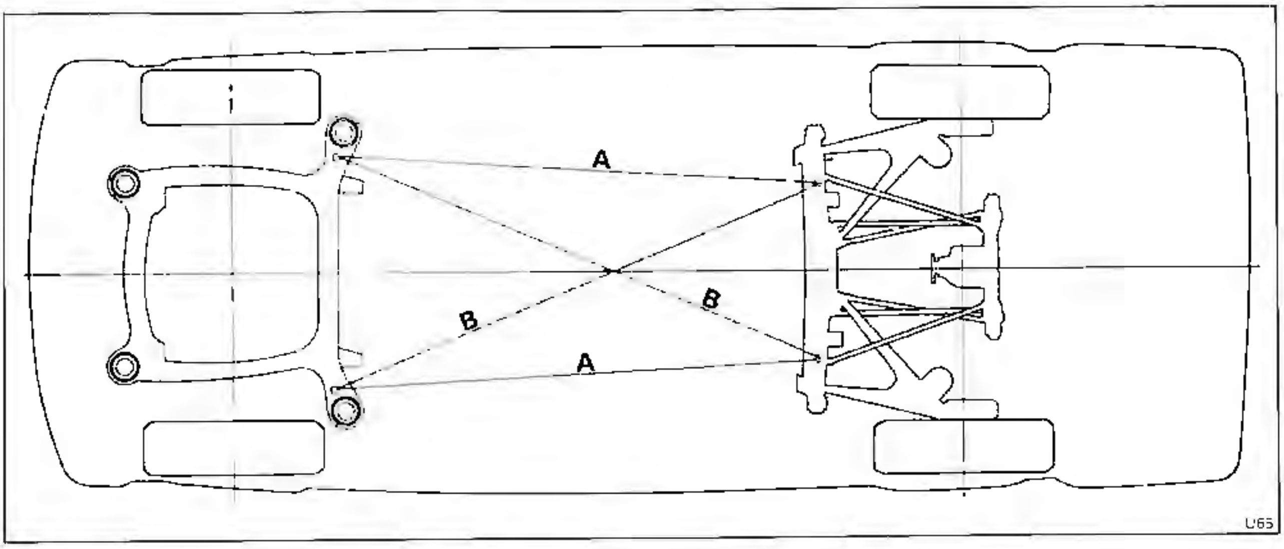


Fig H3-14 Sub-frame alignment
Measurements to be equal within 1,60 mm (0.062 in)

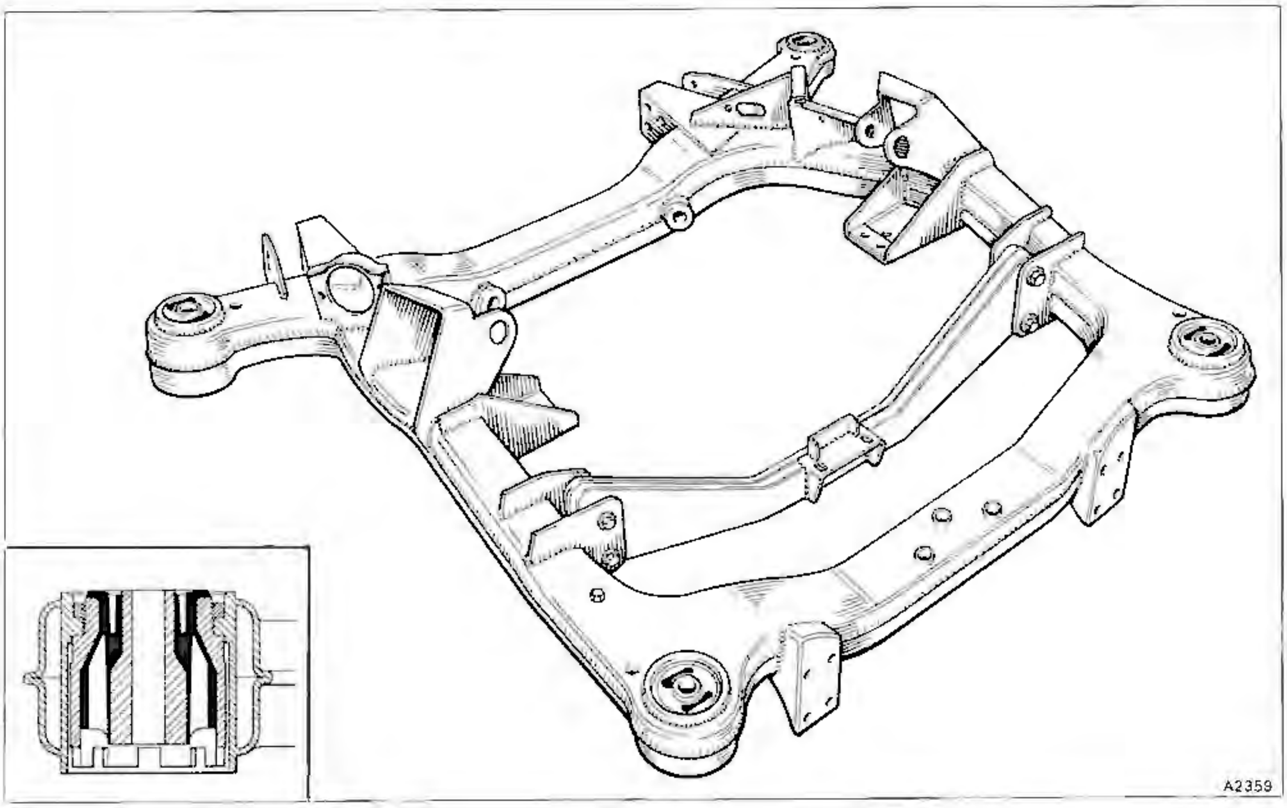


Fig. H3-15 Front sub-frame assembly
Inset – Sub-frame mount

Note the position and quantity of spacing washers that are fitted.

9. Carefully lower the jack situated beneath the sub-frame until sufficient clearance is obtained between the mount and the longeron to gain access to the mount locking ring.

10. Using spanner RH8576 to restrain the lock-ring; unscrew the mount using spanner RH7774 on the lower castellations of the mount and withdraw the mount.

Sub-frame mount – To fit

If new mounts are being fitted always ensure they are of the correct type. Two types of mount are used and although they are visually the same, the hardness rating of the rubber used is different. Always identify the mounts by the part number which is moulded into the rubber of the mount. For further information refer to Section H2.

1. Ensure that the bore and upper face of the sub-frame, the threads and faces of the lock-ring, and the threads of the mount are clean.
2. Apply Molytone C grease to the threads of the mount. Ensure that the top three or four threads are completely covered. Do not use mineral based greases as they can have a detrimental effect on the rubber of the mount.
3. Insert the mount into position in the sub-frame and fit the lock-ring in the upper well. Screw the mount into the lock-ring. Adjust the lock-ring such that, when the rubber mount is tightened to the figure quoted in Section H13, the slots in the moulded rubber are at right-angles to the centre line of the car (see fig. H3-15).
4. Secure the sub-frame to the body by reversing the removal procedure. Ensure that all nuts and setscrews are torque tightened to the figures quoted in Section H13 and Chapter P.

Front shock dampers, road springs, and damper ball joints

Introduction
The shock dampers (see fig. H4-1) are of the sealed unit type and no servicing is required. In the event of a damper becoming faulty, it should be discarded and a new damper fitted.

Dampers of varying damping characteristics are fitted dependent on the car model. It is important therefore to ensure that dampers of the correct type are fitted when replacement is required.

If only one damper requires renewal the new damper must be of the same type and rating as the damper remaining on the car. In the event of a matching damper becoming obsolete and therefore unobtainable both dampers should be renewed.

Important Each damper contains nitrogen gas under pressure. Under no circumstances should it be subjected to undue force. Do not clamp the damper in a vice.

If the road spring support collar has seized to a faulty damper, the collar should be discarded with the damper. Do not attempt to hammer the collar from the damper.

When using the spring retention tools RH8809 and RH7909 on cars fitted with pressed steel spring plates (see fig. H4-1), it will be necessary to use the adapter plate RH12053.

Front road spring and damper – To remove

1. Drive the car onto a ramp; apply the parking brake and chock the rear wheels.
2. Fit the support plate halves of the road spring retention tool RH8809, around the lower section of the damper and secure them together.

Insert the four long studs of the tool through the upper spring plate and screw them securely into the tool support plate. Fit the special nuts, thrust races, and washers to the top of each stud.

Warning Always examine the spring retention tool for signs of thread wear or damage prior to its use. If you have doubts concerning any parts of the tool and their ability to withstand spring load you should renew those parts.

Always take extreme care when handling a road spring in a compressed condition.

3. Evenly tighten the four spring retention tool nuts to retain the road spring in its compressed condition.
4. Support the front of the car body on sill blocks.
5. Remove the bolts securing the upper spring plate to the body spring tower. Use hand pressure on the spring plate to counteract any damper lift and to allow removal of the bolts.
6. Remove the split pin, castellated nut, and washer securing the damper ball pin assembly to the lower triangle levers. Using a suitable extractor, release the ball pin taper from the triangle levers. Leave the taper loosely in position to support the damper.
7. Carefully lift the road spring and damper assembly from the car.

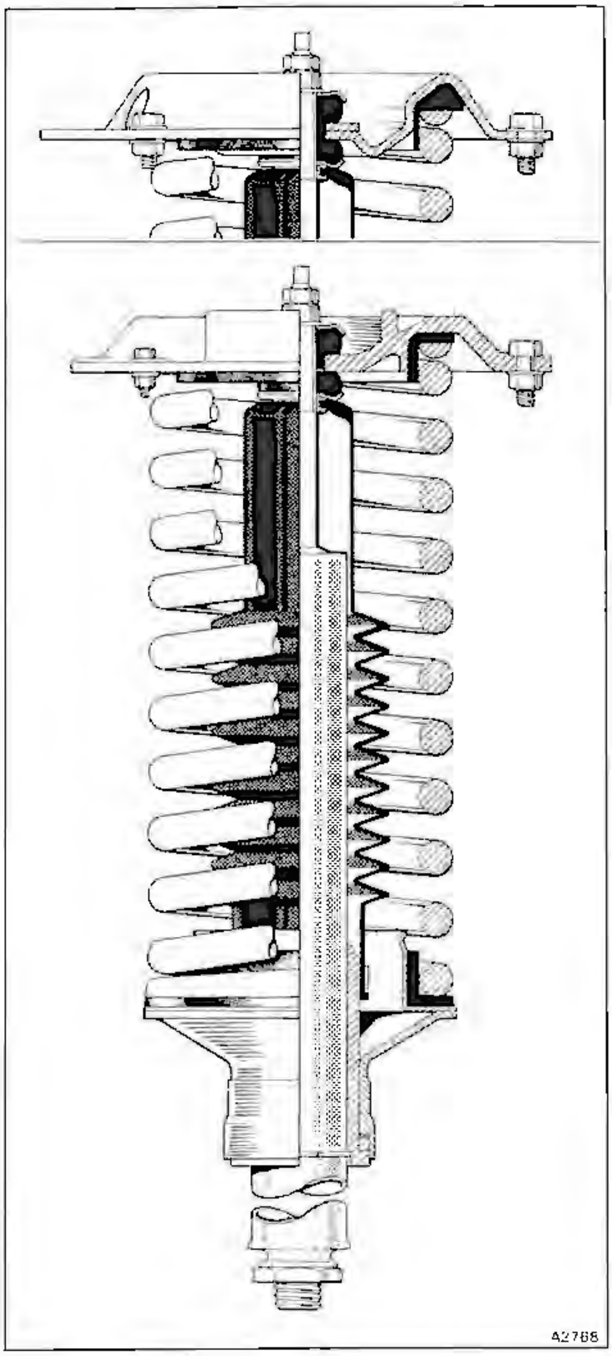


Fig. H4-1 Front road spring and shock damper assembly
Inset – Pressed steel spring plate arrangement

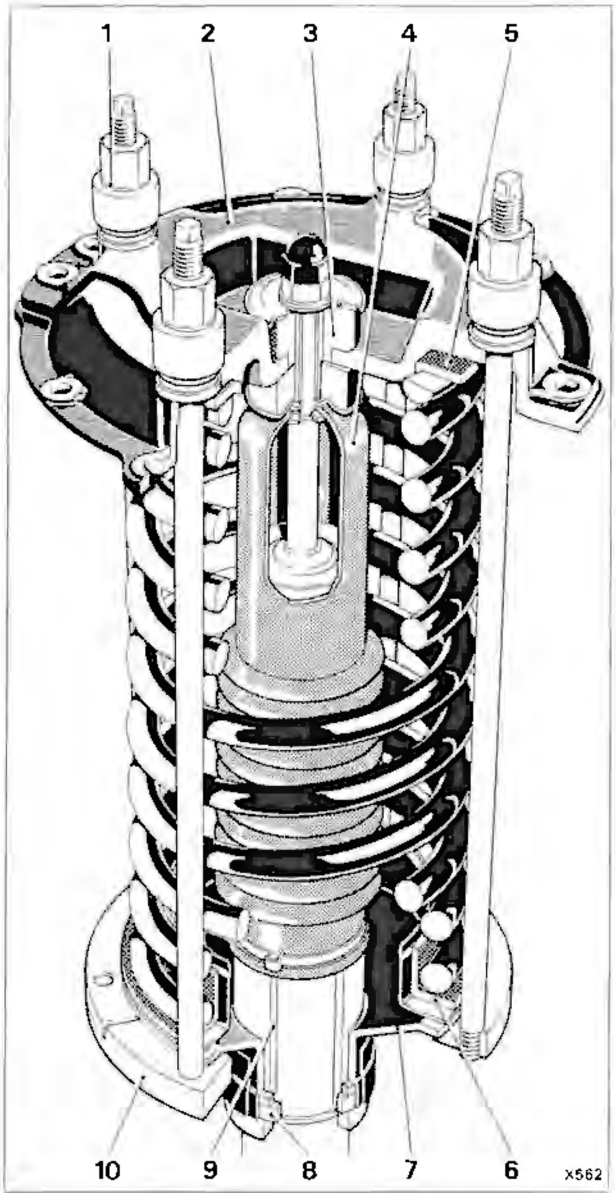


Fig. H4-2 Spring retention tool in position

1 Nut and thrust race
2 Upper spring plate
3 Damper mounting rubbers
4 Convoluted rubber sleeve
5 Spring seat
6 Spring seat
7 Spring support plate
8 Spring support plate collets
9 Spring support collar
10 Tool support plate

Place the complete assembly into spring compression tool RH7909. Fit and secure the top plate of the tool to retain the spring (see fig. H4-3).

8. Remove the nuts securing the damper to the upper spring plate cover. Collect the rubber mount and washers. Withdraw the damper from the spring support plate and collar.

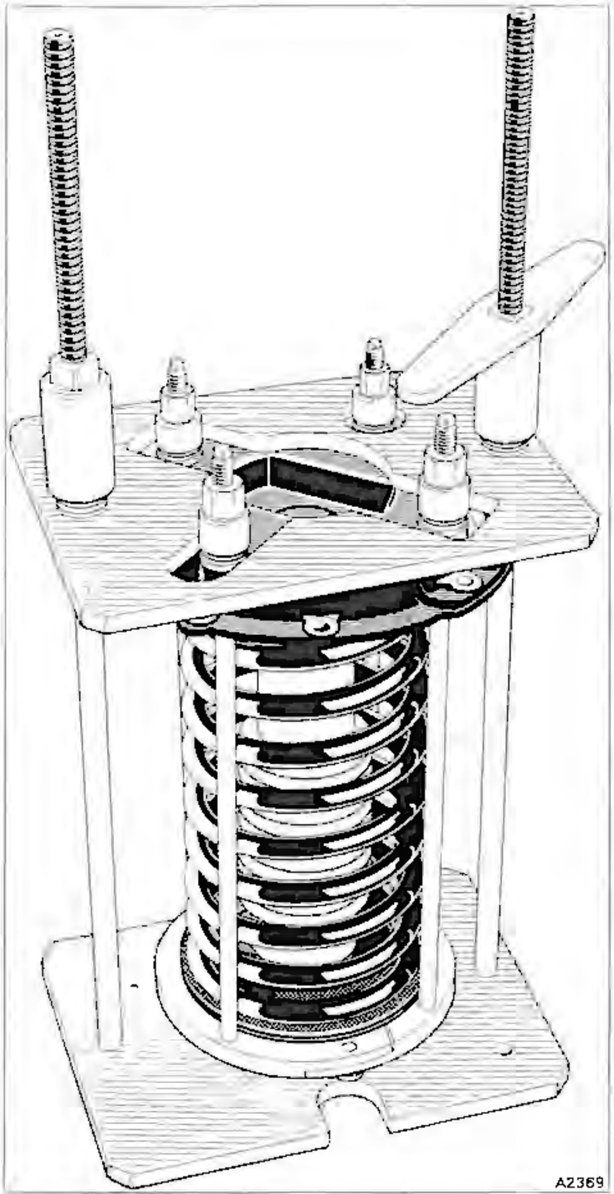


Fig. H4-3 Spring compression tool

Note Care should be taken to avoid damaging the convoluted rubber sleeve situated between the spring plate collar and the upper damper mount (see figs. H4-1 and H4-2) during damper withdrawal. The sleeve will prevent the collar being withdrawn from the spring support plate. In the event of the collar having seized to the damper, remove the nuts securing the top of the damper then carefully release and lift the spring from the spring support plate as described in the following operations.

9. To release the spring from the retention tool compress the spring until the spring load is relieved from the retention tool, allowing the removal of the four retaining nuts.

Measure the distance between the two plates of the spring compression tool to facilitate assembly.

Evenly release the two nuts on the compression tool until the spring is fully released.

Examine all the components for serviceability and renew as necessary.

Front road spring and damper – To fit

Fit the road spring and damper by reversing the removal procedure. The road spring and damper can be assembled as a bench operation as follows.

1. Ensure that all the components are in a serviceable condition. Renew any components that are faulty.
2. Insert the support collar through the spring support plate. Fit the convoluted cover onto the neck of the collar together with a securing band. Ensure that a distance of 19 mm (0.750 in) exists between the shoulder of the collar and the bottom face of the support (see fig. H4-4). Fasten the cover to the collar with the securing clip using tool RH9733.
3. Using a small amount of Loctite Superbonder or equivalent adhesive secure the location washer into the top of the damper cover. Also secure the damper mounting rubber and washer to the underside of the upper spring plate. This operation is to assist assembly and ensure correct component location.
4. Place the road spring and its associated components (see fig. H4-3) into spring compression tool RH7909. Compress the spring to the measurement taken on removal.
5. Fit the washer onto the damper stem then insert the damper into the spring assembly. Ensure that all the components are correctly located (see fig. H4-1). Fit the top mount rubber, distance piece, cup washer, and plain washer onto the damper stem. Fit and torque tighten the retaining nut and lock-nut.
6. Fit the spring support plate collets around the damper collar. Carefully release the spring compression tool, thus allowing the damper collar and collets to be drawn into the spring support plate. Do not completely remove the spring compression tool.

Note The original thickness of collets should be used if the original spring is fitted. When selecting new collets, use the minimum number required to obtain the correct setting and always fit the thickest collets at the bottom of the selection (see fig. H4-2).

For spring poundage information refer to the chart on page H4-4.

7. Fit spring retention tool RH8809 to the spring assembly to retain the spring in its compressed condition. Remove compression tool RH7909.
8. Fit the ball joint assembly to the damper.
9. Fit a new gasket to the body spring tower and carefully lower the spring and damper assembly into the body.
10. Locate the damper ball joint taper into the triangle levers. Fit and torque tighten the castellated nut and insert a new split pin.
11. Bolt the upper spring plate to the body.
12. Carefully release and then remove the spring retention tool. Ensure that the collets are correctly entered into the spring support plate during removal.
13. Remove all jacks and support blocks.

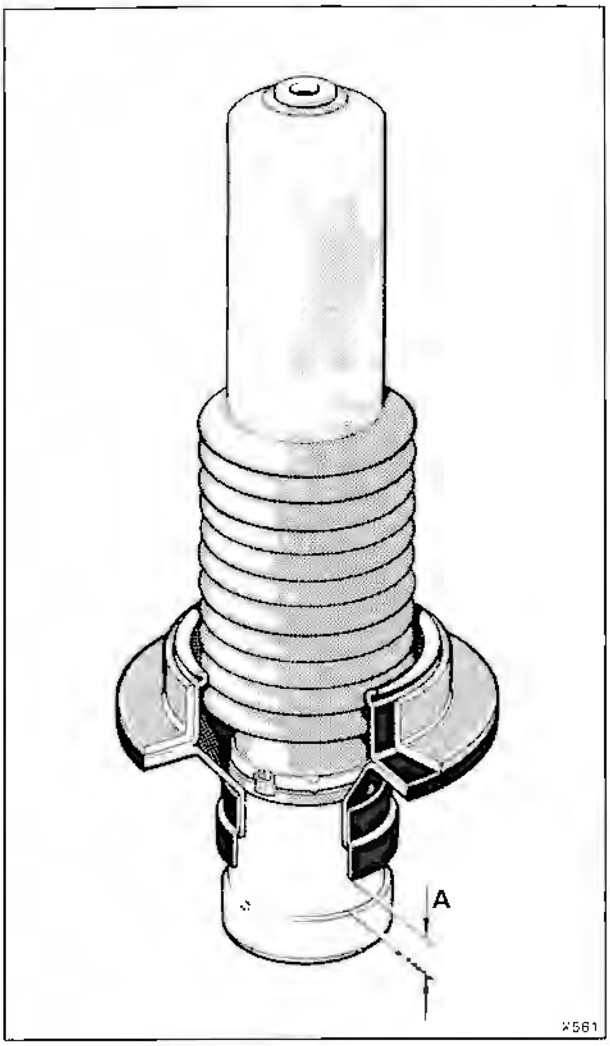


Fig. H4-4 Spring support plate, collar, and sleeve assembly
A 19 mm (0.75 in)

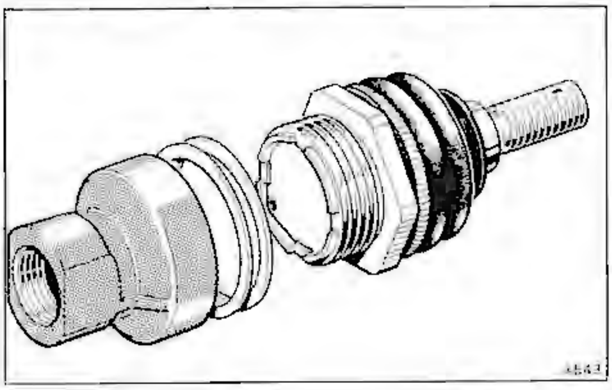


Fig. H4-5 Damper ball joint assembly

14. After fitting the spring and damper assembly, remove the car from the ramp and drive it back and forth to allow the assembly to settle.
15. Check the car ride height as described in Section H7 if a new road spring has been fitted.

Front spring loading chart

	Right-hand spring			Left-hand spring		
	N	kgf	lbf	N	kgf	lbf
Right-hand drive cars						
Silver Spirit, Mulsanne, Mulsanne S, and Bentley Eight	8007	817	1800	7940	810	1785
Silver Spur	8251	842	1855	8096	826	1820
Corniche, Corniche II, and Bentley Continental	8340	851	1875	8340	851	1875
Bentley Turbo R (prior to 1989 model year)	8518	869	1915	7985	814	1795
Bentley Turbo R (Long Wheelbase prior to 1989 model year)	8629	880	1940	8096	826	1820
Bentley Turbo R (1989 model year)	8830	900	1985	8251	842	1855
Bentley Turbo R (1989 model year fitted with catalyst exhaust system)	8964	914	2015	8341	851	1875
Bentley Turbo R (Long Wheelbase 1989 model year)	8919	910	2005	8341	851	1875
Bentley Turbo R (Long Wheelbase 1989 model year fitted with catalyst exhaust system)	8986	917	2020	8474	864	1905
Left-hand drive cars *(other than those conforming to a Canadian and USA specification)*						
Silver Spirit, Mulsanne, Mulsanne S, and Bentley Eight	7940	810	1785	8007	817	1800
Silver Spur	8096	826	1820	8251	842	1855
Corniche, Corniche II, and Bentley Continental	8340	851	1875	8340	851	1875
Bentley Turbo R (prior to 1989 model year)	8452	862	1900	8050	821	1810
Bentley Turbo R (Long Wheelbase prior to 1989 model year)	8563	873	1925	8251	842	1855
Bentley Turbo R (1989 model year)	8763	894	1970	8319	849	1870
Bentley Turbo R (1989 model year fitted with catalyst exhaust system)	8897	908	2000	8408	858	1890
Bentley Turbo R (Long Wheelbase 1989 model year)	8852	903	1990	8408	858	1890
Bentley Turbo R (Long Wheelbase 1989 model year fitted with catalyst exhaust system)	8986	917	2020	8496	867	1910
Left-hand drive cars *(Conforming to a Canadian and USA specification)*						
Silver Spirit, Mulsanne, Mulsanne S, and Bentley Eight	8050	821	1810	8117	828	1825
Silver Spur	8207	837	1845	8274	844	1860
Corniche II and Bentley Continental	8496	867	1810	8496	867	1910
Bentley Turbo R	8897	908	2000	8408	858	1890
Bentley Turbo R (Long Wheelbase)	8986	917	2020	8496	867	1910

Equivalent load from packing collets									
Packing thickness	mm	1,63	3,25	4,88	6,35	7,98	9,60	11,23	12,70
	in	0.064	0.128	0.192	0.250	0.314	0.378	0.442	0.500
Spring load increase	N	53	107	165	214	267	320	374	427
	kgf	5,44	10,89	16,78	21,77	27,22	32,66	38,10	43,54
	lbf	12	24	37	48	60	72	84	96
Packing thickness	mm	14,33	15,95	17,58	19,05	20,67	22,30	23,93	25,40
	in	0.564	0.628	0.692	0.750	0.814	0.878	0.942	1.00
Spring load increase	N	480	534	587	636	690	747	801	850
	kgf	48,99	54,43	59,87	64,86	70,31	76,20	81,65	86,64
	lbf	108	120	132	143	155	168	180	191

Note When selecting packing collects always use the minimum number necessary to obtain the correct thickness.
A packing thickness of 6,35 mm (0.250 in) will increase the height of the car by approximately 9,5 mm (0.375 in)

Damper ball joint – To remove

1. Carry out Operations 1 to 3 inclusive of Front road spring and damper – To remove.
2. Remove the split pin, castellated nut, and washer securing the ball joint.
3. Using extractor tool RH8100 release the ball joint taper from the triangle levers.
4. Raise the front of the car until the ball joint taper clears the ball pin carrier. Remove the ball joint from the damper.
5. Unscrew the ball pin assembly from its housing, taking care not to damage the protective rubber boot. Collect the pre-load adjustment shims (see fig. H4-5).
6. Examine the ball joint for wear.

Damper ball joint – To assemble and fit

1. Ensure that the components are in a serviceable condition.
2. Hold the ball joint housing in a vice. Screw the new ball pin assembly into the housing without fitting the pre-load shims. Fit and lock together two nuts onto the ball pin (see fig. H4-6).
3. Carefully tighten the ball joint into the housing until a torque of between 5,7 Nm and 9,0 Nm (0,58 kgf m and 0,92 kgf m, 50 lbf in and 80 lbf in) is required to rotate the ball pin. This torque figure should be measured after the ball pin has been rotated through four complete revolutions and with the ball pin in its vertical position.
4. Measure the gap between the ball joint face and the housing face.
5. Remove the ball joint from the housing and fit shims, equivalent to the gap previously measured, onto the ball joint.
6. Fit the ball joint and shims to the housing and torque tighten the assembly to between 163 Nm and 176 Nm (16,6 kgf m and 18,0 kgf m, 120 lbf ft and 130 lbf ft).
7. Check that the torque required to rotate the ball pin is within the limits given in Operation 3. If necessary make adjustments by increasing or decreasing the shim thickness to obtain the correct torque reading.
8. Apply CASCO MLF 13 adhesive to the threads on the bottom of the damper. Fit the ball joint assembly onto the damper. Torque tighten to between 95 Nm and 108 Nm (9,7 kgf m and 11 kgf m, 70 lbf ft and 80 lbf ft).
9. Secure the ball joint to the triangle levers and complete the operations by reversing the removal procedure.

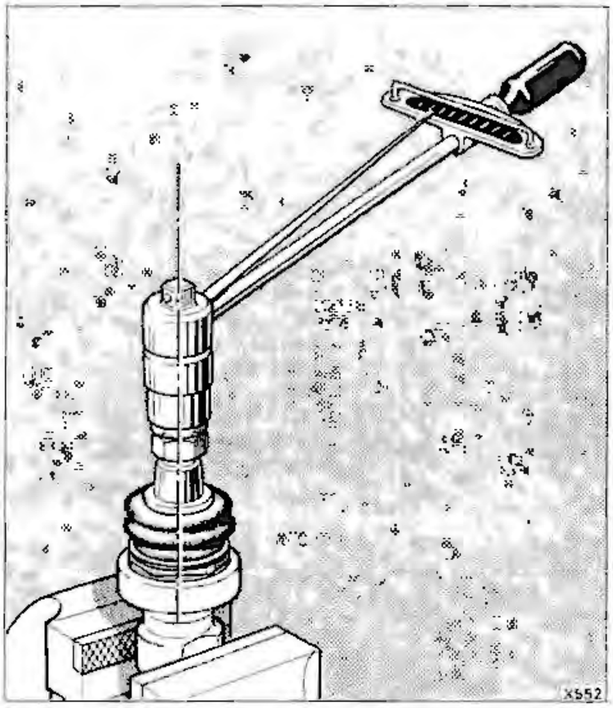


Fig. H4-6 Checking the ball joint pre-load

Compliance assembly, triangle levers, suspension ball joints, and stabilizer

Lower triangle levers – To remove

1. Ensure the gear range selector lever is in the park position and apply the parking brake.
2. Remove the wheel trim from the respective wheel and slacken the wheel nuts.
3. Jack up the front of the car and place sill blocks beneath the front end of the body sills.
4. Remove the road wheel.
5. Place a jack under the lower triangle levers and jack up the suspension to partially compress the road spring. Ensure that the body is still supported by the sill blocks.
6. Fit the support plate halves of the road spring retention tool RH8809 around the lower section of the damper and secure them together.

Insert the four long studs of the tool through the upper spring plate and screw them securely into the tool support plate.

Note On cars fitted with pressed steel spring plates the adapter plate RH12053 should be placed onto the spring plate prior to inserting the four studs.

Warning Always examine the spring retention tool for signs of thread wear or damage prior to its use. If you have doubts concerning any parts of the tool and their ability to withstand spring load you should renew those parts.

Fit the special nuts, thrust races, and washers to the top of each stud (see fig. H4-2).

7. Evenly tighten the retaining tool nuts until the road spring is fully supported.
8. Slacken the bolts securing the lower triangle levers to the sub-frame pivot bushes (see figs. H5-1 and H5-2).
9. Disconnect the stabilizer bar from the front triangle lever as described under Front stabilizer bar – To remove.
10. If removal of the ball pin carrier is required, carry out Operations 11 to 13 inclusive.
11. Remove the split pin and castellated nut securing the front shock damper ball joint. Using a suitable extractor tool release the ball joint taper. Lower the triangle levers to allow the taper to be withdrawn from the ball joint carrier.
12. Support the hub assembly with a jack.
13. Remove the split pin and castellated nut securing the lower suspension ball joint to the yoke. Using a suitable extractor tool release the ball joint taper.
14. Remove the dowel bolt and the setscrew securing the triangle levers to the ball pin carrier. Collect the carrier.
15. Remove the bolts from the triangle lever pivot bushes and remove the triangle levers. Collect the shims if fitted (see fig. H5-1).

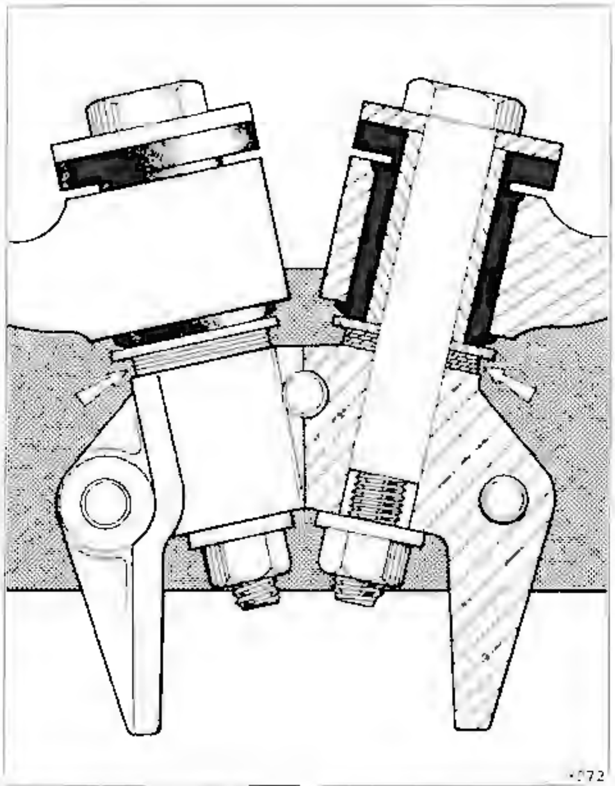


Fig. H5-1 Front triangle lever mount (shims arrowed)

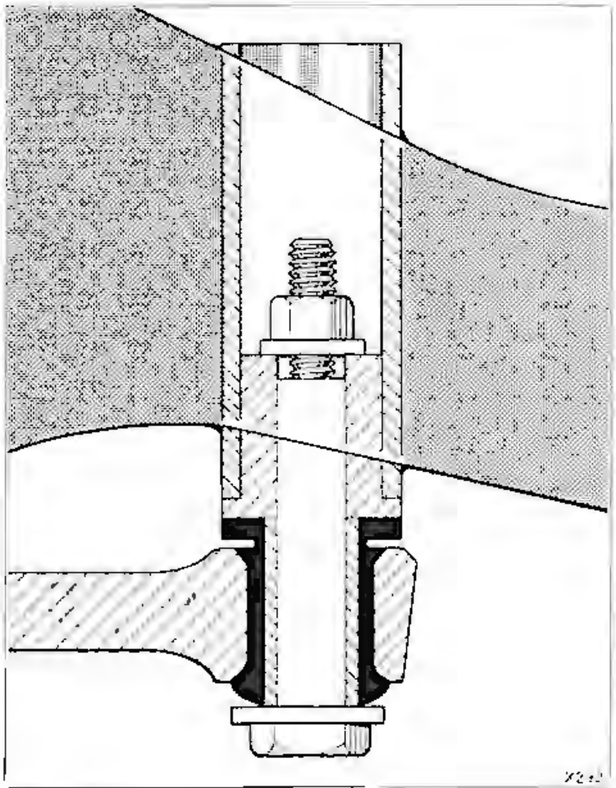


Fig.H5-2 Rear triangle lever mount

16. Examine the pivot bushes for serviceability and renew if necessary.

Lower triangle pivot bushes – To renew

1. Remove the lower triangle levers as described under Lower triangle levers – To remove.
2. To remove the bushes press them out of the triangle levers.
3. Fit the new bushes as follows.

Using Esso Flexon 876 or Gulf Par 125P to lubricate the bush press the bush into the triangle lever.

The bushes should be pressed in so that the large diameter buffer section of the bush faces rearwards when the lever is fitted to the cer (see figs. H5-1 and H5-2).

Lower triangle levers – To fit

Fit the triangle levers by reversing the removal procedure noting the following.

1. Assemble the front triangle lever onto the bearing housing as shown in figure H5-1. Do not tighten the nut or fit the shim washers at this stage.
2. Assemble the rear triangle lever onto the sub-frame as shown in figure H5-2. Do not tighten the nut.
3. Fit the ball pin carrier between the triangle levers. Fit and torque tighten the dowel bolt and setscrew to between 82 Nm and 88 Nm (8,3 kgf m and 9,0 kgf m, 60 lbf ft and 65 lbf ft) and 116 Nm and 122 Nm (11,7 kgf m and 12,4 kgf m, 85 lbf ft and 90 lbf ft) respectively. Do not attach the damper ball joint to the carrier.
4. Set the triangle levers in their normal ride position (see Section H7).
5. Torque tighten the rear triangle lever nut to between 57 Nm and 61 Nm (5,8 kgf m and 6,2 kgf m, 42 lbf ft and 45 lbf ft).
6. Remove the nut from the front triangle lever pivot bolt. Apply sufficient pressure to the two washers on the pivot bush to ensure they are in contact with the centre distance tube of the bush.
7. Measure the distance between the bearing housing and the inner washer (see fig. H5-1). Select the number of shims required to fill this distance, rounding up or down to the nearest shim.
8. Fit the shims into position then fit the washer and nut to the pivot bolt. Torque tighten the nut to between 57 Nm and 61 Nm (5,8 kgf m and 6,2 kgf m, 42 lbf ft and 45 lbf ft).

Note The fitting of these shims ensures that no axial pre-load is applied to the rubber pivot bushes.

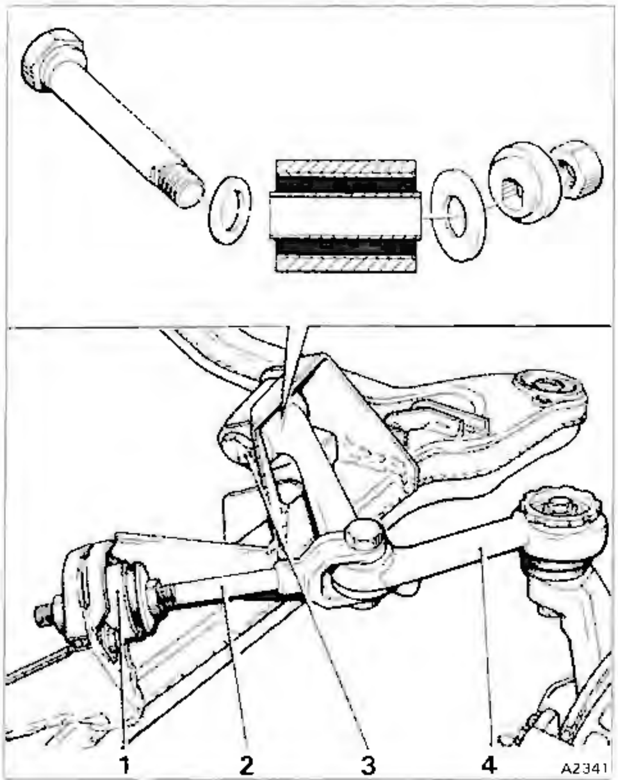


Fig. H5-3 Compliance assembly
1 Compliance mount
2 Compliance rod
3 Pivot bolt
4 Compliance lever

Compliance lever – To remove

1. Carry out Operations 1 to 7 inclusive as described under Lower triangle levers – To remove.
2. Remove the split pin and castellated nut retaining the upper ball pin.
3. Support the hub with a jack and using a suitable extractor release the ball pin taper from the yoke.
4. Remove the bolt securing the compliance rod jaw to the compliance lever.
5. Note the position of the arrow on the compliance lever pivot bolt (see fig. H5-3). Remove the bolt and withdraw the lever from the sub-frame bracket. Collect the special washers.
6. Examine the rubber bushes and ball joint for serviceability and renew as necessary.

Compliance lever – To fit

Fit the compliance lever by reversing the removal procedure noting the following.

1. Ensure that the eccentric adjustment components on the compliance lever pivot are correctly located in the sub-frame bracket (see fig. H5-3). Turn the bolt until the arrow is in the position noted on removal.
2. Check the wheel caster and camber as described in Section H7.

Compliance rod mount – To renew

1. When renewing the compliance mount adjacent to the starter motor the battery must be disconnected.
2. On Bentley Turbo R cars, remove the heat shield from around the compliance mount.
3. Remove the nut and large washer from the rear of the compliance mount. **Do not** disturb the position of the outer nut. If this nut is undisturbed, it should not be necessary to check the caster and camber settings after completion of the mount renewal operations.
4. Remove the two bolts securing the compliance mount to the sub-frame and withdraw the mount.
5. Remove the bolt securing the compliance rod jaw

to the lever. Examine the bush for serviceability and renew if necessary.

6. Fit the new compliance mount and components by reversing the removal procedure. Ensure that the large washer is fitted with the concave side towards the mount.

7. Torque tighten the nuts to the figures quoted in Section H13.

8. If the position of the outer compliance rod nut has been moved the caster and camber should be checked as described in Section H7 and adjusted as necessary.

Suspension ball joints – To renew

Prior to commencement of the following operations, the spring retention tool RH 8809 should be fitted as described in Operations 1 to 7 inclusive of Lower triangle levers – To remove.

Upper ball joint (see fig. H5-3)

1. Using the tube spanner RH 7775 remove the locking ring from the top of the ball joint.
2. Remove the split pin and castellated nut from the ball pin.
3. Support the hub with a jack and using a suitable extractor release the ball pin taper from the yoke.
4. Fit the extractor tool RH 7768 onto the compliance lever and carefully press the ball joint out of the lever.
5. Carefully place the new ball joint into position on the underside of the compliance lever. Using the extractor tool RH 7768 as the insertion tool draw the ball joint into the lever.
6. Fit and torque tighten the locking ring to between 203 Nm and 237 Nm (20,7 kgf m and 24,2 kgf m, 150 lbf ft and 175 lbf ft).
7. Complete the assembly by reversing the removal procedure.

Lower ball joint (see fig. H5-4)

1. Depressurize the hydraulic braking system as described in Chapter G.
2. Disconnect the brake hose(s) from the rear of the front hub. Fit blanks to the hoses and pipes.
3. Disconnect the brake pad wear and anti-lock braking electrical connections (if fitted) from the hub assembly.
4. Remove the split pin and castellated nut from the track rod end. Using extractor tool RH 9710 release the ball pin taper from the side steering lever.
5. Remove the split pin and castellated nut from the upper ball pin.
6. Support the hub with a jack and using a suitable extractor release the upper ball pin taper from the yoke.
7. Remove the split pin and castellated nut from the lower ball pin.
8. Using a suitable extractor release the lower ball pin taper from the ball pin carrier. Lift the yoke and hub assembly from the car.
9. Remove the ball joint assembly and housing from the yoke.
10. Remove the ball joint from the housing and collect the shim washers.
11. Thoroughly clean the housing and shim washers.

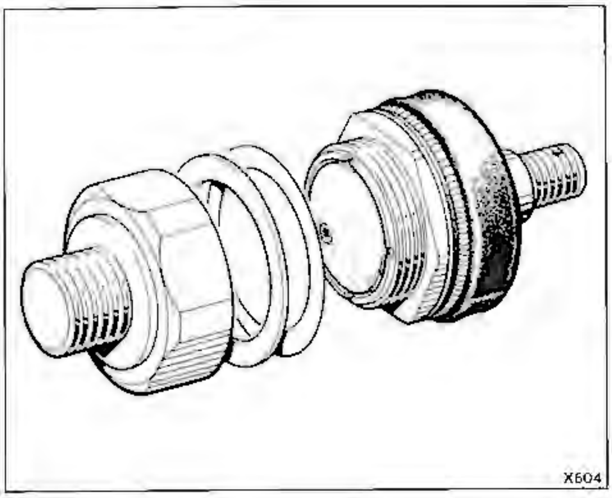


Fig. H5-4 Lower ball joint assembly

12. Enter the new ball joint into the housing without fitting the shim washers. Fit and lock together two nuts onto the ball pin.

Note The ball joint is supplied as a complete assembly and is pre-packed with lubricant.

13. Carefully tighten the ball joint into the housing until a torque of between 14,1 Nm and 19,8 Nm (1,4 kgf m and 2,0 kgf m, 125 lbf in and 175 lbf in) is required to rotate the ball. This torque figure should be measured after the ball pin has been rotated through four complete revolutions, and with the ball pin in its vertical position.
14. Measure the gap between the ball joint face and the housing.
15. Remove the ball joint from the housing and fit shims, equivalent to the gap previously measured, onto the ball joint.
16. Fit the ball joint and shims to the housing and torque tighten the assembly to between 339 Nm and 406 Nm (34,6 kgf m and 41,5 kgf m, 250 lbf ft and 300 lbf ft).
17. Check that the torque required to rotate the ball pin is within the limits given in Operation 12. If necessary make adjustments by increasing or decreasing the shim thickness to obtain the correct torque reading.
18. Apply CASCO MLF 13 adhesive to the threads of the housing then fit the ball joint assembly into the yoke. Torque tighten to between 190 Nm and 216 Nm (19,4 kgf m and 22,1 kgf m, 140 lbf ft and 160 lbf ft).
19. Fit the yoke and hub assembly by reversing the removal procedure.

Front stabilizer – To remove

1. Remove the nuts and washers securing the stabilizer links to the triangle lever brackets and stabilizer bar.
2. Using extractor tool RH 8080 separate the tapers of the stabilizer links from their locations. Remove the links.
3. Remove the setscrews and washers securing the stabilizer bar mounts to the sub-frame.
4. Remove the brackets and stabilizer bar. Collect any

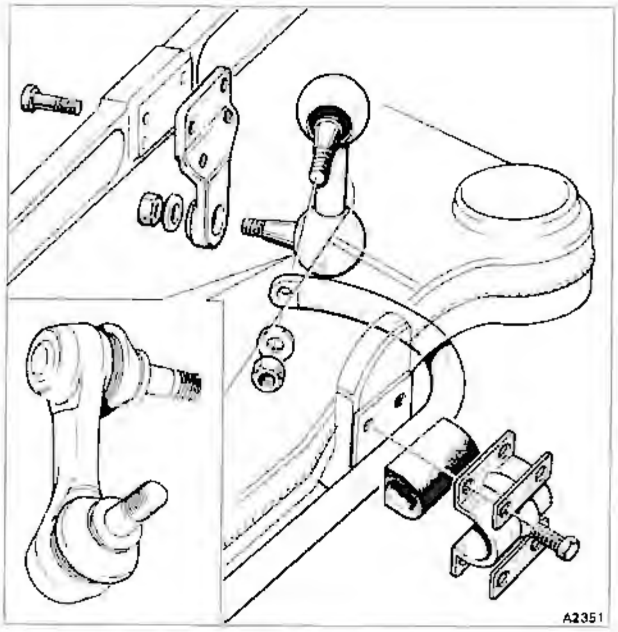


Fig. H5-5 Front stabilizer components
Inset–Link fitted to Bentley cars other than Continental

packing from between the rubber mount and sub-frame (see fig. H5-5).

5. Examine the rubbers of the mounts and links for serviceability and renew as necessary.

Front stabilizer – To fit

Fit the stabilizer by reversing the removal procedure noting the following.

1. Set the suspension triangle levers to the normal ride position.
2. Attach the stabilizer links to the triangle levers and the stabilizer. Do not tighten the securing nuts.
3. Fit the stabilizer to the sub-frame without forcing the clamping brackets into position. Ensure that the packing (if fitted) is located between the sub-frame and the stabilizer mount.
4. Torque tighten the setscrews and link nuts to the figures quoted in Section H13.

Front hubs

Front hub – To remove

1. Apply the parking brake and chock the rear wheels.
2. Depressurize the hydraulic systems as described in Chapter G.
3. Remove the wheel trim from the respective wheel and slacken the wheel nuts.
4. Carefully position a jack below the triangle lever and raise the wheel from the floor. Position a sill block beneath the front end of the body sill to support the car.
5. Remove the road wheel.
6. Disconnect the brake caliper pipes at the flexible hose mounting plate connection. Fit blanks to the pipe ends.
7. Remove the brake caliper mounting bolts and withdraw the calipers off the break disc.
8. Carefully remove the hub dust cap.
9. Break the sealing band and remove the split pin, castellated nut, and keyed washer from the stub axle.

Note The right-hand stub axle nut has a right-hand thread and the left-hand stub axle nut a left-hand thread.

10. Withdraw the hub assembly from the stub axle.

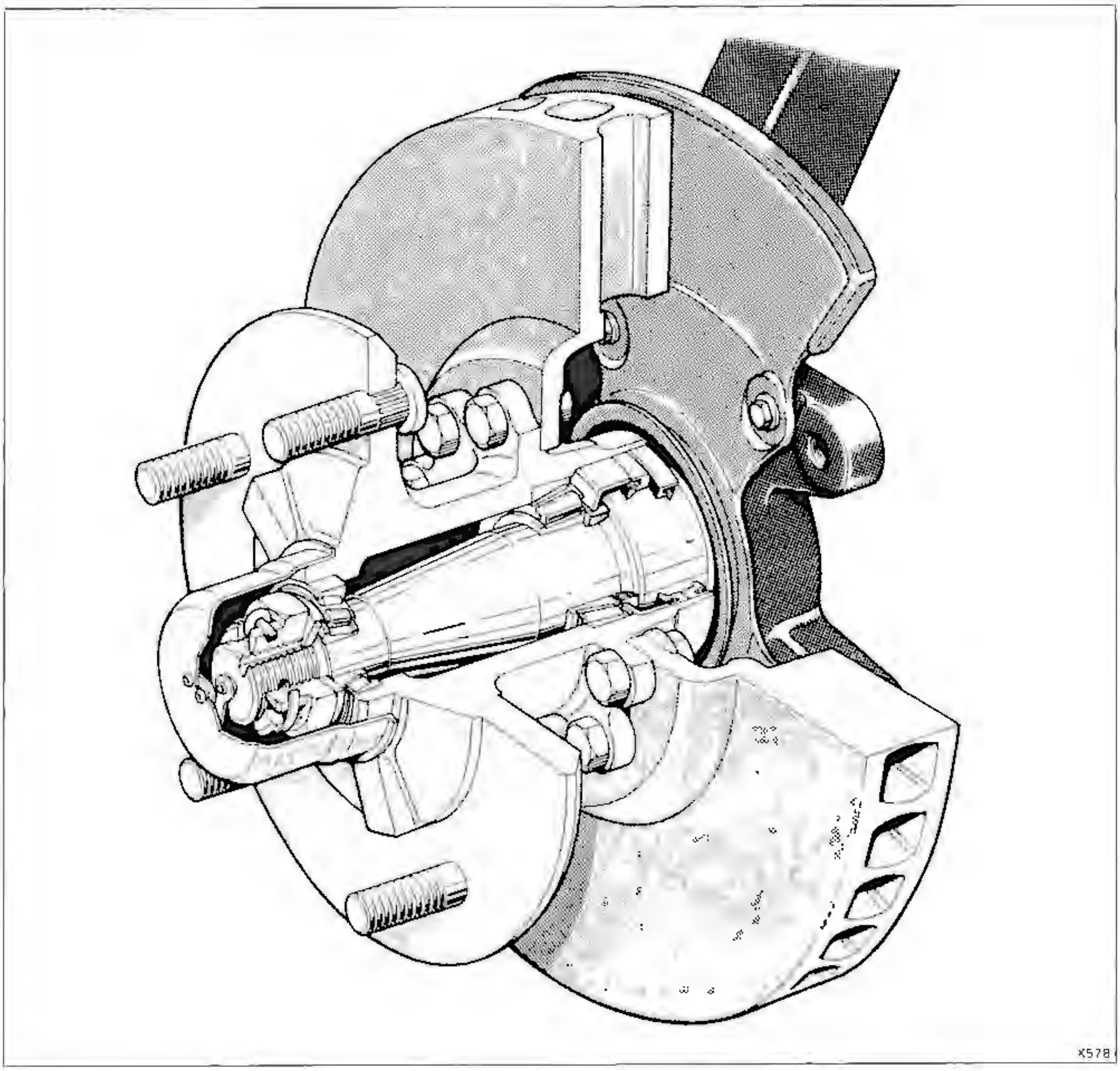


Fig. H6-1 Front hub assembly (Cars not fitted with anti-lock braking)

11. Retain the distance piece.
12. Inspect the brake disc for wear and scoring.

Front hub – To dismantle

1. Remove the inner race from the outer bearing.
2. Using a screwdriver, prise the seals from the rear of the hub. Remove the seal protector and inner bearing race.
3. If new bearings are to be fitted, drive out the bearing outer races from the hub using a soft metal drift.
4. Thoroughly clean the hub and any serviceable components.
5. If it is necessary to remove the brake disc from the hub, reference should be made to Chapter G.

Front hub – To assemble (see figs. H6-1 and H6-2)

1. Press the new bearing races squarely into the hub with the smaller end of the taper leading. Ensure that the bearing races are fully seated on the rear shoulders of the hub.
2. Lubricate the new roller bearings and inner races with approved grease. Fit the rear bearing into the hub.
3. Fit the seal protector with the protective flange towards the bearing.
4. Carefully press the two seals into position. The seals should be fitted back to back with the spring side of the outer seal facing outwards.
5. Pack 42,5 g (1.5 oz) of approved grease onto the inner walls of the hub.
6. Fit the roller bearing and inner race previously greased, into the outer bearing race.

Note Always ensure that the bearings are retained with their respective outer races as they are supplied in matched sets.

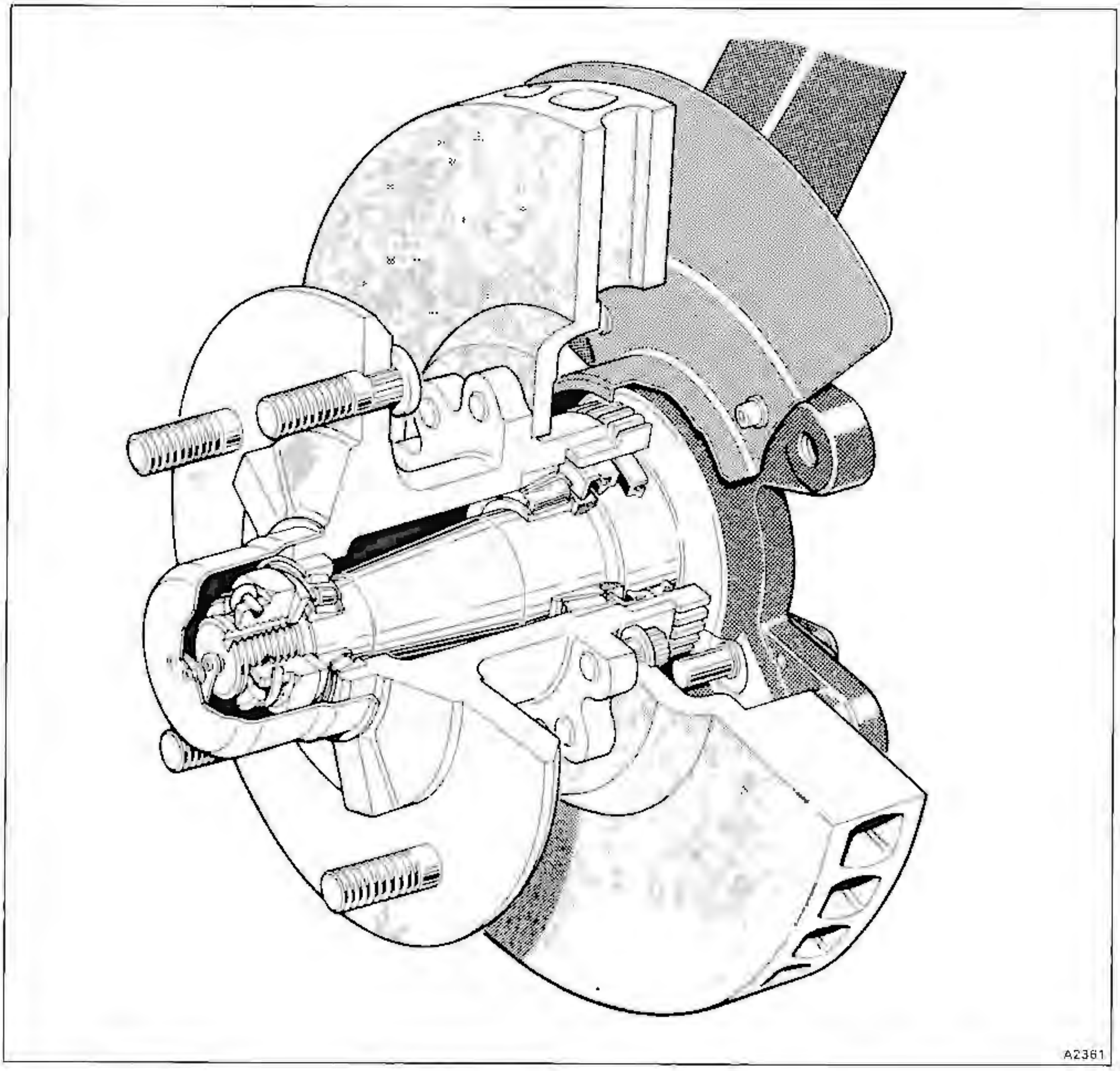


Fig. H6-2 Front hub assembly (Cars fitted with anti-lock braking)

Front hub – To fit

1. Fit the internally tapered distance piece onto the stub axle with the taper towards the yoke (see figs. H6-1 and H6-2).
2. Taking care not to damage the hub seals, position the hub on the stub axle.
3. Fit the key washer and castellated nut. Gradually tighten the nut until the bearing end-float is removed. Using a dial test indicator adjacent to the brake disc check the run-out of the disc at the maximum radius; this must not exceed 0,102 mm (0.004 in) total indicator reading.

Note: The reading obtained is a measure of the tolerances of all the components and if the run-out figure exceeds the limit, the hub should be dismantled and the cause investigated.

4. Slacken the castellated nut sufficiently to give an end-float reading of between 0,051 mm and 0,102 mm (0.002 in and 0.004 in) on a dial test indicator.

Rotation of the hub during this operation is essential to ensure that the taper rollers seat correctly and a true reading is obtained.

5. When the end-float is correct, unscrew the castellated nut the minimum amount to allow the insertion of the split pin.

Again measure the end-float. Subtract the original end-float reading from this new reading and add the remaining amount to the thickness of the key washer being used. The addition of these two figures gives the correct thickness of key washer to be fitted on the stub axle.

Key washers are provided in thicknesses of 3,51 mm and 3,56 mm (0.138 in and 0.140 in).

Incorrect setting of the bearings will result in premature bearing wear.

6. With the correct thickness of key washer fitted, insert a split pin which has been twisted to give a 90° turn to the head. Pass the sealing band through the split pin head, round the nut, and over the split pin legs.

Carefully tap the split pin fully into position then crimp the sealing band ends to secure it around the nut. Finally bend back the split pin legs around the nut.

7. Smear approximately 14 g (0.5 oz) of approved grease into the base of the dust cap. Ensure the earthing strip in the cap is in the correct position to make contact with the end of the stub axla when the cap is fitted. Fit the cap by tapping it onto the hub with a nylon mallet.
8. Fit the brake calipers, road wheel, etc. by reversing the removal procedure.
9. Bleed the braking system as described in Chapter G.

Note New brake discs are treated with a protective film. When a new disc has been fitted, the brakes should be gently applied until the protective film has been removed from the working surface of the disc.

If only one front brake disc has been renewed, the car will gently pull to the side opposite the new disc until the protective film has been removed.

Front suspension settings

Introduction

Whenever the suspension has been partially or fully dismantled, the ride height of the car should be checked. This height is the vertical distance measured between the machined locating pads on the underside of the front sub-frame and the centre line of the triangle lever ball pin carrier securing bolt (see fig. H7-1).

To allow the suspension to settle after assembly, drive the car back and forth before carrying out the ride height checks.

Ride height – To check

1. The height must be checked with a full tank of fuel. If however, the tank is partially empty, weight equivalent to the amount of missing fuel should be positioned adjacent to the fuel tank.

For each 4,5 litres (1 Imp gal, 1.2 US gal) of missing fuel add 3,4 kg (7.5 lb) of weight.

2. Ensure that the spare wheel, jack, tools, and accessories are fitted in their relevant positions.
3. Check the tyre pressures and correct if necessary. It is important that this operation is carried out as incorrect tyre pressures will cause ride height measurement inaccuracy.
4. Drive the car onto a suitable level ramp and chock the front road wheels. Do not attempt to set the ride height with the car on a unlevel surface, as the variation in weight distribution can affect the cars height.
5. Move the gear range selector lever to the neutral position. Remove the gearchange fuse (number A6 on fuse panel F2) from the fuseboard. Release the parking brake.
6. Start and run the engine. Allow the hydraulic systems to fully pressurize.
7. Check that the rear suspension height is set as described in Section H11.
8. Measure the ride height from the level surface on which the car stands, to the face of the front sub-frame locating pads. These pads are situated on the underside of the sub-frame adjacent to the front mounts (see fig. H7-1, dimension A).
9. Measure from the level surface to the centre of the bolt fitted through the lower ball pin carrier (see fig. H7-1, dimension B).
10. Subtract dimension B from dimension A. The difference between the two dimensions should be between 104 mm and 110 mm (4.1 in and 4.35 in). If the resultant dimension is outside this toleranc adjust the car height as described under Ride height – To adjust.

Ride height – To adjust

The car ride height is increased or decreased by altering the thickness of the collets fitted between the spring support collar and spring support plate. Refer to Section H4 for collet thickness information.

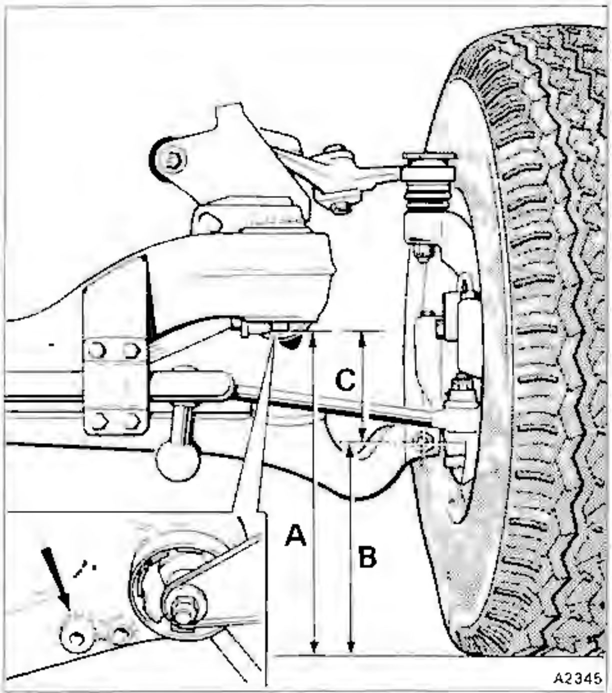


Fig. H7-1 Front height setting
A Floor to sub-frame location pad
B Floor to centre line of triangle lever bolt
C Height setting measurement A minus B
Inset. – Sub-frame location pad

1. Fit the support plate halves of the road spring retention tool RH8809, around the lower section of the damper and secure them together.

Insert the four long studs of the tool through the upper spring plate and screw them securely into the tool support plate.

Fit the special nuts, thrust races, and washers to the top of each stud (see fig. H4-2).

Note On cars fitted with pressed steel spring plates the adapter plate RH12053 should be placed onto the spring plate prior to inserting the four studs.

Warning Always examine the spring retention tool for signs of thread wear or damage prior to its use. If you have doubts concerning any parts of the tool and their ability to withstand spring load you should renew those parts.

2. Evenly tighten the four spring retention tool nuts to retain the spring in its compressed condition.
3. Place a jack under the centre triangle lever pivot and slowly raise the car.

The operation will allow the spring support to be drawn from the spring support plate, exposing the adjustment collets.

When the collets are exposed support the car body on sill blocks then carefully remove the collets.

4. Select the thickness of collets required to obtain the correct car ride height.

Do not fit collets totalling more than 25,4 mm (1.0 in) in thickness.

A packing washer 6,35 mm (0.250 in) thick gives a change in car height of approximately 9,50 mm (0.375 in).

5. Fit the collets into position on the spring support collar. Always ensure that the thinnest collets are fitted to the top of the selection (see fig. H7-2).

6. Remove the sill blocks and carefully lower the car ensuring that the collets enter the spring support plate correctly.

7. Remove the jack and spring retention tool, then lower the ramp to the ground.

8. Roll the car back and forth until the wheels attain a stable camber, then check the ride height again as described previously.

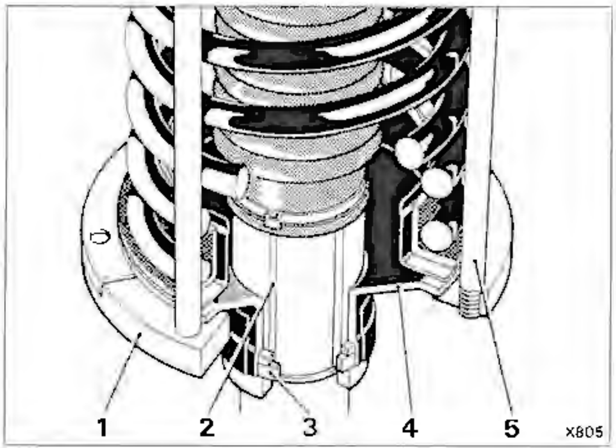


Fig. H7-2 Front height adjustment
1 Spring retention tool support plate
2 Spring support collar
3 Adjustment collets
4 Spring support
5 Retention tool stud (4)

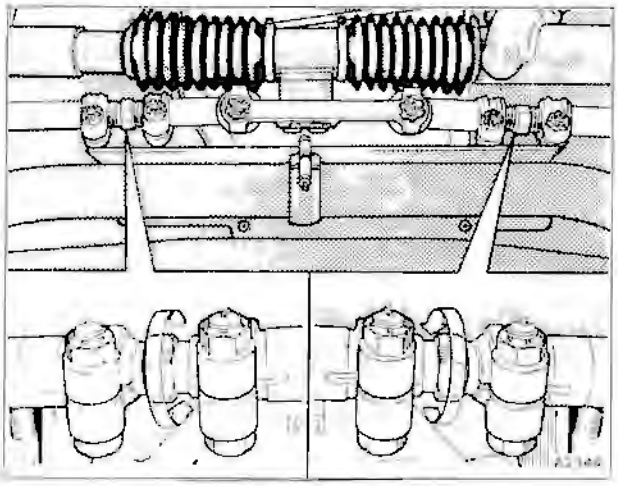


Fig. H7-3 Track rod toe-in adjustment

Steering and suspension geometry

Front wheel toe-in	0° 12′ ± 5′
Camber angle	0° 30′ negative ± 15′
Caster angle	3° 0′ ± 30′

Maximum caster variation from side to side 0° 30′

Front wheel toe-in – To adjust

1. With the car ride height correctly adjusted, position the car on a level surface. Set the steering in the straight ahead position.

2. Set suitable alignment equipment onto the front wheels following the manufacturer's instructions and take a reading.

3. If adjustment is necessary, slacken the pinch bolts securing the track rod adjusters (see fig. H7-3). Rotate the adjusters to bring the wheels into the straight ahead position (zero toe-in).

4. Rotate the adjusters by equal amounts to give an overall toe-in figure of between 0° 7′ and 0° 17′.

5. Tighten the pinch bolts then check the toe-in again.

6. When the toe-in is correct, torque tighten the pinch bolts to between 48 Nm and 54 Nm (4,5 kgf m and 5,5 kgf m, 33 lbf ft and 40 lbf ft) using the tolerance to align the split pin holes. Fit new split pins.

Caster and camber angles – To adjust

The caster and camber angles must be checked at the same time as adjustment of one affects the other.

1. Drive the car onto a ramp setting the front wheels on turntables. Place blocks beneath the rear wheels to maintain the car on a level plane. Chock the rear wheels.

2. Ensure the car ride height is correct.

3. Fit suitable checking equipment to the wheel and check the caster and camber angles in accordance with the equipment manufacturer's instructions.

4. **Caster angle**

To adjust the caster angle, move the compliance rod in or out of the compliance mount using the clamping nuts on the rod (see fig. H5-3). Slacken the compliance rod jaw bolt sufficiently to allow the jaw to pivot on the compliance arm during adjustment.

5. **Camber angle**

To adjust the camber angle, release the eccentric bolt on which the compliance arm pivots. Turn the bolt until the correct camber angle is obtained.

Note The arrow stamped on the bolt head (see fig. H5-3) should always point below the centre line of the bolt.

6. Check the caster angle again to ensure that the adjustment of the camber angle has not altered the caster angle out of the required limits.

Torque tighten the bolts and buts to the figures quoted in Section H13 before carrying out the final checks.

7. Carry out the same adjustment procedure on the other front wheel.

The maximum caster variation allowed between each side of the car is 0° 30′.

7. Carry out the same adjustment procedure on the other front wheel.

The maximum caster variation allowed between each side of the car is 0° 30′.

Rear sub-frame and suspension

Introduction

The rear sub-frame comprises a rear crossmember and a final drive crossmember with frame tubes fixed at angles between the two components to form a space frame assembly.

The trailing arms which are designed to give a semi-swing axle effect, are attached to the rear crossmember. Each trailing arm carries a rear hub assembly and a mounting plate for the suspension strut lower mount.

A stabilizer which is attached to both trailing arms, is mounted on the rear crossmember.

The final drive crossmember supports the final drive unit. Drive-shafts transmit the drive from the unit to the rear hubs.

The sub-frame assembly is secured to underbody brackets by the use of rubber mounts fitted at each end of the crossmembers.

Small longitudinal dampers are mounted at the ends of the rear crossmember to damp any forward or rearward vibration of the sub-frame.

On Bentley Turbo R cars a panhard rod is also fitted to the rear of the final drive crossmember to restrict lateral movement.

Warning When the rear sub-frame is removed from the car, on no account must the frame tubes or crossmembers be dismantled unless an alignment jig is available for re-assembly.

Rear sub-frame and final drive unit – To remove

1. Drive the car onto a ramp and chock the front wheels.
2. Depressurize the hydraulic systems as described in Chapter G.
3. Move the gear range selector lever to the neutral position.
4. Disconnect the battery.
5. Remove the rear sections of the exhaust systems as described in Chapter Q.
6. Remove the rear wheel trims and slacken the wheel nuts.
7. Remove the rear road springs as described in Section H10.

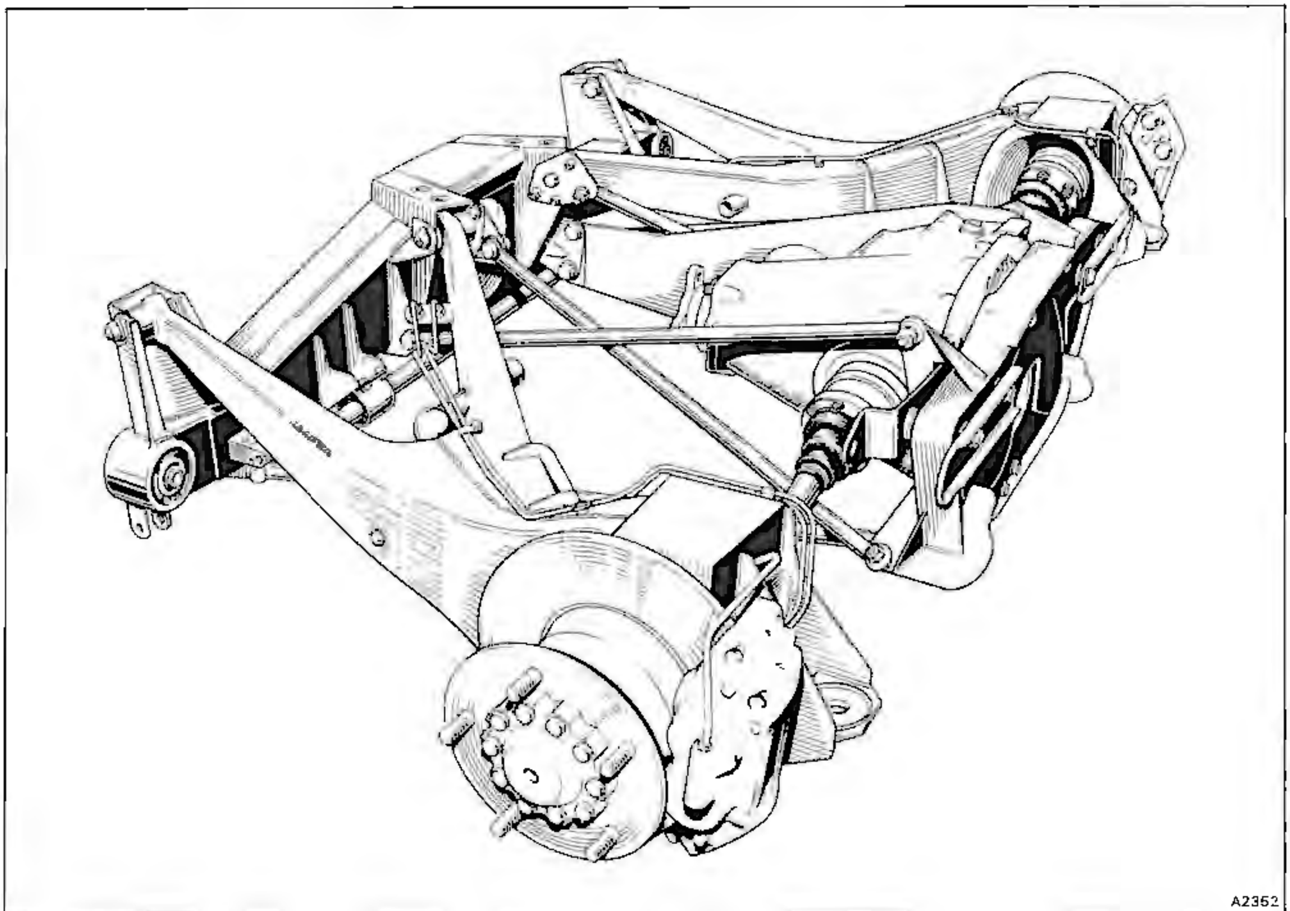


Fig. H8-1 Rear sub-frame and associated components

8. Place a jack beneath the final drive casing and raise the rear of the car. Support the body on sill blocks in the normal ride position.
9. Support the trailing arms with jacks and remove the rear road wheels.
10. Disconnect the pipe and hose connections from the levelling valve situated on the rear crossmember. Fit blanking plugs to the pipes and ports.
11. On cars fitted with anti-lock braking, remove the rear seat cushion (see Chapter S). Disconnect the two sensor connections, situated on the rear seat pan and feed the connectors down through the grommet holes.
12. Disconnect the brake hoses from the trailing arm brackets. Fit blanking plugs to the hose and pipe ends.
13. Disconnect the suspension strut from the rear of each trailing arm.
14. Disconnect the parking brake cables from the operating lever on the rear hubs. Pull back the convoluted sleeves to expose the outer cable securing nuts. Release the nuts and feed the cables through the slot in the brackets. Detach the ring clip supporting each cable beneath the rear stabilizer.
15. Remove the propeller shaft as described in Chapter F.
16. Disconnect the earth braid from the rear of the final drive crossmember.
17. On Bentley Turbo R cars disconnect the panhard rod from the mounting bracket at the rear of the final drive crossmember.
18. Remove the small damper situated at each end of the rear crossmember.
19. Fit a frame similar to that shown in figure H8-2 onto a trolley jack. Raise the jack and position the frame beneath the sub-frame with the central pad beneath the final drive casing. The two arms should support the trailing arms and the forward pan should support the rear crossmember.
20. With the sub-frame fully supported, remove the four bolts securing the rubber mounts to the body mounting brackets.
21. Carefully lower the sub-frame from beneath the car. When the sub-frame is clear of obstructions, pivot the support and sub-frame through 90° to allow the frame to pass between the ramp channels. If the ramp is too

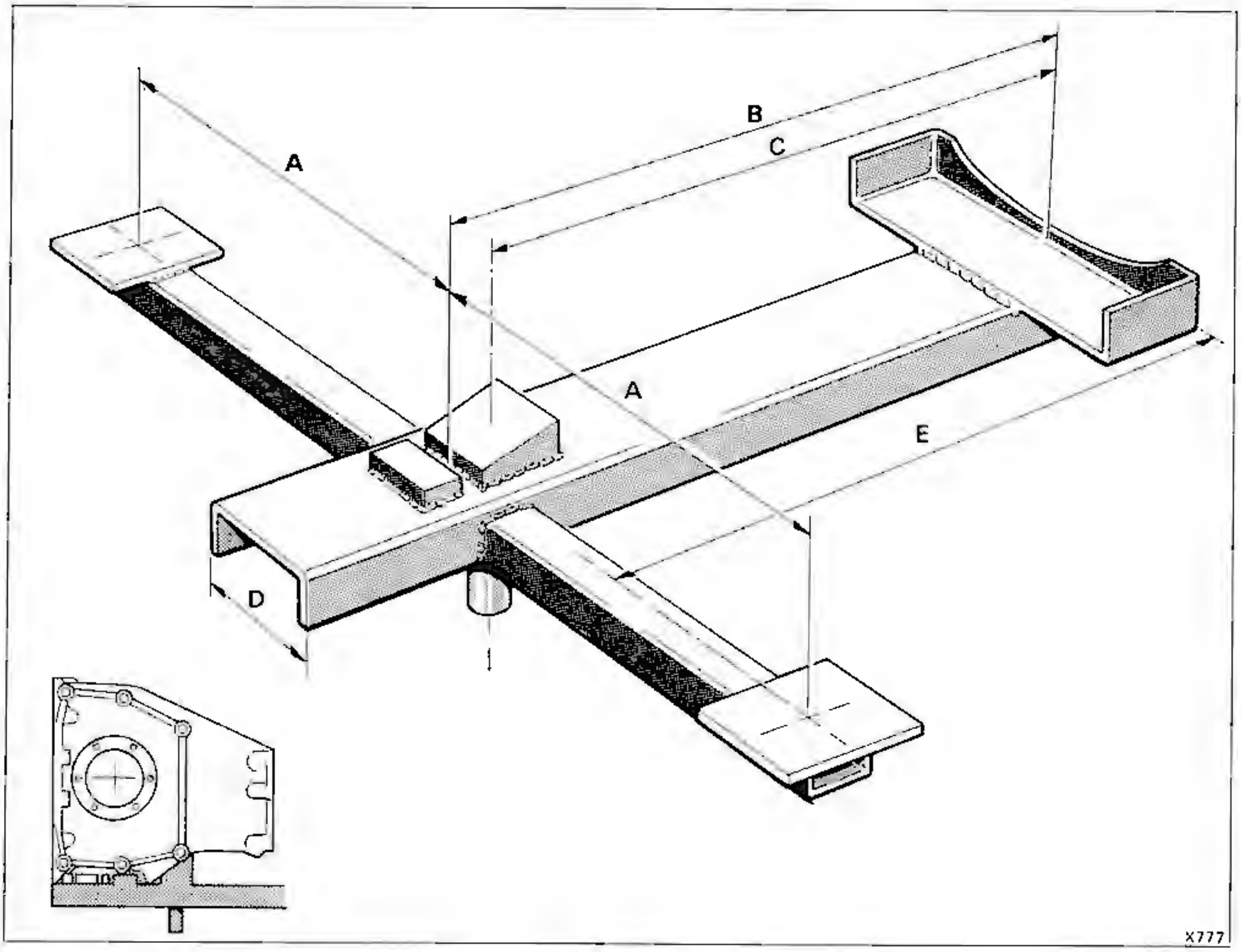


Fig. H8-2 Rear sub-frame removal jig general dimensions
A 635 mm (25.0 in)
B 673 mm (26.5 in)
C 610 mm (24.0 in)
D 127 mm (5.0 in)
E 635 mm (25.0 in)
Inset – Jig to final drive location

narrow to allow the sub-frame to be lowered in this manner, the sub-frame should be lowered onto the ramp and then carefully manoeuvred from beneath the car.

Note When lifting the sub-frame assembly with a hoist, use pick-up points across the trailing arms and under the final drive unit. The rear crossmember should also be supported. **Do not lift the sub-frame on the frame tubes.**

Rear sub-frame and final drive unit – To fit

Fit the sub-frame and final drive unit assembly by reversing the removal procedure noting the following.

1. Inspect all the mounts and components for serviceability. Renew as necessary.
2. Ensure that the front and rear sub-frame are aligned by measuring the longitudinal and diagonal distances between the machined fixture locating pads (see fig. H3-11).

   These measurements must be equal to within 1,60 mm (0.062 in).
3. Check the rear crossmember setting (see fig. H9-3) as described in Section H9 under Rear crossmember mounts – To renew.
4. When fitting the rear road springs ensure that the correct number and sequence of ride height adjustment washers are maintained.
5. Do not tighten the exhaust system joints until the pipes have been manoeuvred to obtain the best alignment which is free from possible fouls. When checking clearances always take into account the exhaust growth that will occur during engine running.
6. Bleed the hydraulic system as described in Chapter G.
7. Check the ride height as described in Section H11 and Chapter G Section G15.
8. Torque tighten all nuts and setscrews to the figures quoted in Section H13 and Chapter P.

Frame tubes – To replace

If damage occurs to one or more of the frame tubes they can be replaced using the following method.

Important Always ensure that all suspension load has been removed from the sub-frame prior to the removal of the frame tube bolts. Only remove one frame tube at a time.

1. Drive the car onto a ramp and chock the front wheels.
2. Move the gear range selector levar to the park position.
3. Depressurize the hydraulic systems as described in Chapter G.
4. Support the final drive unit with a jack.
5. Insert a spring retention tool RH 9299 through the centre of each lower spring support. Screw the tool fully into the upper spring support.

Warning Always axamine the spring retention tool for signs of thread wear or damage prior to its use. Renew the tool if necessary.

6. Raise the rear of the car until the spring load is removed from the trailing arms. Position sill blocks beneath the car sills to support the body. Ensure the trailing arms are supported by the road wheels.

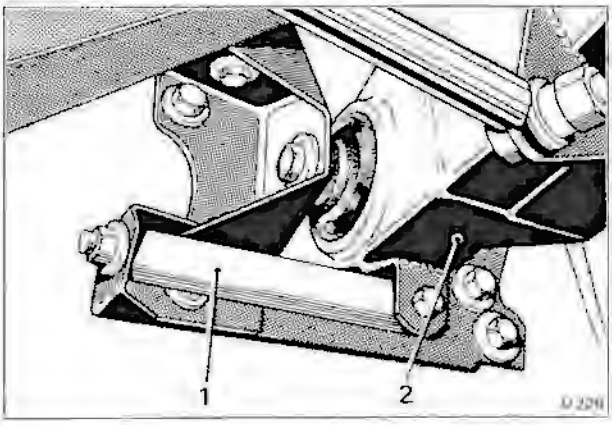


Fig. H8-3 Jury bolt in position
1 Jury bolt
2 Rear crossmember

7. Remove one of the small dampers situated beneath each end of the rear crossmember and insert a jury bolt RH 9575 (see fig. H8-3). With the jury bolt in position, replace the damper from the other end of the crossmember with a jury bolt.

   The jury bolts should not exert any load on the crossmember.
8. Before removing the frame tube, note the mounting of the tube to the bracket, the bolt insertion direction and the washer positions.

   The tube end faces are offset to allow the tube centre line to lie along the location face of the crossmember bracket. Ensure that the new tube is fitted in this manner.
9. Remove the frame tube.
10. Place the new frame tube into position. The alignment of the holes between the frame tube and the crossmember brackets should allow the securing bolts to be inserted without having to apply force to the tube or crossmember.
11. If elignment is correct fit and torque tighten the frame tube securing bolts to between 102 Nm end 108 Nm (10,4 kgf m and 11,0 kgf m, 70 lbf ft and 80 lbf ft).

    Should hole misalignment be evident the cause should be investigated. Do not release the torque arm or other frame tubes to obtain hole alignment. This can cause sub-frame movement, resulting in incorrect sub-freme settings and necessitating the removal of the sub-freme to obtain correct alignment on a setting jig.
12. When all the frame tubes are secured, remove each jury bolt in turn and fit the small damper.
13. Remove the spring retention tools and all jacks and blocks.
14. With the gear range selector lever in the park position, remove the gear change fuse from the fuseboard (fuse A6 on fuse panel F2).
15. Start and run the engine to pressurize the hydraulic systems.

Bump stop – To renew

1. Chock the front wheels.

2. Jack up the rear of the car and remove the road wheel.
3. Remove the two setscrews securing the bump stop.
4. Fit the new bump stop and torque tighten the setscrews to between 22 Nm and 24 Nm (2,2 kgf m and 2,5 kgf m, 16 lbf ft and 18 lbf ft).

Rebound stop

The rebound stop is incorporated into the rear suspension strut and no maintenance is necessary.

Rear sub-frame mounts and stabilizer

Introduction
The rubber sub-frame mounts can be renewed with the sub-frame in position. Always ensure when carrying out the renewal operations that all suspension load is removed from the sub-frame and that the frame tubes are not put under stress.

Never use the frame tubes to support or lift the sub-frame.

Warning Always examine the spring retention tool RH9299 for signs of thread wear or damage prior to its use. Renew the tool if necessary.

Rear crossmember mounts – To renew (sub-frame in position)
1. Drive the car onto a ramp and chock the front wheels.
2. Move the gear range selector to the park position.
3. Depressurize the rear suspension struts as described in Chapter G.
4. Screw a compression tool RH9299 into each bell shaped spring support to retain the springs in their compressed condition.
5. Place a jack under the final drive and raise the rear of the car. Support the body on sill blocks.
6. Support the trailing arms with jacks. Raise the trailing arm sufficiently to allow the mount extractor to be fitted into position on the rear crossmember.
7. Remove the small damper fitted below the rear crossmember.
8. Scribe around the edges of the body bracket to assist in correctly positioning the bracket on assembly.
9. Support the rear crossmember with a jack positioned near to the end of the crossmember. Remove the nut and washer from the long bolt fitted through the rubber mount. Adjust the supporting jack to allow the bolt to be easily withdrawn.
10. Remove the setscrews securing the mounting bracket to the body. Carefully slide the bracket down between the body and the rear crossmember.
11. Position the extraction components of tool RH9291 onto the mount (see fig. H9-5). Tighten the draw bar until the mount is withdrawn from the crossmember. Remove the old mount and the extraction cup from the tool.
12. Check that the bore and rim of the housing are free from burrs and damage. Lightly lubricate the bore with Molytone C or equivalent grease.
13. Locate a new mount in position on the crossmember. Fit tool RH9291 using the insertion components. Ensure that the slots in the rubber of the mount are positioned as shown in figure H9-1. Tighten the tool draw bar to draw the new mount into the sleeve

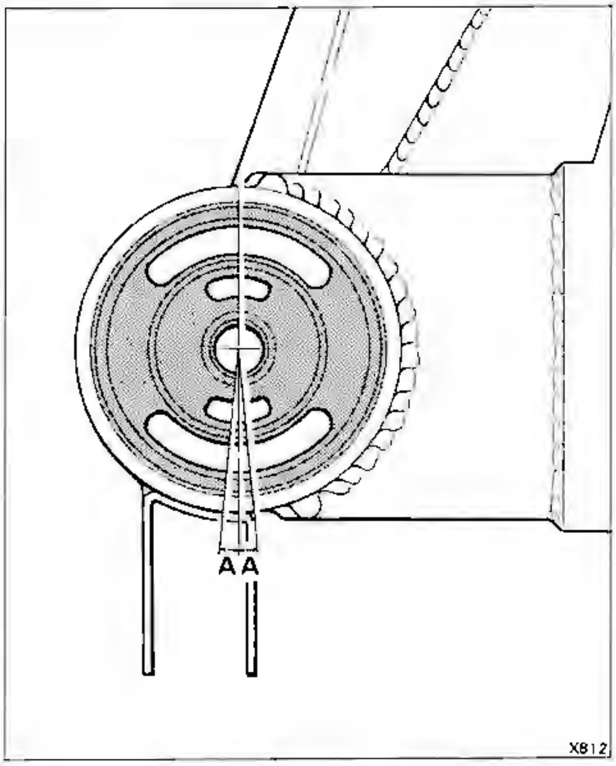


Fig. H9-1 Rear crossmember mount alignment
A Holes to be within 5° of vertical centre line

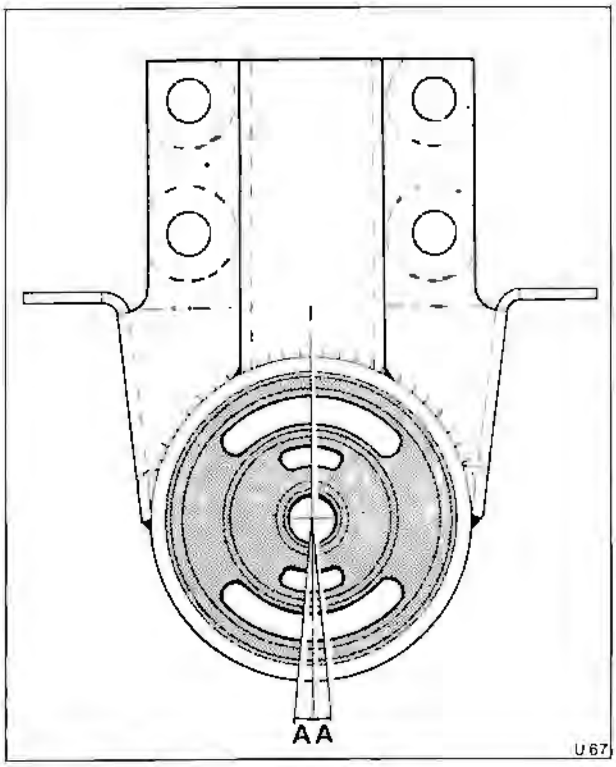


Fig. H9-2 Final drive crossmember mount alignment
A Holas to be within 5° of vertical centre line

Printed in England

of the crossmember until the mount is fully inserted. Remove the tool.

14. Remove any grease that may have been deposited on the rubber of the mount using a soap solution and water.

15. Slide the mounting bracket between the body sill and the crossmember. Position the bracket to the lines scribed in Operation 8 then tighten the setscrews.

16. Fit the long mounting bolt with the washers positioned as shown in figure H9-3.

17. Release the compression tool retaining the spring.

18. Remove the jacks and sill blocks.

19. Check the distance between the large buffer washer and the edge of the crossmember sleeve. This dimension should be between 10,16 mm and 12,07 mm (0.40 in and 0.475 in). If this dimension is incorrect adjust the mounting bracket to obtain the correct clearance.

20. Fit the small sub-frame damper.

21. Torque tighten all nuts and setscrews to the figures quoted in Section H13 and Chapter P.

Final drive crossmember mounts – To remove
(see fig. H9-4)

1. Drive the car onto a ramp and chock the rear wheels.

2. Move the gear range selector lever to the park position.

3. Remove the spare wheel from its carrier, then raise the carrier.

4. Support the final drive unit with a jack.

5. Before removing any of the mount components, scribe lines around the washers on the mounting plates connecting the final drive crossmember to the rubber mounts. These lines will assist in correctly locating the components and centralizing the final drive upon assembly.

6. To remove a crossmember mount, remove the two mounting plates connecting the final drive crossmember to the rubber mount.

7. Remove the two setscrews also the nuts and washers from the four bolts, securing the mount to the body. Slide the mount off the bolts.

8. Remove the mount from its housing using the extraction components of tool RH 9291 (see fig. H9-5).

9. Check that the bore and rim of the housing are free from burrs and damage. Lightly lubricate the bore with Molytone C or equivalent grease.

10. Fit a new mount into the housing using the insertion components of tool RH 9291. Ensure that the slots in the mount are positioned as shown in figure H9-2.

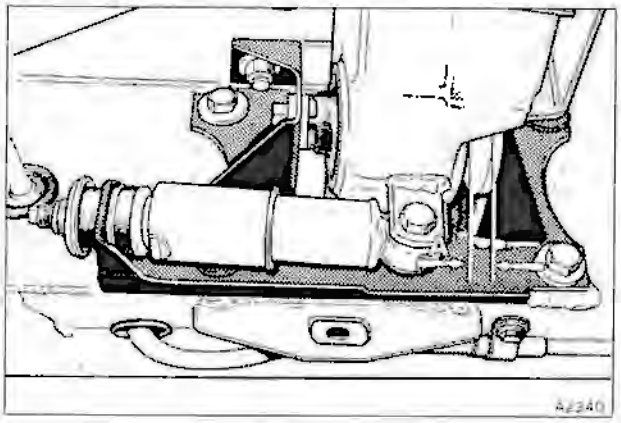


Fig. H9-3 Rear crossmember mount setting
A 10,60 mm to 12,07 mm (0.40 in to 0.475 in)

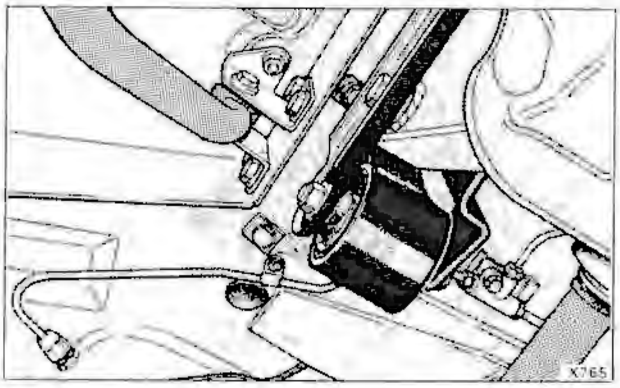


Fig. H9-4 Final drive crossmember mount
(left-hand shown)

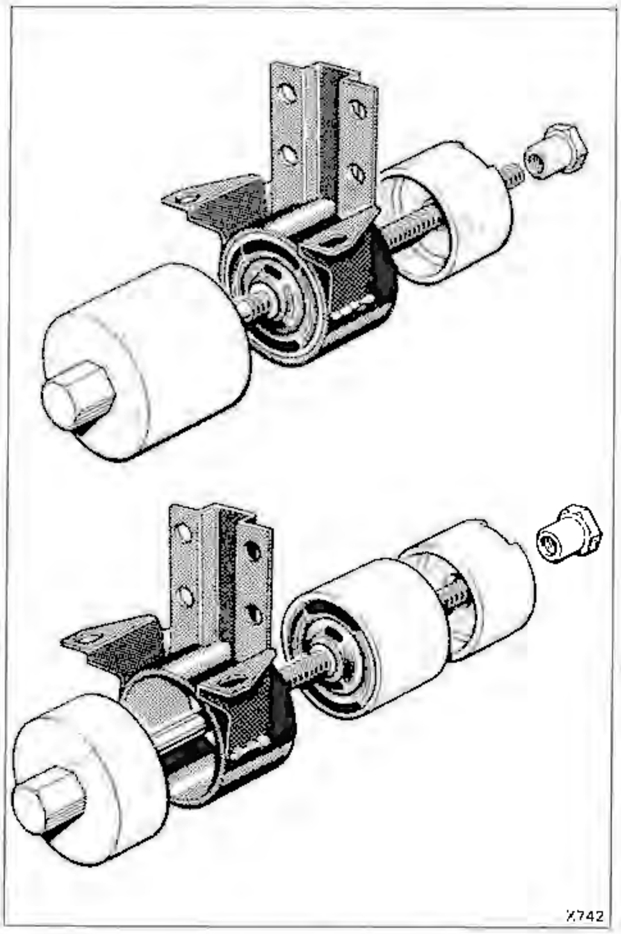


Fig. H9-5 Mount extraction and insertion tool RH9291

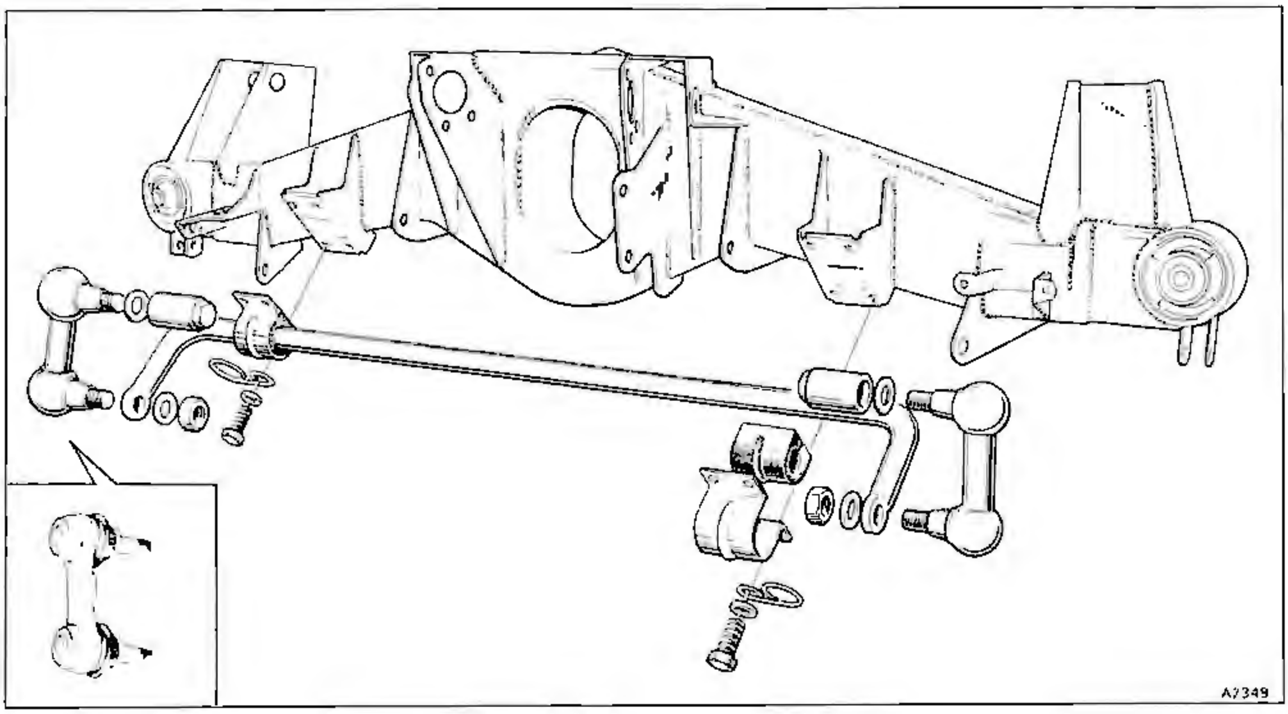


Fig. H9-6 Rear stabilizer components
Inset-Link fitted to Bentley cars other than Bentley Continental

11. Remove any grease that may have been deposited on the rubber of the mount using a soap solution and water.
12. Fit the mounts to the body by reversing the removal procedure.
13. Torque tighten the setscrews and nuts to the figures quoted in Section H13 and Chapter P.

Rear stabilizer bar – To remove (see fig. H9-6)
1. Remove the 'U' clamp securing the levelling valve torsion bar to the centre of the stabilizer bar.
2. Slacken, but do not remove the reach nuts which secure the stabilizer links to the trailing arms.
3. Using a hammer and a soft metal drift placed on the reach nut, separate the stabilizer link tapers from the trailing arms. Remove the reach nuts.
4. Remove the brackets attaching the stabilizer mounting bushes to the crossmember.
5. Remove the stabilizer bar and rubber mounting bushes.
6. To remove the stabilizer links from the stabilizer bar repeat Operations 2 and 3.

Rear stabilizer – To fit
Fit the stabilizer by reversing the removal procedure noting the following.
1. Examine the stabilizer mounting bushes and links for serviceability. Renew if necessary.
2. Loosely assemble the links into the trailing arms.
3. Fit the stabilizer onto the links then with the trailing arms set in the normal ride position, secure the stabilizer bar onto the crossmember. Fit the brake cable support clips on the lower setscrews.
4. Torque tighten the link nuts to between 45 Nm and 48 Nm (4,6 kgf m and 5,0 kgf m, 33 lbf ft and 36 lbf ft).
5. Set the levelling valve as described in Chapter G Section G15.

Rear road springs

Introduction
The rear road spring assembly comprises of a road spring, upper and lower bell shaped support, adjusting rings, and pliable spring seats. A flexible strip is fitted between the first and second spring coils at both ends of the spring. The adjusting rings, are each 1,22 mm (0.048 in) thick and are used to obtain the correct spring load and car ride height. Each ring is equivalent to a spring load increase of 35 N (3,5 kgf, 7.8 lbf) and will increase the car height by approximately 1,78 mm (0.070 in).

Warning Always examine the spring retention tool RH9299 for signs of thread wear or damage prior to its use. Renew the tool if necessary.

Rear road spring – To remove
1. Drive the car onto a ramp and chock the front wheels.
2. Move the gear range selector lever to the park position.
3. Support the final drive unit with a jack.
4. Insert spring retention tool RH9299 through the centre of the lower spring support. Screw the tool fully into the upper spring support.
5. Lift the rear of the car until the suspension is in the full rebound position. Position sill blocks beneath the car sills to support the body.
6. Carefully manoeuvre the spring from its seat and remove it from between the trailing arm and the body.
7. Remove the spring seats and adjusting rings from the spring.

Note On Corniche II and Continental *cars conforming to a Canadian, USA, and 1989 model year Middle East specification* an additional spacer and seat are fitted beneath the normal spring seat and adjusting rings (see fig. H10-1).

8. Remove the two dowels from the baseplate of the spring compression tool RH 7909 and fit adapter block RH 9504.

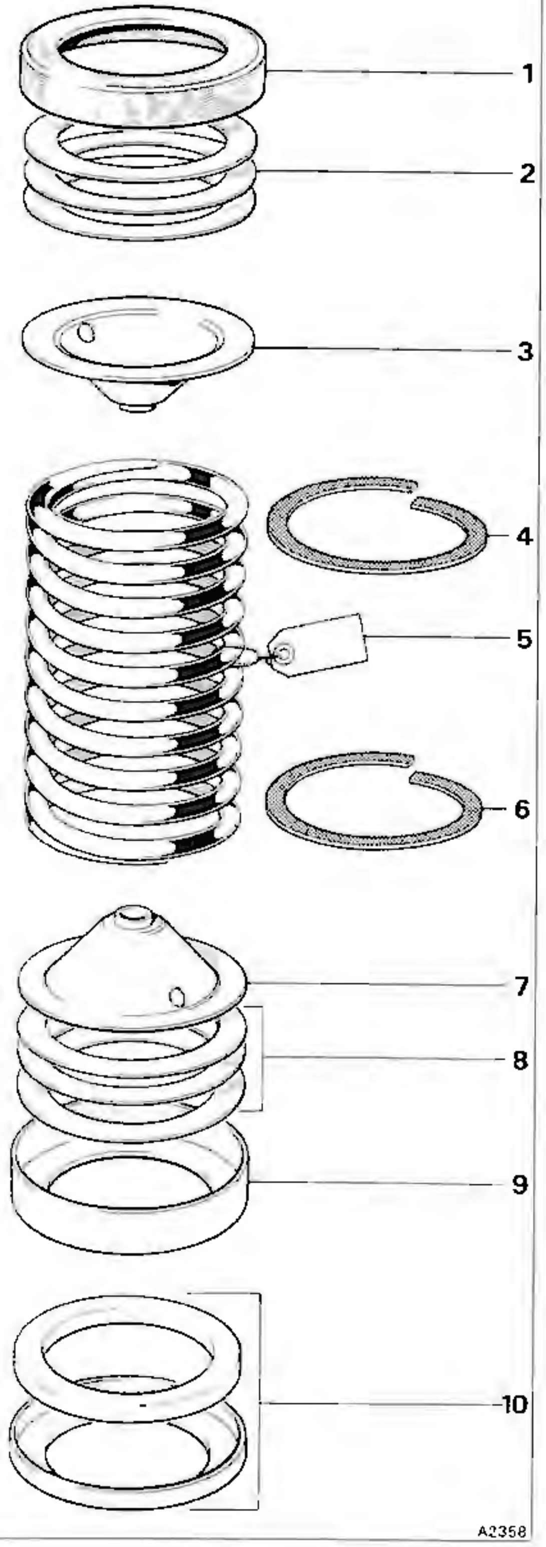


Fig. H10-1 Rear road spring assembly
1 Pliable spring seat
2 Adjusting rings (as required)
3 Upper spring support (threaded centre)
4 Flexible strip
5 Spring loading label
6 Flexible strip
7 Lower spring support
8 Adjusting rings (as required)
9 Pliable spring seat
10 Special 8,89 mm (0.350 in) thick spacer and shortened, pliable seat
(Only fitted to Corniche II and Continental cars conforming to a Canadian, USA, and 1989 model year Middle East specification)

Spring loading chart

	Cars other than those conforming to a Canadian and USA specification			*Cars conforming to a Canadian and USA specification*		
	N	kgf	lbf	N	kgf	lbf
Silver Spirit, Mulsanne, Mulsanne S, and Bentley Eight	5316	542	1195	5382	549	1210
Silver Spur, Mulsanne, and Mulsanne S Long wheelbase	5382	549	1210	5450	556	1225
Bentley Turbo R	5316	542	1195	5316	542	1195
Bentley Turbo R Long wheelbase	5382	549	1210	5382	549	1210
Corniche, Corniche II, and Bentley Continental	5845	596	1314	5996	612	1348
Corniche II and Bentley Continental *conforming to a 1989 model year Middle East specification*	5996	612	1348	–	–	–

9. Position the compressed spring into the compression tool with the upper spring support in the adapter block (see fig. H10-3).
10. Fit the top plate of the tool. Screw down the special nuts and thrust washers to secure the spring.
11. Measure and record the distance between the upper and lower plates.
12. Remove the spring retention tool RH 9299.

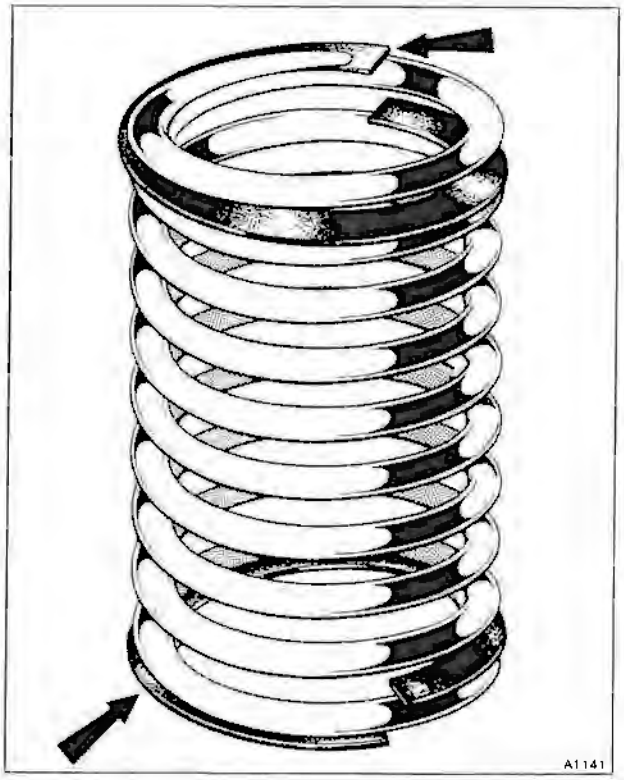


Fig. H10-2 Flexible strip location

Ensure that the threads in the upper spring support are in good condition to withstand the full spring load when the retention tool is inserted.
13. Evenly unscrew the two nuts on the compression tool to completely extend the spring.
14. Examine all the components for serviceability.

Road spring – To fit

1. Fit the spring and spring supports into the compression tool. The threaded support should rest in the baseplate adapter.

The flexible strips should be inserted at both ends of the spring between the first and second coils (see fig. H10-2). On later cars the flexible strips are half the circumference of the spring.

2. Evenly tighten the tool nuts to compress the spring until the measurement taken during spring removal is achieved.
3. Screw the spring retention tool RH9299 into the threaded spring support to retain the spring in its compressed condition.
4. Remove the spring compression tool RH7909 and the adapter block RH9504.
5. When fitting a new spring, obtain the spring load figure from the label attached to the spring.
6. Refer to the spring adjustment chart to ascertain the correct number of adjusting rings required to obtain the correct spring load.

One adjusting ring is equivalent to 35 N (3,5 kgf, 7.8 lbf) therefore to achieve the correct nominal load multiples of this figure should be added to the load figure quoted on the spring label. This will give the number of rings required.

7. Ensure the trailing arm is in the full rebound position.
8. Fit the spring by placing a pliable seating and half the required number of adjusting rings estimated in Operation 6, into the trailing arm spring location.

Spring loading washer selection

		1	2	3	4	5	6	7	8
Number of adjusting washers		1	2	3	4	5	6	7	8
Packing thickness	mm	1,22	2,44	3,66	4,88	6,09	7,31	8,53	9,75
	in	0.048	0.096	0.144	0.192	0.240	0.288	0.336	0.384
Spring load increase/decrease	N	34,7	69,4	104,2	138,9	173,3	208,0	242,8	277,5
	kgf	3,54	7,08	10,61	14,15	17,69	21,23	24,77	28,30
	lbf	7.8	15.6	23.4	31.2	39.0	46.8	54.6	62.4
Standing height increase/decrease	mm	1,78	3,56	5,33	7,11	8,89	10,67	12,45	14,22
	in	0.070	0.140	0.210	0.280	0.350	0.420	0.490	0.560
Number of adjusting washers		9	10	11	12	13	14	15	16
Packing thickness	mm	10,97	12,19	13,41	14,63	15,85	17,07	18,28	19,50
	in	0.432	0.480	0.528	0.576	0.624	0.672	0.720	0.768
Spring load increase/decrease	N	312,2	346,9	381,6	416,4	451,1	485,8	520,2	555,0
	kgf	31,84	35,38	38,92	42,46	45,99	49,53	53,03	56,56
	lbf	70.2	78.0	85.8	93.6	101.4	109.2	116.9	124.7
Standing height increase/decrease	mm	16,00	17,78	19,56	21,34	23,11	24,89	26,67	28,45
	in	0.630	0.700	0.770	0.840	0.910	0.980	1.050	1.120

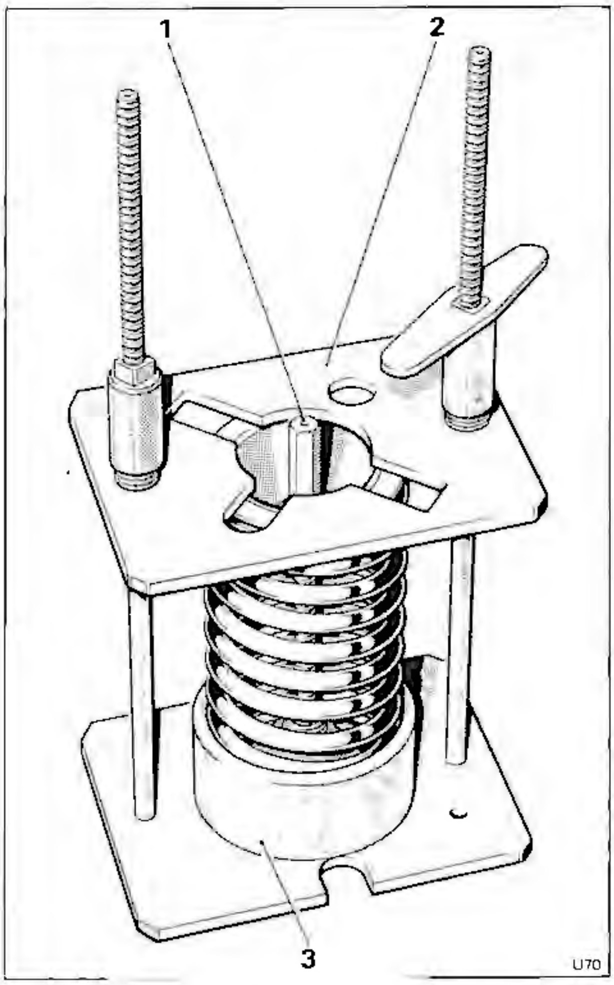


Fig. H10-3 Spring compression tools in position
1 Tool RH9299 and thrust washer
2 Tool RH7909
3 Adapter block RH9504

9. Place the remainder of the adjusting rings and a flexible seat over the upper spring support. Position the spring in the body spring cup.

On Corniche II and Continental cars *conforming to a Canadian, USA, and 1989 model year Middle East specification* the additional 9,0 mm (0.350 in) thick packing and special flexible seat, should be fitted first.

Note Always ensure that the rings used are clean and that no foreign matter becomes trapped between them during assembly.

10. Remove the sill blocks and carefully lower the car onto its wheels until the spring is held in position.
11. Carefully remove the spring retention tool from the centre of the spring.
12. Lower the ramp to the ground.
13. Roll the car backwards and forwards until the wheels attain a stable camber angle.
14. If a new spring has been fitted or the quantity of adjusting rings used has been changed, check the car ride height as described in Section H11.

Rear suspension settings

Introduction
Following operations in which the suspension has been partially or fully dismantled, the ride height of the car should be checked and if necessary adjusted.

To allow the suspension to settle after assembly and prior to this check being carried out, the car should be driven back and forth several times.

The ride height of the car is determined by three factors. The poundage of the road springs, the quantity of adjusting rings fitted to the springs, and the hydraulic mineral oil and gas pressure in the rear suspension strut and gas spring assemblies.

When checking the ride height it is also necessary to determine the closing pressure of the minimum pressure valve, i.e. the amount of hydraulic pressure retained in the rear struts. For full details of the closing pressure setting reference should be made to Chapter G.

Ride height – To check
1. The ride height should be checked with a full tank of fuel. If however the tank is partially empty, weight equivalent to the amount of missing fuel should be positioned adjacent to the fuel tank.

For each 4,5 litres (1 Imp gal, 1.2 US gal) of missing fuel add 3,4 kg (7.5 lb) of weight.

The fuel tank capacity is 108 litres (23.75 Imp gal, 28.5 US gal).

2. Ensure that the spare wheel, jack, tools, and accessories are fitted in their correct positions.
3. Check the tyre pressures and correct if necessary. This operation must be carried out as incorrect tyre pressures will result in incorrect ride height measurements.
4. Drive the car onto a suitable level ramp and securely chock the front road wheels. Do not set the ride height with the car on a surface which is not level as the variation in weight distribution can affect the cars height.
5. Move the gear range selector lever to tha neutral position. **Remove the gearchange fuse from the fuseboard** (fuse A6 on fuse panel F2), and release the parking brake.
6. Depressurize the hydraulic system by releasing the accumulator bleed screws as described in Chapter G. Close the bleed screws.
7. Attach a bleed tube and container to the rear strut bleed screw and release the pressure from the struts.
8. Fit pressure gauge RH 9727 GMF into the strut bleed point.
9. Start the engine and allow the hydraulic systems to fully pressurize (approximately four minutes).
10. Bleed the suspension struts and pressure gauge. Allow the car time to level (approximately one minute).
11. Slacken the 'U' bolt which clamps the torsion rod to the rear stabilizer bar.
12. Position an open ended spanner [maximum length not exceeding 152mm (6.0 in)] onto the bottom of the levelling valve operating lever. Using the spanner as a lever, carefully pivot the operating lever towards the valve. Do not apply excessive pressure. Hold the lever in this position until a pressure of approximately 34,5 bar (500 lbf/in²) is indicated on the pressure gauge.

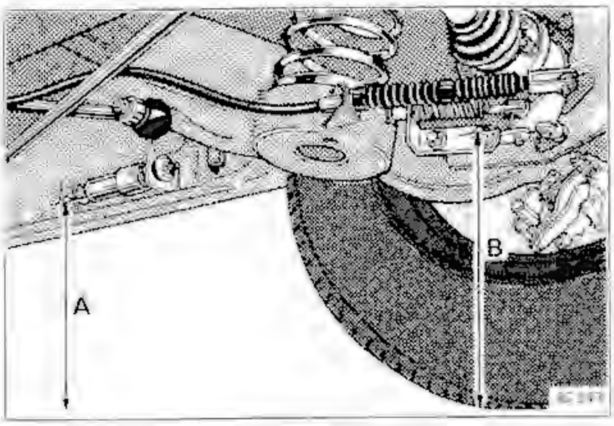


Fig. H11-1 Rear ride height setting
A Floor to centre of body bracket setscrew
B Floor to centre of parking brake linkage bracket setscrew

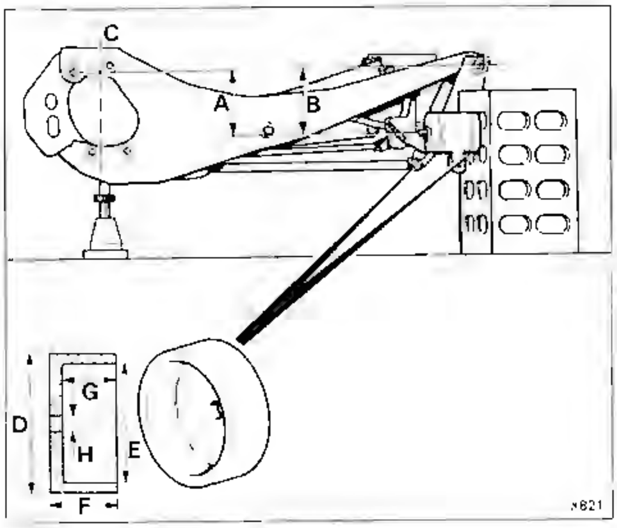


Fig. H11-2 Camber and toe-in setting
A 134,9 mm (5.312 in)
B 141,8 mm (5.582 in)
C Wheel centre line
D 76,2 mm (3.00 in)
E 66,8 mm (2.63 in)
F 25,4 mm (1.00 in)
G 15,2 mm (0.625 in)
H 9,9 mm (0.391)

13. Pivot the lever away from the valve. The pressure will start to descend slowly.
14. Note the pressure on the gauge when it stops falling. This is the minimum pressure valve setting and should be between 24,1 bar and 26,2 bar (350 lbf/in^2 and 380 lbf/in^2).

If the pressure is outside these limits, the minimum pressure valve should be adjusted as described in Chapter G Section G17.

15. When the car has fully lowered, pull down on the rear of the car then release it, this will ensure that the car has fully settled.
16. With the minimum pressure valve retaining the correct strut pressures, measure the height at points A and B as shown in figure H11-1. Both measurements should be taken from the level surface on which the car stands. Dimension A to the foremost bottom bolt securing the sub-frame mounting bracket to the body sill. Dimension B to the centre of the rear bolt attaching the parking brake linkage to the trailing arm.
17. Subtract dimension B from dimension A. The resultant figure must be within the following tolerances.

Applicable to cars other than Corniche II and Continental *built to a Canadian, USA, and 1989 model year Middle East specification.*
+5,0 mm and –5,0 mm (+0.20 in and –0.20 in).

Applicable to Corniche II and Continental cars *built to a Canadian, USA, and 1989 model year Middle East specification.*
+20,3 mm and +10,1 mm (+0.80 in and +0.40 in).

18. If the ride height is incorrect, add or remove the required number of adjusting rings to or from the spring seats.

Refer to Section H10 for details of the spring removal procedure.

19. When the ride height is correct the levelling valve should be set as follows.
20. Position an open ended spanner [maximum length not exceeding 152 mm (6.0 in)] onto the bottom of the levelling valve operating lever. Using the spanner as a lever, carefully pivot the operating lever towards the

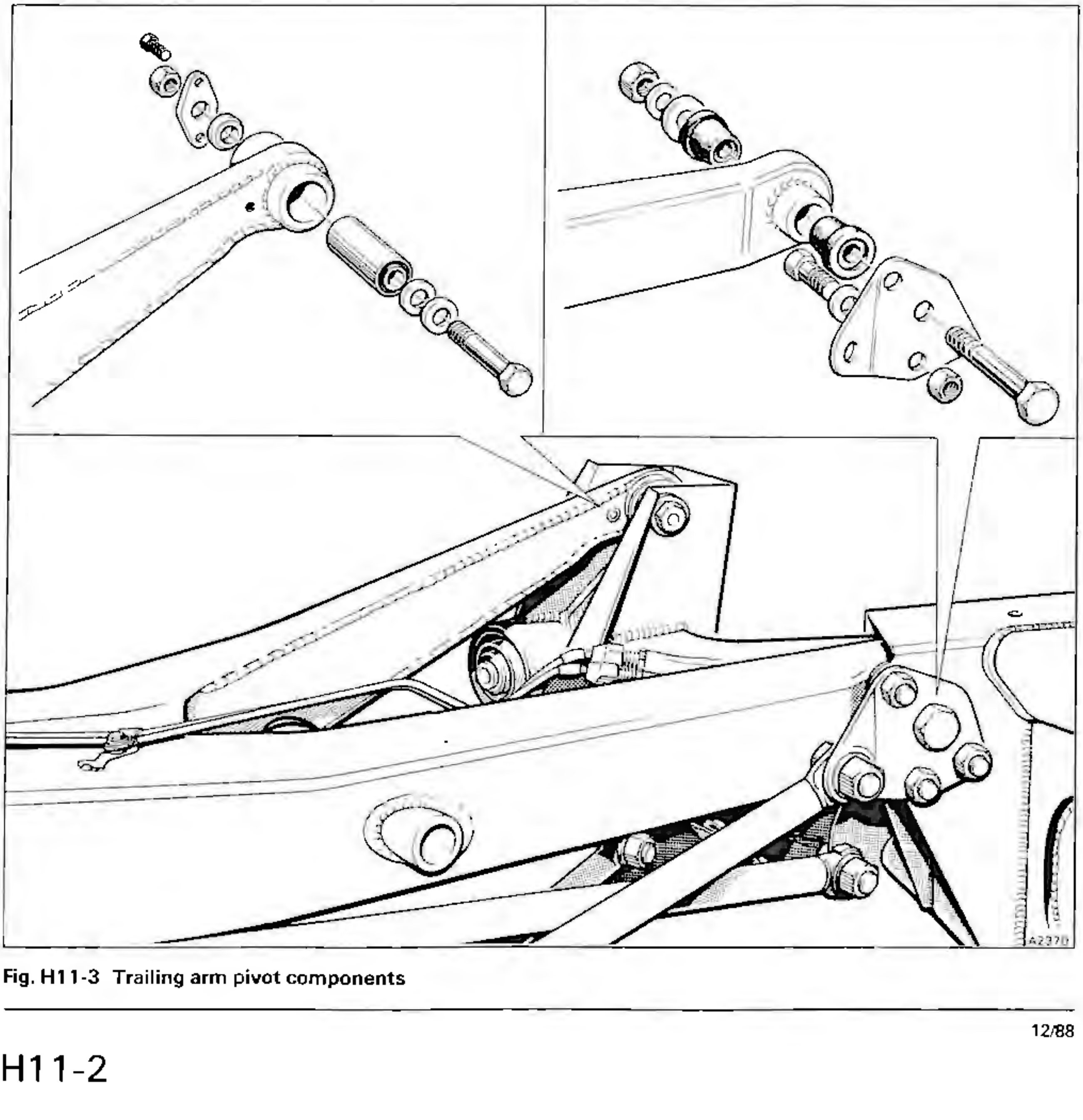


Fig. H11-3 Trailing arm pivot components

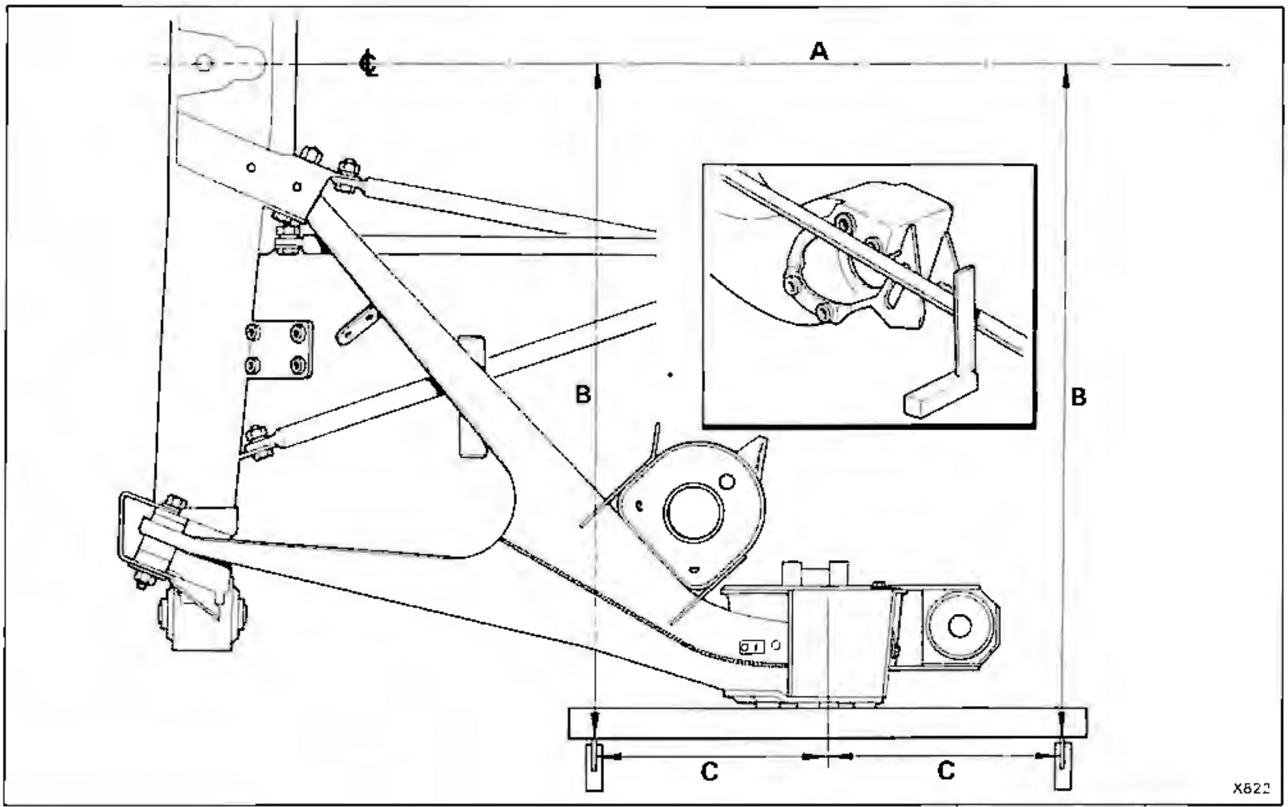


Fig. H11-4 Checking the toe-in setting
A Centre line of rear sub-frame assembly
B Measurement from engineers square to centre line
C 208 mm (8.20 in) from road wheel centre

valve. Do not apply excessive pressure. Hold the lever in this position until a pressure of approximately 34,5 bar (500 lbf/in^2) is indicated on the pressure gauge.

21. Pivot the lever away from the valve. The pressure will start to descend. When the pressure gauge reads between 0,34 bar and 0,69 bar (5 lbf/in^2 and 10 lbf/in^2) **higher** than the minimum pressure valve setting, allow the levelling valve to return to its 'dead area'.

With the levelling valve in this position, push the torsion bar as far as possible into the spherical bearing. Withdraw the torsion bar between 0,50 mm and 0,75 mm (0.020 in and 0.030 in), then torque tighten the torsion bar 'U' clamp nuts to between 5,2 Nm and 6,2 Nm (0,53 kgf m and 0,63 kgf m; 3.8 lbf ft. and 4.6 lbf ft).

Ensure that the area of contact between the clamp and the stabilizer bar is free of grease, oil, etc.

22. Depressurize the hydraulic systems and suspension struts.
23. Remove the pressure gauge and fit the bleed screw.
24. Bleed the hydraulic systems as described in Chapter G Section G5

Trailing arm camber – To set

1. Mount the rear crossmember and trailing arms on a surface table as shown in figures H11-2 and H11-3.
2. Set the trailing arms in the normal ride position using small screw jacks situated beneath the trailing arms (see fig. H11-2).
3. Tighten the centre bolt of the inner bush and the bolts of the frame tube mounting bracket on each trailing arm.
4. Tighten the centre bolt of each outer bush sufficiently to remove end play, but still allow trailing arm adjustment in the mounting bracket. Ensure that the location plate is suitably positioned to allow the two self-tapping screws to be fitted.
5. Using suitable camber setting equipment, or a precision square across the faces of the upper and lower hub location tubes, check the camber of the trailing arms. The setting for each arm must be between minus 0° 15′ and plus 0° 15′. The setting variation between the trailing arms must not exceed 0° 15′. Adjust the trailing arm as necessary to obtain the correct setting.
6. Tighten the outer bush centre bolt.

Note Adjustment of the camber will also affect the toe-in setting. Therefore, it is necessary to adjust both settings until a satisfactory position is obtained.

7. Check the toe-in setting of each trailing arm.

Toe-in – To check (see fig. H11-4)

1. With the crossmember and trailing arm assembly mounted on a surface table as shown in figures H11-2

and H11-4 proceed as follows.
2. Mark a centre line between the centre of the rear crossmember and the final drive crossmember.
3. Place a straight edge across the hub mounting tubes to give the equivalent of the road wheel rim diameter (see fig. H11-4).

With the aid of a precision square positioned 208 mm (8.20 in) from the centre line of the hub (see fig. H11-4), measure the distance from the base of the square to the centre line marked on the table.
4. Repeat the measurement from the same distance on the other side of the hub centre line.
5. Compare the measurements taken on each side of the hub centre line.

The toe-in for one wheel to the centre line on the surface table should be between 1,35 mm and 1,8 mm (0.053 in and 0.071 in).

If the toe-in is incorrect, adjust the outer mounting point of the trailing arm then tighten the centre bolt.

Note Adjustment of the toe-in will also affect the camber setting. Therefore it is necessary to adjust both settings until a satisfactory position is obtained.

6. Repeat the procedure for the other trailing arm.

The maximum permissable toe-in differential between each side of the car is 0,38 mm (0.015 in).
7. On completion, torque tighten the centre bolts to between 82 Nm and 88 Nm (8,3 kgf m and 9,0 kgf m, 60 lbf ft and 65 lbf ft). Repeat the camber and toe-in checks to ensure movement has not occurred during tightening.
8. Secure the location plates on the outer mounting brackets with self-tapping screws. It will be necessary to drill two 4 mm (0.156 in) diameter holes in each crossmember bracket to accept the screws.

General dimensions

The illustrations in this section are provided to assist in assessing accident damage to the sub-frames and suspension components.

If damage is suspected the suspension and steering geometry should be checked prior to the removal of components for dimensional examination.

If demage to the sub-frame is suspected, the removal of the complete sub-frame unit will be necessary, for details refer to Section H3 Front sub-frame and Section H8 Rear sub-frame.

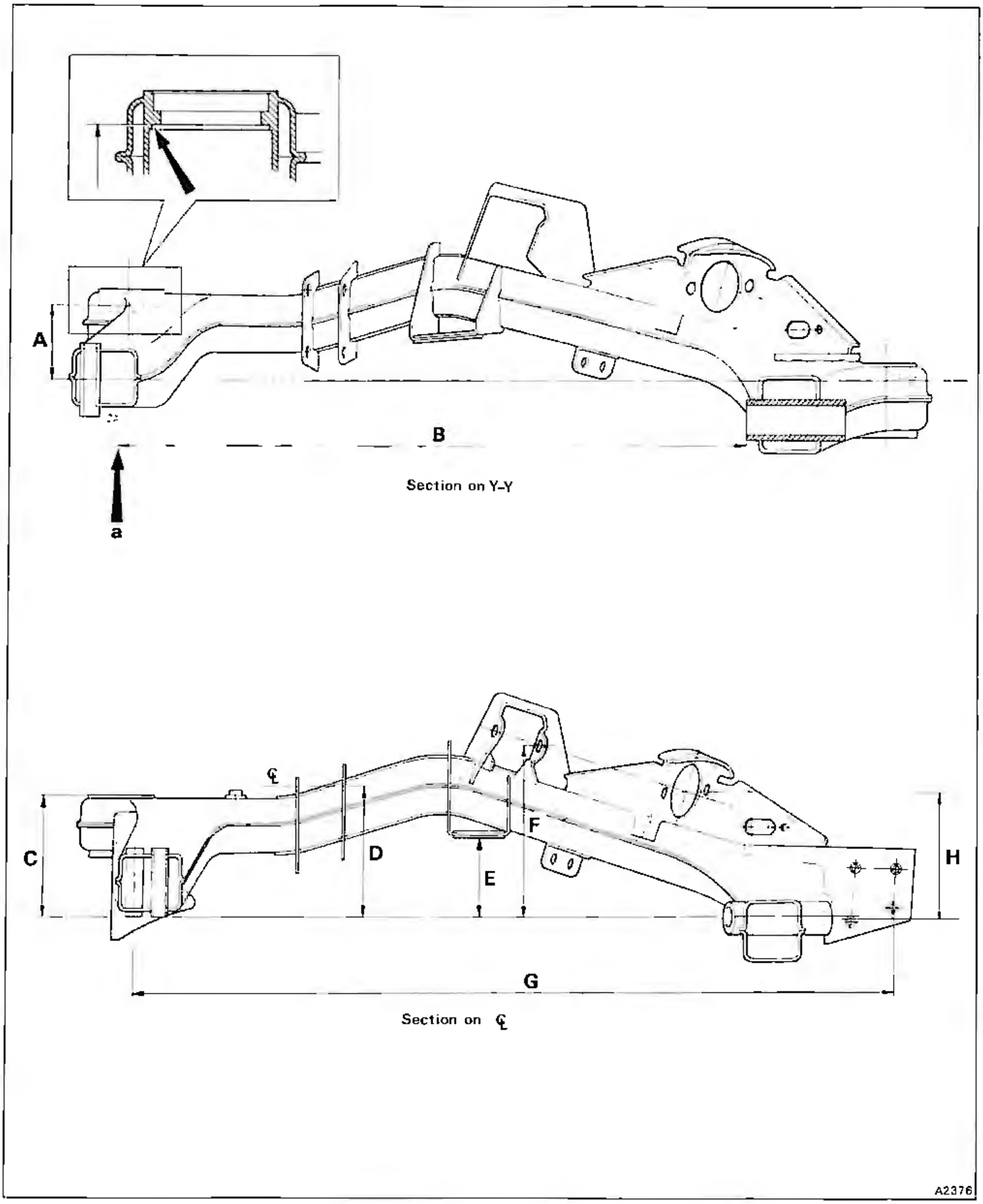


Fig. H12-1 Front sub-frame (side elevation)

A 89,68 mm (3.531 in)
B 782,57 mm (30.810 in)
C 158,19 mm (6.228 in)
D 160,32 mm (6.312 in)
E 100,40 mm (3.953 in) cars prior to 1989 model year
63,12 mm (2.485 in) 1989 model year cars
F 221,64 mm (8.726 in)
G 1007,51 mm (39.666 in)
H 170,91 mm (6.729 in)
a Location point (see fig. H12-2)

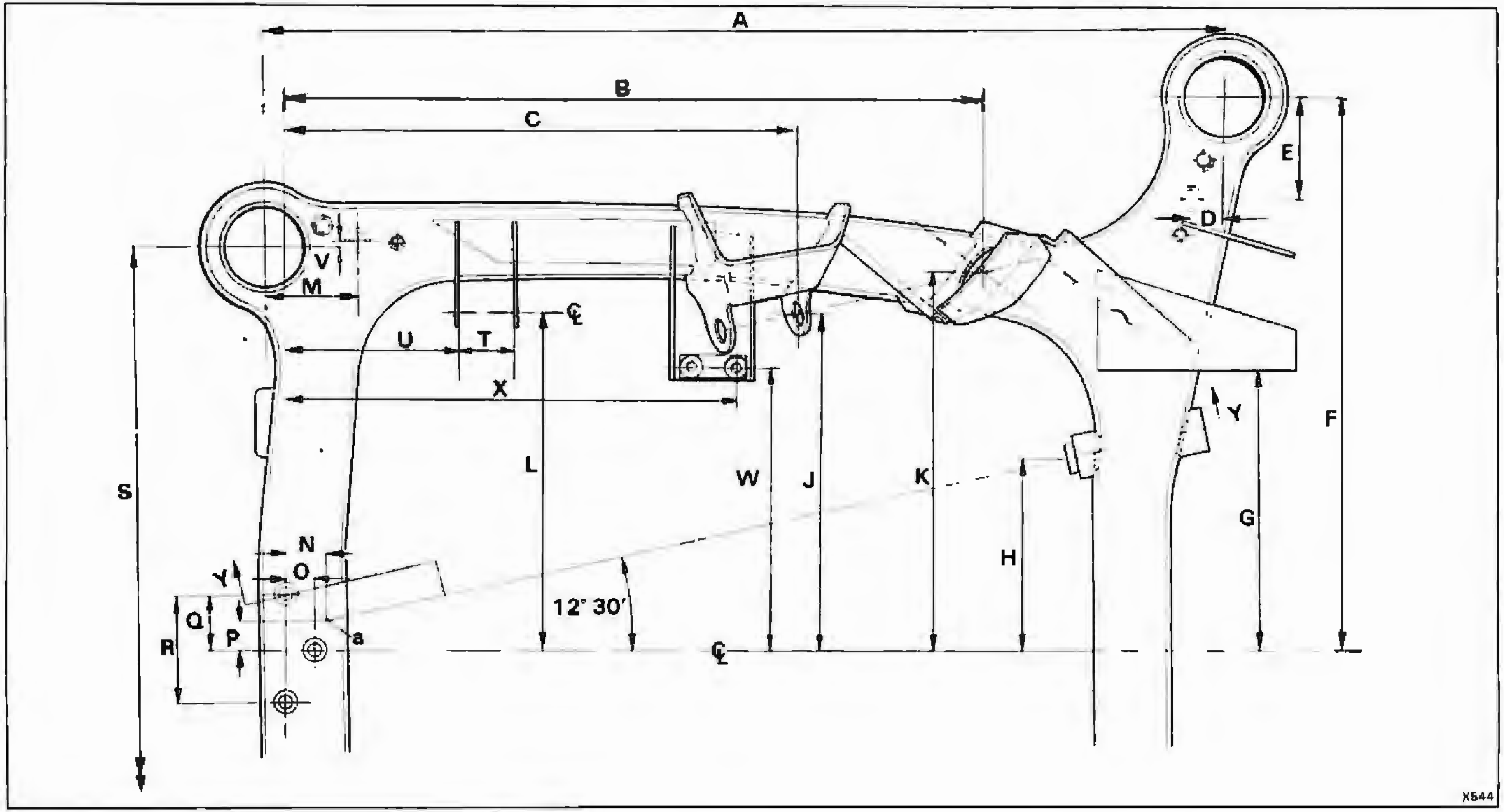


Fig. H12-2 Front sub-frame (plan view)

A 960,93 mm (37.832 in)
B 719,12 mm (28.312 in)
C 519,12 mm (20.437 in)
D 28,57 mm (1.125 in)
E 104,77 mm (4.125 in)
F 551,25 mm (21.703 in)
G 285,75 mm (11.250 in)
H 196,26 mm (7.727 in)
J 328,98 mm (12.952 in)
K 373,32 mm (14.698 in)
L 330,20 mm (13.000 in)
M 95,25 mm (3.750 in)
N 38,10 mm (1.500 in)
O 28,57 mm (1.125 in)
P 26,97 mm (1.062 in)
Q 52,70 mm (2.075 in)
R 105,41 mm (4.150 in)
S 787,40 mm (31.000 in)
T 53,18 mm (2.093 in)
U 209,55 mm (8.250 in)
V 7,92 mm (0.312 in)
W 270,0 mm (10.630 in) cars prior to 1989 model year
295,0 mm (11.614 in) 1989 model year cars
X 453,87 mm (17.869 in) cars prior to 1989 model year
489,89 mm (19.287 in) 1989 model year cars
Y-Y View on side elevation (see fig. H12-1)

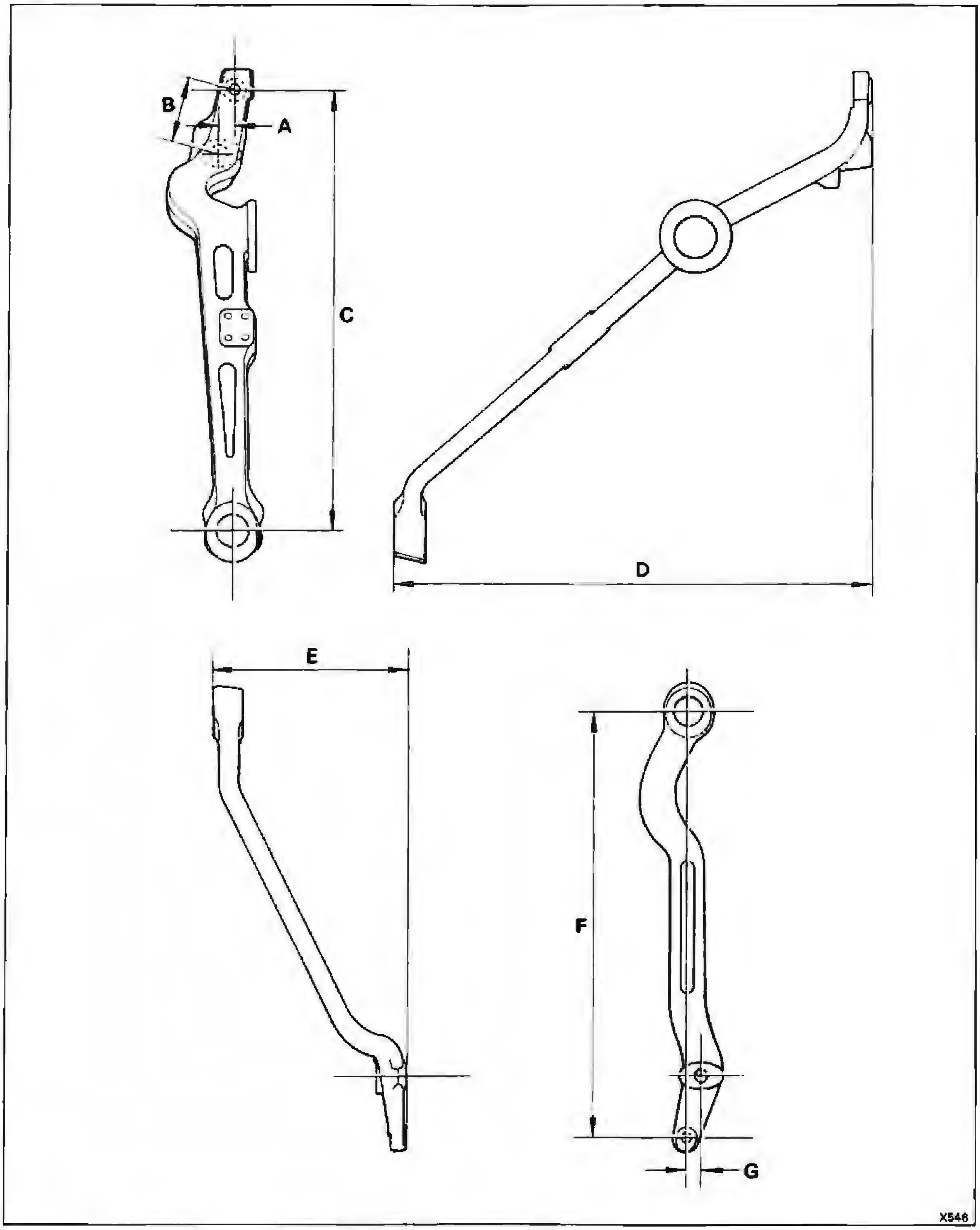


Fig. H12-3 Triangle levers

A 16,51 mm (0.650 in)
B 71,42 mm (2.812 in)
C 480,06 mm (18.900 in)
D 510,35 mm (20.093 in)
E 216,98 mm (8.543 in)
F 480,06 mm (18.900 in)
G 16,51 mm (0.650 in)

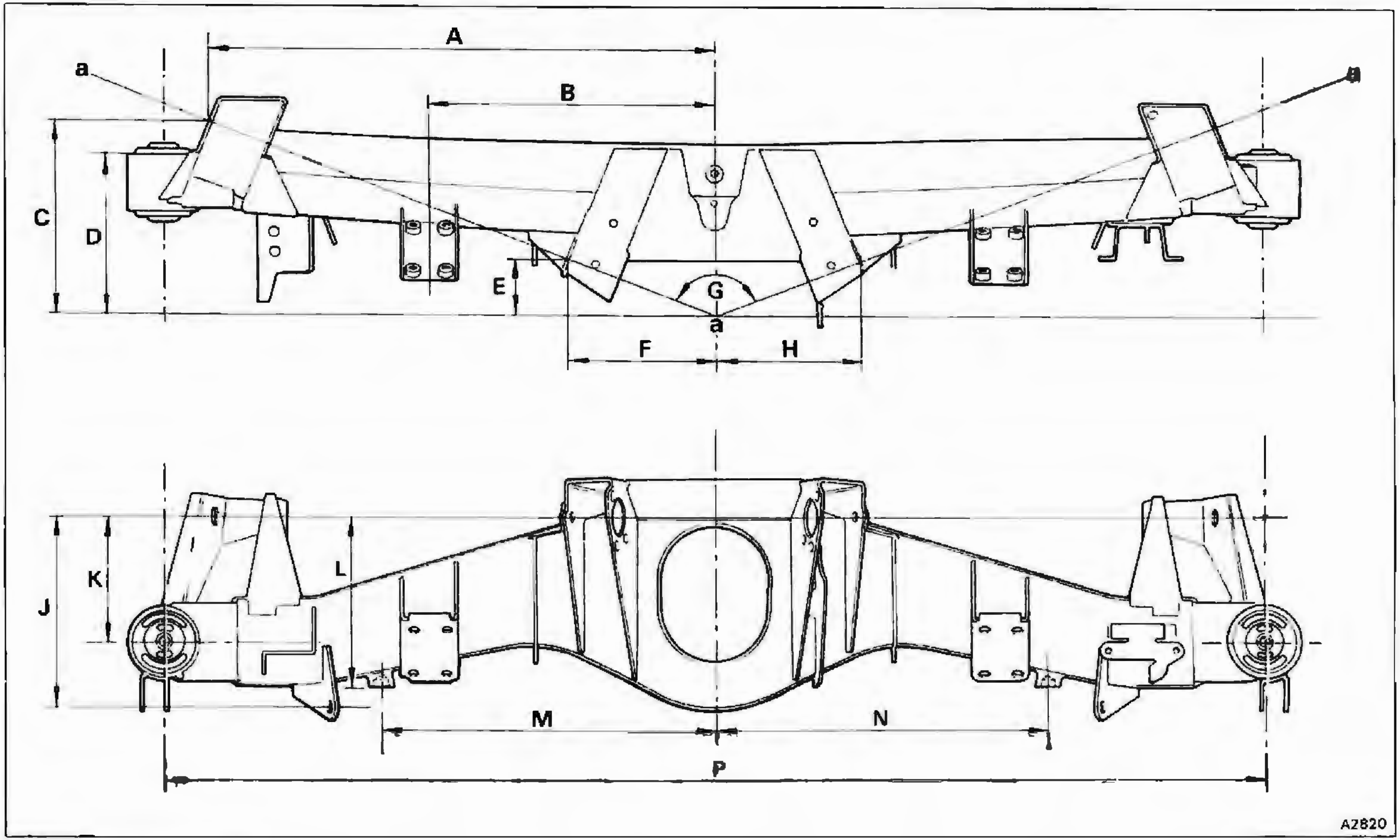


Fig. H12-4 Rear crossmember

A 535,46 mm (21.081 in)
B 304,80 mm (12.000 in)
C 212,42 mm (8.363 in)
D 177,87 mm (7.003 in)
E 61,62 mm (2.426 in)
F 155,35 mm (6.116 in)
G 136° 43′ 28″
H 155,35 mm (6.116 in)
J 203,20 mm (8.000 in)
K 134,92 mm (5.312 in)
L 182,25 mm (7.175 in)
M 355,60 mm (14.000 in)
N 355,60 mm (14.000 in)
P 1172,72 mm (46.170 in)
a Centre line of trailing arm bearings

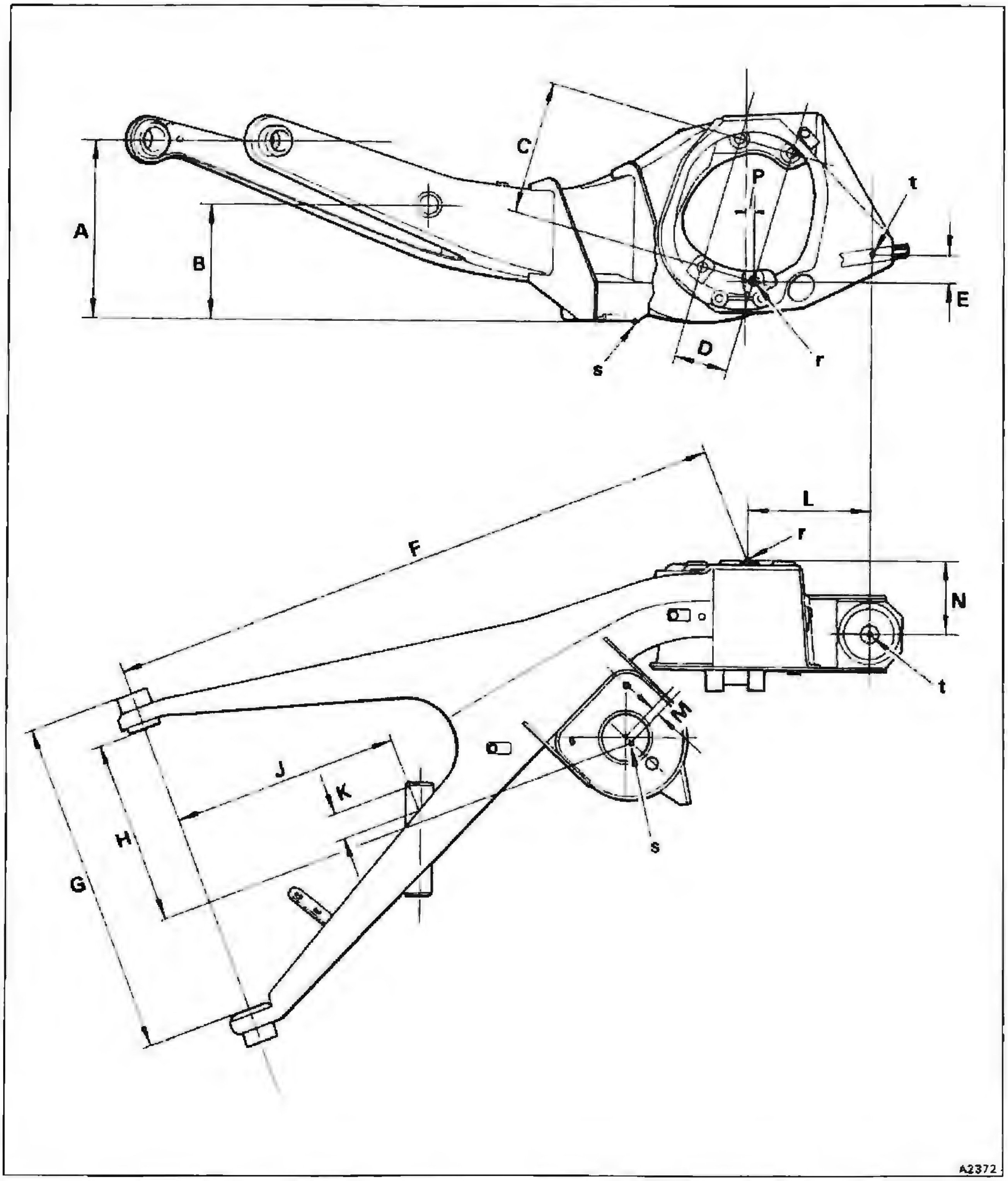


Fig. H12-5 Trailing arms (right-hand shown)

A 210,50 mm (8.287 in)
B 135,50 mm (5.334 in)
C 160,66 mm (6.325 in)
D 63,50 mm (2.500 in)
E 36,00 mm (1.417 in)
F 747,20 mm (29.417 in)
G 407,70 mm (16.051 in)
H 224,50 mm (8.839 in)
J 271,75 mm (10.699 in)
K 31,00 mm (1.220 in)
L 143,75 mm (5.659 in)
M 7,14 mm (0.281 in)
N 86,30 mm (3.398 in)
P 9,88 mm (0.389 in)
r.s.t reference points

12/87
Printed in England

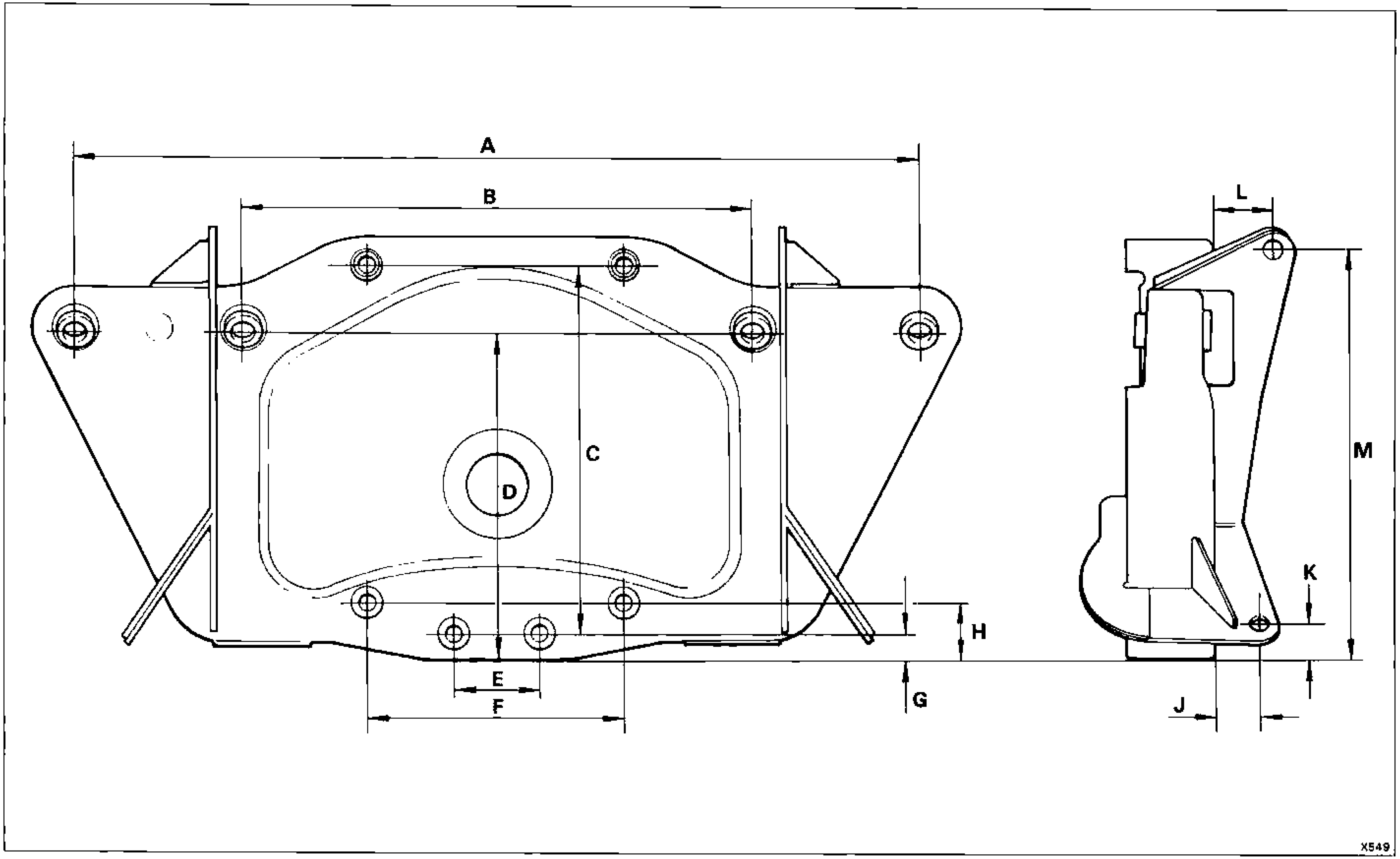


Fig. H12-6 Final drive crossmember

A 565,15 mm (22.250 in)
B 341,30 mm (13.437 in)
C 247,02 mm (9.725 in)
D 219,89 mm (8.657 in)
E 57,15 mm (2.250 in)
F 171,45 mm ((6.750 in)
G 17,45 mm (0.687 in)
H 37,77 mm (1.487 in)
J 32,54 mm (1.281 in)
K 22,22 mm (0.875 in)
L 41,28 mm (1.625 in)
M 275,44 mm (10.844 in)

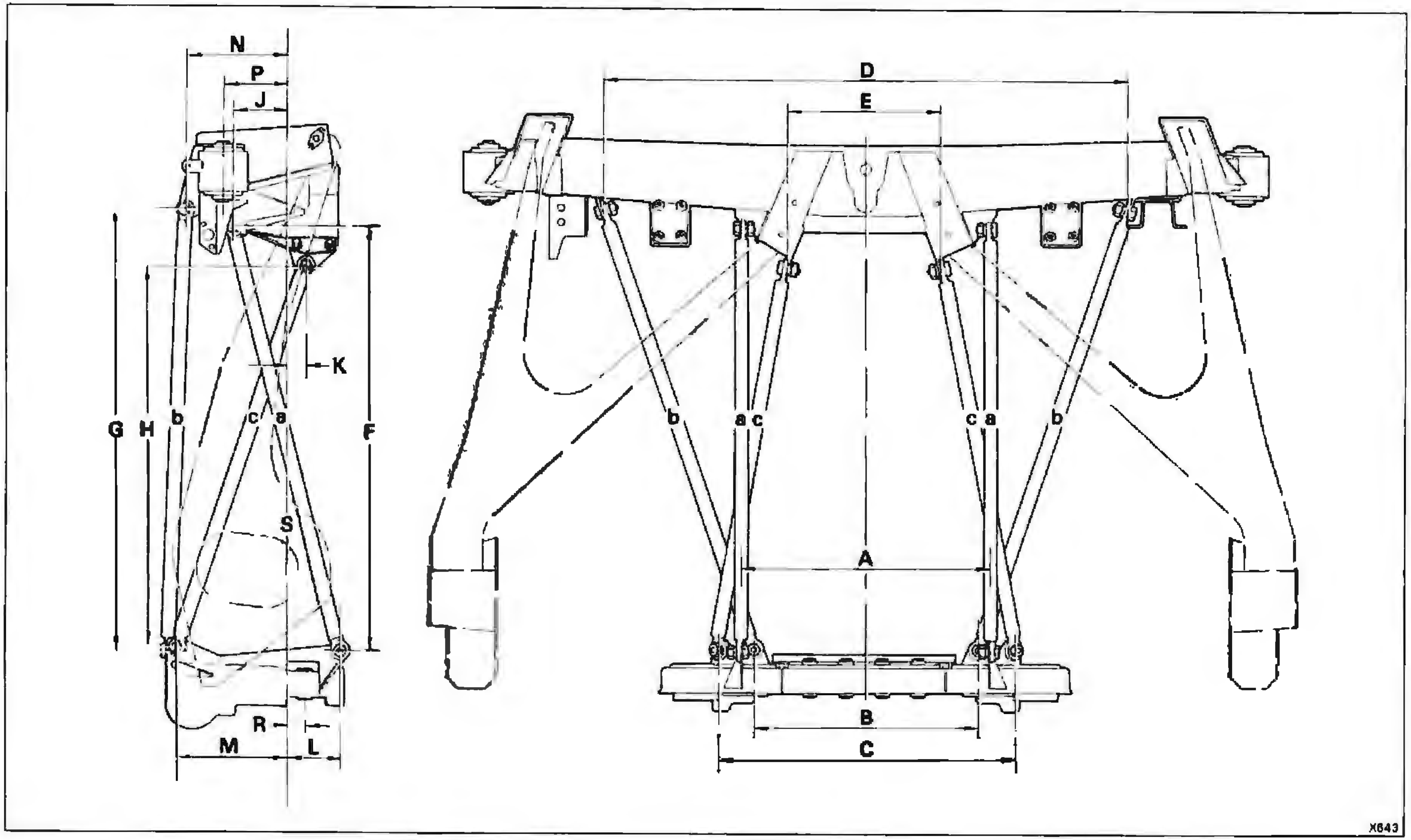


Fig. H12-7 Rear sub-frame assembly

A 381,00 mm (15.00 in)
B 350,52 mm (13.80 in)
C 482,60 mm (19.00 in)
D 819,15 mm (32.250 in)
E 233,68 mm (9.20 in)
F 655,65 mm (25.813 in)
G 690,58 mm (27.188 in)
H 577,04 mm (22.718 in)
J 91,44 mm (3.60 in)
K 22,23 mm (0.875 in)
L 76,20 mm (3.00 in)
M 177,80 mm (7.00 in)
N 165,10 mm (6.50 in)
P 96,82 mm (3.812 in)
R 19,63 mm (0.773 in)
S Horizontal datum line
a Frame tube
b Frame tube
c Frame tube

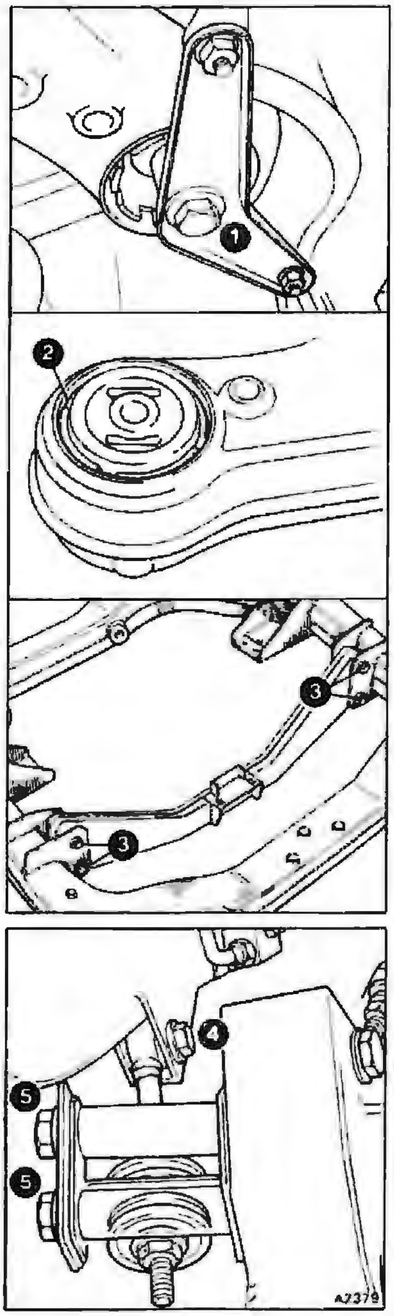
Special torque tightening figures

Introduction
This section contains the special torque tightening figures applicable to Chapter H.

For standard torque tightening figures refer to Chapter P.

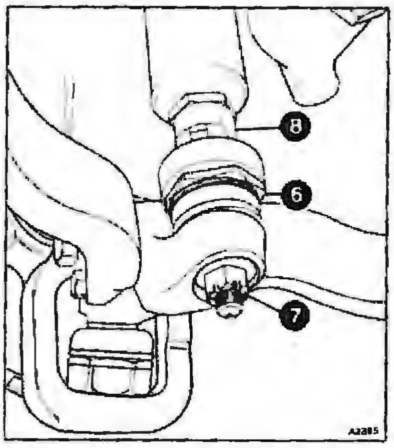
Components used during the manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

Section H3



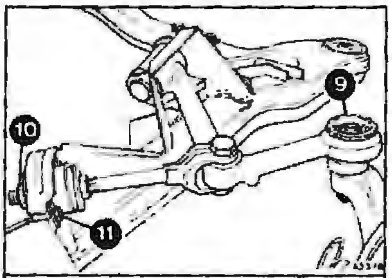
Ref.	Component	Nm	kgf m	lbf ft
1	Sub-frame mounting setscrews	82-88	8,3-9,0	60-65
2	Resilient mount locking ring	169-203	17,2-20,7	125-150
3	Front engine mounting crossmember bolts	115-122	11,7-12,4	85-90
4	Tie bar to longeron bolt	22-24	2,2-2,5	16-18
5	Tie bar mounting bracket setscrews	40-43	4,0-4,4	29-32

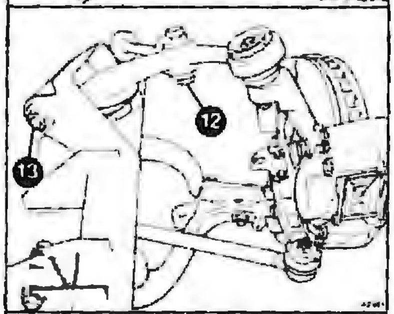
Section H4

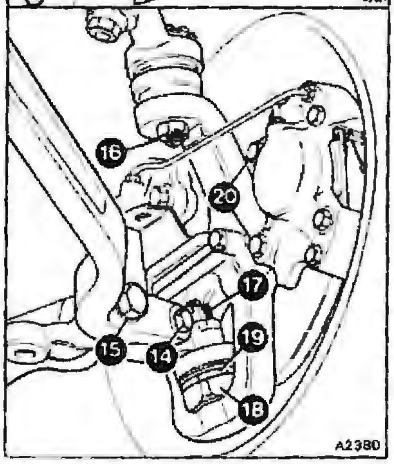


Ref.	Component	Nm	kgf m	lbf ft
6	Damper ball joint to housing	163-176	16,6-18,0	120-130
7	Damper ball pin castellated nut	57-61	5,8-6,2	42-45
8	Ball joint housing to damper stem	95-108	9,7-11,0	70-80

Section H5

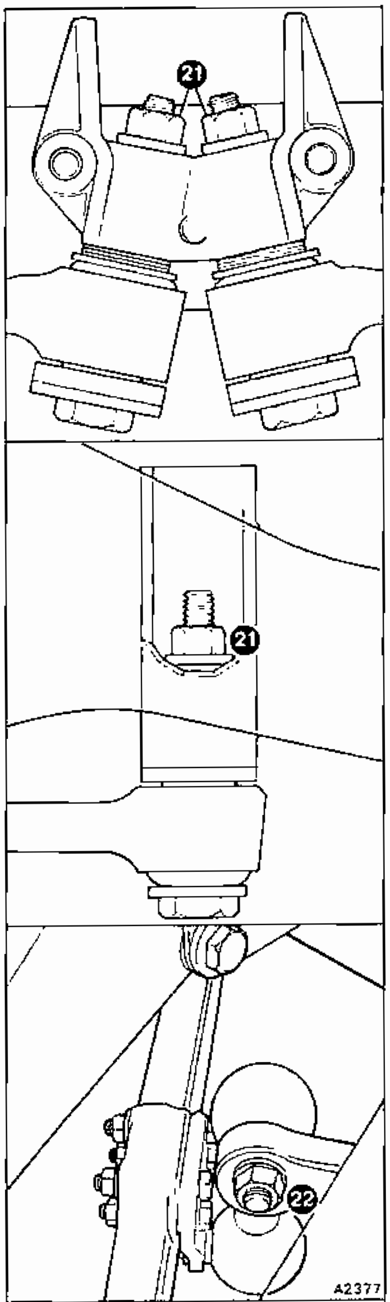


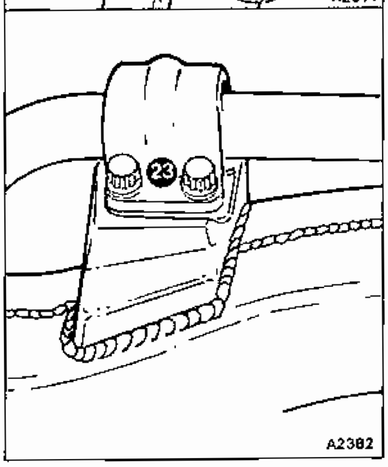




9	Upper ball joint locking ring	203-237	20,7-24,2	150-175
10	Compliance mount nut	99-106	10,1-10,8	73-78
11	Compliance mount setscrews	40-43	4,0-4,4	29-32
12	Compliance rod bolt	99-106	10,1-10,8	73-78
13	Compliance lever eccentric bolt	99-106	10,1-10,8	73-78
14	Lower triangle lever bolt	82-88	8,3-9,0	60-65
15	Lower triangle lever setscrew	116-122	11,7-12,4	85-90
16	Upper ball pin castellated nut	102-108	10,4-11,0	75-80
17	Lower ball pin castellated nut	102-108	10,4-11,0	75-80
18	Lower ball pin to yoke	190-216	19,4-22,0	140-160
19	Lower ball pin to housing	339-406	34,6-41,5	250-300
20	Brake caliper to yoke setscrews	75-81	7,6-8,3	55-60

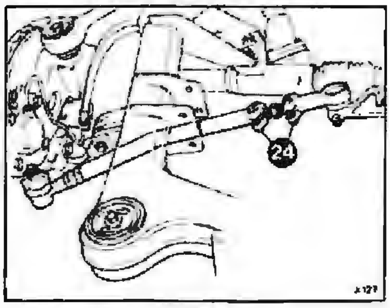
Section H5





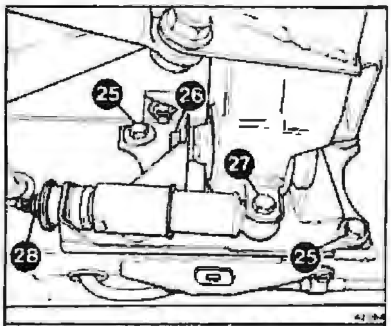
Ref.	Component	Nm	kgf m	lbf ft
21	Lower triangle lever pivot bolts	82-88	8,3-9,0	60-65
22	Stabilizer link nuts	45-48	4,6-4,9	33-36
23	Stabilizer mounting bracket bolts (Bentley models other than Bentley Continental)	31-34	3,2-3,4	23-25

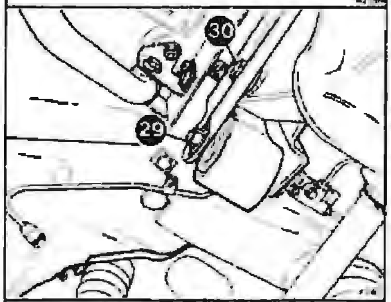
Section H7

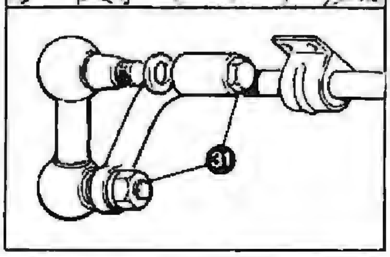


Ref.	Component	Nm	kgf m	lbf ft
24	Steering track rod adjuster clamp bolts	45-54	4,6-5,5	33-40

Section H8/H9

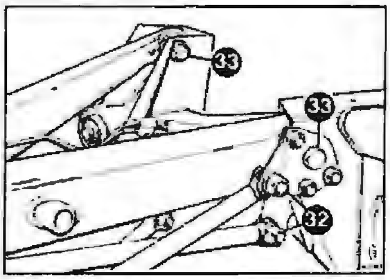






Ref.	Component	Nm	kgf m	lbf ft
25	Crossmember mounting bracket setscrews	40-43	4,0-4,4	29-32
26	Crossmember to mounting bracket bolt	57-61	5,8-6,2	42-45
27	Crossmember damper securing bolt	40-43	4,0-4,4	29-32
28	Crossmember damper self-locking nut	17-20	1,7-2,1	12-15
29	Final drive crossmember to body mount bolt	57-61	5,8-6,2	42-45
30	Final drive crossmember mounting plate bolts	82-88	8,3-9,0	60-65
31	Stabilizer link nuts	45-48	4,6-4,9	33-36

Section H11



Ref.	Component	Nm	kgf m	lbf ft
32	Frame tube securing bolts	102-108	10,4-11,0	75-80
33	Trailing arm mounting bolts	82-88	8,3-9,0	60-65

Workshop tools

RH 7768	Extraction and insertion tool – front suspension upper ball joint
RH 7774	Tube spanner – front sub-frame mount
RH 7775	Tube spanner – upper ball joint
RH 7909 *	Compression tool – road spring
RH 8080	Extractor – stabilizer link – front suspension
RH 8576	Tube spanner – front sub-frame mount
RH 8809 *	Retainer – front road spring
RH 9291	Extraction and insertion tool – rear sub-frame mount
RH 9299	Retainer bolt – rear road spring
RH 9504	Adapter block – road spring compression tool
RH 9575	Jury bolt – rear sub-frame
RH 9710	Ball pin extractor
RH 9733	Crimping pliers – damper sleeve retainer
RH 12053	Adapter plate *This adapter plate should be used in conjunction with RH 8809 and RH 7909 on cars fitted with pressed steel upper spring plates.

Final drive

Contents

7/87
Printed in England

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections Page No.	J1	J2	J3	J4	J5	J6	J7	J8		
1	7/87	7/87	7/87	7/87	7/87	7/87	7/87	7/87		
2		7/87	7/87		7/87		7/87			
3	7/87	7/87			7/87					
4		7/87								
5		7/87								
6		7/87								
7		7/87								
8		7/87								
9		7/87								
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections	J1	J2	J3	J4	J5	J6	J7	J8		
Page No.										
1	7/87	7/87	7/87	7/87	7/87	7/87	7/87	7/87		
2		7/87	7/87		7/87		7/87			
3	3/92	3/92			7/87					
4		7/87								
5		7/87								
6		7/87								
7		7/87								
8		7/87								
9		7/87								
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Printed in England

Final [redacted]

Introduction

The final drive [redacted] differential [redacted] wheel, pinion, [redacted] The final drive [redacted] which is mounted [redacted] mounts.

Final drive [redacted] torque arm [redacted] suspension [redacted]

The [redacted] gearcase, utilize [redacted]

Warning **Never** [redacted] **frame** [redacted]

To [redacted]

A fully [redacted] available as a [redacted] without the [redacted] both side bearing [redacted]

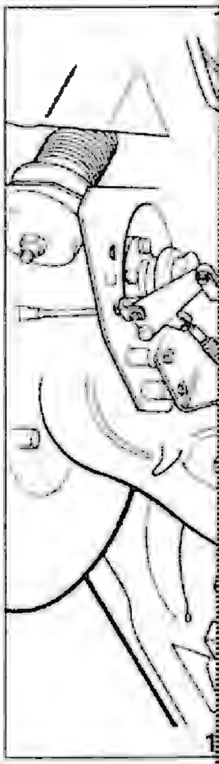


Fig. J2-1 **Final** [redacted]
1 [redacted]
2 Final [redacted]
3 Oil [redacted]
4 Final [redacted]
5 **Torque** [redacted]

5. Remove the wheel discs/trims. Then loosen, but do not remove the wheel nuts.
6. Using a hydraulic jack with an extension piece and hardwood block placed beneath the final drive casing, raise the rear of the car until the road wheels are clear of the ramp.
7. Position sill blocks and beams beneath the car's sills. Lower the jack and allow the blocks to support the car. Support the trailing arms using jacks or suitable blocks.
8. Remove the rear road wheels.
9. Remove the capscrews from the constant velocity joint on each side of the final drive. Care must be taken not to damage the shaft boots.

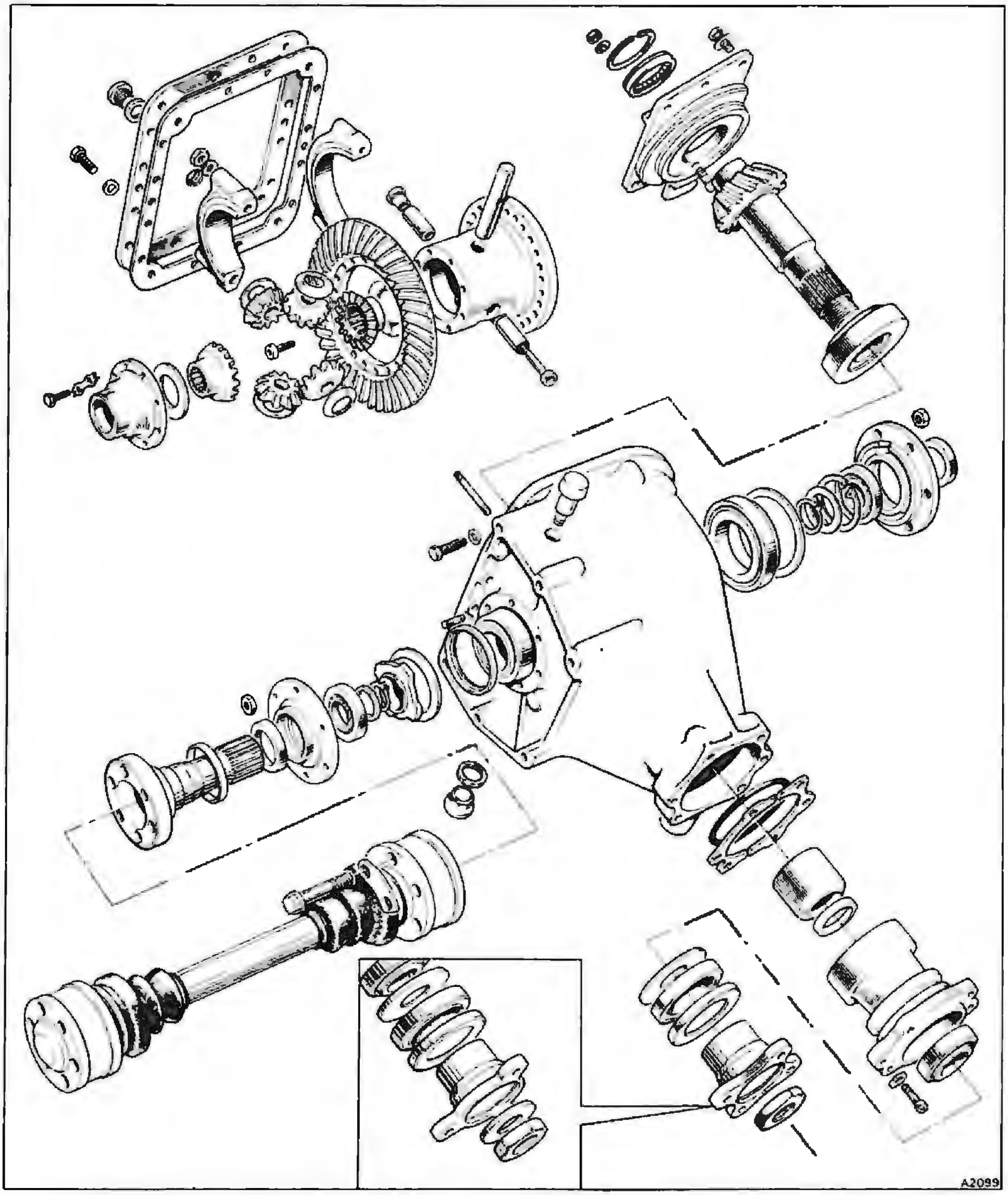


Fig. J2-2 Final drive assembly

10. Carefully ease the constant velocity joint away from its output shaft and support the drive-shaft beneath the body using strong string or wire.
11. Disconnect the propeller shaft from the final drive flange. Slide the shaft as far forward as possible to obtain maximum clearance between the shaft and the final drive pinion flange.
12. Support the final drive unit with a hydraulic jack positioned beneath the centre casing.
13. Remove the two securing bolts from the front end of the torque arm.
14. From the rear face of the final drive crossmember, remove the setscrews securing the final drive assembly.
15. Carefully lower the torque arm and ease the propeller shaft upwards and over the pinion flange. Carefully ease the final drive assembly forwards, then lower the assembly from the car.

Note During this operation care must be taken to ensure that the final drive unit is adequately supported.

Final drive unit – To dismantle (see fig. J2-2)
Ensure that the oil is drained before commencing the dismantling procedure.
1. Remove the nuts securing the bearing housings to each side of the final drive casing. Tap the housings with a nylon headed mallet to break the joint.
2. Withdraw the drive-shafts from the final drive casing.
3. Unscrew the setscrews retaining the final drive casing rear cover. Remove the cover.
4. Remove the nuts and washers from the bearing caps on each side of the crown wheel and differential assembly (see fig. J2-3).

Correlate the caps and casing to ensure that the caps are fitted into their original positions. Then, withdraw the caps.

Note The bearing cap and casing are machined as pairs. Therefore, although the caps cannot be fitted to the incorrect side, they must not be fitted in their reversed positions.

5. The crown wheel and differential assembly can now be raised slightly, moved away from the pinion and carefully removed from the casing.

Note Care should be taken during Operations 4 and 5, to ensure that the two large taper roller bearings are not damaged.

6. Remove the nut securing the pinion flange to the pinion. Collect the washer (if fitted). Withdraw the coupling flange using the hydraulic ram RH 8017 and extractor beam RH 8470.
7. Remove the capscrews which secure the pinion housing to the front flange of the casing. Then, insert extractor screws into the two tapped holes in the pinion housing.
8. Place the casing in an oven having a temperature of 110°C (230°F), for approximately fifteen minutes.
9. Remove the casing from the oven and extract the pinion housing using the two extractor screws. Care should be taken to turn the screws evenly and together.
10. Remove the setscrews from the pinion bearing plate within the gearcase. Withdraw the plate.
11. Withdraw the pinion from within the gearcase.
12. To remove the pinion nose bearing from the bearing plate, remove the two socket headed screws, retaining nuts, and washers. Withdraw the bearing.

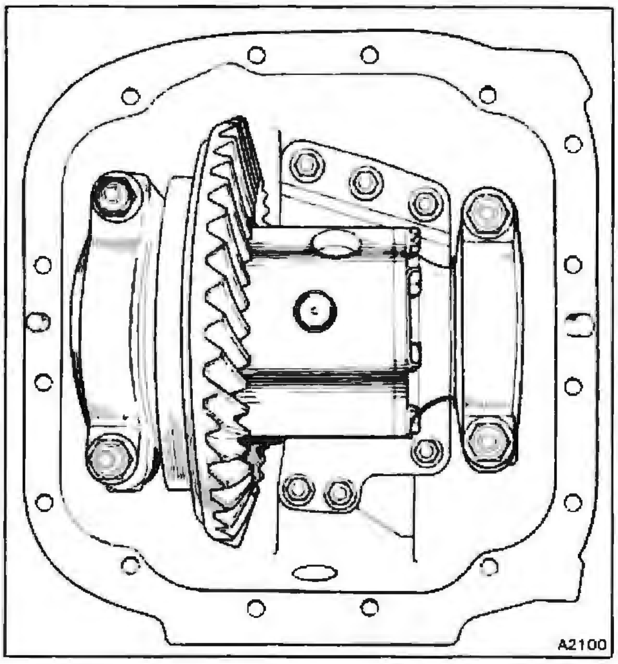


Fig. J2-3 Differential and crown wheel in position

Crown wheel and differential assembly – To dismantle
When dismantling the crown wheel and differential assembly, care should be taken to ensure that all thrust washers and bearing tracks are retained with their appropriate parts. This is to ensure that they are assembled in their original positions.
1. Remove the two bearing outer tracks.
2. Remove the capscrews securing the crown wheel to the differential housing. Remove the crown wheel.
3. Unlock and remove the eight setscrews securing the differential housing end cap. Remove the cap, splined pinion gear, and adjusting washer.
4. Remove the locking-nut and long setscrew from the centre of the split trunnion pin. Remove the trunnion pins, bevel gears, and dished thrust washers.
5. Remove the splined pinion gear and thrust washer from the opposite end of the pinion housing.
6. Wash all parts thoroughly in paraffin and dry with compressed air. If it is necessary to renew the large taper roller bearings, press them off the differential housing and end cap.
7. All components should be thoroughly inspected for wear and damage and any defective items renewed.

Thrust washers should be flat and parallel, **excluding** the four dished thrust washers fitted behind the bevel gears. Ensure that all gears and bearing surfaces are free from damage, pitting, score marks, burrs, and excessive wear.

Crown wheel and differential assembly – To assemble

1. If new taper roller bearings are to be fitted they must be pressed squarely onto their diameters situated on the differential housing and end cap. Note that the larger of the two bearings is fitted to the housing and that both bearings should be seated against their abutment faces.
2. If the adjusting washer positions are not known or new pieces are being fitted, the following procedure described in Operations 3 to 6 inclusive should be carried out.

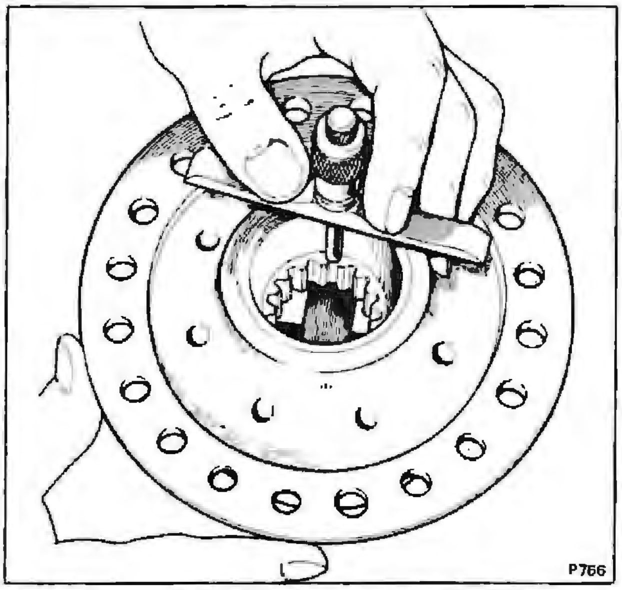


Fig. J2-4 Splined bevel pinion measurement

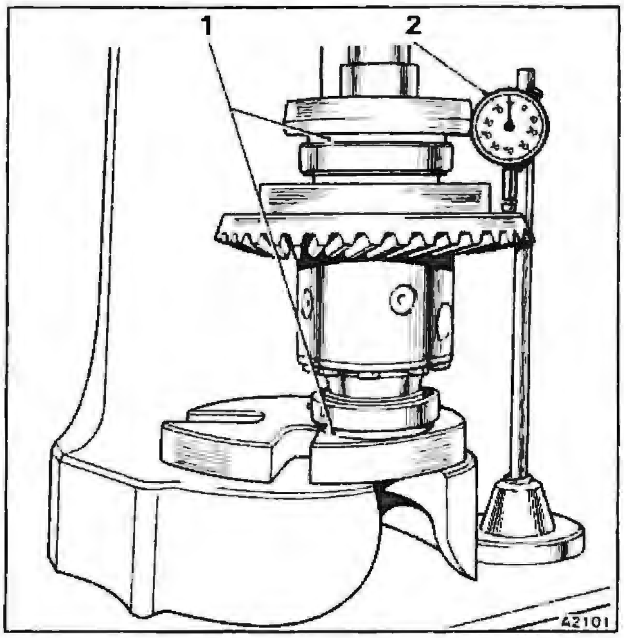


Fig. J2-5 Checking the crown wheel run-out
1 Adjusting washers
2 Dial test indicator

3. Fit the splined bevel pinion into the end of the differential housing without any adjusting washer behind the head.
4. Fit the trunnion pin, dished washers, and bevel gears. The long bolt and nut which connect the split trunnion pin should be torque tightened to the figures quoted in Section J7.
5. Push the splined pinion gear into mesh with the bevel gears as far as possible. Measure the distance from the end of the differential housing to the end face of the pinion gear (see fig. J2-4).

Pull the pinion gear back out of mesh as far as possible and again measure the distance from the end of the housing to the end of the gear.

The difference between these two measurements will give the nominal thickness of the adjusting washer required behind the gear head.
6. Dismantle the gears, place the correct adjusting washer behind the bevel pinion and assemble the gears.

Adjusting washers are available in a range of between 2,13 mm and 2,94 mm (0.084 in and 0.116 in) in 0,10 mm (0.004 in) increments. The washers must be fitted with the chamfer and oil grooves against the back face of the gear.
7. Rotate the gears to ensure that they are free.

Using the adjusting washers as necessary ensure that there is a backlash of between zero and 0,08 mm (0.003 in). Also ensure that there is no end-float on the bevel gear.
8. Fit the housing end cap and the other splined bevel pinions and repeat Operations 3 to 7 inclusive to determine the adjusting washer required.

Note When the unit is assembled correctly the gear should turn freely with a maximum of 0,08 mm (0.003 in) backlash between the gears and no end-float in the splined bevel pinions.

9. When the differential gears are set correctly, check that the torque tightness of the split trunnion centre bolt is within the figures quoted in Section J7. Then, lock the nut in position.
10. Tighten the end cover setscrews to the figures quoted in Section J7, then lock the tab-washers.
11. Fit the crown wheel to the housing and torque tighten the capscrews to the figures quoted in Section J7.
12. Check the crown wheel for axial run-out.

Any convenient method may be used to check this e.g. on a mandrel between the centres. Another method which may be used is described in Operations 13 and 14.
13. Place the roller bearing outer tracks in position and stand the assembly on one end. Position the assembly in a press with one adjusting washer fitted to each bearing (see fig. J2-5).
14. Apply light pressure on the end of the assembly and using a dial test indicator, check the run-out of the crown wheel. The run-out should not exceed 0,05 mm (0.002 in).

If the run-out exceeds this figure vary the crown wheel position relative to the differential housing until the run-out is within limits.

10. Carefully ease the constant velocity joint away from its output shaft and support the drive-shaft beneath the body using strong string or wire.
11. Disconnect the propeller shaft from the final drive flange. Slide the shaft as far forward as possible to obtain maximum clearance between the shaft and the final drive pinion flange.
12. Support the final drive unit with a hydraulic jack positioned beneath the centre casing.
13. Remove the two securing bolts from the front end of the torque arm.
14. From the rear face of the final drive crossmember, remove the setscrews securing the final drive assembly.
15. Carefully lower the torque arm and ease the propeller shaft upwards and over the pinion flange. Carefully ease the final drive assembly forwards, then lower the assembly from the car.

Note During this operation care must be taken to ensure that the final drive unit is adequately supported.

Final drive unit – To dismantle (see fig. J2-2)
Ensure that the oil is drained before commencing the dismantling procedure.

1. Remove the nuts securing the bearing housings to each side of the final drive casing. Tap the housings with a nylon headed mallet to break the joint.
2. Withdraw the drive-shafts from the final drive casing.
3. Unscrew the setscrews retaining the final drive casing rear cover. Remove the cover.
4. Remove the nuts and washers from the bearing caps on each side of the crown wheel and differential assembly (see fig. J2-3).

Correlate the caps and casing to ensure that the caps are fitted into their original positions. Then, withdraw the caps.

Note The bearing cap and casing are machined as pairs. Therefore, although the caps cannot be fitted to the incorrect side, they must not be fitted in their reversed positions.

5. The crown wheel and differential assembly can now be raised slightly, moved away from the pinion and carefully removed from the casing.

Note Care should be taken during Operations 4 and 5, to ensure that the two large taper roller bearings are not damaged.

6. Remove the nut securing the pinion flange to the pinion. Collect the washer (if fitted). Withdraw the coupling flange using the hydraulic ram RH 8017 and extractor beam RH 8470.
7. Remove the setscrews from the pinion bearing plate within the gearcase. Withdraw the plate.

To remove the pinion nose bearing from the bearing plate, remove the two socket headed screws, retaining nuts, and washers. Withdraw the bearing.

8. Support the casing on the rear cover face and press out the pinion. To avoid damage, ensure that the pinion is supported as it is removed.
9. Remove the capscrews which secure the pinion housing to the front flange of the casing. Then, insert extractor screws into the two tapped holes in the pinion housing.
10. Place the casing in an oven having a temperature of 110°C (230°F), for approximately fifteen minutes.
11. Remove the casing from the oven and extract the pinion housing using the two extractor screws. Care should be taken to turn the screws evenly and together.

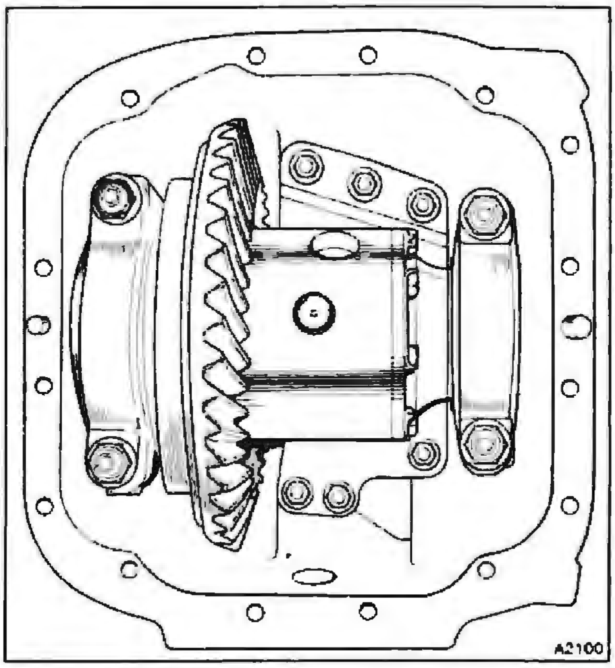


Fig. J2-3 Differential and crown wheel in position

Crown wheel and differential assembly – To dismantle
When dismantling the crown wheel and differential assembly, care should be taken to ensure that all thrust washers and bearing tracks are retained with their appropriate parts. This is to ensure that they are assembled in their original positions.

1. Remove the two bearing outer tracks.
2. Remove the capscrews securing the crown wheel to the differential housing. Remove the crown wheel.
3. Unlock and remove the eight setscrews securing the differential housing end cap. Remove the cap, splined pinion gear, and adjusting washer.
4. Remove the locking-nut and long setscrew from the centre of the split trunnion pin. Remove the trunnion pins, bevel gears, and dished thrust washers.
5. Remove the splined pinion gear and thrust washer from the opposite end of the pinion housing.
6. Wash all parts thoroughly in paraffin and dry with compressed air. If it is necessary to renew the large taper roller bearings, press them off the differential housing and end cap.
7. All components should be thoroughly inspected for wear and damage and any defective items renewed.

Thrust washers should be flat and parallel, **excluding** the four dished thrust washers fitted behind the bevel gears. Ensure that all gears and bearing surfaces are free from damage, pitting, score marks, burrs, and excessive wear.

Crown wheel and differential assembly – To assemble

1. If new taper roller bearings are to be fitted they must be pressed squarely onto their diameters situated on the differential housing and end cap. Note that the larger of the two bearings is fitted to the housing and that both bearings should be seated against their abutment faces.
2. If the adjusting washer positions are not known or new pieces are being fitted, the following procedure described in Operations 3 to 6 inclusive should be carried out.

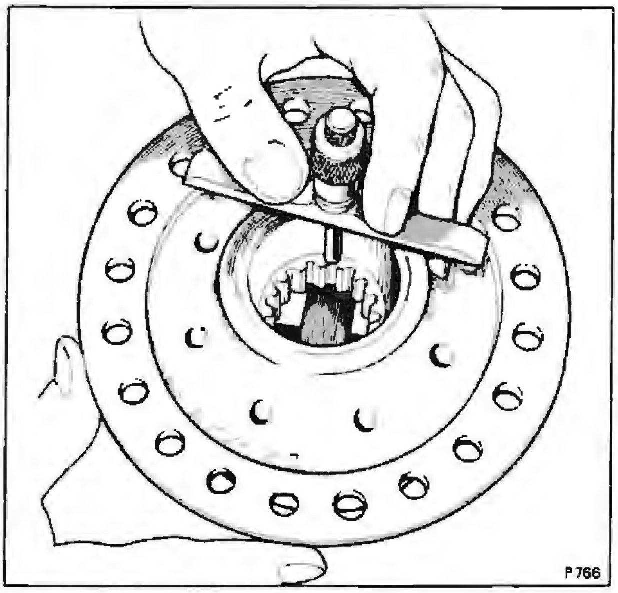


Fig. J2-4 **Splined bevel pinion measurement**

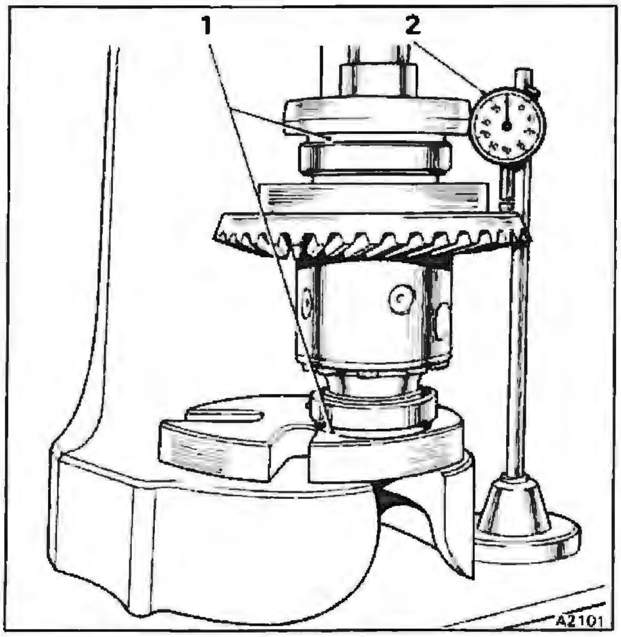


Fig. J2-5 **Checking the crown wheel run-out**
1 Adjusting washers
2 Dial test indicator

3. Fit the splined bevel pinion into the end of the differential housing without any adjusting washer behind the head.
4. Fit the trunnion pin, dished washers, and bevel gears. The long bolt and nut which connect the split trunnion pin should be torque tightened to the figures quoted in Section J7.
5. Push the splined pinion gear into mesh with the bevel gears as far as possible. Measure the distance from the end of the differential housing to the end face of the pinion gear (see fig. J2-4).

Pull the pinion gear back out of mesh as far as possible and again measure the distance from the end of the housing to the end of the gear.

The difference between these two measurements will give the nominal thickness of the adjusting washer required behind the gear head.

6. Dismantle the gears, place the correct adjusting washer behind the bevel pinion and assemble the gears.

Adjusting washers are available in a range of between 2,13 mm and 2,94 mm (0.084 in and 0.116 in) in 0,10 mm (0.004 in) increments. The washers must be fitted with the chamfer and oil grooves against the back face of the gear.

7. Rotate the gears to ensure that they are free.

Using the adjusting washers as necessary ensure that there is a backlash of between zero and 0,08 mm (0.003 in). Also ensure that there is no end-float on the bevel gear.

8. Fit the housing end cap and the other splined bevel pinions and repeat Operations 3 to 7 inclusive to determine the adjusting washer required.

Note When the unit is assembled correctly the gear should turn freely with a maximum of 0,08 mm (0.003 in) backlash between the gears and no end-float in the splined bevel pinions.

9. When the differential gears are set correctly, check that the torque tightness of the split trunnion centre bolt is within the figures quoted in Section J7. Then, lock the nut in position.
10. Tighten the end cover setscrews to the figures quoted in Section J7, then lock the tab-washers.
11. Fit the crown wheel to the housing and torque tighten the capscrews to the figures quoted in Section J7.
12. Check the crown wheel for axial run-out.

Any convenient method may be used to check this e.g. on a mandrel between the centres. Another method which may be used is described in Operations 13 and 14.

13. Place the roller bearing outer tracks in position and stand the assembly on one end. Position the assembly in a press with one adjusting washer fitted to each bearing (see fig. J2-5).
14. Apply light pressure on the end of the assembly and using a dial test indicator, check the run-out of the crown wheel. The run-out should not exceed 0,05 mm (0.002 in).

If the run-out exceeds this figure vary the crown wheel position relative to the differential housing until the run-out is within limits.

Pinion housing – To dismantle (see fig. J2-6)
1. Remove and discard the 'O' ring fitted to the pinion housing.
2. Remove the pinion oil seal and the oil flinger fitted behind it.
3. Withdraw the taper roller bearing, adjusting washer, and spacer from the housing.
4. If new taper roller bearings are to be fitted, the outer tracks must be removed from the housing using a soft drift and a hammer, taking care to avoid damaging the bearing locating bores.
5. The large taper roller bearing should be removed using a press and the special extraction tool RH 8016.
6. Wash all parts thoroughly in paraffin and dry with compressed air.
7. Inspect all parts for serviceability. Any showing damage, pitting, or excessive wear should be renewed.

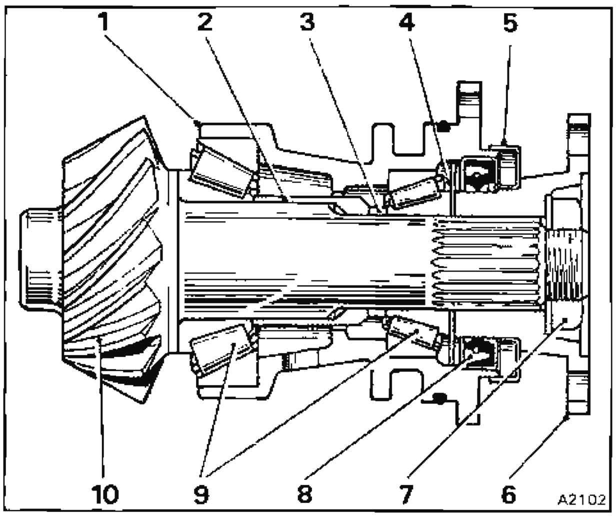


Fig. J2-6 Pinion assembly
1 Pinion housing
2 Spacer
3 Pre-load adjusting washer
4 Oil flinger
5 Shield
6 Pinion flange
7 Pinion flange nut
8 Oil seal
9 Taper roller bearings
10 Pinion

Pinion housing – To assemble
It should be noted that there are two types of pinion flange, dependent upon the type of propeller shaft fitted.

On propeller shafts incorporating universal joints, a four point coupling flange is fitted. On propeller shafts having flexible rubber couplings a three point coupling is fitted.

Note If the assembly is assembled using the original bearings, then the original pre-load adjusting washers should be used. Under no circumstances should the assembly be set to the pre-load figures quoted when new pinion bearings, pinion housing, and adjusting washers are fitted.

1. Lightly lubricate all components, paying particular attention to the roller bearing faces.
2. If new bearings are to be fitted, heat the housing to a temperature of 90°C (194°F) and press the outer bearing tracks into position. Also, press the large roller bearing onto the pinion. Ensure that all bearings are square and seated on their abutment faces.
3. Enter the pinion into the housing, ensuring that the spacer and adjusting washer are fitted on the pinion shank.

The washer determines the pre-load on the pinion bearings.

It is important that the washer is free from defects and is flat and parallel to within 0,012 mm (0.0005 in).

If the pinion bearings have not been renewed, the original washer may be used (see previous note).

If new bearings have been fitted, a new washer having a thickness of between 6,85 mm and 7,10 mm (0.270 in and 0.279 in) should give the best initial setting.
4. Support the pinion and housing. Press the upper bearing onto the pinion shank until it abuts the adjusting washer.
5. Fit the oil flinger.
6. Apply a thin coating of anti-scuffing paste (ASP) to the pinion flange. Enter the pinion flange onto the pinion shank taking care not to damage the pinion threads.
7. Press the coupling flange onto the pinion shank using assembly tool RH 8457. Fit the nut.
8. Tighten the nut to the torque figures quoted in Section J7. Rotate the pinion housing during tightening to check free movement of the bearings.
9. Rotate the pinion in the housing several times in each direction, then check the pre-load.

The pre-load on the pinion bearings when the housing is out of the final drive casing should be between 1,36 Nm and 1,92 Nm (12 lbf in and 17 lbf in). This can be checked using a suitable torque meter.
10. If the pre-load is not correct, the pinion must be extracted from the housing and the adjusting washer changed as necessary to obtain the correct reading.

Adjusting washers are available in a range of between 6,86 mm and 7,24 mm (0.270 in and 0.285 in) in increments of 0,025 mm (0.001 in) and also between 7,37 mm and 7,62 mm (0.290 in and 0.300 in) in increments of 0,127 mm (0.005 in).

Reducing the thickness of the washer will increase the pre-load, increasing the thickness will reduce it. Very small changes to the thickness of the washer have a marked effect on the pre-load figure.
11. When the correct pre-load has been achieved, mark the retaining nut with a centre punch, opposite the first leg of the 'U' of the part number stamped on the pinion.
12. Remove the pinion flange nut and remove the pinion flange.
13. Fit a new oil seal, ensuring that it is fitted squarely with the lip pointing inwards and that the front face

of the seal is 3,20 mm (0.125 in) below the front face of the housing.

Note If a PTFE oil seal is being fitted **do not lubricate**. This type of oil seal is more efficient when fitted dry.

14. Withdraw the pinion from the housing.

Final drive unit – To assemble

To assemble the final drive unit reverse the procedure given for dismantling, ensuring that the crown wheel and pinion are in their correct relative positions. Also, ensure that the amount of backlash between the gears is correct.

All parts must be cleaned thoroughly prior to assembly and all bearings lubricated.

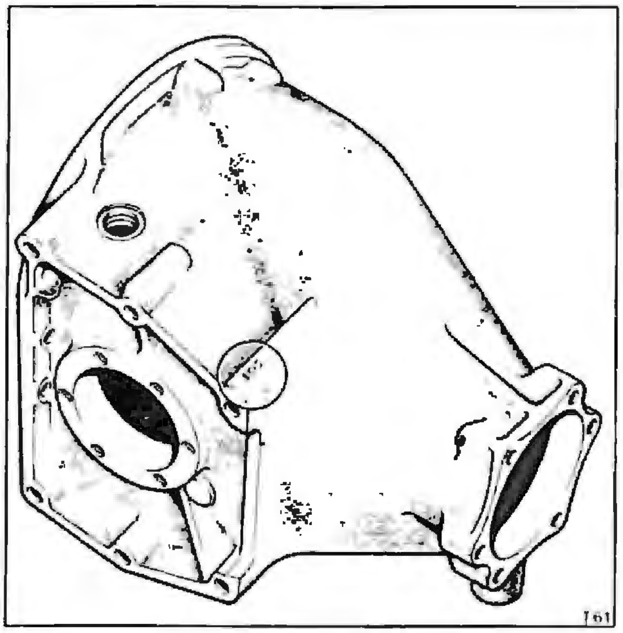


Fig. J2-7 Stamped dimension on case

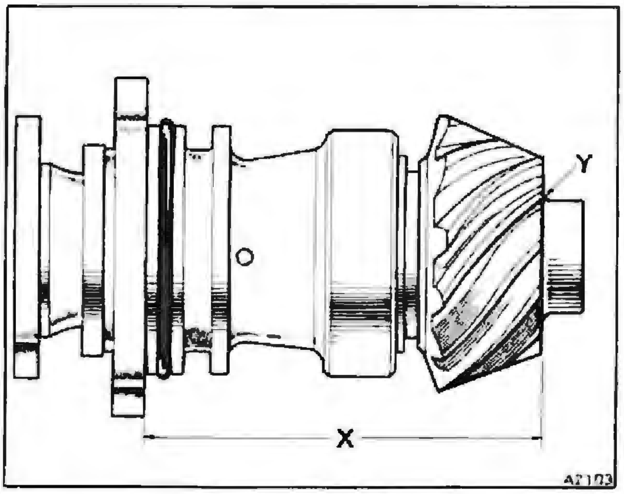


Fig. J2-8 Pinion housing measurement
X Dimension between housing and pinion gear
Y Dimension etched on pinion gear face

1. Before assembling the final drive unit, the stiffening bar RH 8032 should be fitted to the casing.
2. Partially screw two studs into the threaded holes in the front face of the casing. It is sufficient to fit these by hand as they serve only as location pins for the pinion housing.
3. If the pinion nose bearing has been removed from the bearing plate, fit the bearing, snap ring, and the two socket headed retaining screws, nuts, and washers. Tighten the screws in accordance with the standard torque figures quoted in Chapter P. Then, centre punch the nuts in three places to lock them into position.
4. Note the dimension stamped on the final drive casing (see fig. J2-7). Then, place the casing in an oven having a temperature of 110°C (230°F) for approximately thirty minutes.
5. Carefully measure from the back face of the pinion housing front flange to the face of the pinion gear adjacent to the nose bearing diameter (see fig.J2-8, dimension X).

Add this figure to the dimension etched on the rear face of the pinion (dimension Y).

The dimension A stamped on the final drive case which was noted previously, must now be subtracted from the total of dimensions X and Y.

The final dimension gives the thickness of the split adjusting washer which must be used between the pinion housing flange and the case, to place the pinion in the correct position.

Thickness of washer = X + Y – A.

The above measurements must be taken carefully and accurately.

Split adjusting washers are available in the following sizes 3,05 mm (0.120 in), 3,17 mm (0.125 in), 3,30 mm (0.130 in), 3,48 mm (0.137 in), and 3,78 mm (0.149 in).

6. Remove the casing from the oven. Then, fit the split adjusting washers to the pinion housing, retaining them with Keenomax C3 grease.
7. Fit a new 'O' ring to the pinion housing and insert the housing into the case as far as possible.

Note The pinion housing has one offset hole and can therefore only be fitted in one position. It is advisable to establish this position before entering the housing into the case.

8. Remove the locating studs. Fit the four capscrews and tighten them progressively and evenly to the torque figures quoted in Section J7.
9. Fit the pinion into the pinion housing from within the case.
10. Press the drive coupling onto the pinion shaft. Fit the nut and washer (if fitted) and torque tighten so that the centre punch mark on the nut aligns with the first leg of the 'U' of the part number stamped on the pinion. This ensures the correct pre-load.
11. Fit the bearing plate into the case, over the pinion bearing diameter. Torque tighten the bolts to the figures quoted in Section J7.
12. Examine the crown wheel and note the backlash figure etched on the back face.
13. Carefully fit the crown wheel and differential

assembly in position. Fit the bearing caps, but do not fully tighten the nuts.
14. If the two final drive side housings are still connected to the splined shafts, remove the retaining circlips. Then, remove the housings from the shafts.
15. Fit the adjusting washer, with the chamfered face outwards, the belleville washer and spacer assembly, and housing on the right-hand side of the final drive case and torque tighten the housing securing nuts.
16. Fit the adjusting washer behind the crown wheel bearing. Then, fit the left-hand side housing. Progressively tighten the housing nuts whilst rocking the crown wheel back and forth to ensure that there is backlash between the gears.
17. Mount a dial test indicator on the final drive case with the indicator pad on the flank of a crown wheel tooth.
18. Zero the indicator and 'rock' the crown wheel back and forth noting the backlash.
19. The backlash should be checked at four positions around the crown wheel and an average reading taken. This figure should be between 0,13 mm and 0,23 mm (0.005 in and 0.009 in).

If it does not conform, the thickness of the washer behind the bearing must be varied to obtain the correct reading.

Washers are available in a range of between 5,66 mm and 6,60 mm (0.223 in and 0.260 in) in increments of 0,10 mm (0.004 in).
20. In order to obtain the required result, equal amounts may be ground from each side of the washer, taking care to ensure that, after grinding, the washer is still flat and parallel to within 0,02 mm (0.001 in).
21. When the backlash is correct, remove the side housings from the centre case.
22. Accurately measure the distance from the case flange to the taper roller bearing outer track on the right-hand side of the final drive case (see fig. J2-9).
23. Place the right-hand housing, spacer, and belleville washer in the checking jig RH 9578 and tighten the jig until the belleville washer is flat (see fig. J2-10).
24. Using feeler gauges, measure the distances between the housing flange face and the top of the two pins on the gauge. The result added to the nominal pin height marked on the gauge gives the distance from the side housing to the belleville washer.

Subtract this dimension from the dimension previously taken between the case flange and the taper bearing. The result gives the thickness of the adjusting washer which must be fitted between the belleville washer and the taper bearing, to give the correct pre-load.

Adjustment washers are available in a range of between 6,35 mm and 7,87 mm (0.250 in and 0.310 in) in increments of 0,05 mm (0.002 in). Washers may be lightly ground to obtain the correct dimensions, but if this is done, equal amounts must be removed from each side and the washer must be kept flat and parallel.
25. Fit the right-hand housing to the splined shaft.
26. Fit the correct size washer with the chamfered side outwards, also the spacer assembly (spacer and

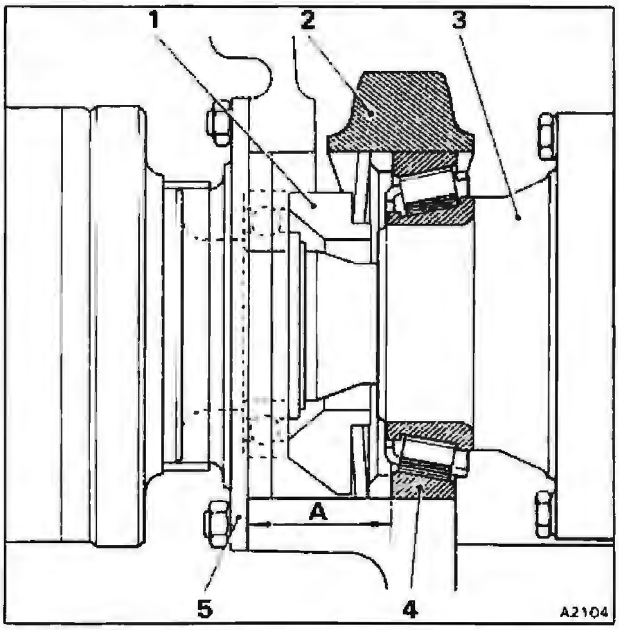


Fig. J2-9 Casing flange to bearing measurement
1 Belleville washer and spacer assembly
2 Bearing cap
3 Differential housing end cap
4 Bearing
5 Side bearing housing

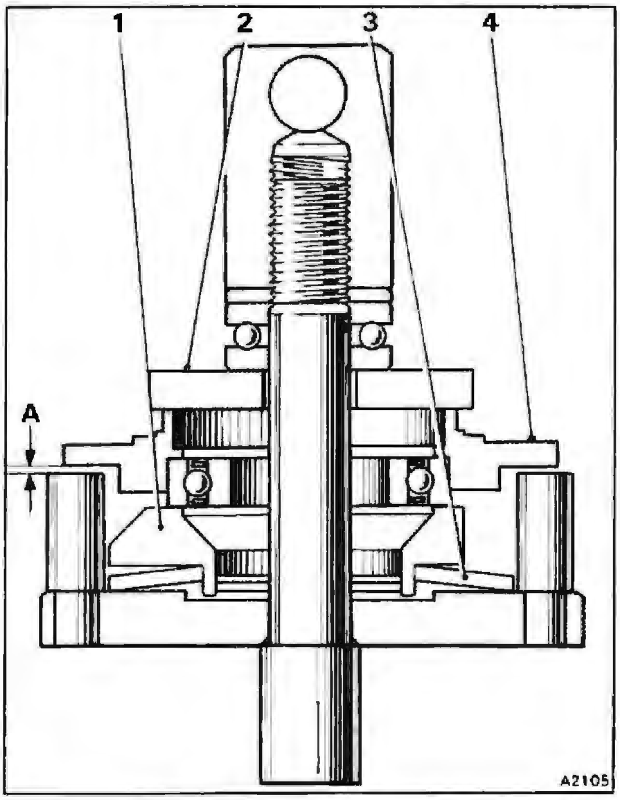


Fig. J2-10 Right-hand housing belleville washer setting
1 Spacer
2 Tool (RH 9578)
3 Belleville washer
4 Right-hand side housing
A Measured gap

belleville washer). Fit the housing and splined output shaft assembly.

27. Fit the left-hand side housing to the splined shaft. Fit the housing and output shaft assembly.

28. Tighten the housing nuts progressively and evenly. Then, torque tighten them to the standard torque figures quoted in Chapter P.

29. Tighten the nuts securing the two large bearing caps in accordance with the torque figures quoted in Section J7.

30. Release the side housing retaining nuts approximately 3,17 mm (0.125 in) to release the case load.

31. Remove the stiffening bar RH 8032. Fit the joint and case rear cover. Two countersunk headed setscrews are used in the top face and four hexagon headed setscrews and washers in the side faces.

32. After applying a light coating of SQ32M jointing compound to the flange faces, progressively tighten the side housing retaining nuts (previously released in Operation 30).

33. Rotate the pinion coupling flange to ensure that there are no tight spots or roughness of operation.

Final drive – To fit

Fit the final drive unit by reversing the removal procedure, noting the following.

1. Each end of the drive-shaft must be clean and free from damage. Ensure that the retaining screws are in good condition.

2. The propeller shaft and pinion flange faces must be clean and free from damage.

3. When tightening the bolts securing the final drive assembly to the final drive crossmember, it is essential that the two torque arm to crossmember bolt holes are in alignment. If the holes do not align, correct alignment must be achieved by slackening off the torque arm to axle case securing setscrews. Then, reposition the torque arm.

Note Should any other method be used to force alignment, the resultant higher stresses within the sub-frame members will cause premature failure.

4. All bolts, setscrews, and capscrews should be torque tightened to the figures quoted in Section J7 and Chapter P.

5. This operation should be carried out with the car standing in a levelled condition.

Check that the drain plug has been tightened.

Remove the filler plug from the rear of the final drive case and fill the axle with one of the recommended lubricants (see Chapter D) up to the bottom of the filler plug hole, approximately 2,3 litres (4 Imp pt; 4.8 US pt). Fit the filler plug together with a new washer.

6. Before starting the engine in order to pressurize the hydraulic system, replace fuse A6 on fuse panel F2 on the main fuseboard, switch on the ignition and move the gear range selector lever to the park position. Switch off the ignition and again remove fuse A6 from fuse panel F2 on the main fuseboard.

Pinion flange oil seal – To renew

The pinion flange oil seal can be removed with the final drive unit in position.

1. Drive the car on a ramp and securely chock the front road wheels.

2. Switch on the ignition. Select neutral position with the gear range selector lever. Then, remove fuse A6 from fuse panel F2 on the main fuseboard. Switch off the ignition.

3. Using a hydraulic jack with an extension piece and hardwood block placed beneath the final drive casing, raise the rear of the car until the road wheels are clear of the ramp.

4. Position sill blocks and beams beneath the car's sills. Lower the jack and allow the blocks to support the car. Support the trailing arms using jacks or suitable blocks.

5. Remove the propeller shaft (see Chapter F).

6. Scribe correlation marks across the pinion face and coupling flange.

Note The centre punch mark on the nut aligns with the first leg of the 'U' of the part number stamped on the pinion. This ensures the correct pre-load on the pinion.

7. Remove the nut (and washer if fitted).

8. Using the hydraulic ram RH 8017 and special extractor RH 8470, remove the pinion flange.

9. Using a lever or simple extractor, remove the oil seal from the pinion housing.

10. Fit a new oil seal, ensuring that it is fitted squarely, with the lip pointing inwards until the front face of the seal is 3,20 mm (0.125 in) below the front face of the housing.

Note Ensure that the PTFE seal is fitted dry. No lubricant is necessary, as this type of seal is more efficient when fitted dry.

11. Clean, degrease, and fit the pinion flange, ensuring that the correlation marks are aligned. Fit and tighten the nut (and washer if fitted) until the centre punch mark aligns with the first leg of the 'U' of the part number.

12. Assemble the remaining components by reversing the dismantling procedure.

13. Torque tighten the propeller shaft bolts to the figures quoted in Chapter F.

Torque arm – To remove

1. Drive the car on a ramp and securely chock the front road wheels.

2. Depressurize the hydraulic systems as described in Chapter G.

3. Insert spring retainers RH 9299 through both rear springs.

4. Position a hydraulic jack under the final drive centre case and raise the rear of the car. Position sill blocks and beams beneath the car's sills. Lower the jack and allow the blocks to support the car.

5. Support the final drive by leaving the jack beneath the centre case.

6. Remove one of the small dampers fitted to each side of the rear suspension crossmember. Insert a

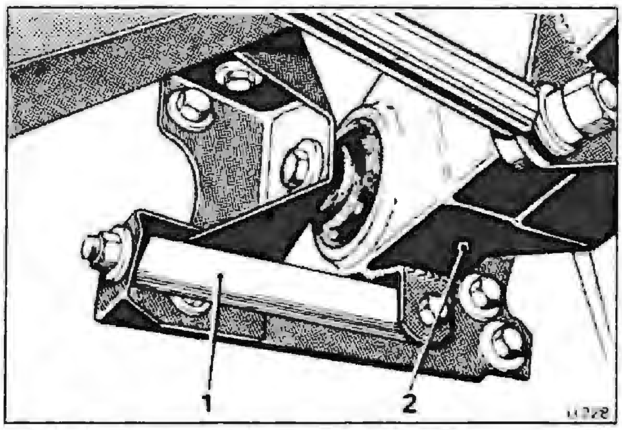


Fig. J2-11 Jury bolt in position
1 Jury bolt
2 Rear suspension crossmember

'Jury bolt' RH 9575 and secure it in position (see fig. J2-11). Ensure that load is not applied to the crossmember by the Jury bolt. Repeat this operation to the other side of the crossmember.

7. Remove the bolts securing the upper and lower frame tubes to the final drive crossmember on the torque arm side of the final drive.

Carefully note the positions of the tubes and to which side of the mounting bracket they are secured. Also, the direction in which the bolts are fitted.

8. Remove the setscrews and bolts securing the torque arm to the final drive casing, and suspension crossmember. Lower the torque arm from the car.

Torque arm – To fit

Fit the torque arm by reversing the procedure given for removal, noting the following.

1. When fitting the torque arm, ensure that the front bolt holes align with the holes in the fixing bracket on the sub-frame, prior to tightening the setscrews to the final drive casing.

Do not use force to align the torque arm as this will create high stress loads in the sub-frame members, which could result in premature component failure.

2. Ensure that the frame tubes are fitted with the centre line of the tube in line with the mating face of the mounting bracket (see Chapter H), and to the same side of the mounting bracket from which they were removed.

3. All frame tube bolts must be torque tightened. Also, the crossmember dampers must be fitted prior to the suspension spring load being released and the suspension struts are pressurized.

4. All other nuts, bolts, and setscrews should be torque tightened in accordance with the figures quoted in Section J7.

5. Care must be taken when removing the sill blocks and lowering the car onto its wheels. Ensure that the rear springs locate correctly into their retainers.

No attempt should be made to remove the spring retainers until the springs are located correctly and the car is standing on its wheels.

Drive-shafts

Introduction
The 'Lobro' drive-shafts utilize constant velocity joints (see fig. J3-1). They can be removed from the car without removal of other components.

Note On turbocharged cars, the drive-shafts are of a larger diameter to compensate for the additional torque produced by the engine.

Drive-shaft – To remove
1. Drive the car onto a ramp and securely chock the front road wheels.
2. Using a hydraulic jack and a hardwood block placed beneath the final drive casing, raise the rear of the car until the road wheel is clear of the ramp.
3. Position sill blocks beneath the car sill. Lower the hydraulic jack to allow the blocks to support the car. Support the trailing arm on a jack.
4. Remove the six retaining screws from each end of the drive-shaft, taking care not to damage the joint and convoluted seals. Collect the retaining screws and load spreading washers. Remove the drive-shaft.
5. Inspect the drive-shaft joints and convoluted seals.

Note If one or both of the convoluted seals are found to be unserviceable, the constant velocity joints must be removed from the shaft in order to fit replacements. However, if more serious damage has occurred, the complete drive-shaft assembly must be renewed.

Convoluted seal – To renew
1. Release the two convoluted seal retaining clips and slide the seal down the shaft.
2. Remove the convoluted seal retainer from the constant velocity joint. Slide the retainer down the shaft.
3. Remove the closed end cap from the end of the constant velocity joint.
4. Remove the circlip from the end of the drive-shaft. Using a suitable press, remove the constant velocity joint from the shaft.
5. Remove the convoluted seal and its retainer from the shaft. Discard the seal.
6. Clean the metal components with a suitable solvent.
7. Examine the components for adverse wear. Replace parts if necessary.
8. Pack the constant velocity joint with Rocol MTS 1000 grease, until the grease is level with the outer faces.
9. Fit and slide the new convoluted seal onto the shaft, followed by its retainer.
10. Press the constant velocity joint onto the shaft. Secure it in place with the circlip.
11. Lightly smear the flange of the convoluted seal retainer with Wellseal sealant.

Fit the retainer to the constant velocity joint.

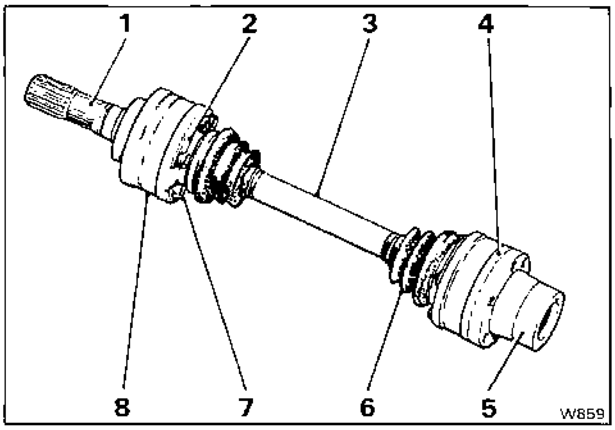


Fig. J3-1 Constant velocity joint
1 Output shaft
2 Load spreading washers
3 Drive-shaft
4 End cap – grease retainer
5 Hub coupling
6 Convoluted seal
7 Retaining screws
8 Constant velocity joint body

Ensure that the bolt holes align correctly.

12. Fit the convoluted seal. Secure in position using new retaining clips.
13. Lightly smear the flange of the joint end cap with Wellseal sealant. Fit to the joint, ensuring that the bolt holes align.

Drive-shaft – To fit
Fit the drive-shaft by reversing the removal procedure noting the following.
1. Always fit the shaft as it is removed. **Never** turn the shaft from end-to-end, or from one side of the car to the other.
2. Ensure that the load spreading washers are fitted beneath the retaining screws.
3. Torque tighten the retaining screws in accordance with the figures quoted in Section J7.

Output shaft oil seal – To renew
The oil seal on the splined output shafts are located in the housings, on each side of the final drive unit and can be renewed with the final drive in position.
1. Remove the drive-shaft as described under Drive-shaft – To remove.
2. Remove the six nuts securing the bearing housing to the final drive casing. If necessary, tap the housing with a nylon mallet to break the joint.
3. Withdraw the output shaft and housing from the final drive casing.
4. Remove the circlip (and washer on the right-hand

housing) located on the output shaft behind the bearing housing. Remove the shaft from the housing.

5. Remove the seal from the housing.
6. Fit a new seal, ensuring that it is fitted squarely into its locating bore and with the lip pointing inwards towards the bearing.

Note If a PTFE oil seal is being fitted **do not lubricate,** this type of oil seal is more efficient when fitted dry.

7. Fit the housing onto the shaft (place the washer in position behind the bearing; right-hand housing only) and fit the circlip. Ensure that the circlip locates correctly into its groove.
8. Fit the output shaft and housing assembly to the final drive casing and secure.
9. Torque tighten the nuts in accordance with the figures quoted in Section J7.
10. Fit the drive-shaft as described under Drive-shaft – To fit.

Output shaft bearing – To renew

1. Carry out Operations 1 to 4 inclusive of Output shaft oil seal – To renew.
2. Remove the bearing from the housing using a mandrel or drift. Remove the seal and discard.

Note The bearing in the left-hand housing is retained with a circlip. Remove this circlip before attempting to remove the bearing.

3. Clean and inspect the housing bore. Lightly stone out any damage marks and burrs.
4. Fit a new bearing. Ensure that it is fitted squarely into the bore and up to its abutment face.

Note The bearing in the left-hand housing is retained with a circlip. Ensure that the bearing is located correctly.

5. Fit a new seal ensuring that it is fitted squarely with the lip pointing inwards.

Note If a PTFE oil seal is being fitted **do not lubricate,** this type of oil seal is more efficient when fitted dry.

6. Lightly smear the output shaft housing sealing face with Wellseal. Fit the assembly onto the final drive casing and secure.
7. Torque tighten the nuts in accordance with the figures quoted in Section J7.
8. Fit the drive-shafts as described under Drive-shaft – To fit.

Final drive crossmember

The final drive crossmember is an integral part of the rear sub-frame assembly.

The sub-frame which consists of the rear suspension crossmember, six frame tubes and the final drive crossmember, is jig assembled. It is adjusted together with the trailing arms, final drive unit, and torque arm during manufacture.

Although certain components can be removed from the assembly as individual items, under no circumstances should the final drive crossmember only be removed from the car.

If removal of the final drive crossmember or renewal of the mounts is necessary, reference should be made to Chapter H prior to work being commenced.

Printed in England

Rear hubs

Hub unit – To remove

1. Position the car on a ramp and securely chock the front road wheels.
2. Remove the rear wheel disc/trim. Loosen, but do not remove the wheel retaining nuts.
3. Using a hydraulic jack positioned beneath the final drive casing, raise the rear of the car until the road wheels are clear of the ramp.
4. Position sill blocks beneath the body sills. Lower the hydraulic jack and allow the blocks to support the car body. Support the trailing arms with screw jacks.
5. Remove the rear road wheel.
6. Depressurize the hydraulic system as described in Chapter G. Depressurization of the suspension struts is not necessary.
7. Disconnect the parking brake actuation rod from the brake caliper.
8. Disconnect the two pressure feed pipes from the brake caliper. Fit blanks to the pipe ends and caliper ports.
9. Disconnect and remove the brake caliper bridge pipe. Fit blanks to the pipe ends and caliper ports.
10. On cars fitted with anti-lock braking, remove the socket headed setscrew securing the rear wheel sensor to the stub axle. Withdraw the sensor.
11. Remove the capscrews securing the constant velocity joint to the hub coupling. Separate the constant velocity joint from the hub coupling by easing the drive-shaft inwards toward the final drive.
12. If the rear hub assembly is to be dismantled,

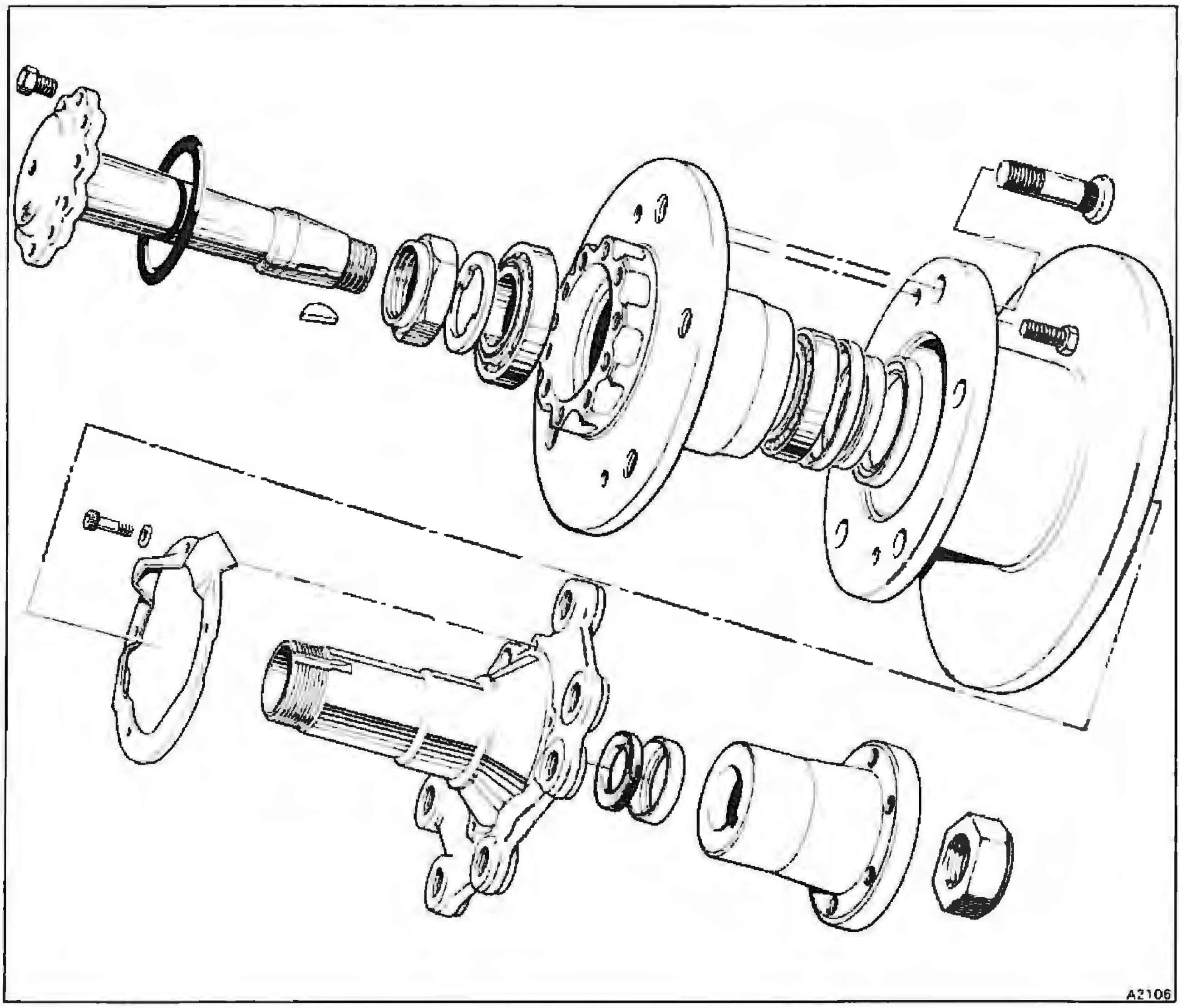


Fig. J5-1 Rear hub (cars other than Bentley Turbo R)

loosen the two setscrews securing the brake caliper to the hub yoke.

13. Remove the two lower setscrews securing the stub axle flange to the trailing arm (see fig. J5-3).

Note To assist in the removal and assembling of the stub axle, screw in two studs to act as guides in the lower setscrew holes.

14. Support the rear hub and brake caliper assembly. Remove the two upper setscrews securing the stub axle to the trailing arm.

15. Carefully withdraw the rear hub and brake caliper assembly from the trailing arm and remove it from the car.

Hub unit – To dismantle

1. Remove the rear hub and brake caliper assembly as described previously.
2. Remove the setscrews securing the brake caliper to the hub yoke.
3. Carefully slide the brake caliper off the brake disc. Fit a distance piece between the brake pads to ensure that the caliper pistons are retained in their bores.
4. Remove the large nut securing the hub coupling to the drive-shaft (see fig. J5-3).
5. On Bentley Turbo R cars, remove the circlip and washer from within the coupling.
6. Using extractor tool RH9690, remove the coupling from the hub drive-shaft.

   On cars other than Bentley Turbo R, collect the Woodruff key.
7. Remove the setscrews securing the outer flange of the drive-shaft to the hub. Withdraw the drive-shaft from the hollow stub axle. Discard the 'O' ring.
8. Unlock and remove the shrouded nut and the key washer from the stub axle.
9. Withdraw the hub complete with bearings from the stub axle. Collect the spacer.
10. Remove the outer bearing inner race. Using a soft metal drift, drive out the inner bearing together with the oil seal.
11. Drive out the outer bearing track from the hub.
12. On cars other than Bentley Turbo R, remove the

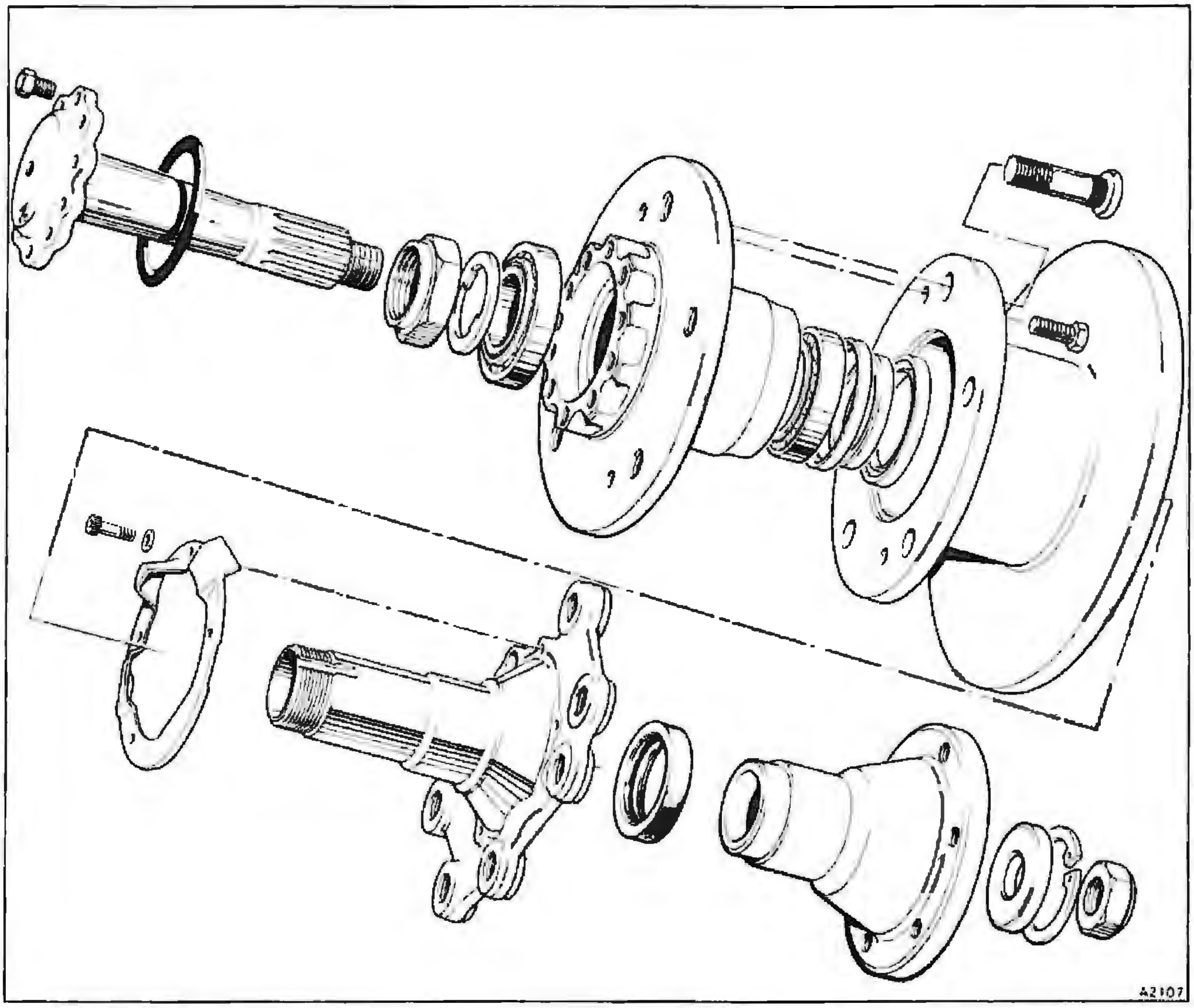


Fig. J5-2 Rear hub (Bentley Turbo R)

retainer and felt seal from the stub axle counterbore.
13. On Bentley Turbo R cars, remove the oil seal from the stub axle counterbore.
14. With the hub dismantled, inspect the brake disc and caliper pads for wear or damage. If it is necessary to remove the brake disc, remove the securing setscrews and withdraw the disc from the hub.
15. Thoroughly clean all hub components and inspect for wear and damage.

Hub unit – To assemble

1. On cars other than Bentley Turbo R, fit a new felt seal and retainer into the stub axle. The seal should be soaked thoroughly in engine oil prior to fitting.
2. On Bentley Turbo R cars, fit a new oil seal into the stub axle. Apply a small quantity of an approved grease (see Chapter D).
3. Fit the spacer (chamfered inner edge leading) onto the stub axle to abut the shoulder.
4. Repack the hub with 57 g (2 oz) of Shell Retinax A grease.
5. After fitting new bearings (if necessary), position the hub on the stub axle. Fit the hardened key washer and a new shrouded nut.
6. Tighten the nut sufficiently to remove any bearing end-float. Using a dial test indicator mounted adjacent to the brake disc, measure the run-out of the disc at the maximum possible radius.

The run-out must not exceed 0,18 mm (0.007 in) total indicator reading. If the run-out exceeds this figure, it will be necessary to dismantle the hub and brake disc to investigate the cause.

7. After checking the run-out, slacken the shrouded nut. Place a 0,05 mm (0.002 in) feeler gauge between the outer bearing and the key washer. Tighten the nut sufficiently to lightly grip the feeler gauge. This gives a bearing end-float of between 0,05 mm and 0,10 mm (0.002 in and 0.004 in), when the feeler gauge is removed.

Alternatively, the required end-float can be obtained by use of suitable dial test indicator equipment secured to the stub axle.

Continuous rotation of the hub is essential during this operation to ensure that the taper rollers seat correctly in the outer races.

8. Peen the shroud of the nut to locate into the grooves of the stub axle. Remove the feeler gauge or dial test indicator.

Note Exerting a load on the bearings or excessive end-float, will promote premature bearing wear.

The remaining operations for fitting the rear hub unit are a careful reversal of the dismantling procedure, noting the following.

9. Fit a new rubber 'O' ring onto the hub drive-shaft, ensuring a small quantity of grease is applied before fitting.
10. On cars other than Bentley Turbo R, fit the Woodruff key to the hub drive-shaft taper. Ensure that the tapers are perfectly clean and dry before fitting the hub coupling.
11. On Bentley Turbo R cars, lubricate the splines of the shaft and coupling with Rocol ASP grease. Then,

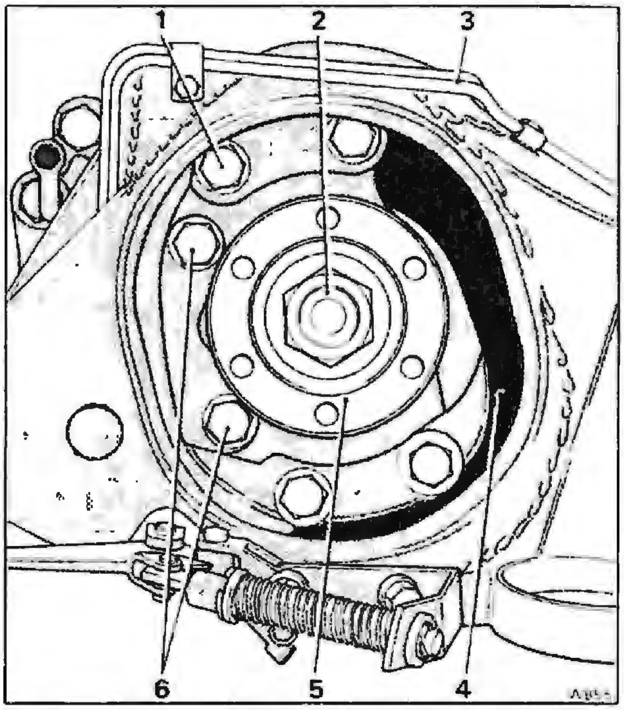


Fig. J5-3 Rear hub and brake caliper mounting
1 Hub mounting setscrew (4)
2 Hub drive-shaft retaining nut
3 Hydraulic brake pipes
4 Trailing arm
5 Hub coupling
6 Brake caliper mounting bolts

press the coupling onto the drive-shaft, and secure by fitting the special washer and a new circlip. Torque tighten the nut to the figures quoted in Section J7. Stake the nut into the shaft slot.
12. On cars other than Bentley Turbo R, apply Molytone 265 grease to the shaft threads and abutment face of the hub coupling retaining nut. Torque tighten the nut to the figures quoted in Section J7, using torque spanner RH 8014 and socket RH 8026.
13. Fit the drive-shaft assembly into position and torque tighten the retaining screws in accordance with the figures quoted in Section J7.
14. Prior to fitting the brake pipes and parking brake linkage refer to Chapter G regarding the bleeding procedure and precautions to be taken.
15. Check the adjustment and operation of the parking brake as described in Chapter G.

Dimensional data

Final drive unit

Backlash – pinion to crown wheel	Etched on crown wheel
Backlash – differential housing pinions	0,0762 mm (0.003 in)
End-float – differential housing pinions	Nil
Crown wheel run-out (maximum)	0,05 mm (0.002 in)
Differential housing – trunnion diameters	19,042 mm - 19,05 mm (0.7497 in - 0.750 in)
Differential housing pinion – bore diameters	19,062 mm - 19,075 mm (0.7505 in - 0.751 in)
Differential housing bevel pinion gear – bearing diameter	44,272 mm - 44,297 mm (1.743 in - 1.744 in)
Differential housing bevel pinion gear – bore diameter	44,450 mm - 44,475 mm (1.750 in - 1.751 in)
Differential housing and end cap – bearing locating diameters	50,85 mm - 50,863 mm (2.002 in - 2.0025 in) 66,732 mm - 66,738 mm (2.62725 in - 2.6275 in)
Differential housing bearings – bore diameters	50,8 mm - 50,812 mm (2.000 in - 2.0005 in) 66,675 mm - 66,687 mm (2.625 in - 2.6255 in)
Differential housing bearings – outside diameters	88,9 mm - 88,925 mm (3.500 in - 3.501 in) 107,950 mm - 107,975 mm (4.250 in - 4.251 in)
Final drive casing – differential housing bearing locating bores	88,925 mm - 88,938 mm (3.501 in - 3.5015 in) 107,975 mm - 108,0 mm (4.251 in - 4.252 in)
Final drive casing – pinion housing locating diameters	105,410 mm - 105,422 mm (4.150 in - 4.1505 in) 105,715 mm - 105,73 mm (4.162 in - 4.1625 in)
Pinion housing – locating diameters	105,410 mm - 105,422 mm (4.150 in - 4.1505 in) 105,753 mm - 105,765 mm (4.1635 in - 4.164 in)
Pinion shaft – bearing locating diameters	34,956 mm - 34,963 mm (1.37625 in - 1.3765 in) 44,481 mm - 44,488 mm (1.75125 in - 1.7515 in)
Pinion bearings – bore diameters	34,925 mm - 34,937 mm (1.375 in - 1.3755 in) 44,450 mm - 44,462 mm (1.750 in - 1.7505 in)
Pinion housing – pinion bearing locating diameters	72,194 mm - 72,219 mm (2.8423 in - 2.8433 in) 95,199 mm - 95,224 mm (3.748 in - 3.749 in)
Pinion bearings – outside diameters	72,232 mm - 72,257 mm (2.8438 in - 2.8448 in) 95,250 mm - 95,275 mm (3.750 in - 3.751 in)
Pinion – splined diameter	37,843 mm - 37,868 mm (1.4899 in - 1.4909 in) over 3,05 mm (0.120 in) diameter rollers
Pinion – nose bearing locating diameter	38,524 mm - 38,536 mm (1.5167 in - 1.5172 in)
Bearing plate – pinion nose bearing bore diameter	61,981 mm - 61,986 mm (2.4402 in - 2.4404 in)
Pinion nose bearing – outside diameter	61,987 mm - 62,000 mm (2.44045 in - 2.44095 in)
Pinion nose bearing – running clearance	0,0127 mm - 0,038 mm (0.0005 in - 0.0015 in)
Pinion bearing housing – oil seal locating diameter	80,9498 mm - 80,9879 mm (3.187 in - 3.1885 in)
Oil seal – pinion bearing housing locating diameter	81,03 mm - 81,13 mm (3.190 in - 3.194 in)

Final drive – drive-shafts

Side housings – bearing locating bore	66,655 mm - 66,661 mm (2.6242 in - 2.62445 in)
Bearing – side housings – outside diameter	66,649 mm - 66,662 mm (2.6240 in - 2.6245 in)
Bearing – side housings – bore diameter	38,092 mm - 38,105 mm (1.4997 in - 1.5002 in)
Right-hand side housing – oil seal locating bore	64,77 mm - 64,81 mm (2.550 in - 2.5515 in)
Oil seal – right-hand	To suit above housing
Left-hand side housing – oil seal locating bore	63,50 mm - 63,54 mm (2.500 in - 2.5015 in)
Oil seal – left-hand	To suit above housing

Special torque tightening figures

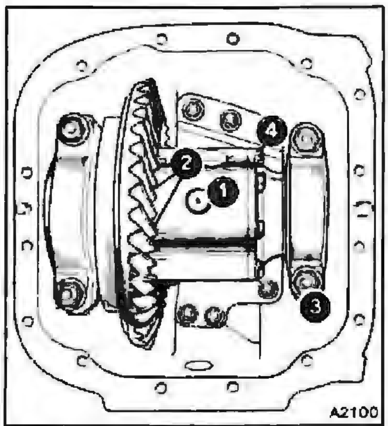
Introduction

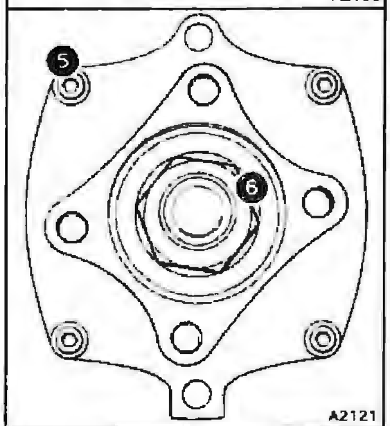
This section contains the special torque tightening figures applicable to Chapter J.

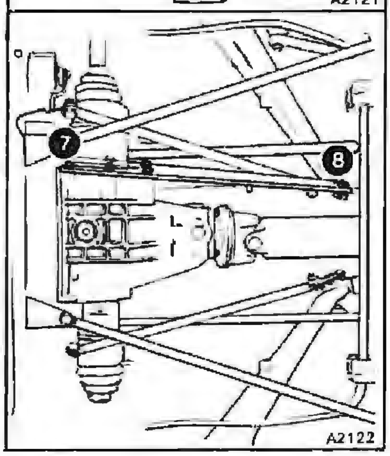
For standard torque tightening figures refer to Chapter P.

Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

Section J2



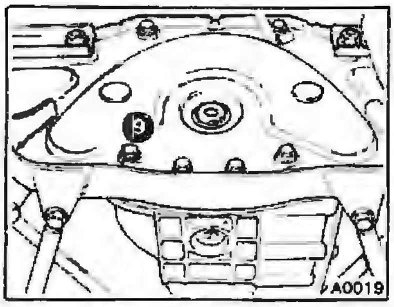




Ref.	Component	Nm	kgf m	lbf ft
1	Differential trunnion – bolt and lock-nut	16-19	1,63-1,94	12-14
2	Crownwheel to differential housing – capscrews	57-61	5,82-6,22	42-45
3	Nut-bearing cap final drive	81-88	8,3-8,9	60-65
4	Setscrew-end cover differential housing	11-13	1,10-1,38	8-10
5	Pinion housing to differential housing casing – capscrews	39-43	3,98-4,38	29-32
6	Input flange to input pinion – nut	271-305	27,7-31,1	200-225
7	Torque arm mount to final drive casing-bolts	46-50	4,70-5,10	34-37
8	Torque arm front mount – nuts and bolts	81-88	8,3-8,9	60-65

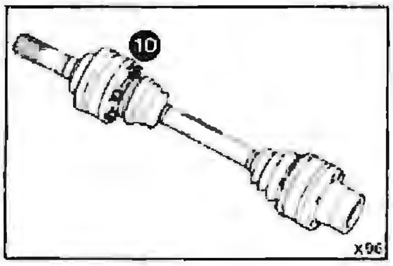
Ref.	Component	Nm	kgf m	lbf ft

Section J2



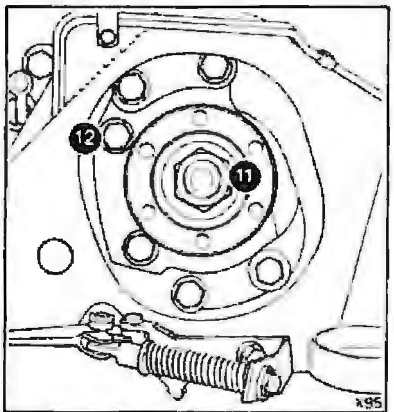
Ref.	Component	Nm	kgf m	lbf ft
9	Setscrew – final drive to crossmember	39-43	3,98-4,38	29-32

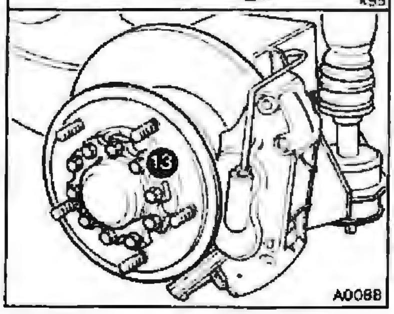
Section J3



Ref.	Component	Nm	kgf m	lbf ft
10	Constant velocity joint – bolts (cars other than Bentley Turbo R)	81-88	8,3-8,9	60-65
	Constant velocity joint – capscrews (Bentley Turbo R only)	95-101	9,7-10,3	70-75

Section J5





Ref.	Component	Nm	kgf m	lbf ft
11	Coupling flange to drive-shaft – nut (cars other than Bentley Turbo R)	664-691	67,8-70	490-510
	Coupling flange to drive-shaft – nut (Bentley Turbo R only)	102-108	10,4-11,0	75-80
12	Rear brake caliper to stub axle – setscrew	109-115	11,1-11,5	80-85
13	Setscrew – drive-shaft to rear hub	44-48	4,4-5,0	32-36

Workshop tools

RH 8014	Torque wrench – 0 lbf ft to 600 lbf ft Hub yoke nut
RH 8016	Extractor beam When used in conjunction with RH 8017, RH 8020, RH 8021, and RH 8022, the extractor beam can be used to remove the rear tapered roller bearing from the final drive pinion
RH 8017	Hydraulic ram To be used in conjunction with RH 8016, RH 8020, RH 8021, and RH 8022 as detailed above
RH 8020	Separator See RH 8017 for uses
RH 8021	Bolt – See RH 8017 for uses
RH 8022	Pressure pads See RH 8017 for uses
RH 8026	Socket head 1 11/16 A/F (cars other than Bentley Turbo R) To be used in conjunction with RH 8014
RH 8032	Stiffening bar – Final drive casing
RH 8307	Converter – Torque spanner Converts the 19 mm (0.75 in) square drive of the torque spanner RH 8014 to 25,4 mm (1.0 in) square drive
RH 8308	Applicator – Rear drive-shaft rubber seal
RH 8457	Assembly tool – Pinion coupling flange
RH 8470	Extractor – Pinion coupling flange To be used in conjunction with RH 8017
RH 9005	Hydraulic ram To be used in conjunction with RH 9690
RH 9299	Compression bolt – Rear springs
RH 9575	Jury bolt – Torque arm removal
RH 9578	Pre-loading jig – Belleville washer – Final drive right-hand side housing
RH 9690	Extractor – Rear hub coupling flange To be used in conjunction with RH 9005

Printed in England

Fuel system and Emission control systems

Refer to TSD 4737 Engine Management Systems

Printed in England

Workshop Manual

Rolls-Royce & Bentley motor cars

Rolls-Royce Silver Spirit
Rolls-Royce Silver Spur
Rolls-Royce Corniche
Rolls-Royce Corniche II
Bentley Eight
Bentley Mulsanne
Bentley Mulsanne S
Bentley Turbo R
Bentley Continental

Cars built from vehicle identification number (VIN)
SCBZS0T03HCX20001
to
SCBZE00A5KCX27799
inclusive

Volume 2

TSD 4700

September 1989

Printed and Published by
Rolls-Royce Motor Cars Limited
Crewe
Cheshire
CW1 3PL
England

The information in this document is correct at the time of going to print but in view of the Company's continuing efforts to develop and improve its products it may have become out of date by the time you read it and you should, therefore, refer to publication TSD 4736 Product Support Information.

The information given here must not be taken as forming part of or establishing any contractual or other commitment by Rolls-Royce Motor Cars Limited and no warranty or representation concerning the information is given.

Workshop Manual

Rolls-Royce & Bentley motor cars

Rolls-Royce Silver Spirit
Rolls-Royce Silver Spur
Rolls-Royce Corniche
Rolls-Royce Corniche II
Bentley Eight
Bentley Mulsanne
Bentley Mulsanne S
Bentley Turbo R
Bentley Continental

Cars built from vehicle identification number (VIN)
SCBZS0T03HCX20001
to
SCBZD00A2KCH29290
inclusive

Volume 2

TSD 4700

October 1989

Printed and Published by
Rolls-Royce Motor Cars Limited
Crewe
Cheshire
CW1 3PL
England

Contents

Printed in England

Engine cooling system

Contents

Printed in England

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections	L1	L2	L3	L4	L5	L6	L7	L8		
Page No.										
1	5/88	5/88	12/86	5/88	5/88	12/86	12/86	5/88		
2			12/86	5/88	12/86	5/88				
3	5/88		5/88	5/88		12/86				
4			5/88							
5			5/88							
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Introduction

The sealed cooling system comprises a pressurized expansion bottle, a radiator, and a pump. Also, various passages and pipes convey the coolant around the system (see fig. L2-1).

A mixture containing equal amounts of approved coolant/anti-freeze and water should be used in the system at all times.

The coolant mixture in the system should always be maintained at the correct level and this must be checked at the intervals specified in the Service Schedule Manual, TSD 4702.

The coolant level can be checked at the translucent expansion bottle. The correct level should be between the MAX and MIN marks on the bottle. If a full check is to be carried out refer to page L3-3.

The cooling system is pressurized and the correct pressure is maintained by the expansion bottle pressure cap. **Removal of the pressure cap while the engine and radiator are still hot requires extreme care.**

The coolant pump is situated at the front of the engine and is driven from the crankshaft by twin matched 'Vee' belts.

Coolant from the bottom of the radiator is pumped via transfer pipes and crankcase passages directly onto the outside of the 'wet' type engine cylinder liners and then into the cylinder heads. From the cylinder heads the coolant travels along transfer pipes and then flows past the thermostat to the top of the radiator.

When the engine is cold the thermostat is closed. Therefore, the coolant by-passes the radiator matrix and is recirculated through the engine to reduce the warm-up period. Once normal operating temperature is attained, the thermostat opens and the coolant is directed to the radiator.

The temperature of the coolant is registered on the gauge situated on the facia. Whenever the ignition is on, a transmitter situated in the thermostat housing signals the coolant temperature to the gauge.

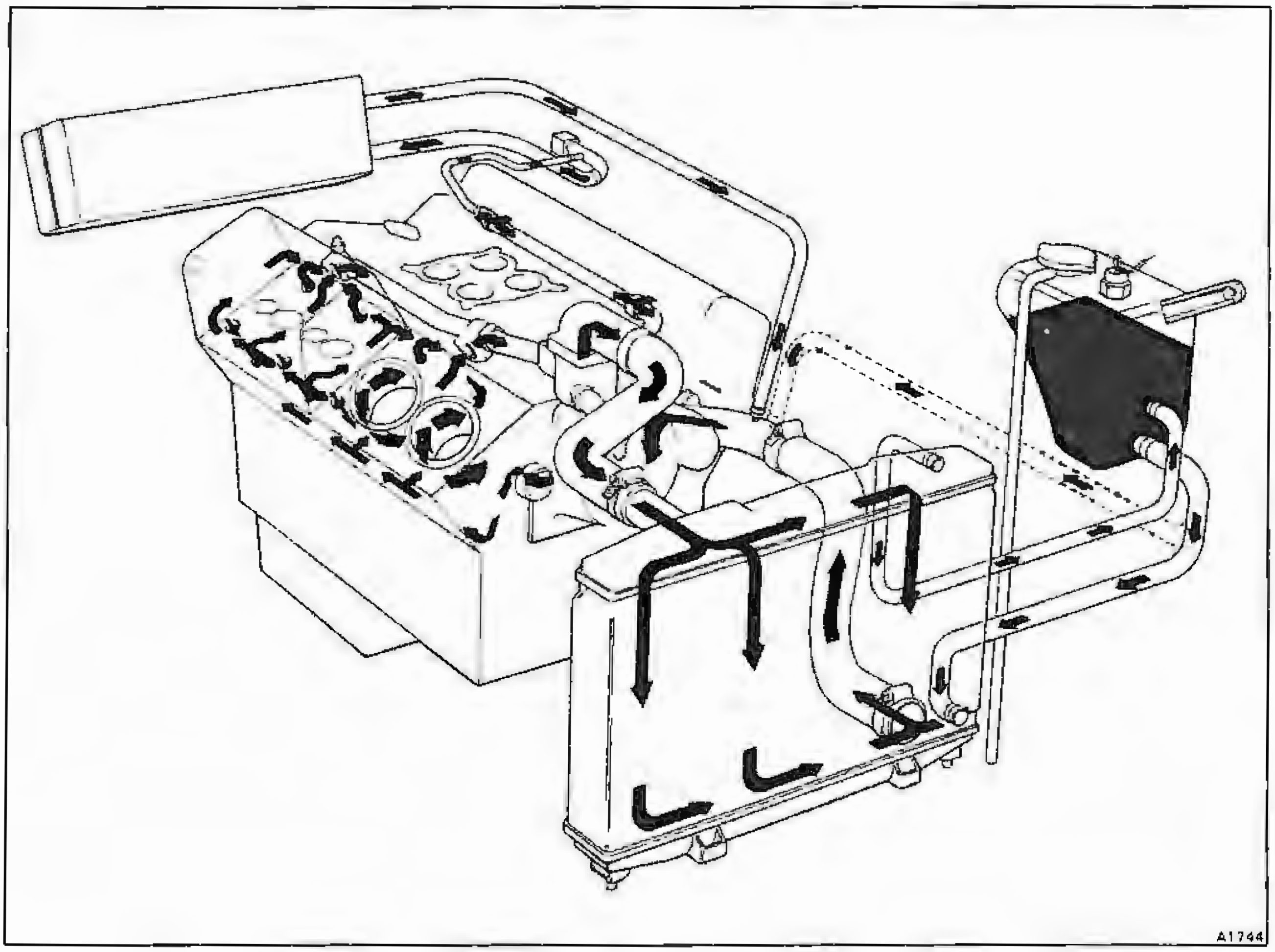


Fig. L2-1 Diagrammatic view of the cooling system Dotted line – 1989 model year cars

Coolant

The cooling system should contain a 50% mixture of an approved coolant/anti-freeze and water. This mixture not only provides frost protection down to a temperature of −37°C (−35°F), but it also prevents corrosion of the cooling passages.

Refer to the Service Schedule Manual, TSD 4702, to obtain the specified service intervals for renewing the coolant, fitting a new thermostat, and reverse flushing the system.

Except in an emergency, water must not be used to either fill or top-up the cooling system. If a situation does arise where water is used, **the coolant mixture must be corrected as soon as possible, otherwise corrosion damage will occur to the engine coolant passages.**

Coolant/anti-freeze
The trade name of the coolant/anti-freeze is ICI 007/400F (obtainable under a Rolls-Royce and Bentley label) and should be used all year round. Do not mix ICI 007/400F or top-up with any other brand of coolant/anti-freeze.

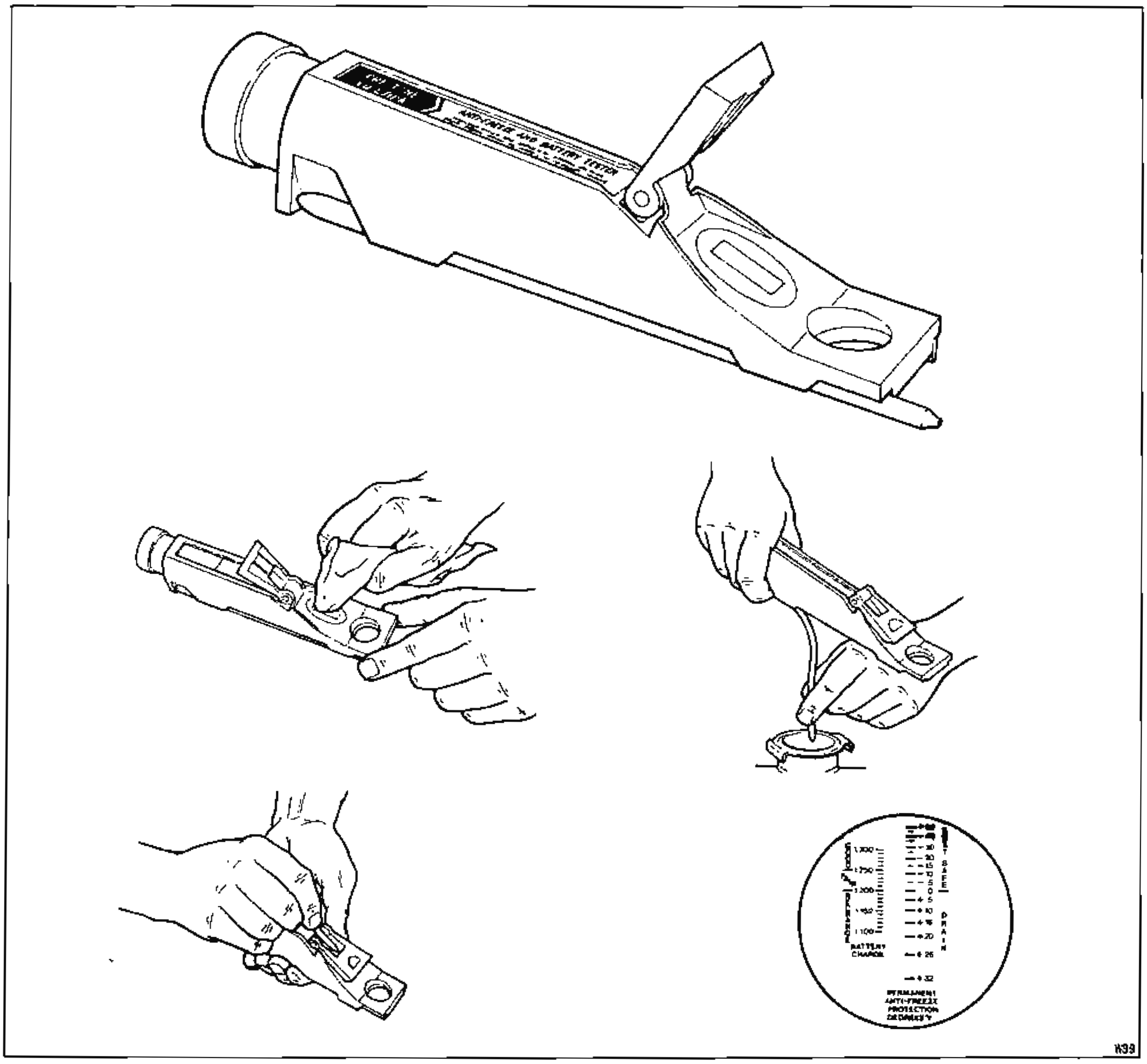


Fig. L3-1 Checking the anti-freeze concentration

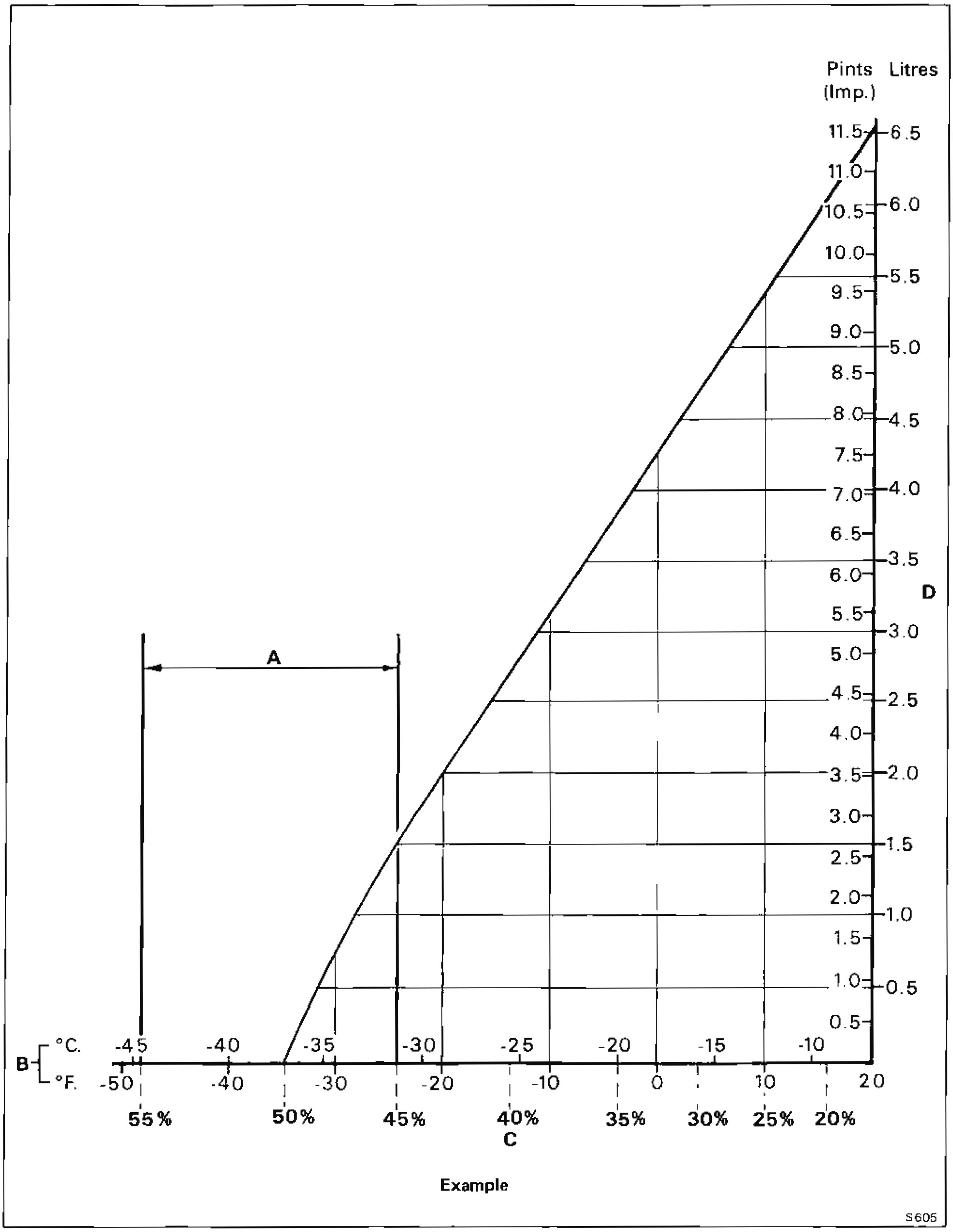


Fig. L3-2 Anti-freeze correction chart to give a 50% solution

A Acceptable service range of concentration
B Freezing point of coolant
C Percentage concentration
D Volume of 100% anti-freeze to be added to maintain a 50% solution after removal of the same volume of old coolant first

Anti-freeze concentration – To check
If the strength of the coolant requires increasing, sufficient coolant should be drained from the radiator and replaced with undiluted anti-freeze. Afterwards run the engine until normal operating temperature is attained and the anti-freeze has become thoroughly mixed with the coolant. Stop the engine and again check the concentration in the expansion bottle.

An acceptable level of anti-freeze concentration is between 45% and 55%. Therefore, as a hydrometer may be inaccurate where readings above 40% are expected, it is recommended that a refractometer (see fig. L3-1) is used in the following manner.

1. Lift the plastic cover on the refractometer (tester) to expose both the measuring window and bottom of the plastic cover.
2. Thoroughly clean both exposed surfaces with clean water and then wipe them dry with a clean soft cloth.
3. Carry out the usual workshop safety precautions.
4. Raise the bonnet and remove the expansion bottle cap.
5. Release the tip of the clear plastic tube from the tester and insert it into the coolant in the expansion bottle.
6. Press and then release the bulb on the end of the plastic tube. This will draw a small quantity of coolant into the tube.
7. Withdraw the test equipment and bend the end of the plastic tube around the tester so that the tip of the tube can be inserted into the cover plate opening.
8. Press the bulb on the end of the plastic tube and eject a few drops of coolant onto the measuring surface.
9. Point the tester towards the light and look into the eye piece.

Do not open the plastic cover when taking a reading. Evaporation of water from the fluid sample being tested can affect the reading.

10. The anti-freeze protection reading is at the point where the dividing line between light and dark (edge of shadow) crosses the scale. The anti-freeze reading is on the right-hand scale.

Note The tester temperature scale is **reversed** from a standard thermometer. Below zero readings are on the upper half of the scale.

11. If the temperature reading is higher (further down on the scale) than –31°C (–24°F) it will be necessary to refer to figure L3-2 and add the appropriate amount of anti-freeze to the system.

Example
A tester reading of –29°C (–20°F) is equal to an anti-freeze concentration of 43% and is outside the service limits. Follow the line upwards until the angled line is reached, then trace the horizontal line to the scale on the right-hand size of the graph to find that 2 litres (3.5 Imp pt, 4.2 US pt) of coolant should be removed from a full system and replaced with undiluted anti-freeze.

Once the additional concentrated anti-freeze has mixed with the existing coolant the percentage concentration will be 50%.

12. After adding undiluted anti-freeze, allow the engine to operate normally for a few days before carrying out further checks to determine the percentage of anti-freeze concentration. This will allow time for the anti-freeze to be thoroughly mixed with the existing coolant.

The anti-freeze concentration should be checked in both the expansion bottle and the radiator as approximately 0,28 litres (0.5 Imp pt, 0.6 US pt) is transferred to and from the expansion bottle each time the engine is warmed-up and then left to cool. **Failure to allow the new anti-freeze to circulate properly will result in a false reading.**

Note If a refractometer is not available and a hydrometer has to be used a scale reading of between 1,06 and 1,07 should be obtained, with the coolant at room temperature, for the mixture to be correct.

Coolant level – To check and top-up

Warning The cooling system becomes pressurized during engine running. Therefore, extreme care should be taken when removing the pressure cap from an engine that is warm or at normal running temperature.

Routine check
To check the coolant level outside a normal service schedule and when no cooling/heating system fault is reported or suspected, proceed as follows.

1. If the **engine is hot** ensure that the coolant level in the translucent expansion bottle is at the MAX mark. Top-up if necessary and replace the expansion bottle cap.
2. If the **engine is cold** ensure that the coolant level in the translucent expansion bottle is half-way between the MIN and MAX marks. Top-up if necessary and replace the expansion bottle cap.
3. If the coolant level in the expansion bottle is either below the MIN mark or there is no coolant in the expansion bottle, carry out the Full check procedure.

Full check
To check the coolant level during a service schedule and/or when a cooling/heating system fault is reported or suspected, proceed as follows.

1. Carry out the usual workshop safety precautions.
2. Check the coolant level in the translucent expansion bottle and if the level is low or the bottle is empty, allow the engine to cool. Then, remove the pressure cap from the expansion bottle.

To remove the cap, turn it slowly anti-clockwise until a check position is reached. Wait for any pressure in the system to be exhausted, then continue to turn the cap until it is released.

3. Fill the expansion bottle to the MAX level mark with the approved coolant mixture.
4. Disconnect the radiator to expansion bottle hose from the radiator and hold the hose above the level of the radiator top tank.
5. Remove the bleed plug from the top of the radiator, by unscrewing it anti-clockwise.

6. Using a small funnel or a suitable size hose, add the approved coolant mixture to the radiator through the bleed plug aperture until coolant flows from the radiator stub pipe.
7. Reconnect the hose to the stub pipe.
8. Fit the radiator bleed plug.
9. Start and run the engine. Then, turn the air conditioning system function control fully clockwise to the defrost position. This procedure opens the heater system water tap.
10. Run the engine for a minimum of 10 minutes with the pressure cap still removed. After 5 minutes, check that warm air is passing from the windscreen demister outlets.
11. Top-up the expansion bottle as necessary to ensure that the coolant in the bottle does not fall below the MIN level mark.
12. Switch off the ignition
13. Top-up the expansion bottle with the approved coolant mixture to approximately midway between the MAX and MIN level marks on the bottle.
14. Fit the pressure cap to the expansion bottle.

Cooling system – To drain

1. Carry out the usual workshop safety precautions.
2. Place a clean container beneath the radiator drain plug.
3. Remove the radiator drain plug.
4. Raise the bonnet and remove the expansion bottle pressure cap, allowing the coolant to drain into the container.
5. To complete the draining procedure, unscrew the crankcase drain plug(s).

Cars prior to 1989 model year, have one on either side of the crankcase.

1989 model year cars, have one on 'B' bank side only (see fig. L3-3).

Note To drain 'B' bank, it will be necessary to remove the engine dipstick tube assembly, to gain access to the drain plug. Then, it is important to plug the dipstick union to prevent water entering the engine oil sump.

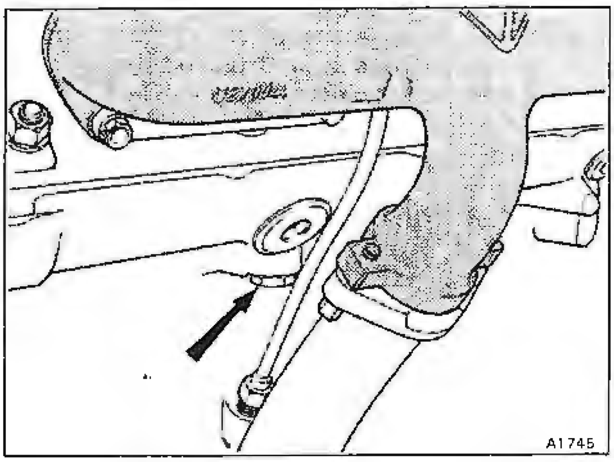


Fig. L3-3 Crankcase coolant drain plug

Cooling system – To fill

Warning The following procedure must be carried out exactly as described. Incorrect filling will create air locks within the engine and cause irreparable damage due to resultant overheating.

1. Carry out the usual workshop safety precautions.
2. Ensure that the crankcase drain plug(s) are fitted and tightened.
3. Ensure that the radiator drain plug is fitted.
4. Raise the bonnet and remove the expansion bottle pressure cap.
5. Fill the expansion bottle to the MAX level mark.
6. Disconnect the radiator to expansion bottle hose from the radiator, and hold the hose above the level of the radiator top tank.
7. Remove the bleed plug from the top of the radiator, by unscrewing it anti-clockwise.
8. Using a small funnel or a suitable size hose, fill the system using the correct coolant/anti-freeze and water mixture. Pour the mixture into the system slowly to avoid air locks.
9. When coolant flows from the radiator stub pipe, reconnect the hose.
10. Fit the radiator bleed plug.
11. Start and run the engine. Then, turn the air conditioning system function control fully clockwise to the defrost position. This procedure opens the heater system water tap.
12. Run the engine for a minimum of 10 minutes with the pressure cap still removed. After 5 minutes, check that warm air is passing from the demister outlets.
13. Top-up the expansion bottle as necessary to ensure that the coolant in the bottle does not fall below the MIN level mark.
14. Switch off the ignition.
15. Top-up the expansion bottle with the approved coolant mixture to approximately midway between the MAX and MIN level marks on the bottle.
16. Fit the pressure cap to the expansion bottle.

Cooling system – To flush

Under no circumstances should a strong alkaline compound or detergent be used to clean the cooling system. Such compounds have a detrimental chemical action on aluminium alloys.

1. Drain the coolant (see Cooling system – To drain).

Radiator

2. Remove the radiator top and bottom hoses.
3. Connect a waste pipe to the top connection on the radiator.
4. Apply mains water through the bottom connection to reverse flush the radiator until the water runs clear.
5. Examine the top and bottom radiator hoses and renew any that show signs of deterioration.
6. Turn off the water supply, disconnect the connections to the radiator and fit the top and bottom hoses.

Engine

7. Remove the top and bottom hoses connecting the radiator to the engine.

8. Unscrew and remove the crankcase drain plug(s).
Cars prior to 1989 model year, have one on either side of the crankcase.
1989 model year cars, have one on 'B' bank side only (see fig. L3-3).

Note To drain 'B' bank, it will be necessary to remove the engine dipstick tube assembly, to gain access to the drain plug. Then, it is important to plug the dipstick union to prevent water entering the engine oil sump.

9. Remove the thermostat (see Section L5) and again fit the outlet cover.
10. Produce a suitable adapter to fit into the cylinder block drain plug aperture and connect via a hose to the mains water supply.
11. Turn on the water and reverse flush the coolant passages until the water runs clear.
12. Repeat the operation to the drain plug aperture on the other side of the crankcase (if fitted).
13. Remove the flushing equipment.
14. Fit the drain plug(s), thermostat, and cover. Use a new thermostat cover gasket.
15. Examine all coolant hoses and renew any that show signs of deterioration.

Heater matrix

16. To flush the heater system, detach the matrix feed hose at the water tap and the return hose at the coolant pump connection.
17. Connect a waste pipe to the feed hose connection and a water main connection to the return connection.
18. Turn on the water and reverse flush the matrix until the water runs clear.
19. Turn off the water and remove the flushing equipment.
20. Examine all heater system hoses and renew any that show signs of deterioration.

Radiator assembly and expansion bottle

The radiator assembly and expansion bottle are mounted in the engine compartment, at the front of the car (see fig. L4-2).

Radiator assembly
This assembly is situated between the front of the engine and the radiator grille.

On cars other than Corniche/Continental, the bottom of the radiator is located in rubber mounts by two pegs and at the top by two clamping blocks.

On Corniche/Continental cars, the bottom of the radiator is located in rubber mounts by two pegs and at the top by two clips which attach to the top deflector panel.

Rubber hoses connect the inlet and outlet pipes of the radiator with their respective connections on the engine. Also, dependent on the model year of the car, either one or two rubber hoses connect to the expansion bottle. Worm drive clips are used to retain all the hoses.

Two transmission oil cooler pipes connect into the radiator bottom tank (see fig. L4-1).

Situated in the radiator are two plugs, a bleed/filler plug in the top tank and a drain plug in the bottom tank.

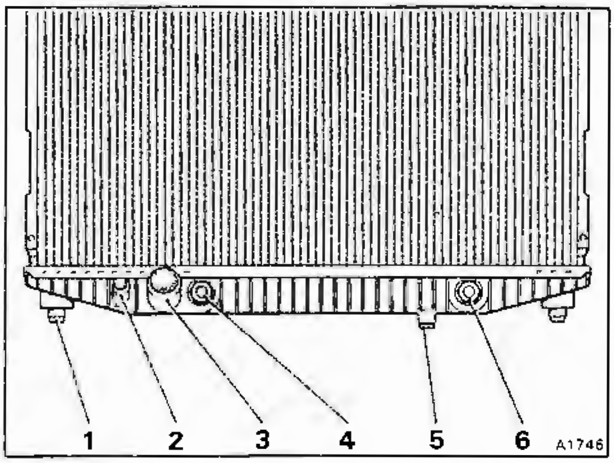


Fig. L4-1 Bottom of radiator assembly
1 Lower mount location peg (2)
2 Feed pipe connection from expansion bottle – Cars prior to 1989 model year
3 Bottom hose outlet to engine
4 Oil connection to transmission
5 Drain plug
6 Oil connection from transmission

Radiator assembly – To remove and fit
1. Carry out the usual workshop safety precautions.
2. Remove the bonnet if necessary (see Chapter S).
3. Drain the coolant (see Section L3).
4. Slacken the worm drive clips securing the top hose to the thermostat outlet elbow and to the radiator. Free the joints and withdraw the hose. Blank the open connections.
5. Slacken the worm drive clips securing the bottom hose to the coolant pump and to the radiator. Free the joints and withdraw the hose. Blank the open connections.
6. Slacken the worm drive clip(s) securing the hose(s) from the expansion bottle to the radiator. Free the joint(s) and withdraw the hose(s).
7. Remove the two setscrews and clips which attach the air bleed hose to the top left-hand side of the radiator.
8. Unscrew the two pipe union connections from the bottom of the radiator (see fig. L4-1). One pipe conveys oil from the transmission to the radiator where it is cooled in a separate matrix within the base of the radiator. The other pipe returns the cooled oil to the transmission. Allow any transmission fluid that drains out to run into a clean container. Blank the open connections.
9. Secure a sheet of foam rubber to the radiator matrix inside the fan cowl. This will afford protection to the matrix when the fan assembly is withdrawn.
10. Unscrew the fan coupling from the coolant pump spindle, noting that it has a left-hand thread (see fig. L4-3).
11. Withdraw the fan assembly.
12. On cars other than Corniche/Continental, remove the radiator clamping block setscrews. Collect the plates.

On Corniche/Continental cars, remove the setscrews securing the radiator top mounting clips. Collect the washers and clips.

Support the radiator assembly as the top mounts are removed.
13. Lift the radiator assembly from the bottom mounts.
14. Immediately the radiator is removed, secure blanks to the inlet and outlet connections and half fill the radiator with coolant.
15. Fit the assembly by reversing the procedure given for removal.

Note the special torque tightening figures (see Section L7), and the torque spanner RH 9747 necessary for securing the fan coupling.
16. Check and adjust the transmission oil level (see Chapter T).

Radiator assembly – To dismantle and assemble
1. Remove the setscrews securing the fan cowl to the radiator. Collect the washers and withdraw both the upper and lower halves of the cowl.

Note that on four door cars the top two setscrews on the left-hand side are longer, to accommodate the clips securing the top air bleed hose.

2. Upon assembly, inspect the foam rubber strips secured to the edges of the fan cowl; renew if necessary.

3. Fit the two halves of the fan cowl (see fig. L4-4), ensuring that on four door cars the clip on each half of the cowl engages in the bracket on the radiator.

4. Ensure that the two hose securing clips are fitted to the top two setscrews on the left-hand side (four door cars only).

5. Screw in the setscrews until the cowl faces abut the radiator, then tighten each setscrew between a half and a full turn.

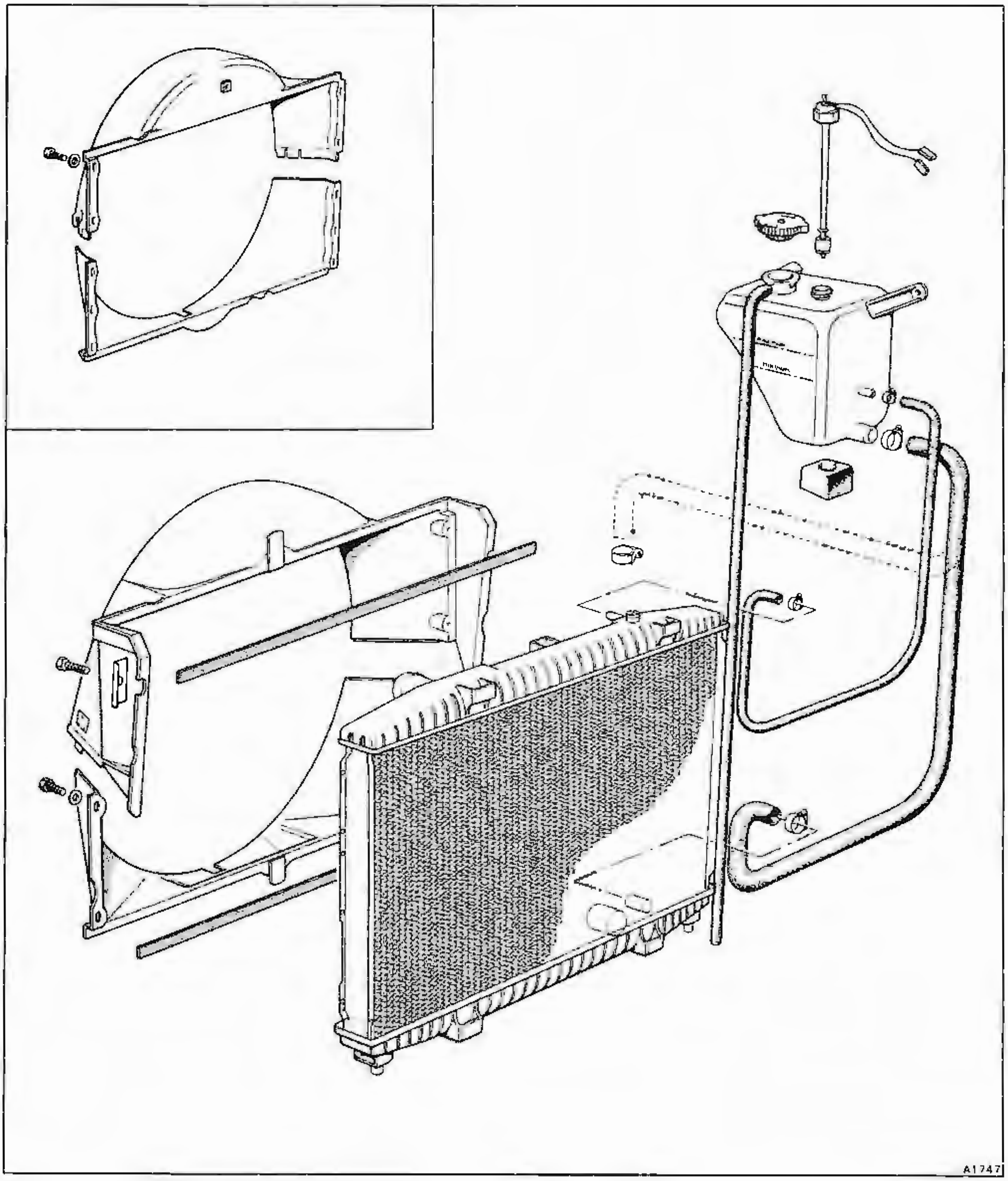


Fig. L4-2 Radiator and expansion bottle Inset – Fan cowl (Two door cars) Dotted line – 1989 model year cars

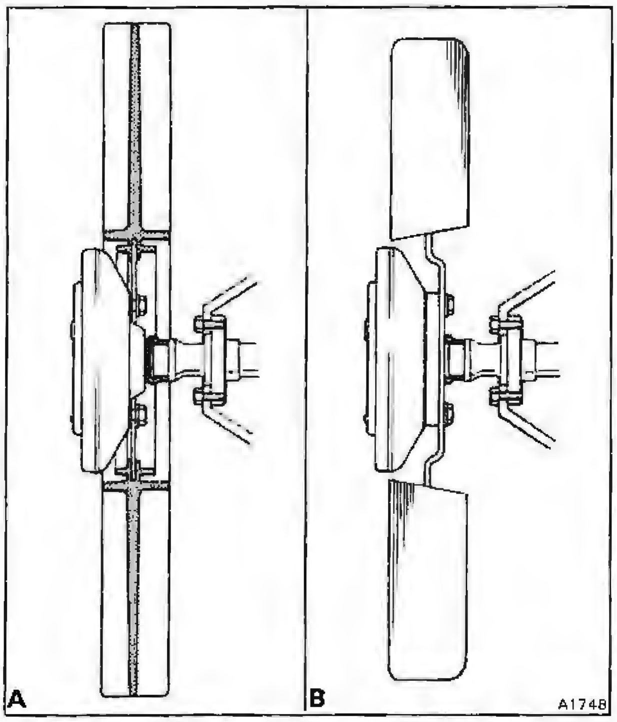


Fig. L4-3 Fan assembly retention
A Four door cars
B Two door cars

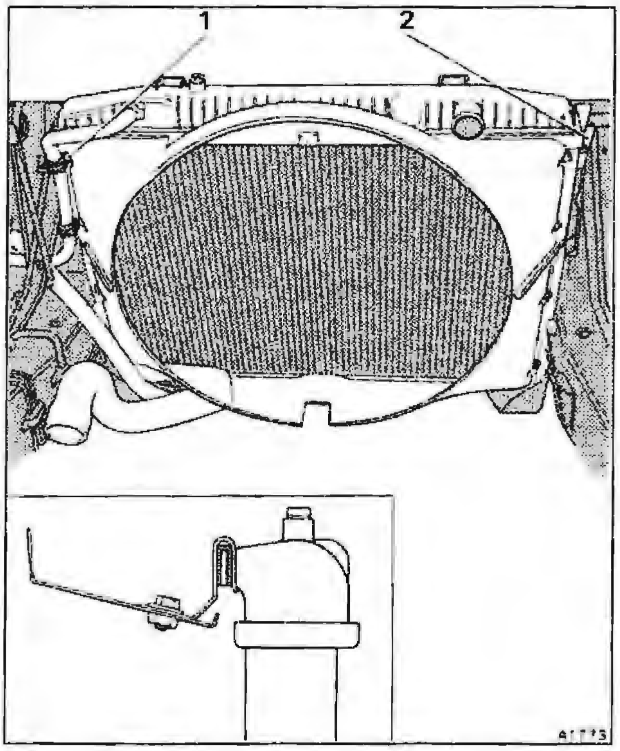


Fig. L4-4 Mounting points for radiator and fan cowl
1 Fan cowl retaining setscrews
2 Radiator top mount
Inset – Radiator top mounts (Two door cars)

Radiator – To reverse flush
Refer to Section L3 – Coolant.

Expansion bottle
The plastic expansion bottle is situated on the left-hand valance, forward of the wheel arch.

The bottle is fitted with a pressure cap that operates as both a pressure and vacuum relief valve. The valve controls the pressure in the system to 1,03 bar (15 lbf/in²). In addition, the vacuum relief valve opens up to 0,1 bar (1.45 lbf/in²) below atmospheric pressure.

The coolant level indicator float switch is positioned in the top of the bottle.

Cars prior to 1989 model year

The bottle has two connections to the radiator, a feed pipe to the bottom tank and an air bleed pipe to the top tank. Also, an overflow pipe connection to atmosphere.

1989 model year cars

The bottle has a feed pipe to the coolant pump elbow and an air bleed pipe to the top tank of the radiator. Also, an overflow pipe connection to atmosphere.

Expansion bottle – To remove and fit
1. Unscrew the worm drive clips securing the hoses to the expansion bottle. Free the joints and withdraw the hoses. Blank the open ends of the hoses to prevent coolant draining from the radiator. Drain the coolant from the bottle into a clean container.
2. Disconnect the electrical leads from the coolant level indicator switch.
3. Support the expansion bottle and remove the mounting setscrews. Collect the washers.
   Withdraw the expansion bottle.
4. Fit the expansion bottle by reversing the procedure for removal, noting the coolant topping-up procedure given in Section L3.

Cooling system booster fans
Twin booster fans are located between the radiator grille and the refrigeration condenser. They are switched from either engine coolant temperature, or from refrigerant pressure.

The booster fans are electrically operated assemblies. For additional information refer to Electrical Manuals, TSD 4701 (prior to 1989 model year) or TSD 4848 (1989 model year).

Thermostat housing assembly

The thermostat housing is situated at the forward end of the induction manifold (see fig. L5-1). It is connected to the induction manifold by transfer pipes.

All cars are fitted with the same thermostat housing. However, various thermostat outlet elbows can be fitted, dependent upon the specification of the vehicle.

A number of electrical switches are fitted into the thermostat housing dependent upon the specification of the vehicle. For service details of these switches refer to Electrical Manuals, TSD 4701 (prior to 1989 model year) or TSD 4848 (1989 model year).

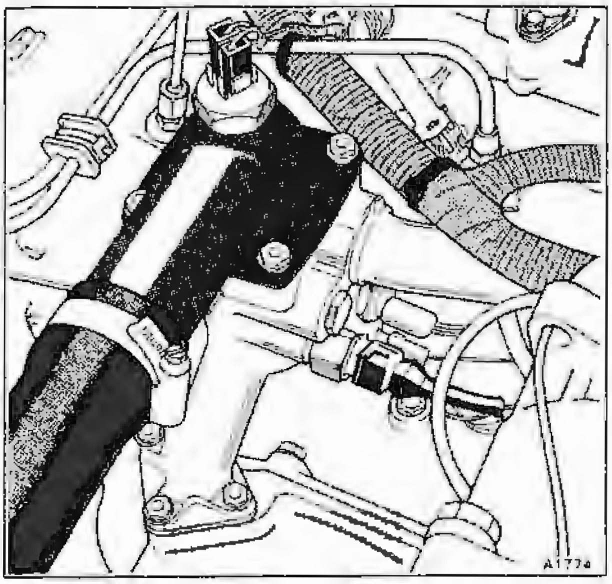


Fig. L5-1 Thermostat housing assembly

Thermostat

The engine cooling system incorporates a wax element thermostat (see fig. L5-2). When the engine is started from cold the thermostat is in the closed position. This reduces the engine warm-up time by recirculating the coolant leaving the engine back to the coolant pump, thus by-passing the radiator. As the coolant approaches its normal working temperature the thermostat opens and allows the engine coolant to flow through the radiator. When the thermostat is in the fully open position it closes the by-pass circuit.

On top of the thermostat is the bridge piece and into this is secured the fixed piston rod.

The valve assembly containing the wax capsule seat, is on the underside of the top flange. It is biased in this position by a spring and retained by a 'U' piece.

A second outer 'U' piece (by-pass valve) loaded by a light poundage spring, is fitted to the bottom of the thermostat to operate the by-pass circuit.

The top flange incorporates a vent hole containing a jiggle pin. This vent allows air to escape when the cooling system is being filled. When the system is operating the jiggle pin rises to close the vent.

Also situated around the top flange are fusible plugs. These plugs melt at approximately 124°C (255°F) and provide vent holes for the coolant, in the event of the thermostat not opening, to control the coolant temperature.

The thermostat operates when the coolant temperature approaches between 85°C and 89°C (185°F and 192°F). At this point the wax in the capsule changes its state and expands rapidly. The expansion compresses the rubber sleeve forcing it off the end of the tapered piston rod. As the sleeve is an integral part of the main valve assembly, this movement is transmitted to the valve moving it downwards off its seat. A small quantity of warm coolant is then allowed to pass between the valve and its seat to the radiator matrix, where it is cooled.

Further rises in engine coolant temperature cause a progressive opening of the main valve until a temperature of between 99°C and 102°C (210°F) and 215°F) is attained. At these temperatures the main valve is fully open [maximum travel 14,27 mm (0.562 in)].

When the main valve assembly has opened 10 mm (0.375 in), the by-pass valve on the base of the thermostat assembly will have moved under spring pressure sufficiently to close the coolant by-pass circuit and all coolant is then directed to the radiator matrix.

A decrease in engine temperature will cause the wax in the capsule to contract and, due to spring pressure, close the main valve and also open the by-pass circuit.

The thermostat main valve assembly, being sensitive to the temperature of the surrounding coolant, controls the flow of coolant to the radiator matrix to suit the requirements of the engine.

At the service intervals quoted in the Service Schedule Manual, TSD 4702, a new thermostat should be fitted.

Do not attempt to adjust the thermostat.

Thermostat – To remove

1. Carry out the usual workshop safety precautions.
2. Drain approximately half the radiator coolant into a clean container (see Section L3).
3. Disconnect the electrical connection from the thermostat outlet elbow.
4. Remove the setscrews securing the outlet elbow to the thermostat housing. Collect the washers.
5. Free the joint and lift off the thermostat cover.
6. Lift the thermostat out of the housing.

Thermostat – To fit

Fit the thermostat by reversing the procedure given for removal, noting the following.

1. Ensure that the joint faces are clean.
2. Always use a new gasket.
3. Fill the cooling system as described in Section L3.

Thermostat – To test

1. Remove the thermostat from the engine.
2. Suspend the thermostat and a thermometer in a container filled with engine coolant.
3. Ensure that neither the thermostat nor the thermometer are touching the container.
4. Slowly heat the coolant, stirring continuously to ensure a uniform temperature.
5. Note when the thermostat opens and compare the temperature with the information contained in the following table.

Thermostat starts to open between 80°C and 89°C (176°F and 192°F).
Thermostat fully open [maximum travel 14,27 mm (0.562 in)] between 99°C and 102°C (210°F and 215°F).

Do not attempt to adjust the thermostat setting. If its operation is suspect, fit a new unit.

6. Allow the test equipment to cool and remove the thermostat.
7. Examine the condition of the fusible plugs situated around the top of the thermostat body (see fig. L5-2). Ensure that they are intact and in good condition.

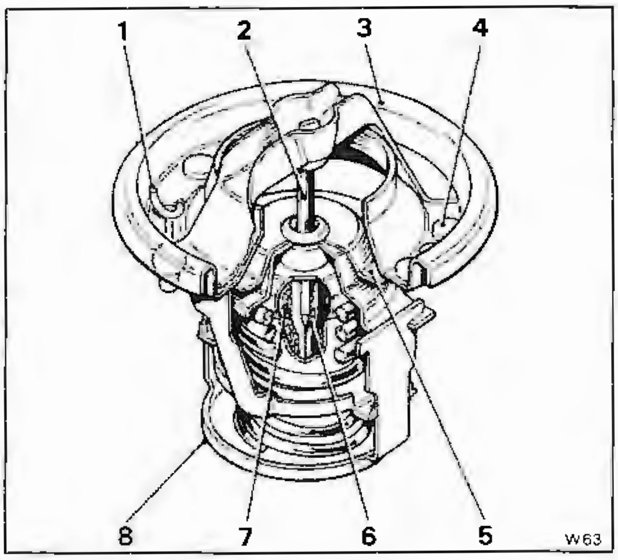


Fig. L5-2 Thermostat

1 Jiggle pin
2 Tapered piston rod
3 Top flange
4 Fusible plug
5 Main valve
6 Rubber sleeve
7 Wax filled element
8 By-pass valve

Thermostat housing – To remove and fit

1. Carry out the usual workshop safety precautions.
2. Drain the coolant (see Section L3).
3. Disconnect the electrical connections from the various switches in the thermostat housing and outlet elbow. Label each connection to facilitate assembly.
4. Slacken the worm drive clip securing the rubber outlet hose. Free the joint and withdraw the hose.
5. Remove the three setscrews retaining the thermostat by-pass pipe to the coolant pump.
6. Remove the setscrew and retaining plate securing 'B' bank water transfer pipe to the thermostat housing.
7. Unscrew the setscrews securing the water transfer pipes to the inlet manifold.
8. Free the joints and manoeuvre the thermostat housing away from the water transfer pipes. Slight resistance may be encountered when withdrawing the housing due to the rubber sealing rings situated on the transfer pipes.
9. Fit the thermostat housing by reversing the procedure given for removal, noting that new gaskets and sealing rings must be used.
10. Fill the cooling system as described in Section L3.

Coolant pump

The coolant pump is situated at the front of the engine and is belt driven from the crankshaft pulley.

The pump draws coolant from the bottom tank of the radiator assembly and pumps it via the coolant galleries in the crankcase to circulate directly onto the outside of the cylinders liners. The coolant then circulates through galleries in the top of the crankcase, via the cylinder heads and transfer pipes to the thermostat housing.

Dependent upon the temperature in the thermostat housing, the coolant either by-passes the radiator (because the thermostat is closed) and recirculates through the engine, or passes through the thermostat to be cooled in the radiator assembly.

The coolant pump is fitted to the engine as an individual component. When either overhaul or maintenance work becomes necessary it is not essential to remove the complete assembly, the pump body can remain fitted to the engine and all moving parts withdrawn as a sub-assembly (see fig. L6-1).

If the coolant pump requires overhaul it is recommended that a service replacement unit is fitted.

However, if this is not possible for any reason the existing assembly can be overhauled.

Impeller and bearing assembly – To remove
(see fig. L6-1)

1. Drive the car onto a ramp and carry out the usual workshop safety precautions.
2. Raise the ramp to a convenient working height.
3. Drain the coolant (see Section L3).
4. Secure a piece of foam rubber inside the fan cowl to protect the radiator matrix.

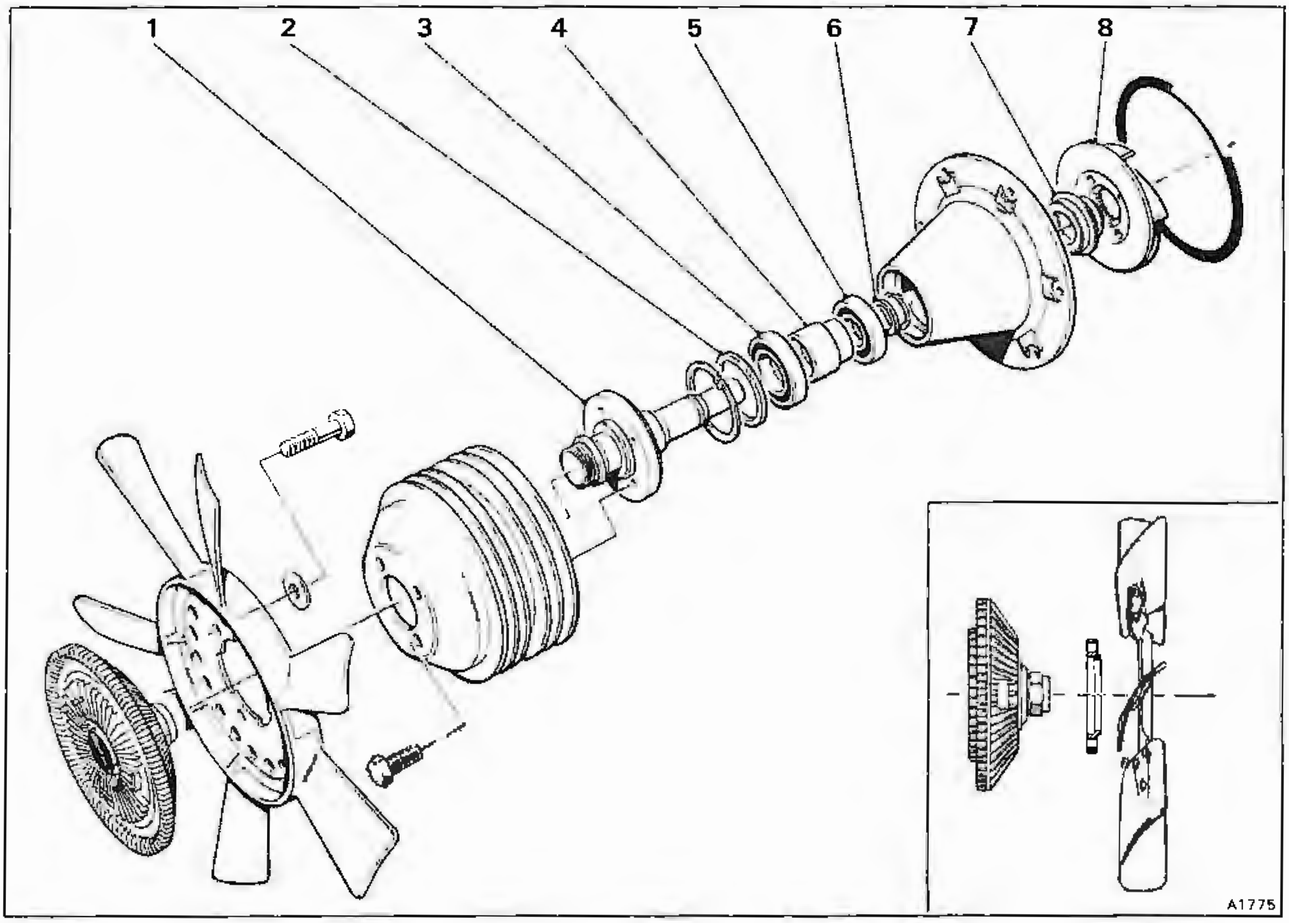


Fig. L6-1 Coolant pump
1 Spindle
2 Abutment washer (outer)
3 Front bearing
4 Distance piece
5 Rear bearing
6 Abutment washer (inner)
7 Pump seal
8 Impeller

Inset – Corniche/Continental cars only

5. Unscrew the fan coupling from the spindle, noting that it has a left-hand thread.
6. Withdraw the fan assembly and lift it upwards past the refrigeration pump.

Note With the exception of Corniche/Continental cars, a plastic type engine cooling fan is fitted.
Corniche/Continental cars have an aluminium type engine cooling fan and a spacing washer fitted between the fan and coupling.

7. Slacken, but do not remove the setscrews securing the coolant pump pulley.
8. Release the tension of the drive belts. Remove the belts.
9. Carefully ease the coolant pump pulley forward to reveal the bearing housing setscrews.
10. Remove the setscrews that secure the bearing housing to the coolant pump casing.
11. Withdraw the bearing housing containing all the moving parts.

At this stage of the removal procedure it is possible to remove the pulley assembly from the spindle spigot.

12. Remove and discard the rubber 'O' ring from the pump casing.
13. If the casing is to be removed, refer to Coolant pump casing – To remove.

Coolant pump casing – To remove

1. Refer to Impeller and bearing assembly – To remove, and carry out Operations 1 to 8 inclusive.
2. Slacken the worm drive clips securing both ends of the radiator bottom hose. Free the joints and withdraw the hose.
3. Unscrew the worm drive clip(s) securing the hose(s) to the coolant pump elbow. Withdraw the hose(s).
4. If the car is fitted with an air injection pump it should be removed as described in TSD 4737, Engine Management Systems.
5. Remove the alternator and mounting bracket.
6. Remove the refrigeration compressor and mounting bracket (see Chapter C).
7. On turbocharged engines, it will be necessary to remove the turbocharger exhaust outlet pipe and heatshield.
8. Unscrew the setscrews retaining the thermostat housing to the coolant pump.
9. Remove the setscrews that secure the pump casing to the crankcase. Collect the washers.
10. Remove the two remaining setscrews situated at the top of the pump casing which are fitted from the crankcase side.
11. Withdraw the coolant pump casing and the sealing strip fitted to the lower edge.
12. Using a sharp knife, cut the paper gasket across the top edge of the crankshaft front cover and discard this portion of the gasket.

Coolant pump – To dismantle

1. Remove the impeller and bearing assembly from the coolant pump casing (refer to Impeller and bearing assembly – To remove).
2. Withdraw the impeller from the pump shaft using the special extractor RH 7098.
3. Remove the rear circlip from the spindle and tap out the spindle from the housing using a mallet and aluminium drift. Turn the housing over and remove the circlip retaining the front bearing. Then, tap out both the front and rear bearings, together with the distance piece, and abutment washers. Discard the pump seal.

Coolant pump – To inspect

1. Examine the spindle for wear and damage.
2. Examine the bearings for free movement and the inner bores for wear and damage.

Normally if the coolant pump is faulty a service exchange unit should be fitted. If this is not available, proceed as follows.

Coolant pump – To assemble (see fig. L6-1)
It is essential to keep all parts clean during the assembly procedure.

1. Before commencing to assemble the coolant pump, ensure that any damage marks on the joint faces of the bearing housing and pump casing are rectified using a fine carborundum stone.
2. Insert the rear bearing into the housing and tap down using a mallet and suitable aluminium drift until the bearing is approximately flush with the front inner face of the housing.
3. Fit the front bearing onto the spindle together with the distance piece and insert the assembly into the bearing housing. Tap the spindle gently with a mallet until the bearing starts squarely into its bore. Then, remove the spindle and using a mallet and aluminium drift, drive the bearing into the housing until it locates against the shoulder. This operation will also drive the rear bearing the correct distance into the housing.
4. Fit the outer abutment washer into the housing.
5. Fit the front bearing retaining circlip, ensuring that the chamfered side is fitted away from the bearing.
6. Fit the spindle into the housing and invert the housing onto the spindle front face.
7. Fit the inner abutment washer onto the spindle.
8. Fit the rear circlip securing the spindle into the housing.
9. Wipe clean the end of the spindle and the counterbore in the housing with a clean cloth. Lubricate the end of the spindle with clean engine oil. Then, tap the pressure balance seal onto the spindle and into the counterbore.
10. Again lubricate the end of the spindle with clean engine oil and press on the impeller, noting that a minimum load of 363 kgf (800 lbf) should be required. This ensures that the correct interference fit exists between the mating faces.
11. Using feeler gauges, ensure that the gap between the face of the bearing housing and the impeller is between 1,143 mm and 1,219 mm (0.045 in and 0.048 in).

12. Spin the assembly to ensure that the shaft rotates freely.

Coolant pump – To fit

Fit the coolant pump to the engine by reversing the removal procedure, noting the following.

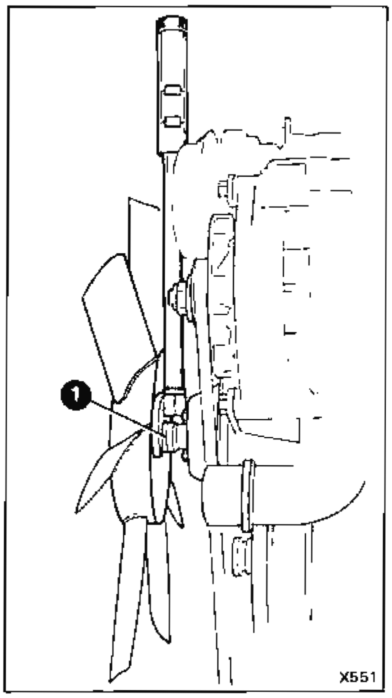
1. If the casing has been removed from the crankcase, ensure that the joint faces are free from burrs. Any burrs should be removed using a fine carborundum stone.
2. Obtain a new gasket and modify it to suit the crankcase to coolant pump joint faces.
3. Tighten all bolts to the standard torque figures given in Chapter P.
4. Tighten the drive belts as detailed in Chapter E.
5. Fill the system with coolant as described in Section L3.
6. Upon completion of the assembly procedure start the engine and immediately check for coolant system leaks. If satisfactory, run the engine until normal operating temperature is attained and again, check the coolant system for leaks.

Special torque tightening figures

Introduction
This section contains the special torque tightening figures applicable to Chapter L.
For standard torque tightening figures refer to Chapter P.

Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

Section L4



Ref.	Component	Nm	kgf m	lbf ft
1	Fan coupling retention (L.H. thread)	48-54	5–5,5	35–40

Workshop tools

RH 7098	Extractor – Coolant pump impeller
RH 9747	Torque spanner – Fan coupling
RH 9982	Duo-Chek – Anti-freeze/Battery tester

Electrical system

1987/88 model year cars – refer to TSD 4701 Electrical Manual

1989 model year cars – refer to TSD 4848 Electrical Manual

Steering system

Contents

Sections

	Rolls-Royce Silver Spirit	Rolls-Royce Silver Spur	Rolls-Royce Corniche / Corniche II	Bentley Eight	Bentley Mulsanne / Mulsanne S	Bentley Turbo R	Bentley Continental
Contents and issue record sheet	N1	N1	N1	N1	N1	N1	N1
Rack and pinion unit	N2	N2	N2	N2	N2	N2	N2
Steering pump	N3	N3	N3	N3	N3	N3	N3
Steering wheel and gear range selector unit	N4	N4	N4	N4	N4	N4	N4
Steering column	N5	N5	N5	N5	N5	N5	N5
Steering linkage	N6	N6	N6	N6	N6	N6	N6
Fault diagnosis	N7	N7	N7	N7	N7	N7	N7
Special torque tightening figures	N8	N8	N8	N8	N8	N8	N8
Steering racks. Retrospective fitting of the type fitted to 1989 model year cars onto pre 1989 model year cars	N9	N9	N9	N9	N9	N9	N9
Workshop tools	N10	N10	N10	N10	N10	N10	N10

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10
1	4/89	8/88	6/87	6/87	8/88	6/87	6/87	8/88	4/89	4/89
2		2/88	6/87	6/87	8/88	8/88	6/87	8/88		
3	4/89	6/87	6/87	6/87	8/88			8/88		
4		2/88	6/87	6/87	8/88					
5		2/88	6/87							
6		2/88								
7		6/87								
8		6/87								
9		8/88								
10		8/88								
11		8/88								
12		8/88								
13		8/88								
14		8/88								
15		8/88								
16		8/88								
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Rack and pinion unit

1987 and 1988 model years

Introduction
The steering unit is a rack and pinion power assisted mechanism with centre connection to 'one-piece' track rods. Toe-in can be set by the movement of an intermediate adjuster linking the track rod inner and outer components. An anti-joggle valve is fitted into the hydraulic pressure line (located in the spool valve housing), to minimise any feedback to the steering wheel caused by road irregularities. The steering rack is fitted with internal lock stops.

Important Damage can be caused to the steering column and rack boots if the steering is operated without the engine running, i.e. distortion to the column, broken column mounts, and cut rack boots.

To overhaul the rack and pinion assembly, the following kits of parts are available.

Spool valve renewal kit
Rack overhaul kit
Bellows replacement kit.

Power assistance
Pressure is applied to the steering system rack in varying degrees. This provides assistance to the steering wheel, dependent on the effort required to move the road wheels.

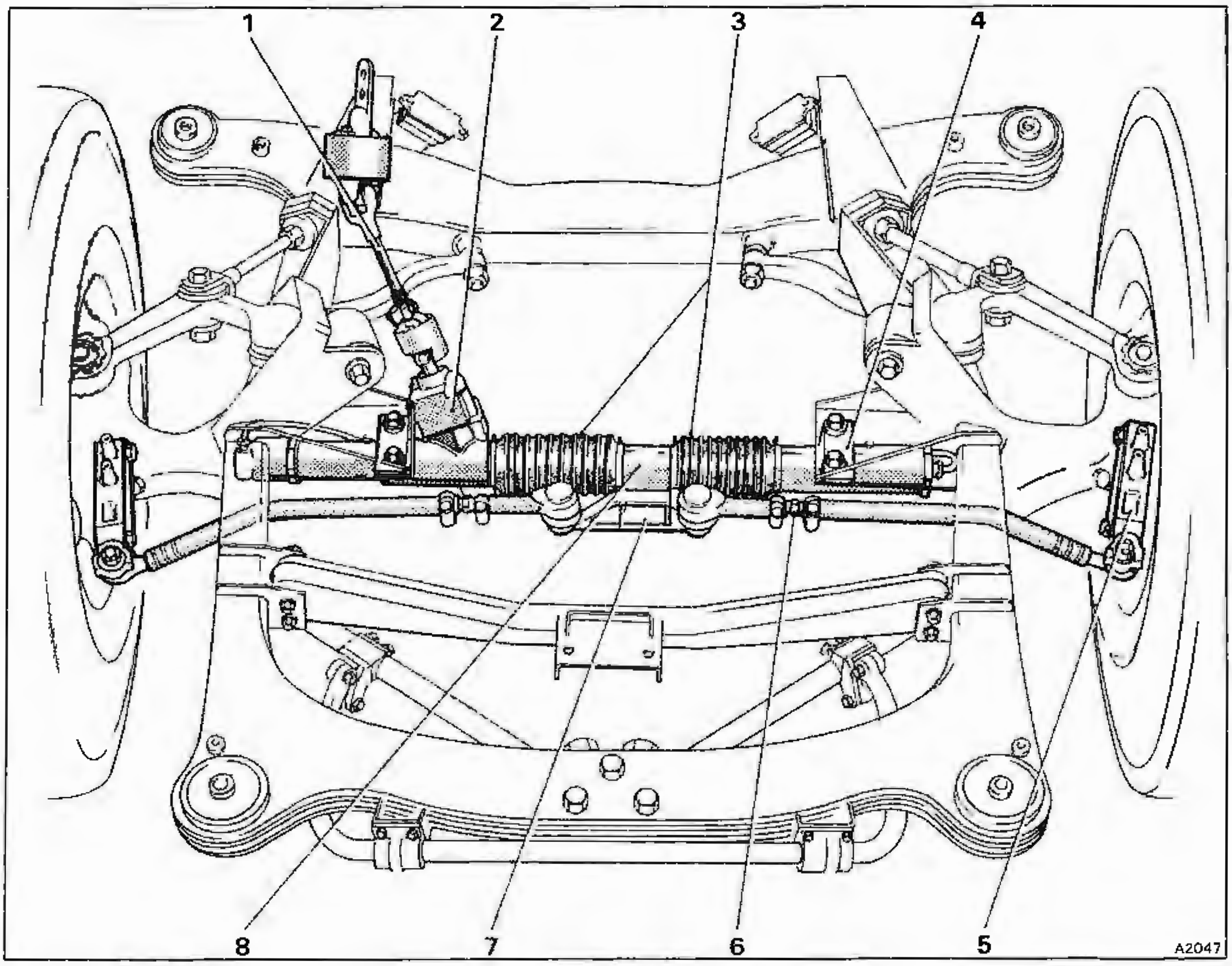


Fig. N2-1 Steering unit mounted in sub-frame
1 Intermediate link
2 Spool valve and pinion
3 Convoluted seals
4 Steering to sub-frame attachment
5 Side steering lever
6 Track rod adjuster
7 Inner ball joint bracket
8 Centre tube and seal

The amount of assistance is controlled by the passage or restriction of oil through a series of ports in the upper half of the pinion box. This creates a pressure differential across the rack, proportional to the load applied at the steering wheel.

The system operates by causing a small torsion bar to twist, immediately the steering wheel is moved, rotating the concentric valve components to provide the pressure differential required. A 'fail safe' device prevents the torsion bar from being overstressed by limiting the number of degrees through which it can twist.

Important The steering unit must be handled with exceptional care. Avoid impact loads on the input shaft and centre off-take, and damage to the convoluted seals which could cause premature failure of the unit.

Do not disturb the end plug or locking nut whilst the rack and pinion unit is fitted to the car.

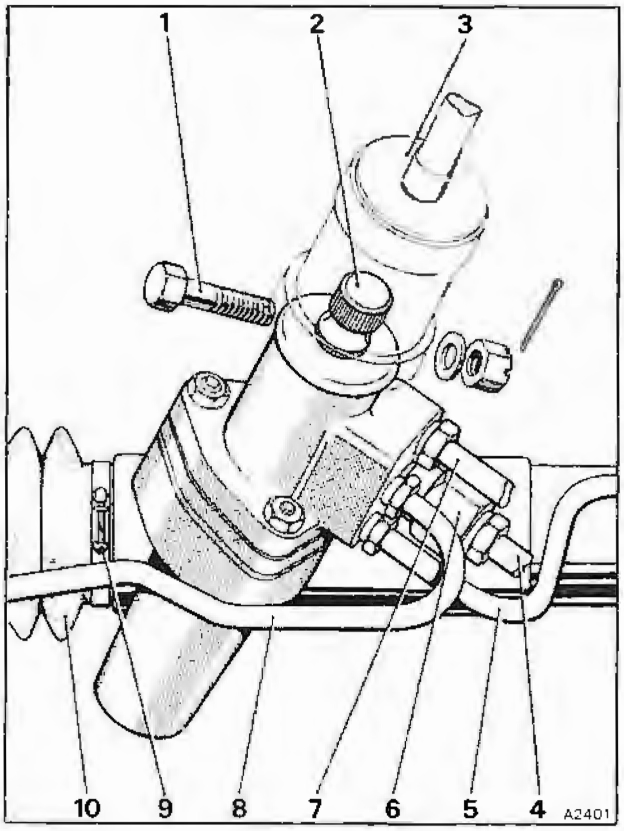


Fig. N2-2 Spool valve and pinion housing
1 Bolt – lower link to spline
2 Valve and pinion shaft
3 Heatshield
4 Hydraulic feed pipework
5 Fluid feed to end of rack
6 Anti-joggle valve adapter
7 Hydraulic return pipework
8 Fluid feed to end of rack
9 Seal attachment clip
10 Convoluted neoprene seal

The majority of the threads on the rack assembly are metric, except for the mounting bolts to the sub-frame and the lower steering column linkage. Therefore, always ensure the correct nuts and bolts are fitted.

Rack and pinion unit – To remove

1. Place the car on a ramp and remove fuse A6 from fuse panel F2 on the main fuseboard.
   Disconnect the battery.
2. Chock the road wheels and raise the ramp to a convenient working height.
3. Fit a clamp to the feed hose from the remote reservoir.
4. Position drip trays beneath the spool valve. Then, remove the pipe unions from the valve.
   Fit blanks to prevent the ingress of foreign matter.
5. Remove the split pin, castellated nut, and bolt securing the lower linkage to the pinion shaft splines (see fig. N2-2).
6. Straighten the tab-washer. Then, remove the setscrews holding the inner ball joint bracket to the steering rack centre position. Care must be taken not to disturb the steering rack centre block oil seal.
7. Support the rack and pinion unit, then remove the setscrews attaching the unit to the sub-frame brackets.
8. Lower the unit from beneath the suspension, carefully withdrawing the pinion shaft from the lower column linkage.

Warning Never strike the rack and pinion unit with a hammer.

9. Examine the convoluted seals for damage, etc., and the centre block oil seal for leaks.

Replacement of convoluted seals (see fig. N2-4)

If when a convoluted seal is removed due to splits and/or leakage, and there is evidence of the ingress of water and/or road dirt, a complete stripdown, clean, and inspection should be made of the unit.

1. Position drip trays under the ends and centre sections of the unit.
2. Carefully remove the hydraulic pipe union situated at the end of the unit, opposite the pinion box housing.
3. Grip the bracket, at the same end, in a vice. Unscrew and remove the blanking plug from the end of the rack tube and withdraw the outer tube from the bracket. Collect the dismantled parts and cover with a clean cloth. Discard the 'O' rings.
   If it is only necessary to replace the convoluted seal at the dismantled end of the unit, there will be no need to disturb the centre block and oil seal. However, if both convoluted seals are to be removed, the central block and seal must be removed as described in the following operations.
4. Unscrew the capscrew holding the central block in position against the rack gear, withdraw the block and oil seal. Protect the components by covering with a clean cloth.
5. Slacken the sealing clips screws that secure the convoluted seals in position.

Remove the ring clips, seals, and central spacer tube. The spacer tube must be covered to prevent the ingress of dirt.

6. Turn the unit over with the slot facing downwards. This will enable the lubricating oil to drain from the unit into a suitable tray.

7. Fit new convoluted seals, clipping these to the pinion box, outer tube, and the central spacer tube.

To enable service inspection checks on the tightness of the clips when the unit is fitted to the vehicle, ensure that the screw heads of all the retaining clips face downwards and towards the rear of the rack.

Lift the unit higher at the dismantled end and pour 0,057 litre (0.1 Imp pt; 0.12 US pt) of new approved lubricating oil (see Chapter D) through the slot in the central spacer tube.

8. Fit the centre block using the flexible bonding agent Silastic 732 RTV sealant on the mating surfaces of the seal, to ensure a leak free joint.

9. Fit a new 'O' ring and position the support bracket onto the outer tube. Apply Loctite 542 to the threads of the blanking plug, and fit a new 'O' ring. Carefully screw the blanking plug into position.

Note To ensure control of the parallelism of the two mounting bracket faces, place the assembled unit with the bracket face downwards onto a surface table or a similar flat fixture plate.

10. Lightly clamp the two mounting brackets of the unit onto the flat surface.

11. Torque tighten the blanking plug to the figures quoted in Section N8.

12. Screw the hydraulic pipe union into the blanking plug. Torque tighten to the figures quoted in Section N8.

Rack and pinion unit – To dismantle
(see figs. N2-8 and N2-9)

If the unit has an internal fault which necessitates the removal of the rack, dismantling to the stage of withdrawing the centre block should be completed before carrying out the following operations. Removal of the centre block is described under the heading Replacement of convoluted seals, Operations 1 to 6 inclusive.

1. After draining the lubricating oil, place the unit onto two 'Vee' shaped wooden blocks.

2. Remove the remaining feed pipe. Blank off the hole in the pinion box and cover.

3. Mark the relationship between the input shaft spline and pinion box housing with the steering in the straight ahead position. Use the screwed plug to ensure a correct setting.

4. Unscrew the nuts, and release the pinion and valve housing assembly by gripping the pinion spline with one hand, and keeping the two halves of the valve housing together with the other hand. With a turning movement lift the assembly **using the splined shaft**, clear of the pinion position (see fig. N2-5).

5. Release the lock-nut. Unscrew the remaining end cap. Discard the internal 'O' ring.

6. Using an appropriate sized wooden dowel,

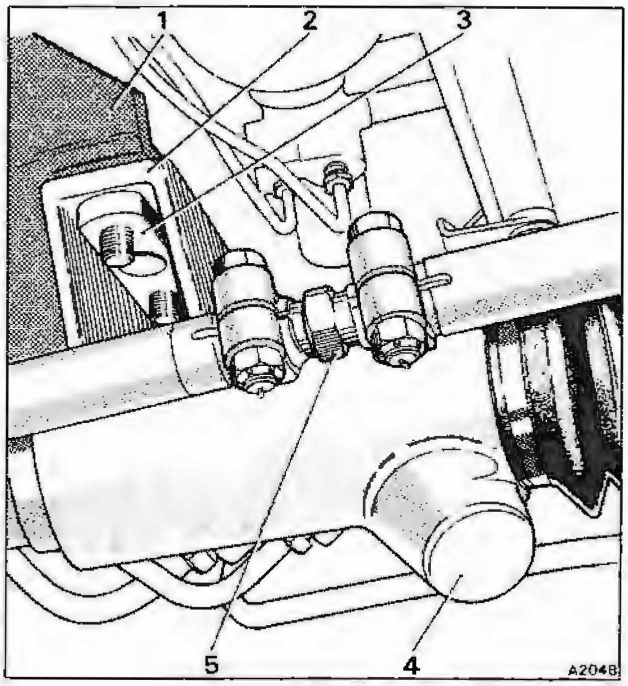


Fig. N2-3 Steering to sub-frame mounting
1 Sub-frame bracket
2 Steering unit mounting foot
3 Tapping block
4 Pinion housing
5 Track rod adjuster

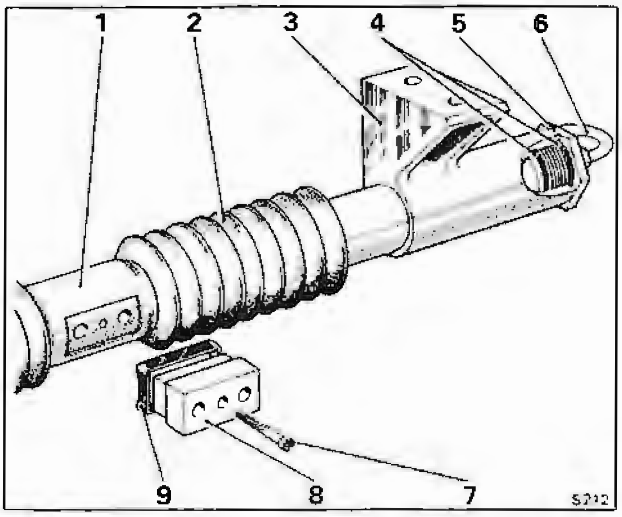


Fig. N2-4 Removal of convoluted seals
1 Centre tube
2 Seal
3 Mounting foot
4 'O' rings
5 Blanking plug
6 Fluid feed pipework
7 Cap head socket screw
8 Centre block
9 Shaped seal

carefully press the end of the rack until the P T F E ring and oil seal appear at the pinion box end of the unit.
7. Support the end of the rack whilst continuing to withdraw it from the tube. Ensure that the rack and tube do not make contact. It is easy to damage the internal surface of the tube and therefore care must be taken during this operation. Also, ensure that the P T F E bearing is not damaged during removal past the centre slot and pinion opening.
8. Inspect all components including the internal faces of the end caps, oil seals, and P T F E bearing carrier.

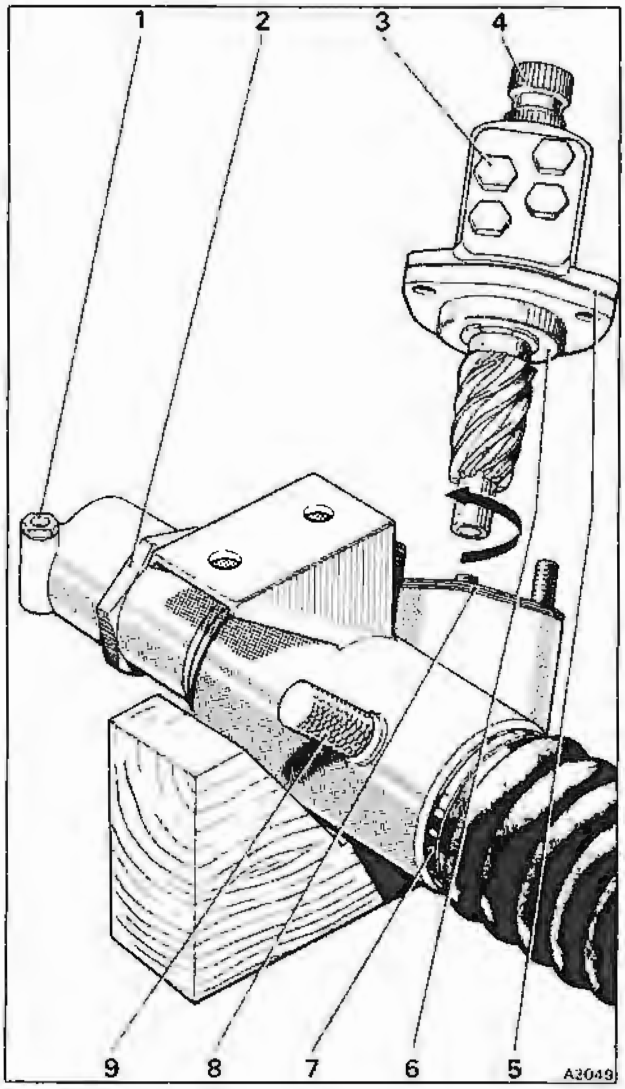


Fig. N2-5 Pinion and spool valve removal
1 Plastic dust cap
2 End cap lock-nut
3 Plastic dust caps
4 Pinion boss splines
5 Bearing pre-load shim
6 Bearing carrier
7 Seal clip
8 Pinion pre-load shims
9 Rack centring plug

Wash all metal parts in Genklene or an equivalent cleaning fluid.

Pinion and spool valve housing assembly
The pinion and spool valve housing assembly comprises the following main service items. An upper oil seal, P T F E sealing rings, lower oil seal, lower oil seal carrier, 'O' rings, paper joint washers, pre-load shims, and circlips.

Upper oil seal – To replace
1. Carefully lift the housing off the spool valve unit, ensuring that the P T F E rings are not damaged.
Ensure that the pre-load shim situated between the ball race carrier and pinion housing is not damaged.
2. Carefully remove the upper oil seal and 'O' ring from the housing and discard.
3. Fit a new upper 'O' ring and oil seal ensuring that the sealing lip is pointing downwards (see fig. N2-6).
Note This type of seal should be fitted dry. Do not use any lubricant.
4. Fit the spline cover tool RH 9120 over the splines and then lower the housing down onto the spool valve. Ensure that each P T F E ring enters the bore squarely with no pinching of the edges against the bore.

P T F E sealing rings – To replace
1. Carefully lift the housing off the spool valve unit.
2. Cut into the P T F E sealing rings with a sharp instrument having a smaller dimension than the width of the groove. Take care not to damage the finely machined surfaces of the spool valve. Use 'Vee' shaped wooden blocks to support the end diameters during removal of the rings.
3. Inspect the ring grooves of the valve pinion.
4. Immerse the new P T F E rings in warm oil prior to fitting onto the applicator RH 9117. Failure to warm the rings before fitting could cause cracking.
5. Place the tool over the input shaft spline and adjust until the bottom edge of the tool corresponds with the upper edge of the lowest 'O' ring groove.
6. Slide a P T F E sealing ring into the groove.
7. Adjust the tool to fit the remainder of the rings into their respective grooves.
8. Remove the sleeve tool then size the rings by carefully pressing the tool RH 9118 over the rings to reduce their diameter.
9. Fit the spline cover tool RH 9120 over the spool valve splines to protect the upper and lower seals whilst assembling the pinion and spool valve housing.
10. Fit the upper ball race carrier, spacers, and ball bearings. Locate these components by fitting a new circlip.
11. Carefully assemble the pinion and spool valve housing.

Lower oil seal – To replace
1. Carefully remove the housing off the spool valve unit. Avoid damage to the P T F E sealing rings.

2. Remove the carrier and lower seal from the housing.
3. Press out the lower oil seal from the carrier.
4. Inspect the carrier for damage.
5. Press a new oil seal into the carrier. Ensure that the lip face of the seal is uppermost. Fit the carrier into the housing.
6. Fit the spline cover tool RH 9120 over the spool valve splines to protect the upper and lower seals whilst assembling the pinion and spool valve housing.
7. Fit the upper ball race carrier, spacers, and ball bearings. Locate these components by fitting a new circlip.
8. Carefully assemble the pinion and spool valve housing.

Thrust ball race

If the spool valve and pinion unit is dismantled to the stage of inspecting the thrust ball race and it is found necessary to replace any thrust race components, the pre-load torque must be reset.

The following table gives a conversion of the spring balance readings quoted in the text, to a figure for use with Nm (lbf in and kgf m) torque spanner.

To protect the components wrap clear adhesive tape over the spline and spool valve rings.

Spring balance and arm		Torque spanner		
kgf	lbf	Nm	kgf m	lbf in
0,0544	0.120	0,054	0,0055	0.480
0,272	0.600	0,316	0,0320	2.400
0,510	1.125	0,508	0,0520	4.500
0,820	1.800	0,813	0,0830	7.200
0,910	2.000	0,904	0,0922	8.000
1,130	2.500	1,131	0,1153	10.010
1,950	4.300	1,943	0,1981	17.200
2,040	4.500	2,034	0,2074	18.000

1. Fit the ball race with any new components required and lubricate the assembly with a light application of new approved EP 90 grade oil. Ensure that the oil does not contaminate the area bounded by the two oil seals.
2. Replace the lower oil seal carrier as described in Lower oil seal – To replace.
3. If a new lower oil seal has been fitted, first place a new paper gasket onto the face of the lower oil seal carrier. Then place the original stack of shims plus one additional shim of at least 0,254 mm (0.010 in) thickness onto the carrier.

This additional shim will effectively remove any bearing pre-load when assembly is completed.

Shims are available in the following sizes.
0,063 mm (0.0025 in)
0,127 mm (0.005 in)
0,254 mm (0.010 in)
1,270 mm (0.050 in).

4. Remove the adhesive tape from the spool valve shaft only and wipe the spool valve assembly with a clean lint free cloth. Lightly lubricate the assembly with power steering fluid.

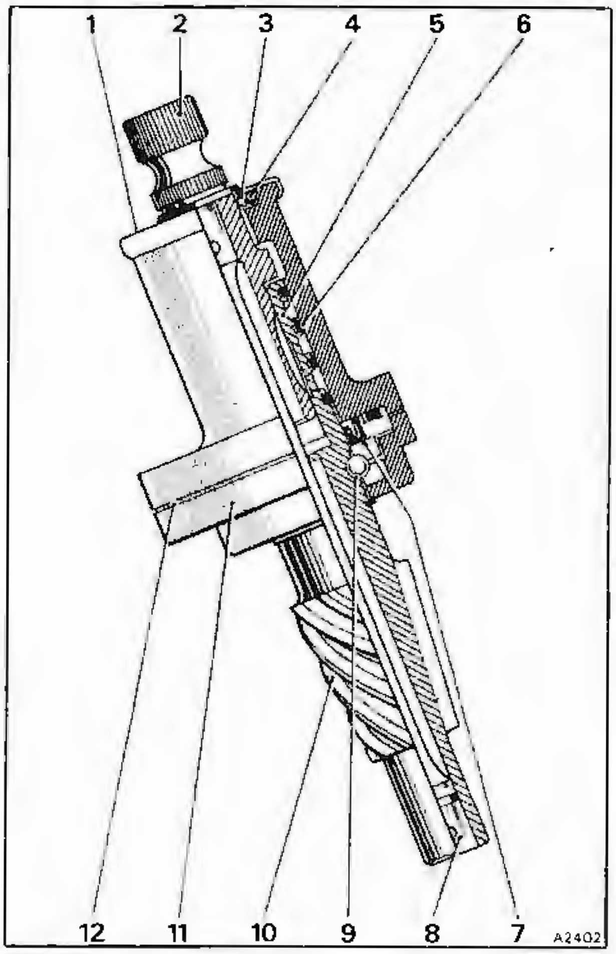


Fig. N2-6 Pinion and spool valve unit
1 Spool valve housing
2 Spline
3 Lip-type oil seal
4 'O' ring
5 Spool valve
6 P T F E rings (4)
7 Lower oil seal
8 Torque arm
9 Thrust ball race
10 Pinion
11 Ball race carrier
12 Pre-load shim(s)

Do not fit the lower oil seal carrier 'O' ring at this stage.

5. Carefully fit the spool valve housing onto the spool valve shaft. Ensure that each P T F E sealing ring enters the bore of the housing squarely with no pinching of the ring edges. **Do not use force to assemble.**
6. Lightly assemble the housing and carrier together, using three nuts and bolts. Then rotate the input shaft a number of turns to reduce initial drag.
7. Grip the sub-assembly in a soft jawed vice and fit the torque arm tool RH 9123 to the input shaft spline.
8. To measure the pinion seal drag and spool valve

friction use a spring balance. Note the reading required to rotate the input shaft. This should be between 0,016 kgf and 0,08 kgf (0.120 lbf and 0.60 lbf).

If the reading is above 0,08 kgf (0.60 lbf), bearing pre-load may still exist and it will be necessary to fit an additional shim.

If after fitting additional shims to the extent that no bearing pre-load exists, i.e. end-float appearing in the spool valve, then some other source of tightness such as incorrectly sized P T F E rings could be the cause.

9. Assemble and test the unit again as described in Operations 5 to 8 inclusive, until a figure within the limits quoted in Operation 8 have been achieved.

10. Dismantle the spool valve housing. Then, reduce the shims by one 0,063 mm (0.0025 in) shim.

Check that a spring balance reading of 0,510 kgf (1.125 lbf) is required to rotate the shaft. If this reading is not obtained reduce the shims (one at a time) until the correct reading is achieved.

Important Ensure that this procedure is carried out correctly otherwise excessive pre-load can damage the bearing parts.

11. Remove the spool valve housing to fit an 'O' ring into the lower oil seal carrier.

Ensure that paper gaskets are in good condition and fitted at the top and bottom of the shim stack.

12. Lubricate the spool valve and pinion seals with steering fluid and the upper oil seal with a light coating of molybdenum disulphide grease.

13. Carefully assemble the spool valve housing.

14. Ensure new paper gaskets are fitted to the underside of the ball race carrier and to the steering rack pinion housing face.

15. Fit the original number of shims and carefully fit the complete spool valve assembly into the pinion housing.

16. Ensure that the hydraulic pipe connections of the spool valve housing are in the correct relative position.

17. The correlation mark on the input shaft should align with the mark on the spool valve housing when the assembly is fully engaged with the rack in the central position.

18. Torque tighten the retaining nuts to the figures quoted in Section N8.

19. Replace any rack lubricating oil (EP 90 grade), that may have been lost during dismantling, up to the total amount of 0,057 litre (0.1 Imp pt; 0.12 US pt).

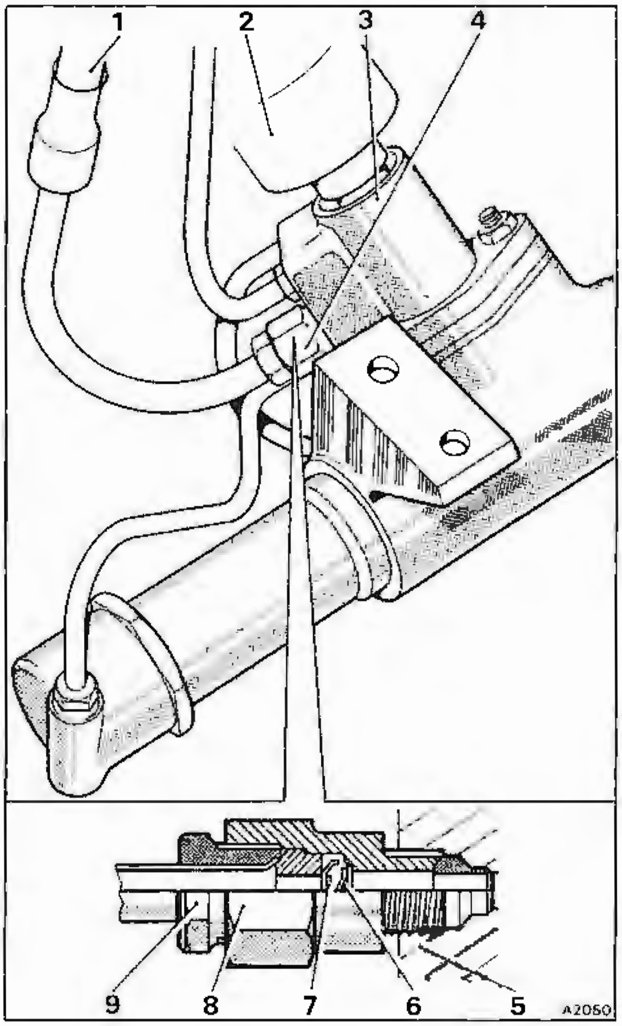


Fig. N2-7 Anti-joggle valve
1 High pressure fluid
2 Heatshield
3 Spool valve housing
4 Anti-joggle valve
5 Spool valve casting
6 Spring
7 Flap valve
8 Adapter
9 Pipe union

Anti-joggle valve (see fig. N2-7)

1. With the steering dismantled remove the anti-joggle valve.
2. Check that the spring and flap are functioning correctly by pressing a probe carefully onto the top of the flap. Ensure that adequate compression of the assembly occurs and the flap seats correctly.
3. Wash out the assembly in Genklene or an equivalent cleaning solution. Dry using a controlled jet of dry pressurized air into the male threaded end of the unit only.
4. Fit blanking plugs into each end of the adapter.

Pipe union

If the olive which forms the seating of the pipe union is found to be damaged it will be necessary to remove the spool valve housing before it can be renewed. It must be emphasized that cleanliness must be observed when carrying out this procedure.

Rack and pinion unit – To assemble

It is essential that the rack should only be removed or replaced from the pinion end of the unit. This ensures that the P T F E bearings or oil seals are not damaged by the internal thread of the blanking plug end of the assembly.

At this stage, check the bore of the rack tube for scoring or damage.

1. With the rack unit out of the tube, fit the scarf jointed P T F E rack bearings into the respective grooves in each end of the rack.
2. Gently press each scarf joint together. Ensure that each gap has an initial (nominal) measurement of 2,03 mm (0.080 in).

In the case where the two ends of the P T F E ring butt together or in the event of a smaller than nominal gap being observed, it will be necessary to remove the ring and cut one end of the scarf joint until the correct figure is obtained.

3. Using sizing tools (in the following order) RH 9114, RH 9113, and RH 9112, progressively reduce the diameter of the P T F E bearings until these are a sliding fit in the rack tube.

At this stage ensure that the gap at the scarf joint has not gone below a minimum of 0,25 mm (0.010 in). Also ensure that it is positioned so as not to come into contact with the edges of the centre slot when the rack is assembled.

Remove any burrs from the slot. Wipe the area clean before assembly.

4. From the pinion end, press the rack slowly into the tube until the P T F E bearing reaches the mid-position of the centre slot.

Ensure that the bearing is not damaged when moving along the slot.

5. With the P T F E bearing visible in the centre slot, lightly lubricate a rack oil seal. Fit the seal through the slot in the tube and using finger pressure, press the seal onto the end groove of the rack. Turn the rack slowly during this operation, to assist in assembly of the seal.
6. Lubricate the other rack oil seal and again using finger pressure fit this seal onto the pinion end groove.
7. Slide the rack unit slowly into the tube. Ensure that no nipping occurs when the oil seal passes into the closed portion of the tube. The pinion end seal must be manipulated into the tube by the fingers.
8. Lock the rack into the mid-position using centring plug RH 9119.
9. Manipulate a new 'O' ring and fit it into the end cap of the unit. Fit the lock-nut onto the tube. A degree of feel must be applied when screwing on the cap to ensure the 'O' ring fits correctly.
10. Allow the end cap to butt against the inner face. Then screw back the cap approximately one full turn to allow for hydraulic pipe alignment.
11. Torque tighten the lock-nut to the figures quoted in Section N8 using the open ended torque wrench adaptor tool RH 9125.
12. Fit new convoluted seals as described in Replacement of convoluted seals.
13. Lift the unit higher at the dismantled end and pour 0,057 litre (0.1 Imp pt; 0.12 US pt) of new EP 90 lubricating oil through the slot in the centre sleeve.
14. To set the pinion mesh pre-load, ensure new

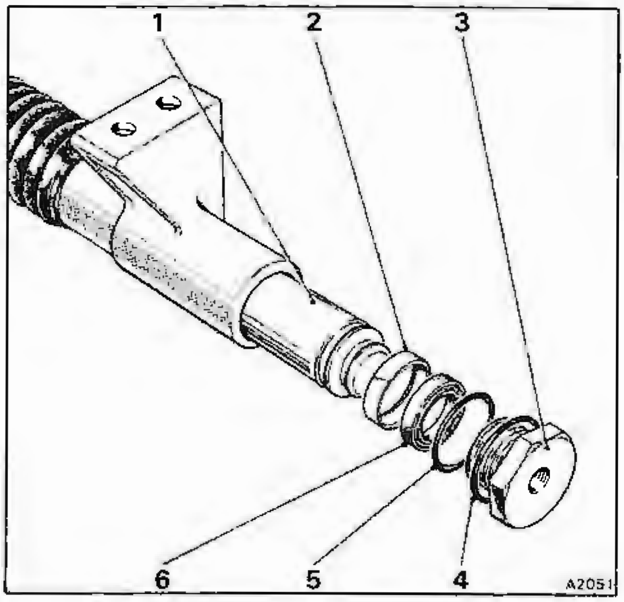


Fig. N2-8 Assembly of free end components
1 Rack spindle
2 P T F E seal
3 Blanking plug
4 End plug 'O' ring
5 Tube 'O' ring
6 Oil seal

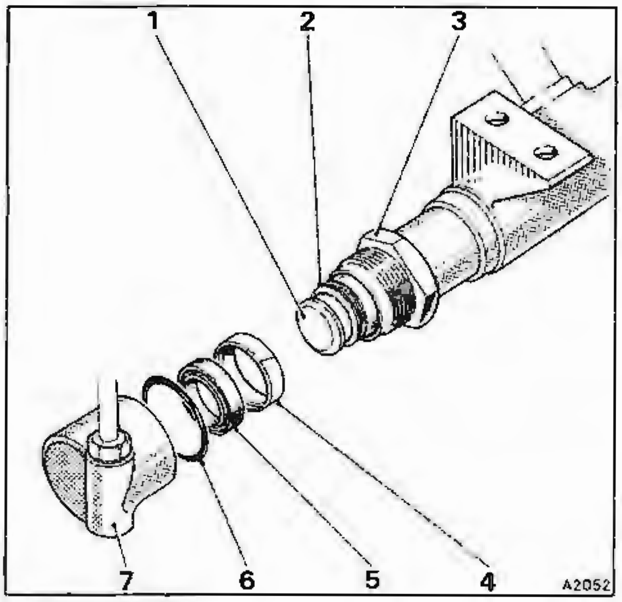


Fig. N2-9 Assembly of pinion box end components
1 Rack spindle
2 P T F E seal carrier
3 Lock-nut
4 P T F E seal
5 Oil seal
6 End cap 'O' ring
7 End cap

paper gaskets are fitted to the underside of the ball race carrier and to the steering rack pinion housing face.

15. Fit the original shims together with additional shims of approximately 3,80 mm to 5,08 mm (0.150 in to 0.20 in) over the studs of the pinion housing.

16. Carefully assemble the spool valve and pinion unit into the steering rack housing. Ensure that with the rack in the central position, the correlation mark on the input shaft and spool valve housing, align when the pinion is fully engaged in the rack. Finger tighten the retaining nuts. Remove the centring plug RH 9119.

17. Torque tighten the flange retaining nuts to the figures quoted in Section N8. Fit the special arm RH 9123 to the input shaft spline. Using a spring balance, measure the load required to rotate the input shaft approximately one revolution in each direction from the centre position.

The maximum load necessary to rotate the shaft to overcome both rack seal drag and spool valve friction should be 0,91 kgf (2 lbf).

If the force required is above this figure, then pinion mesh pre-load is still present. Therefore, additional shims must be fitted between the pinion and rack assembly.

Alternatively, the steering rack P T F E bearings could be incorrectly sized and the rack will have to be withdrawn. Reduce the diameter of the bearings further using sizing tools (in the following order) RH 9114, RH 9113, and RH 9112.

18. Carefully replace the steering rack ensuring no damage occurs to the P T F E bearings and oil seals. Fit the pinion unit.

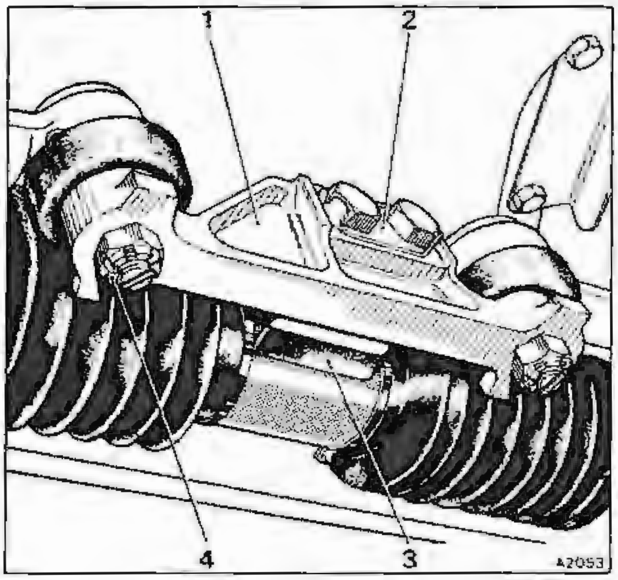


Fig. N2-10 Inner ball joint bracket in position
1 Bracket
2 Tab-washer
3 Centre block seal
4 Castellated nut and split-pin

Top-up the system with new lubricating oil, grade EP 90.

19. Using special arm RH 9123 and a spring balance, progressively reduce the number of shims to give a minimum figure of 1,13 kgf (2.50 lbf) above the seal drag and spool valve friction detailed in Operation 17.

The maximum total turning load should not exceed a spring balance reading of 2,04 kgf (4.50 lbf).

Example

If the total rack drag and spool valve friction is equal to 0,82 kgf (1.80 lbf) using a spring balance, then the minimum total load by progressively removing shims will be 0,82 kgf + 1,13 kgf = 1,95 kgf (1.80 lbf + 2.5 lbf = 4.30 lbf).

20. Return the rack to the straight-ahead position. Fit the centring plug RH 9119.

21. Carefully assemble the pinion unit to the steering rack housing. Ensure that the correlation marks on the input shaft and spool valve housing align when the pinion is fully engaged with the rack.

22. Torque tighten the flange retaining nuts to the figures quoted in Section N8.

23. Fit the centre block using the flexible bonding agent Silastic 732 RTV sealant on the mating surfaces of the seal to ensure a leak free joint. Secure the centre block in position using the socket headed capscrew.

24. Manipulate new 'O' rings before they are fitted to the blanking plug and lubricate them with power steering fluid to ensure that they fit correctly into their respective grooves.

Replace the outer tube and bracket assembly.

25. Set the two suspension brackets of the assembly squarely onto a surface table and clamp firmly into position.

26. Screw in the blanking plug to the torque figures quoted in Section N8.

27. Fit the pipe runs from the end caps to the pinion valve assembly using the torque figures quoted in Section N8.

28. The unit is now ready for fitting to the car, but do not remove the centring plug at this stage.

Rack and pinion unit – To fit to the sub-frame

1. Position and hold the steering wheel in its central position. Carefully fit the pinion box spline into the lower link universal coupling and support the unit in position. Finger tighten the pinch bolt.
2. Fit the setscrews and washers to the sub-frame brackets tapping blocks (see fig. N2-3). Torque tighten the setscrews to the figures quoted in Section N8, using the special tool arm RH 9122.
3. Align the spacer between the inner ball joint bracket and the steering unit centre block seal (see fig. N2-10).
4. Fit the new tab-washer and finger tighten the setscrews. Remove the centring plug RH 9119.
5. Torque tighten the inner ball joint bracket setscrews to the figures quoted in Section N8, carefully checking that the oil seal is not displaced. Lock the tab-washer to the setscrews, avoiding any impact to the unit. Also, torque tighten the lower

linkage universal couplings pinch bolt, in accordance with the figures quoted in Section N8.

6. Connect the pipework from the pump and oil cooler to the pinion box, ensuring that the union joints are wiped clean before fitting. Torque tighten in accordance with the figures quoted in Section N8.

Note Correct routing of the pipework is essential.

7. Fit the gearchange fuse (fuse A6 on fuse panel F2 on the main fuseboard).

8. Connect the battery.

1989 model year

Introduction

The steering unit is a rack and pinion power assisted mechanism with centre connection to 'one-piece' track rods. Toe-in can be set by the movement of an intermediate adjuster linking the track rod inner and outer components. An anti-joggle valve is fitted into the hydraulic pressure line (located in the pinion valve housing), to minimise any feedback to the steering wheel caused by road irregularities. The steering rack is fitted with internal lock stops.

Important Damage can be caused to the steering column and rack boots if the steering is operated without the engine running, i.e. distortion to the column, broken column mounts, and cut rack boots.

To overhaul the rack and pinion assembly, the following kits of parts are available.

Pinion valve overhaul kit
Rack overhaul kit
Bellows replacement kit
Pinion valve housing replacement kit.

Power assistance

Pressure is applied to the steering system rack in varying degrees. This provides assistance to the steering wheel, dependent on the effort required to move the road wheels.

The amount of assistance is controlled by the passage or restriction of oil through a series of ports in the upper half of the pinion box. This creates a pressure differential across the rack, proportional to the load applied at the steering wheel.

The system operates by causing a small torsion bar to twist, immediately the steering wheel is moved,

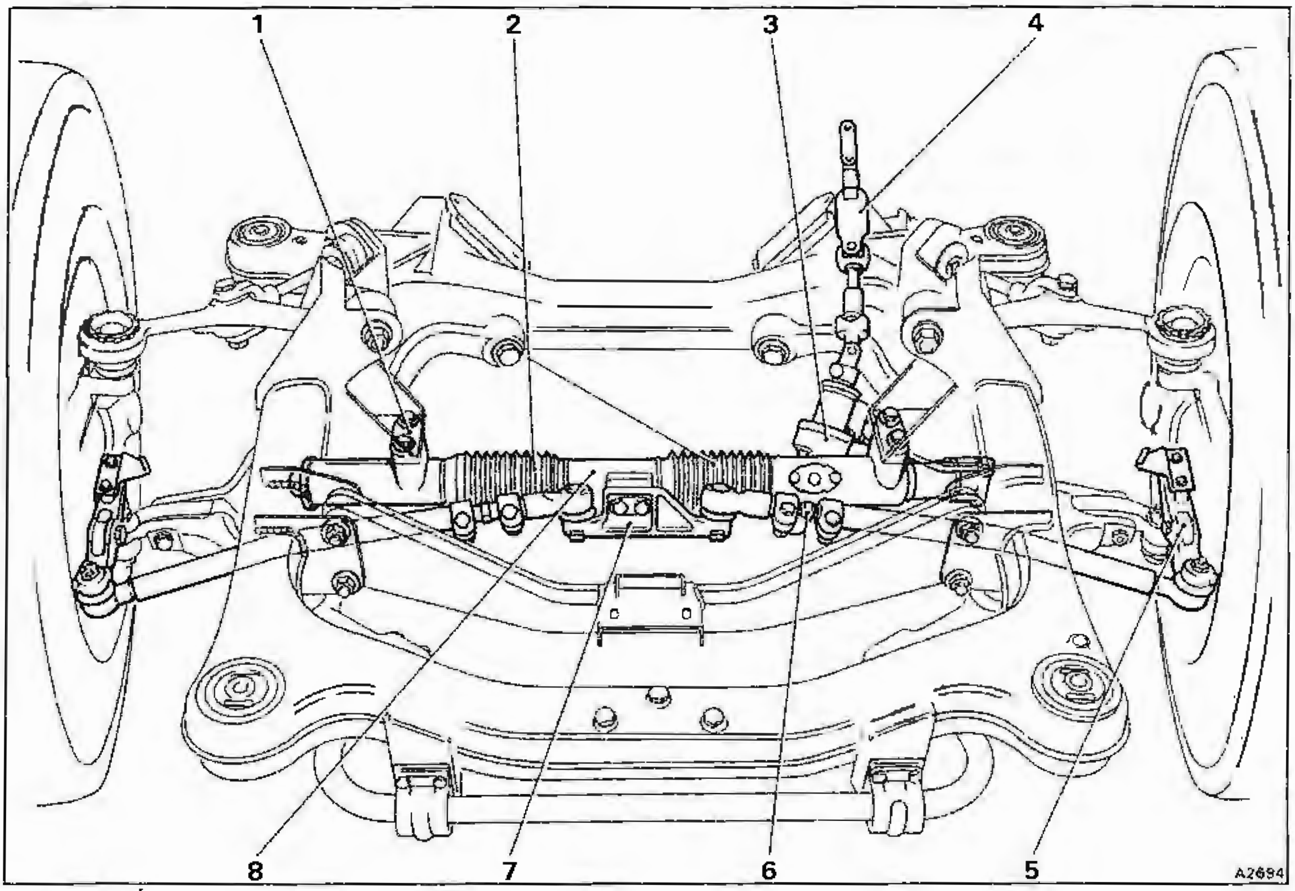


Fig. N2-11 Steering unit mounted in sub-frame

1 Steering unit mounting bolts
2 Convoluted seals
3 Pinion valve housing
4 Intermediate linkage
5 Side steering lever
6 Track rod adjuster
7 Inner ball joint bracket
8 Centre tube and seal

rotating the concentric valve components to provide the pressure differential required. A 'fail safe' device prevents the torsion bar from being overstressed by limiting the number of degrees through which it can twist.

Important The steering unit must be handled with exceptional care. Avoid impact loads on the input shaft and centre off-take, and damage to the convoluted seals which could cause premature failure of the unit.

Do not disturb the end plug or locking nut whilst the rack and pinion unit is fitted to the car.

The majority of the threads on the rack assembly are metric, except for the mounting bolts to the sub-frame and the lower steering column linkage. Therefore, always ensure the correct nuts and bolts are fitted.

Rack and pinion unit – To remove (see fig. N2-12)

1. Place the car on a ramp and remove fuse A6 from fuse panel F2 on the main fuseboard.
   Disconnect the battery.
2. Chock the road wheels and raise the ramp to a convenient working height.
3. Fit a clamp to the feed hose from the remote reservoir.
4. Position drip trays beneath the pinion valve. Then, remove the pipe unions from the valve housing.
   Fit blanks to prevent the ingress of foreign matter.
5. Remove the split pin, castellated nut, and bolt securing the lower linkage to the pinion shaft splines.
6. Straighten the tab-washer. Then, remove the setscrews holding the inner ball joint bracket to the steering rack centre position. Care must be taken not to disturb the steering rack centre block oil seal.
7. Support the rack and pinion unit, then remove the setscrews attaching the unit to the sub-frame brackets.
8. Lower the unit from beneath the suspension, carefully withdrawing the pinion shaft from the lower column linkage.

Warning Never strike the rack and pinion unit with a hammer.

9. Examine the convoluted seals for damage, etc., and the centre block oil seal for leaks.

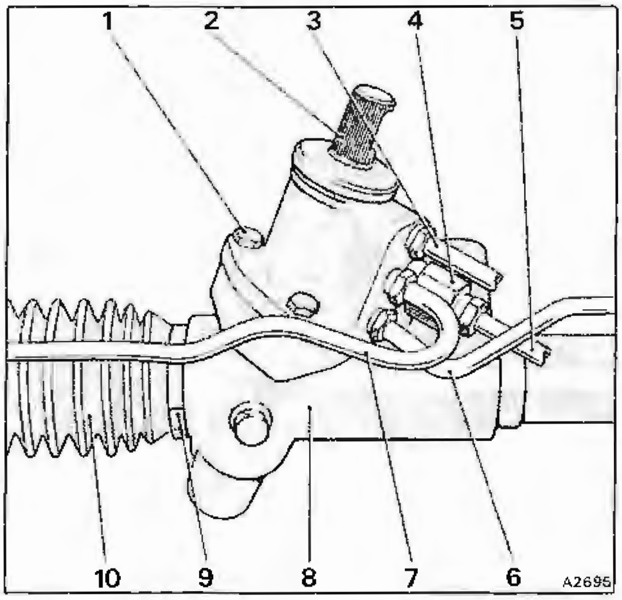


Fig. N2-12 Pinion and valve housing
1 Setscrew – housing to pinion box assembly
2 Pinion valve spline
3 Hydraulic return pipework
4 Anti-joggle valve adapter
5 Hydraulic feed pipework
6 Feed to end of rack
7 Feed to end of rack
8 Pinion box assembly
9 Seal clip
10 Convoluted seal

Replacement of convoluted seals (see fig. N2-13)
If when a convoluted seal is removed (due to splits and/or leakage) there is evidence of the ingress of water and/or road dirt, a complete stripdown, clean, and inspection should be made of the unit.

Note Whenever the steering rack unit is dismantled either partially or completely, cleanliness is of the utmost importance. Always ensure that any parts that are dismantled are cleaned and then covered with a clean cloth to prevent the ingress of foreign matter, etc.

1. Position drip trays under the ends and centre sections of the unit.
2. Carefully remove the banjo bolt hydraulic fitting from the end of the unit furthest from the pinion box housing. Discard the sealing washers.
3. Grip the support bracket at that same end, in a vice. Unscrew and remove the blanking plug from the end of the rack tube and withdraw the outer tube from the bracket.
   Collect the dismantled parts and cover with a clean cloth. Discard the 'O' rings.
   If it is only necessary to replace the convoluted seal at the dismantled end of the unit, there will be no need to disturb the centre block and oil seal. However, if both convoluted seals are to be removed, the centre block and seal must be removed as follows.
4. Unscrew the capscrew holding the central block in position against the rack bar. Withdraw the block and oil seal.
   Clean the sealing compound off the block, seal, and spacer tube.
   Protect the components by covering with a clean cloth.
5. Remove and discard the clips which secure the convoluted seals.
6. Remove the convoluted seals and the central spacer tube. The slot now exposed in the main tube must be covered to prevent the ingress of foreign matter.
7. Turn the unit over with the slot facing downwards. This will enable the lubricating oil to drain from the unit into a suitable tray.
8. Fit new convoluted seals and the central spacer

tube. **Do not** tighten the new securing clips at this stage.

9. Fit the centre block and seal using the flexible sealing agent (Silastic 732 RTV) on the mating surfaces of the seal to ensure a leak free joint.

10. Fit a new 'O' ring in the support bracket and assemble the support bracket to the tube.

11. Fit a new 'O' ring to the blanking plug. Then, carefully screw the blanking plug into position.

Note To ensure control of the parallelism of the two mounting bracket faces, place the assembled unit with the bracket mounting faces onto a surface table or a similar flat surface. Lightly clamp both bracket castings onto the flat surface.

12. Torque tighten the blanking plug to between 73 Nm and 80 Nm (7,5 kgf m and 8,1 kgf m; 54 lbf ft and 59 lbf ft).

13. Fit the banjo bolt hydraulic fitting, ensuring new sealing washers are fitted.

14. Clip the convoluted seals to the central spacing tube and the support bracket, using tool number RH 12212.

15. Lift the rack unit higher at the pinion end and pour 0,057 litre (0.1 Imp pt; 0.12 US pt) of approved lubricating oil (see Chapter D) into the convoluted seal.

16. Clip the convoluted seal to the pinion box casting, using tool number RH 12212.

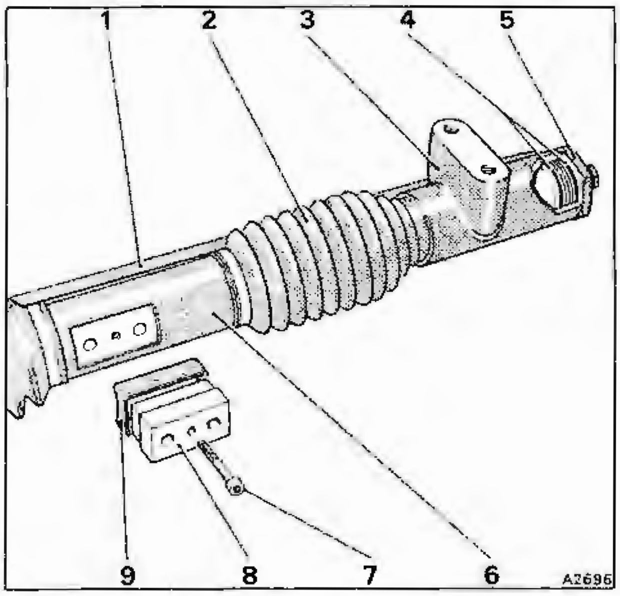


Fig. N2-13 Removal of convoluted seals
1 Fluid feed pipework
2 Convoluted seal
3 Mounting foot
4 'O' rings
5 Blanking plug
6 Centre tube
7 Capscrew
8 Centre block
9 Shaped seal

Rack and pinion unit – To dismantle (see fig. N2-14)
Commence by following the instructions under the heading, Replacement of convoluted seals, Operations 1 to 7 inclusive.

1. After draining the lubricating oil, place the unit onto two 'Vee' shaped wooden blocks.

Note Cover the wooden blocks with clean cloths to ensure complete cleanliness.

2. Remove the remaining feed pipe. Discard the sealing washers.

3. Unscrew the retaining bolts to release the rack slipper coverplate. Remove the coverplate, shim(s), paper gaskets, spring, and rack slipper. Rotate the rack bar to aid removal of the rack slipper.

4. Unscrew the three setscrews. Then, release the pinion and valve housing assembly by gripping the pinion spline, and with a turning movement lift the assembly, **using the splined shaft**, clear of the pinion housing.

Note Do not remove the valve housing from the pinion at this stage.

5. Release the end cap lock-nut. Unscrew the end cap and discard the internal 'O' ring.

6. Using an appropriate sized wooden dowel, carefully press the end of the rack until the PTFE ring and oil seal appear at the pinion box end of the unit.

7. Support the end of the rack whilst continuing to withdraw it from the tube. Ensure that the rack and tube do not make contact. It is easy to damage the internal surface of the tube and therefore care must be taken during this operation. Also, ensure that the PTFE bearing is not damaged during removal past the centre slot and pinion opening.

8. Inspect all components including the internal faces of the end caps, oil seals, and PTFE bearing carrier. Wash all metal parts in Genklene or an equivalent cleaning fluid.

Pinion and valve housing assembly
The pinion and valve housing assembly comprise the following main service items. Upper oil seals, PTFE sealing rings, lower oil seal, lower oil seal carrier 'O' ring, paper joint washers, pre-load shims, and circlip.

Note The upper oil seal is easily damaged by the spline on the valve. Therefore, it is important that when the valve housing is removed from the pinion and valve assembly, the splines on the valve are protected with clear adhesive tape.
Also, dismantling and assembly of these two components should not be carried out more times than is absolutely necessary.

Upper oil seal – To replace (see fig. N2-15)

1. Carefully lift the housing off the valve and pinion assembly, ensuring that the PTFE rings are not damaged.

2. Remove the upper oil seal and 'O' ring from the housing, and discard.

3. Fit a new upper 'O' ring and oil seal ensuring that the sealing lip is pointing downwards (see inset).

4. Fit the spline cover tool RH 9120 over the splines and then lower the housing down onto the valve.

Ensure that each PTFE ring enters the bore squarely with no pinching of the edges against the bore.

PTFE sealing rings – To replace

1. Carefully lift the housing off the valve unit.
2. Cut into the PTFE sealing rings with a sharp instrument having a smaller dimension than the width of the groove. Take care not to damage the finely machined surfaces of the valve. Use 'Vee' shaped wooden blocks to support the end diameters during removal of the rings.
3. Inspect the ring grooves of the valve pinion.
4. Immerse the new PTFE rings in warm oil prior to fitting onto the applicator RH 9117. Failure to warm the rings before fitting could cause cracking.
5. Place the tool over the input shaft spline and adjust until the bottom edge of the tool corresponds with the upper edge of the lowest PTFE ring groove.
6. Slide a PTFE sealing ring into the groove.
7. Adjust the tool to fit the remainder of the rings into their respective grooves.
8. Remove the sleeve tool, then size the rings by carefully pressing the tool RH 9118 over the rings to reduce their diameter.
9. Fit the spline cover tool RH 9120 over the valve splines to protect the upper seal whilst assembling the pinion valve housing.
10. Carefully assemble the pinion and valve housing.

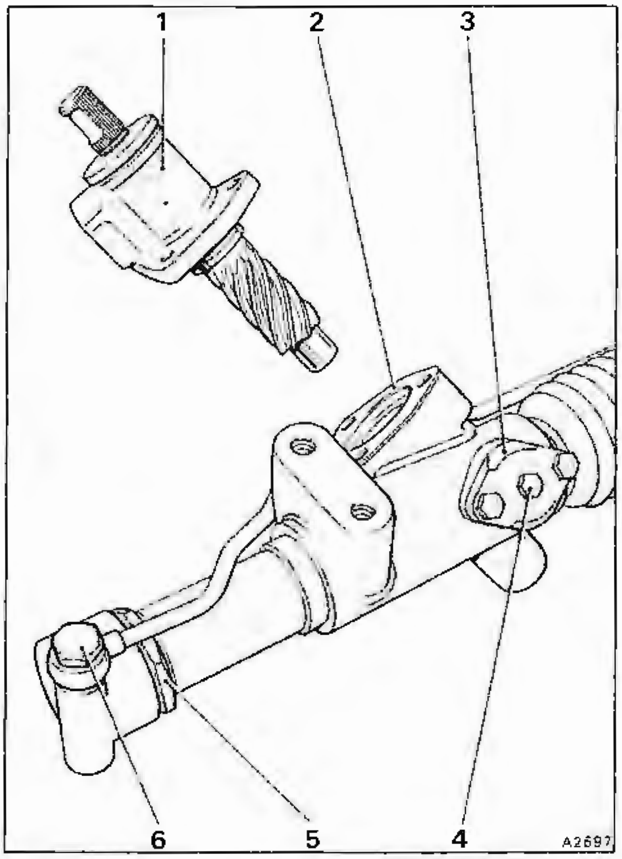


Fig. N2-14 Pinion and valve housing removal

1 Pinion and valve housing
2 Thrust ball race shim(s)
3 Slipper cover plate
4 Rack centring blanking plug
5 End cap lock-nut
6 Banjo bolt

Lower oil seal – To replace (see fig. N2-15)

1. Carefully remove the housing off the valve unit and remove the PTFE sealing rings.
2. Remove the backing spring from inside the lower lip seal. Then, remove the carrier and lower seal from the pinion.
3. Press out the lower oil seal from the carrier and discard the 'O' ring.
4. Inspect the carrier for damage.
5. Fit a new oil seal into the carrier, using tool RH 9121. Ensure that the lip face of the seal is uppermost. Fit the carrier onto the pinion until it abuts the ball race, using tool RH 9117.
6. Fit four new PTFE rings as described in, PTFE sealing rings – To replace.
7. Fit a new 'O' ring to the lip seal carrier.
8. Fit the spline cover tool RH 9120 over the valve splines to protect the upper seal whilst assembling the pinion and valve housing.
9. Carefully assemble the pinion and valve housing.

Thrust ball race – To replace (see fig. N2-15)

1. Remove the valve housing, PTFE rings, lip seal, and carrier as described in, Lower oil seal – To replace (Operations 1 to 4 inclusive).
2. Remove the upper half of the ball race.
3. Remove the circlip from beneath the lower race.
4. Remove the balls and lower race.
5. Examine all components and replace as necessary.
6. Replace the lower race complete with balls and hold in position by fitting the circlip.
7. Lubricate the balls with approved steering fluid (see Chapter D), and fit the upper half of the ball race.
8. Complete the assembly procedure as described in, Lower oil seal – To replace (Operations 5 to 9 inclusive).

Note When the pinion and valve housing assembly is fitted to the steering rack, the shim pack between the pinion box casting and the valve housing must be adjusted to give the correct pre-load to the ball race assembly, if any of the following components have been renewed.
Pinion and valve housing, pinion and valve, ball races, or lower seal carrier.

Thrust ball race assembly pre-load – To set

The pre-load must be adjusted with the rack bar removed from the pinion box and tube assembly.

1. Assemble the pinion and valve housing assembly to the pinion box and assess the thickness of the shim pack required, i.e. gap between valve housing and pinion box casting.
2. Produce a shim pack 0,25 mm (0.010 in) thicker than the dimension assessed in Operation 1. Place a

paper gasket at each end of this shim pack.

3. Position the shim pack between the valve housing and pinion box and fit the three retaining setscrews.

Note It is important to tighten these setscrews slowly and evenly, whilst rotating the pinion, to ensure that the ball race is not over pre-loaded.

4. Before torque tightening the three setscrews, the torque required to rotate the pinion to overcome seal drag should be measured and recorded. This should be between 0,06 Nm and 0,28 Nm (0,006 kgf m and 0,028 kgf m; 0.50 lbf in and 2.50 lbf in).

5. Carefully torque tighten the three setscrews to between 20 Nm and 25 Nm (2,1 kgf m and 2,5 kgf m; 15 lbf ft and 18 lbf ft).

Initially, the three setscrews should be able to be fully torque tightened without any increase occurring in the torque required to rotate the pinion. This initial tightening will compress the paper gaskets.

6. The shim pack should now be progressively reduced in thickness, until the torque required to rotate the pinion (with the setscrews torque tightened) is between 0,11 Nm and 0,28 Nm (0,011 kgf m and 0,028 kgf m; 1.0 lbf in and 2.5 lbf in) **above** the seal drag measured in Operation 4.

Rack and pinion unit – To replace oil seals and bearing rings (see figs. N2-17 and N2-18)

It is important that the pinion and valve housing assembly has been overhauled and the associated thrust ball race has been correctly shimmed before fitting the rack to the tube assembly.

Remove the pinion and valve housing assembly as described in, Rack and pinion unit – To dismantle. **Ensure that this assembly stays together.** Remove it by pulling on the splined input shaft. If the valve housing is allowed to slide up over the splined shaft, the upper and lower oil seals may be damaged.

There are three seals on each end of the rack bar.

(i) Wiper seal – Narrow black ring seal with a sharp outer diameter. Note which way it is fitted before removing (if necessary).

(ii) Bearing ring – Broad white PTFE ring with a scarf joint.

(iii) Piston seal – Black lip seal without an energising spring.

The wiper seals and bearing rings are fitted to the rack bar **before** it is fitted to the pinion box and tube assembly.

The piston seals are fitted to the rack bar **after** it has been assembled into the pinion box and tube assembly.

1. Grip the rack bar firmly in a padded vice. Remove the bearing rings and piston seals from both ends.

2. Examine the wiper seals for damage. If damage is apparent, using a suitable punch and hammer, remove the retaining pin from the floating piston assembly. Discard the pin and piston assembly.

3. To remove the fixed bearing ring carrier from the opposite end of the rack bar, secure tool RH 12213 in a vice and position the bearing ring carrier into the tool. Using a soft headed mallet, drive the rack bar out of the bearing ring carrier. Discard the carrier and seal.

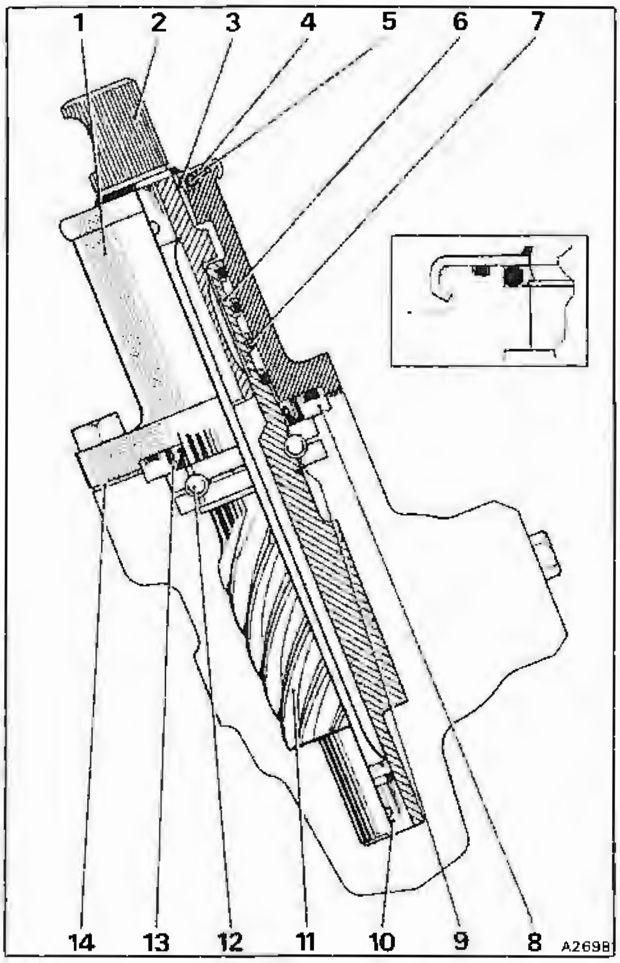


Fig. N2-15 Pinion and valve unit

1 Valve housing
2 Spline
3 Lip-type oil seal (upper)
4 'O' ring (top cap)
5 'O' ring (oil seal)
6 Valve
7 PTFE rings (4)
8 Lower oil seal carrier
9 Circlip
10 Torsion bar
11 Pinion
12 Thrust ball race
13 Lower oil seal
14 Pre-load shim(s)
Inset Upper sealing arrangement

4. Fit a new floating piston assembly, complete with wiper seal, to the rack bar. Secure in position with a new retaining pin. Take care to drive the pin in squarely, so that it passes cleanly through the hole in the opposite side.

5. Fit a new wiper seal to the fixed bearing ring carrier end of the rack bar, ensuring that the sharp edge of the seal faces in towards the centre of the rack bar.

6. Fit a new bearing carrier, taking care to ensure that it goes on squarely and abuts the shoulder on the rack bar.
7. Fit new scarf jointed PTFE rack bearings into their respective grooves at each end of the rack.
8. Gently press each scarf joint together. Ensure that each gap has an initial (nominal) measurement of 2,03 mm (0.080 in).

If a smaller gap is observed, cut one end of the scarf joint until the gap is correct.
9. Using sizing tools (in the following order) RH 9114, RH 9113, and RH 9112, progressively reduce the diameter of the PTFE bearings, until they are a sliding fit in the rack tube.

At this stage ensure that the gap at the scarf joint has not gone below a minimum of 0,25 mm (0.010 in). Also, ensure that it is positioned so as not to come into contact with the edges of the centre slot, etc., when the rack is assembled.

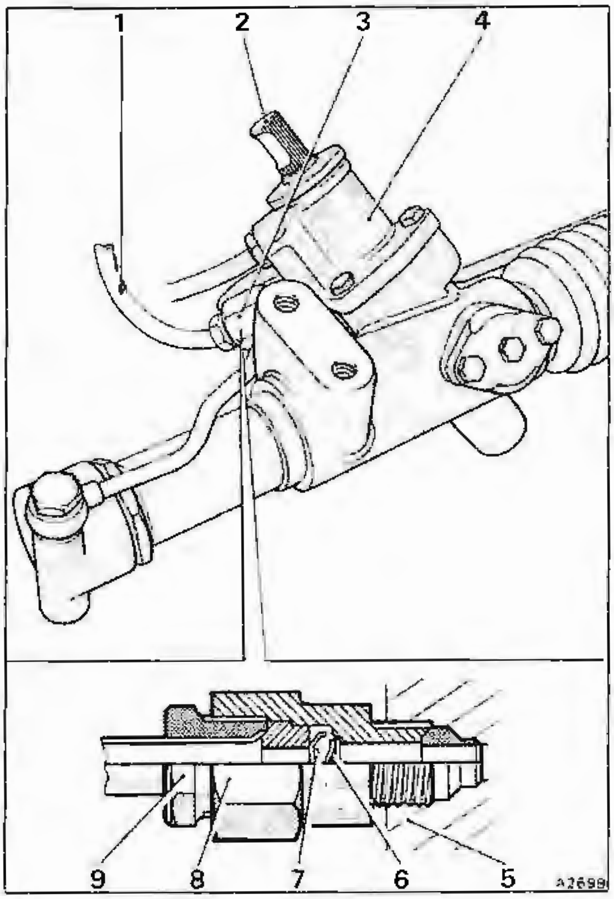


Fig. N2-16 Anti-joggle valve
1 High pressure fluid
2 Spline
3 Anti-joggle valve
4 Pinion valve housing
5 Valve housing casting
6 Spring
7 Flap valve
8 Adapter
9 Pipe union

Remove any burrs from the slot. Wipe the area clean before assembly.

Anti-joggle valve (see fig. N2-16)
1. With the steering dismantled remove the anti-joggle valve.
2. Check that the spring and flap are functioning correctly by pressing a probe carefully onto the top of the flap. Ensure that adequate compression of the assembly occurs and the flap seats correctly.
3. Wash out the assembly in Genklene or an equivalent cleaning solution. Dry using a controlled jet of dry pressurized air into the male threaded end of the unit only.
4. Fit blanking plugs into each end of the adapter.

Pipe union
If the olive which forms the seating of the pipe union is found to be damaged it will be necessary to remove the pinion valve housing before it can be renewed. It must be emphasized that cleanliness must be observed when carrying out this procedure.

Rack and pinion unit – To assemble (see fig. N2-19)
1. Remove the rack bar from the vice and replace it with the pinion box and tube assembly. Clamp the tube horizontally in the vice with the valve housing mounting face uppermost and the rack slipper hole facing towards the operator.
2. From the pinion box end (smooth bore end) of the tube, push the rack bar into its central position. Ensure that the centralizing hole is in the middle of the rack slipper hole.
3. Assemble the valve and pinion assembly (complete with shim pack, etc.) into the steering box.

Ensure that with the rack in the central position, the flat on the pinion spline is on the same side and at right-angles to the short tube for right-hand drive cars, and the long tube for left-hand drive cars.
4. Fit the three setscrews and lightly screw down. Do not torque tighten at this stage.

The torque required to rotate the valve should not exceed 0,9 Nm (0,09 kgf m; 8 lbf in). If it does exceed this figure, the rack PTFE bearing rings could be incorrectly sized. Withdraw the rack bar and using tools (in the following order) RH 9114, RH 9113, and RH 9112, progressively reduce the diameter of the PTFE bearings.
5. Torque tighten the three retaining setscrews to between 20 Nm and 25 Nm (2,0 kgf m and 2,5 kgf m; 15 lbf ft and 18 lbf ft) whilst rotating the pinion, to ensure that the pinion pre-load is still correct.
6. Fit the rack bar piston seals to each end of the rack using pusher tool RH 12214.

When fitting the seal to the long end tube, ensure that the seal is not damaged by the threaded bore.

Ensure each seal seats correctly in its location groove.
7. Fit the rack slipper (without the spring) and then fit the centre block to the rack.
8. Fit the slipper cover plate with a shimpack, including a paper gasket at either end. Ensure that the

shim pack is thick enough to produce between 1 mm and 2 mm (0.040 in and 0.080 in) radial free play of the centre block in the rack tube.

9. Progressively reduce the thickness of the shim pack until zero free play is achieved, with the rack in the central position and the pinion housing retaining setscrews torque tightened.

Add one extra 0,05 mm (0.002 in) shim to the shim pack and insert the spring into the rack slipper. Torque tighten the slipper cover plate retaining setscrews to between 20 Nm and 25 Nm (2,0 kgf m and 2,5 kgf m; 15 lbf ft and 18 lbf ft).

The torque required to rotate the valve should now be between 1,13 Nm and 1,69 Nm (0,12 kgf m and 0,17 kgf m; 10 lbf in and 15 lbf in), with the rack in the central position.

10. Fit the centring plug RH 12123.

11. Fit new convoluted seals as described in, Replacement of convoluted seals, Operations 8 to 16 inclusive. Prior to Operation 13, fit the long oil pipe to the valve housing and torque tighten the retaining nut to between 23 Nm and 27 Nm (2,4 kgf m and 2,7 kgf m; 17 lbf ft and 20 lbf ft).

12. Screw the lock-nut onto the threaded end of the rack tube and then clean the threads and prime with Loctite primer.

13. Fit a new 'O' ring into the groove in the end cap.

14. Commence to screw the end cap onto the tube. After 2 or 3 complete turns, apply a ring of Loctite 542 to the next three threads. Then, continue to screw on the end cap until it abuts the end of the tube.

Note Ensure when carrying out this operation that the 'O' ring is not displaced.

15. Fit the short oil pipe to the valve housing and unscrew the end cap up to one complete turn, until it lines up with the banjo fitting on the oil pipe.

16. Tighten the lock-nut to between 47 Nm and 54 Nm (4,8 kgf m and 5,5 kgf m; 35 lbf ft and 40 lbf ft), using tool RH 9125.

17. Torque tighten the short oil pipe into the valve housing to between 23 Nm and 27 Nm (2,4 kgf m and 2,7 kgf m; 17 lbf ft and 20 lbf ft).

Fit the banjo bolt hydraulic fitting, ensuring new sealing washers are fitted.

Torque tighten the banjo bolts to between 35 Nm and 41 Nm (3,6 kgf m and 4,1 kgf m; 25 lbf ft and 30 lbf ft).

18. The unit is now ready for fitting to the car, but do not remove the centring plug at this stage.

Rack and pinion unit – To fit to the sub-frame

1. Position and hold the steering wheel in its central position. Carefully fit the pinion box spline into the lower linkage coupling and support the unit in position. Finger tighten the pinch bolt.

2. Fit the rack and pinion unit to the sub-frame using the setscrews and washers. Torque tighten the setscrews to between 57 Nm and 61 Nm (5,8 kgf m and 6,2 kgf m; 42 lbf ft and 45 lbf ft), using tools RH 12124 and RH 12125.

3. Align the inner ball joint bracket and the steering rack unit centre block seal (see fig. N2-20).

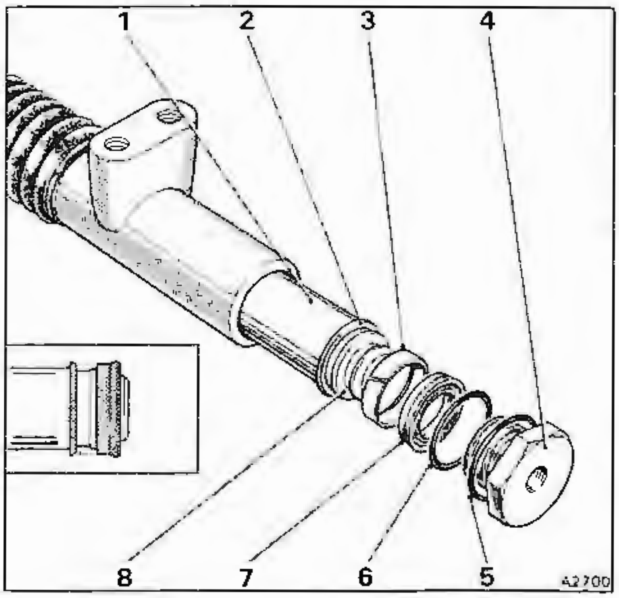


Fig. N2-17 Assembly of free end components
1 Rack bar
2 Wiper seal
3 PTFE seal
4 Blanking plug
5 Blanking plug 'O' ring
6 Tube 'O' ring
7 Oil seal
8 Bearing carrier

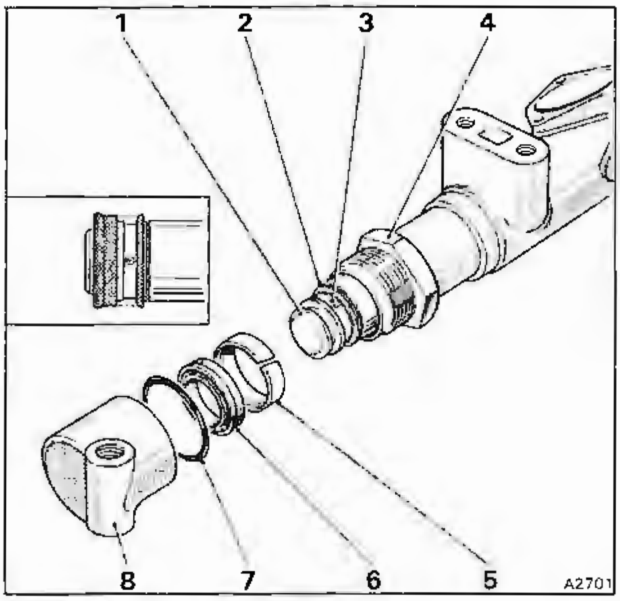


Fig. N2-18 Assembly of pinion box end components
1 Floating piston assembly
2 Wiper seal
3 Retaining pin
4 Lock-nut
5 PTFE seal
6 Oil seal
7 End cap 'O' ring
8 End cap

4. Fit the new tab-washer and finger tighten the setscrews. Remove the centring plug RH 12123 and fit the blanking plug and washer. Torque tighten the plug to between 7 Nm and 11 Nm (0,7 kgf m and 1,1 kgf m; 5 lbf ft and 8 lbf ft).

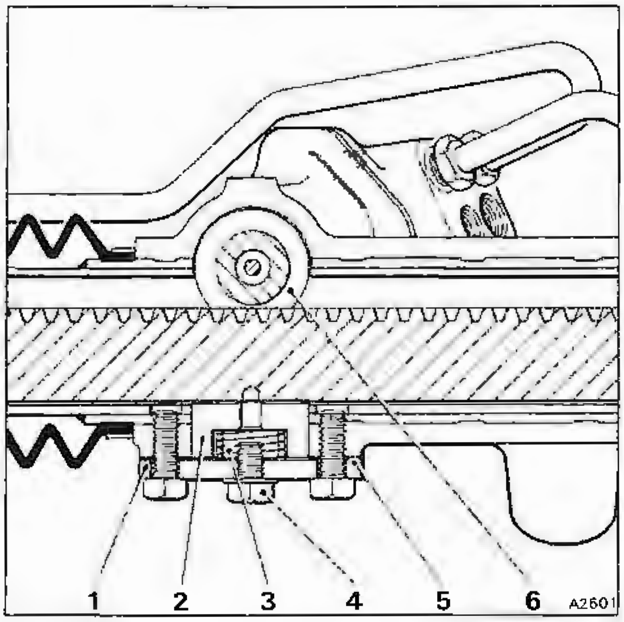


Fig. N2-19 Pinion mesh adjustment
1 Cover plate
2 Rack slipper
3 Spring
4 Blanking plug
5 Shim(s)
6 Pinion

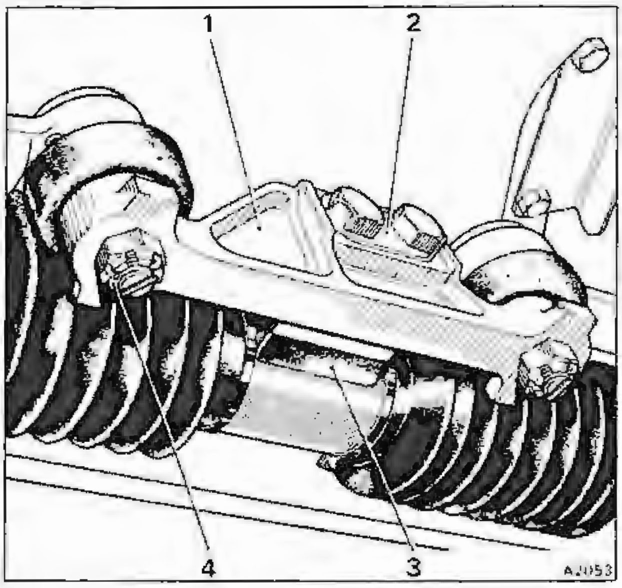


Fig. N2-20 Inner ball joint bracket in position
1 Bracket
2 Tab-washer
3 Centre block seal
4 Castellated nut and split pin

5. Torque tighten the inner ball joint bracket setscrews to between 38 Nm and 40 Nm (3,9 kgf m and 4,1 kgf m; 28 lbf ft and 30 lbf ft). Ensure that the oil seal is not displaced. Lock the tab-washer to the setscrews, avoiding any impact to the unit.

6. **On cars not fitted with a 'one-piece' lower linkage,** slacken the spline adjustment bolt and set the lower linkage coupling to the rack pinion, by lining up the shoulder of the lower yoke with the top of the pinion shaft (see fig. N5-6, A). Then, check for clearance between the lower coupling shaft and the universal joint spider (see fig. N5-6, B). Adjust on the rack pinion shaft, if necessary.

Note It is important that neither the pinion shaft or lower coupling shaft contact the universal joint spider.

On cars fitted with a 'one-piece' lower linkage, set the lower linkage coupling to the rack pinion using tool RH 12122, as shown in figure N5-7.

7. Torque tighten the lower pinch bolt(s) and castellated nut(s) to the figures quoted in Section N8, utilizing the torque allowance to allow the fitting and securing of the new split pin(s).

8. Connect the pipework from the pump and oil cooler to the pinion box, ensuring the union joints are wiped clean before fitting. Torque tighten in accordance with the figures quoted in Section N8.

Note Correct routing of the pipework is essential.

9. Fit the gearchange fuse (fuse A6 on fuse panel F2 on the main fuseboard).

10. Connect the battery.

Steering pump

Introduction
The steering pump is fed from a remote fluid reservoir which has a dipstick attached to the filler cap.

The pump is driven from the engine crankshaft via twin matching belts. It continually circulates oil to the rack and pinion assembly through a control valve, at a constant flow rate, independent of the pump's operating speed.

Steering pump – Routine checks and topping-up procedure (see fig. N3-2)
The fluid level in the steering pump reservoir should be checked with the fluid at normal operating temperature, approximately 77°C (170°F), with the engine stopped.

1. Remove the filler cap and check that the fluid level is at least up to the MIN mark on the dipstick. If necessary, add fluid. Use only approved steering fluid as quoted in Chapter D.
2. Start the engine and run until the normal operating temperature is attained, then stop the engine.
3. Remove the filler cap and check the fluid level on the dipstick. If necessary, add fluid to raise the level to the MAX mark. **Do not overfill.**
4. Replace the filler cap.

Belt tension – To check
The steering and cooling system pumps are driven by a matched pair of belts from the engine crankshaft pulley.

Refer to Chapter E for the belt tensioning figures.

Steering pump – To remove
1. Fit a clamp to the feed hose from the remote reservoir. Slacken the lower wormdrive clip and remove the hose from the pump connection.
2. Slacken the pump belts by loosening the pivot mounting setscrew beneath the alternator. Then, slacken and remove the lower tensioning nut and bolt assembly beneath the pump.
3. Slacken the setscrew securing the pressure pipe to the rear mounting plate. Unscrew the pipe union from the rear face of the pump.

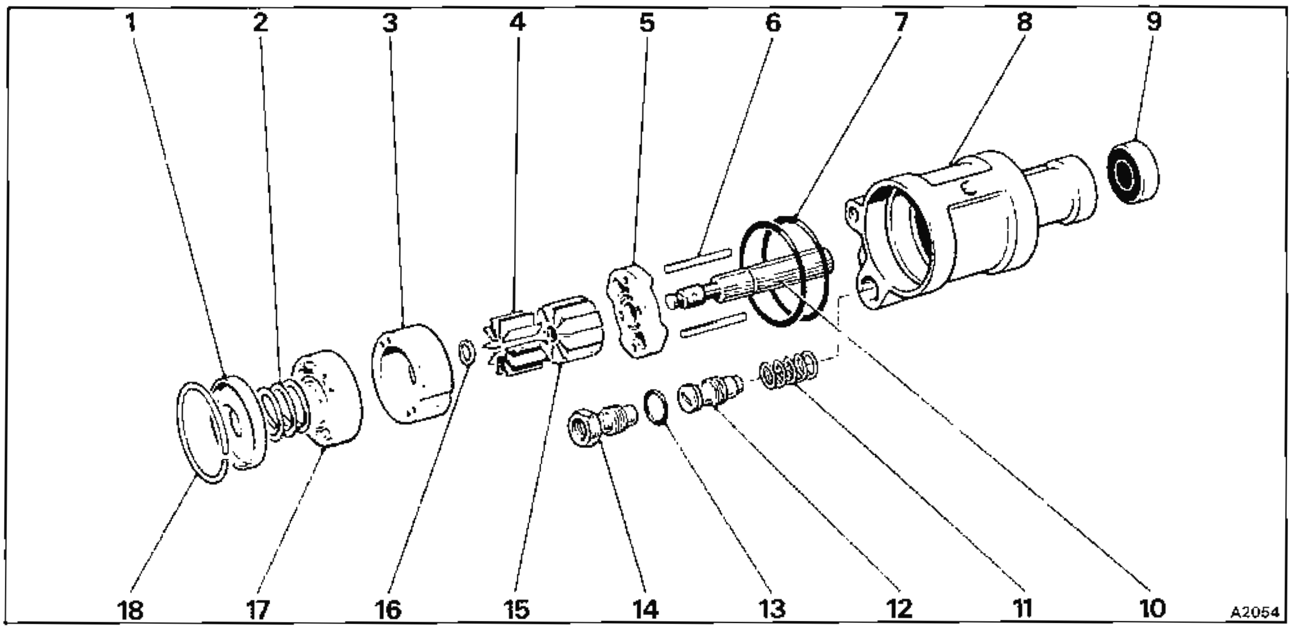


Fig. N3-1 Steering pump

1 End plate
2 Pressure plate spring
3 Pump ring
4 Vanes
5 Thrust plate
6 Dowel pins
7 'O' rings – pressure plate and end plate
8 Pump housing
9 Oil seal
10 Drive-shaft
11 Return spring – control valve
12 Control valve/pressure relief valve
13 'O' ring – control valve outlet adapter
14 Control valve outlet adapter
15 Rotor
16 Snap ring
17 Pressure plate
18 End plate retaining ring

4. Remove the bolt securing the rear mounting plate.
5. Support the pump assembly and remove the upper pivot mounting setscrew. Lower the pump from the car and replace the setscrew through the alternator, brackets, etc., into the cylinder head.

Steering pump – To dismantle
The pump is a service exchange unit and should normally be replaced with a new one.

However, if difficulty is experienced in obtaining a service replacement unit, the following information on servicing the existing pump is provided.

1. Drain any fluid remaining in the pump.
2. Remove the pulley using tool RH 9106. **Never use a hammer to drive the pulley from the shaft.**
3. Remove the three setscrews securing the front pivot plate to the pump housing. Note that distance pieces are fitted between the plate and pump.
4. Lightly clamp the pump in a vice ensuring suitable soft-jaw covers are used.
5. Press a centre punch or similar tool into the small hole in the pump housing directly opposite the control valve adapter (see fig. N3-4).
6. Using a small screwdriver, lever out the retaining ring. Withdraw the centre punch.

Note Care should be taken when the retaining ring is removed, due to internal spring pressure.

7. Remove the end plate and spring.
8. Remove the end plate 'O' ring and discard.
9. Unscrew the control valve outlet adapter. Discard the 'O' ring.

Note Care should be taken when the adapter is removed, due to internal spring pressure.

10. Remove the pump from the vice and withdraw the control valve assembly and spring.
11. Place the pump housing onto a bench with the shaft uppermost. Using a soft-headed mallet, tap on the shaft until the pressure plate is freed.

Note Do not strike the shaft downward into the housing more than is necessary to free the pressure plate.

12. Remove the pressure plate, pump ring, and vanes. Discard the second 'O' ring.

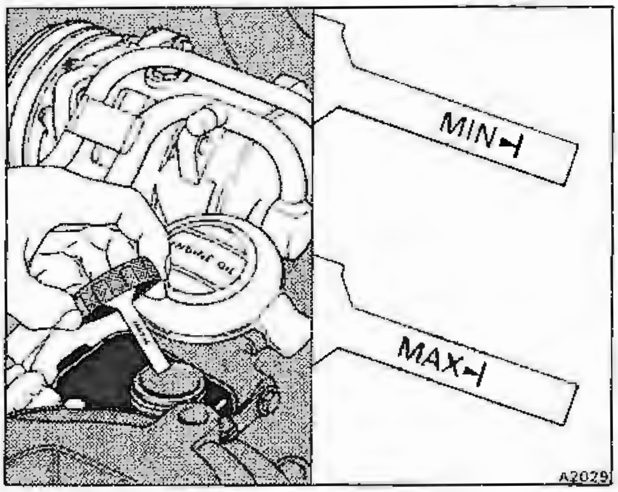


Fig. N3-2 Reservoir filler cap markings

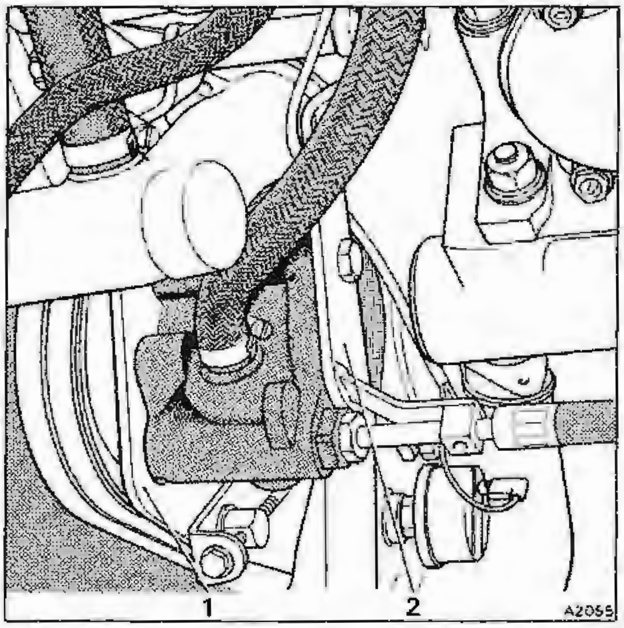


Fig. N3-3 Pump mountings
1 Front pivot plate
2 Rear mounting plate

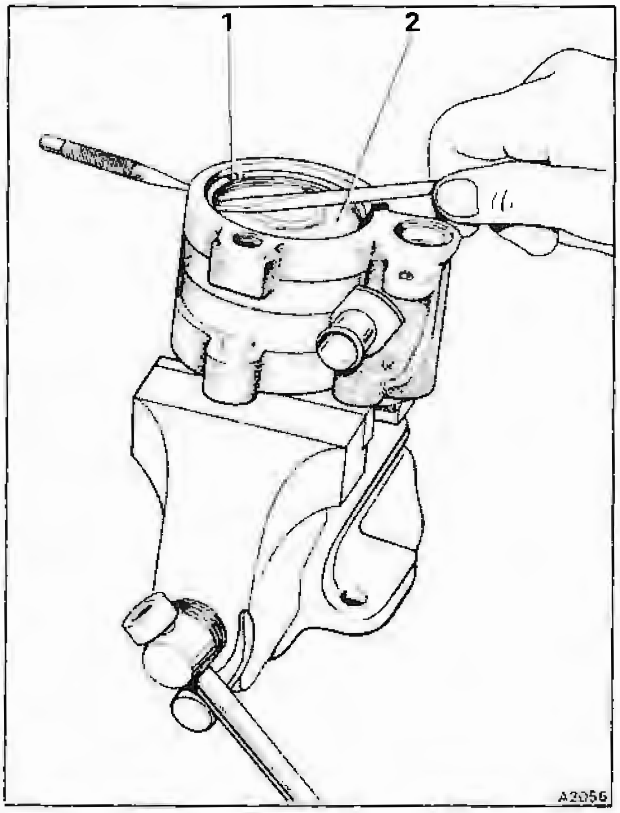


Fig. N3-4 End plate removal
1 Retaining ring
2 End plate

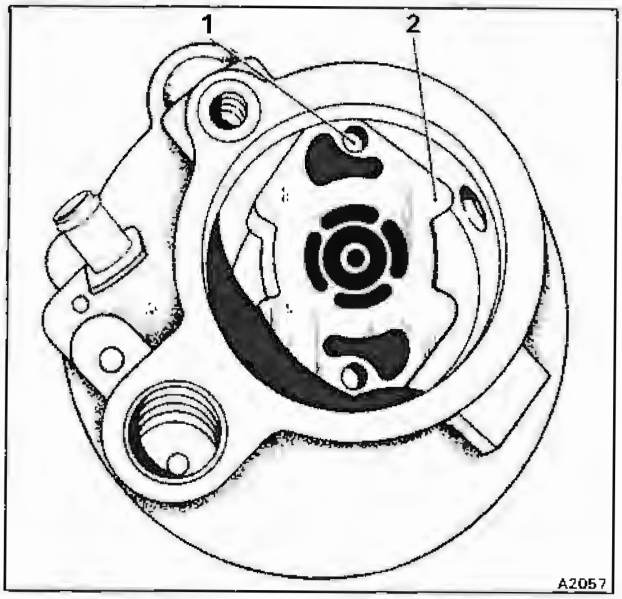


Fig. N3-5 Positioning of thrust plate
1 Dowel pin (2)
2 Thrust plate

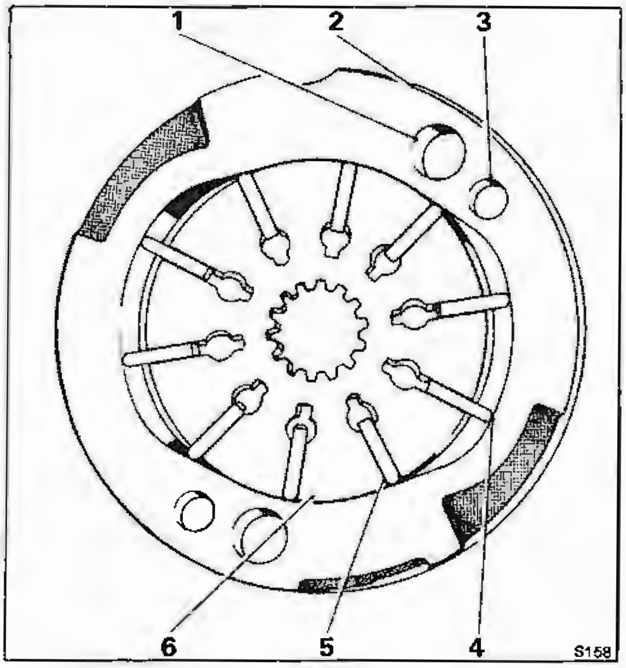


Fig. N3-6 Pump rotor and vanes
1 Oil transfer hole (2)
2 Pump ring
3 Dowel hole
4 Radiused edge of vane
5 Vane (10)
6 Rotor

13. Grip the pump housing in a vice, with the open end uppermost.
14. Remove the snap ring holding the vane rotor and thrust plate.
15. Withdraw the drive-shaft through the pulley end of the housing.

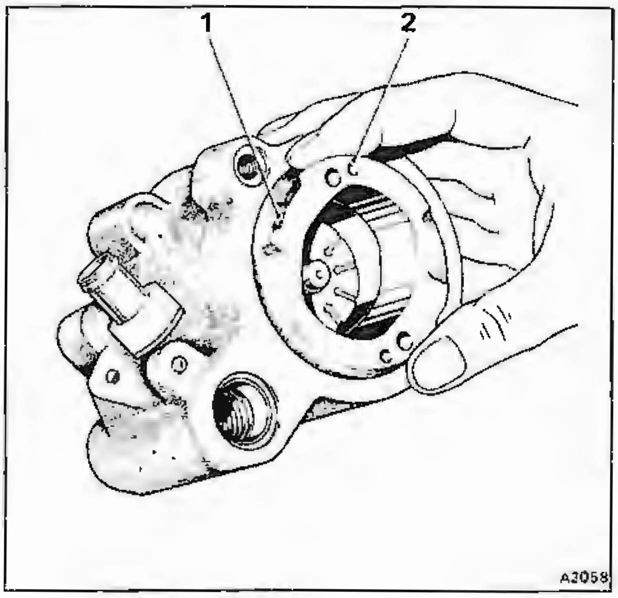


Fig. N3-7 Correct positioning of pump ring
1 Direction of rotation arrow
2 Dowel hole (2)

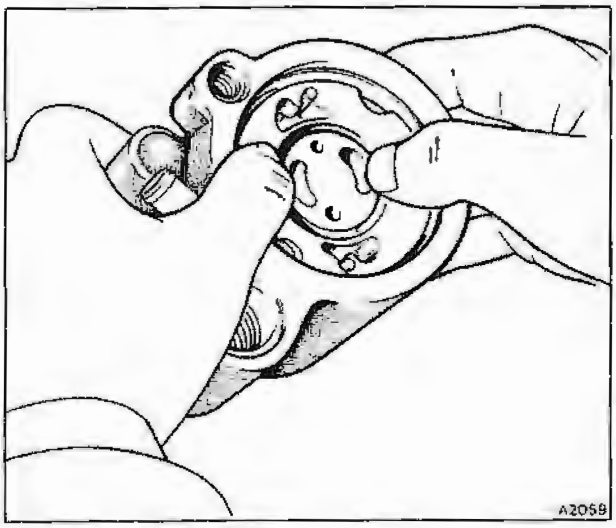


Fig. N3-8 Fitting the pressure plate

16. Renew the oil seal. Avoid excessive force when fitting to prevent dishing the seal.

Steering pump – To inspect
1. Clean all components prior to inspection. Apply air pressure to the pump housing to clean out all the fluid passages.
2. Check the pressure plate and rotor for scoring. Light scoring may be removed by lapping with a fine carborundum stone. Heavy scoring will necessitate renewal of the component concerned.
3. Ensure that the pressure plate is flat by checking it against the abutting surface of the pump ring.

Note Highly polished surfaces are always present on the inner surfaces of the thrust and pressure plates as a result of normal wear.

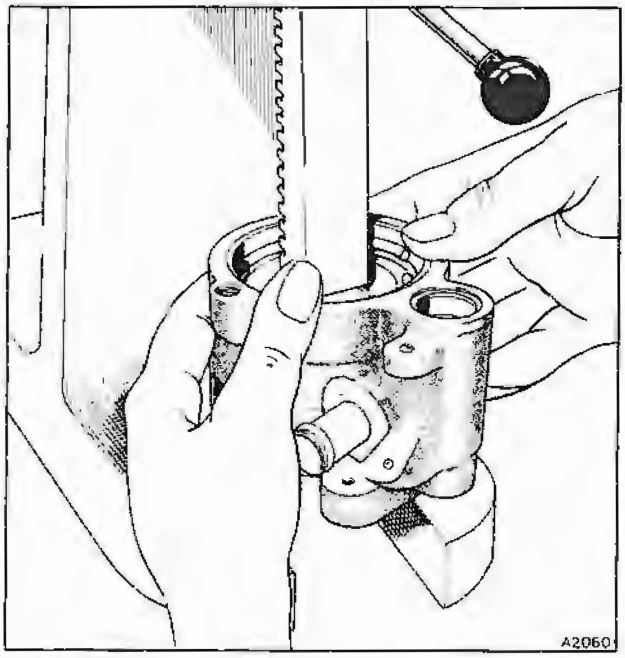


Fig. N3-9 Method of replacing end plate

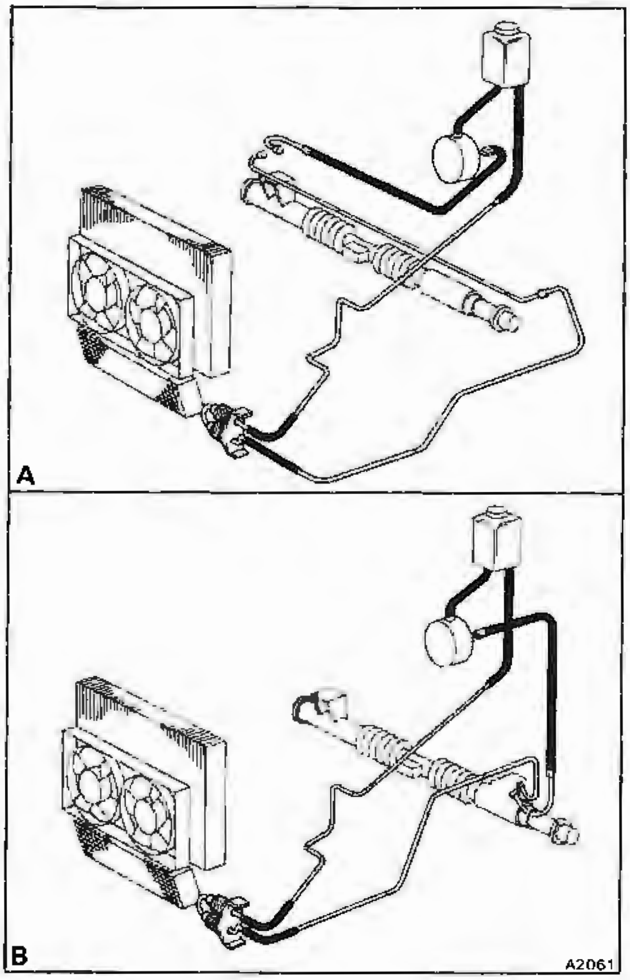


Fig. N3-10 Hydraulic pipe layouts
A Right-hand drive
B Left-hand drive

4. Check the pump ring contours for extreme wear. Some slight scuff marks and wear may be evident. This will not increase pump noise and is not detrimental to its function. However, if chatter marks, etc., can be felt with the finger, renew the pump ring, rotor, and rotor vanes (supplied as a service kit).
5. Check the condition of the shaft bush in the pump housing.
6. Check the flow control valve for burrs, etc., which may cause the valve to stick in its bore. Check the control valve bore for scoring, etc.
7. Check the small screw in the control valve for tightness. If loose, tighten using extreme care not to damage the machined surfaces.

Steering pump – To assemble

1. Before assembly, clean all components with the exception of the 'O' rings and oil seal, which should be renewed.
2. Smear the 'O' rings and oil seal with petroleum jelly to facilitate fitting. Lubricate the internal components with new steering fluid.
3. Insert the drive-shaft into the front of the pump housing, passing it through the oil seal until the shoulder on the shaft is level with the bottom face of the pump housing.
4. Fit the thrust plate over the dowel pins in the housing with the port face uppermost i.e. to the rear of the pump housing.
5. Fit the rotor to the splines on the shaft with the counterbore towards the thrust plate. The rotor must be a slide fit on the splines.
6. Position the pump ring on the dowel pins with the direction of rotation arrow uppermost.
   The direction of rotation is anti-clockwise when viewed from the rear of the pump (see fig. N3-7).
7. Fit the drive-shaft snap ring to retain the rotor.
8. Fit the vanes into the rotor slots with the radiused edge facing outwards (see fig. N3-6).
9. Fit the pressure plate 'O' ring. Lubricate the outer diameter of the pressure plate with petroleum jelly to prevent damage to the 'O' ring. Locate the plate onto the dowels, with the port face towards the pump ring.
10. Apply pressure to the plate at its outer edges (see fig. N3-8). Never use excessive force as this may cause permanent distortion.
11. Position the pressure plate spring, locating the leading coil in the groove on the upper side of the pressure plate.
12. Fit the end plate 'O' ring into the pump housing groove.
13. Lubricate the outer diameter of the end plate. Position the pump under a suitable press (see fig. N3-9), and press down the end plate sufficiently to allow the retaining ring to be fitted.
14. Fit the retaining ring ensuring that it is seated fully. Remove the pump from the press and tap the end plate to ensure correct sealing.
15. Fit the control valve assembly and spring. Screw in the outlet adapter, ensuring a new 'O' ring is fitted. Torque tighten the adapter to between 50 Nm and 75 Nm (5,1 kgf m and 7,6 kgf m; 37 lbf ft and 55 lbf ft).

16. Fit the pump front pivot plate using the three setscrews and distance pieces. A distance piece is fitted between the pump and pivot plate on all three setscrews.
17. Press the pulley onto the shaft using tool RH 9106.

Steering pump – To fit
Fit the steering pump by reversing the removal procedure, noting the following.
1. Check that all the hoses and pipes are serviceable. Renew any that are damaged or worn.
2. Fit and adjust the drive belts as described in Chapter E.
3. Fit and torque tighten the pipe union to between 28 Nm and 40 Nm (2,8 kgf m and 4,1 kgf m; 20 lbf ft and 30 lbf ft).

Steering pump – Priming and filling
1. Remove the reservoir cap and add sufficient steering fluid to raise the level to the MIN mark on the filler cap dipstick.
2. Remove one end of the upper hose connected to the steering oil cooler. When fluid emerges from both pipes, reconnect the hose. Top-up the fluid level to the MIN mark on the dipstick.
3. Crank the engine over, but switch off immediately it starts to run. Top-up the fluid level to the MIN mark on the dipstick. Repeat, until no more fluid needs to be added between each crank.
4. Start the engine and bleed air from the system by turning the steering wheel gently from side to side, gradually lengthening the stroke, **but do not hold against the lock stops.**

Note Ensure that the fluid level never falls below 50 mm (2.0 in) from the bottom of the reservoir.

5. When satisfied that the fluid level is no longer aerated (no small bubbles visible in the fluid), return the steering to the centre position and run the engine between two and three minutes.
6. Stop the engine. Observe the fluid level in the reservoir; if it rises by more than 3 mm (0.120 in) the fluid is still aerated. Repeat Operation 4.
7. Leave the engine stationary for 5 minutes. Then, add fluid up to the MAX mark on the filler cap dipstick. **Do not overfill.**
8. Replace the filler cap.

Steering wheel and gear range selector unit

Steering wheel – To remove (see fig. N4-1)
1. Disconnect the battery.
2. Fit a protective cover to the steering wheel.
3. Feed a 305 mm (12 in) length of strong thin string in a loop into the gap between the horn button and plastic steering wheel surround.
4. Grip the two free ends of the string and with a sharp pull, withdraw the horn button assembly.
5. Remove the screws securing the support plate. Withdraw the support plate and disconnect the Lucar connector from the underside of the plate.
6. Remove the steering wheel centre nut and washer (see fig. N4-2).

Note Feed the horn wire and connector into the socket body, to avoid pinching the wire.

7. Scribe a line across the steering wheel lower boss and inner column rim, to ascertain the correct relationship of the wheel to the column splines.
8. Grip the steering wheel spokes and remove the wheel with a straight pull. Take care not to damage the splines.

   The wheel must be removed as a unit, part dismantling is not recommended.
9. Inspect the support plate, contact rivet, Lucar blade, bearing pin, and the return spring of the horn assembly. Replace any parts if necessary.

Steering wheel – To fit (see fig. N4-2)
1. Fit a protective cover to the steering wheel.
2. Feed the horn wire through the steering wheel centre hub. Align the marks on the lower boss and inner column rim of the steering wheel and fit the wheel firmly onto the splines.
3. Fit the washer and nut to secure the steering wheel. Using a deep hexagon socket spanner, torque tighten to the figures quoted in Section N8.

   If any adjustment to the straight ahead position is necessary, reference should be made to Section N5, Steering link – To remove and fit.
4. Check that the self-cancelling stalk contacts the flasher switch arms. Also, ensure that the end of the stalk does not foul the gear range selector lever when in the low (L) position.

   If a foul does exist, the self-cancelling stalk must be filed down to clear the gear range selector lever.
5. After filing, the exposed metal must be painted with dull nickel paint.
6. Fit the electrical horn connector onto the Lucar connection. Secure the support plate to the centre hub.
7. Lubricate the bearing pin of the horn push button assembly with Rocol MTS 1000 grease or any suitable equivalent. Push the horn button into position through the support plate. Ensure that the retaining clip securely holds the horn button in place by gripping the bearing pin.

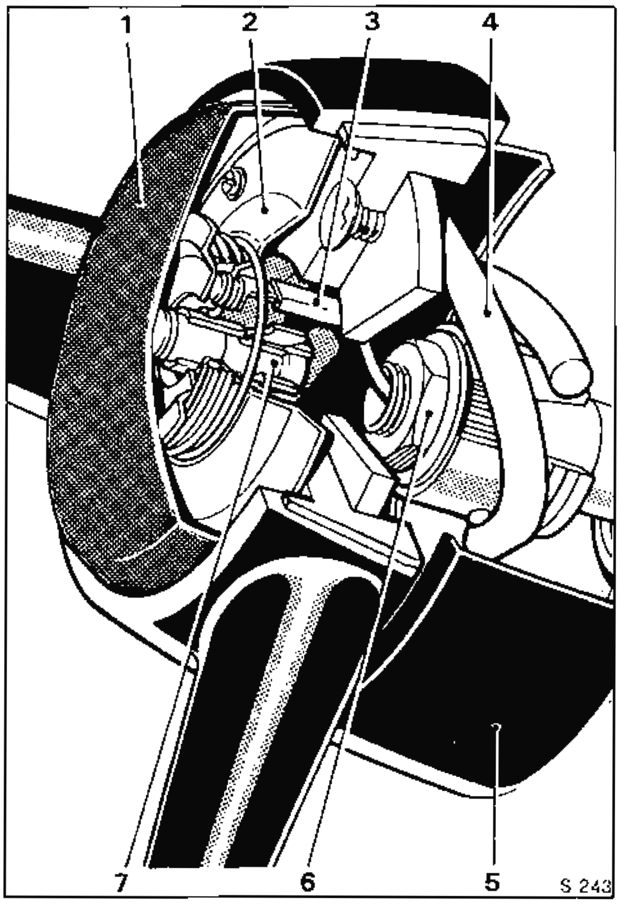


Fig. N4-1 Steering wheel components
1 Horn button
2 Support plate
3 Connector
4 Energy absorbing device
5 Metal shroud
6 Column nut
7 Bearing pin

Direction indicator/headlamp flasher lever and windscreen/headlamps washer switch – To remove and fit (see fig. N4-3)
1. Disconnect the battery.
2. Unscrew the two Phillips headed screws that secure the upper cowl to the lower cowl. Remove the upper cowl.
3. Unscrew and remove the two clamps holding the lower cowl. Remove the cowl and secure the clamps back into the cowl.
4. Disconnect the electrical plug at the main distribution loom plug and socket.
5. Unscrew the two Phillips headed mounting screws and remove the unit.

6. Fit the assembly by reversing the removal procedure, ensuring that the positioning dowel locates into the steering column.

Gear range selector unit – To remove (see fig. N4-3)
1. Disconnect the battery.
2. Unscrew the two Phillips headed screws that secure the upper cowl to the lower cowl. Remove the upper cowl.
3. Unscrew and remove the two clamps holding the lower cowl. Remove the cowl and secure the clamps back into the cowl.
4. Disconnect the electrical plugs at the main distribution loom plugs and sockets.
Disconnect both the horn (screw cap) and earth (Lucar) connections from the steering column.
5. Unscrew the two setscrews that secure the clamp to the quadrant. Remove the clamp and quadrant from the column. Fasten the clamp back onto the quadrant base.

Gear range selector unit – To dismantle
1. Remove the screws securing the micro-switch mounting plate to the front face of the quadrant assembly. Remove the micro-switch from the mounting plate.
2. Move the selector lever to the intermediate (I) position. Remove the Phillips headed screw now

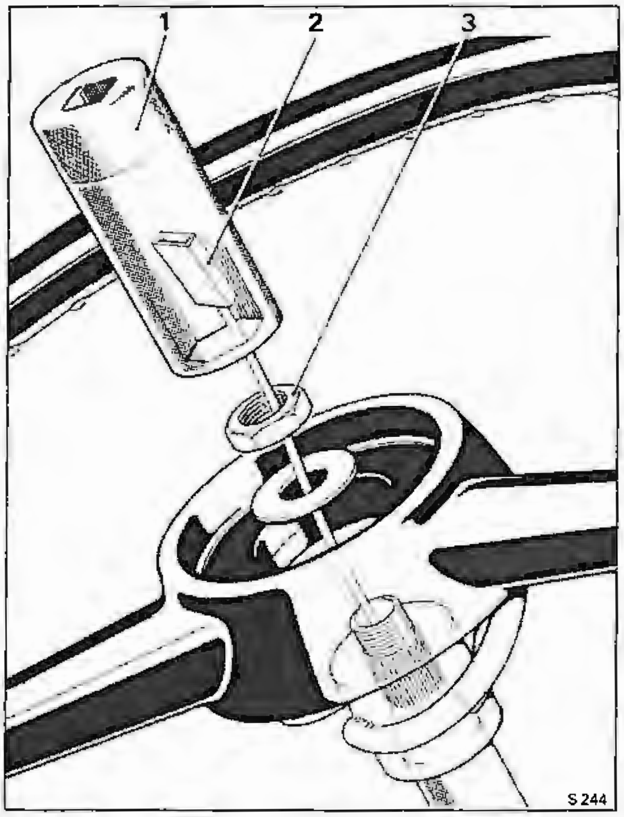


Fig. N4-2 Steering wheel fitting
1 Deep bodied hexagon socket
2 Electrical horn connector
3 Steering wheel nut

exposed, together with any packing washers. Remove the scale pointer.
Replace the Phillips headed screw together with any packing washers.
Take care during this operation not to scratch the pointer or the indicator scale.
3. Disconnect the Lucar connection from the gear range indicator lamp. Remove the filter from the lamp.
4. Remove the two Phillips headed screws securing the indicator support bracket. Remove the assembly.
5. Remove the two hexagon headed setscrews that secure the selector gate assembly to the underside of the base unit.
6. Remove the circlip, clevis pin, and spring securing the selector lever to the quadrant, then remove the lever together with the gate assembly.
7. Remove the gearchange loom by removing the three screws that secure the insulating plate to the quadrant base unit.
8. Remove the two Phillips headed screws securing the phosphor bronze contact to the quadrant base unit. Retain the two insulating dowels and strips.
9. Disconnect the rocker arm by releasing the tension springs at the quadrant end of the assembly. Remove the circlips and withdraw the clevis pins from each end.
10. Remove the nut from the quadrant spindle. Remove the quadrant plate from the base unit.

Gear range selector unit – To assemble
1. Fit the quadrant assembly to the base unit and 'nip' the nut and washer. Ensure that the quadrant will rotate freely.
2. Remove the quadrant assembly and lubricate the spindle with Rocol MTS 1000 grease or any suitable equivalent. Replace the quadrant and fully tighten the nut. Do not overtighten the nut as the bearing boss tends to spread, resulting in a tight bearing.
3. Fit the rocker arm assembly, ensuring that the roller lines up correctly with the detent in the quadrant (see fig. N4-4).
4. Fit the two small tension springs, one either side of the quadrant, to the spindle. Assembly is easier if the quadrant is rotated anti-clockwise, clear of the rocker arm so that the springs are not under tension.
Note Do not fit the retaining clip to the rocker arm at this stage.
5. Move the quadrant to a midway position. Fit the phosphor bronze contacts between the two insulating strips and locate into position using the two insulating dowels. Secure the assembly with the two setscrews and washers.
Note Ensure that the moving contact is not damaged.
6. Prior to fitting the selector lever assembly, carry out the following.
a. Check that the clevis pin will slide through the fork end on the lever and the holes in the mounting arms on the quadrant.
b. Check that the fork end will also slide between the arms of the quadrant.
7. . Smear Rocol MTS 1000 grease or any suitable equivalent onto the bearing surfaces of the selector

lever fork, the inside of the supporting arms, and the clevis pin.

8. Loosely fit the selector lever through the gate assembly. Then, locate the fork and spring between the support arms.

Fit the clevis pin and secure with the circlip. Check that the lever will return easily under the load of the spring.

9. Secure the gate assembly to the underside of the base unit with the two setscrews. Check that when the position of the lever is controlled by the detents, it lines up with the profile of the gate assembly and that

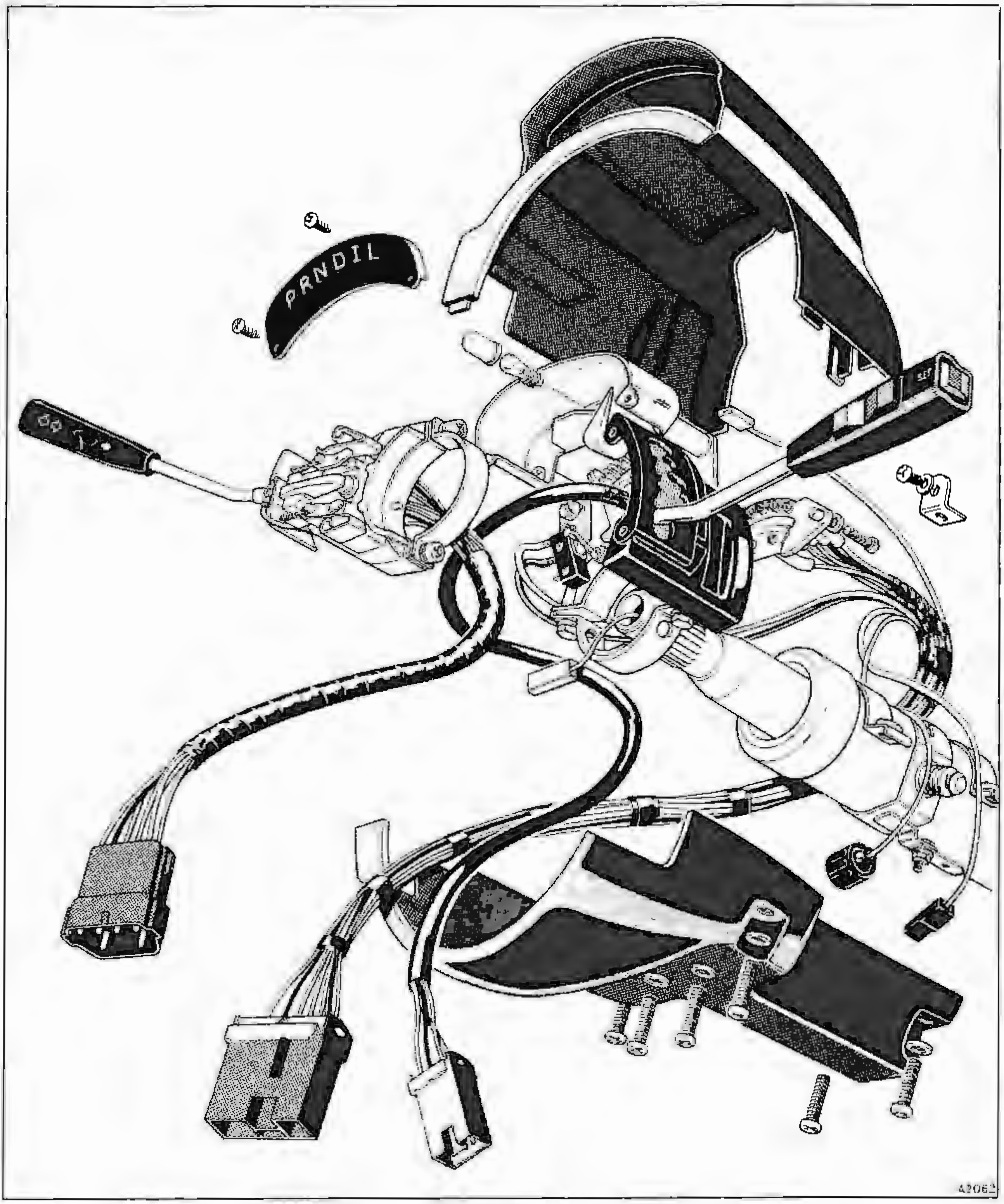


Fig. N4-3 Gear range selector, direction indicator, wash/wipe units, upper and lower cowlings

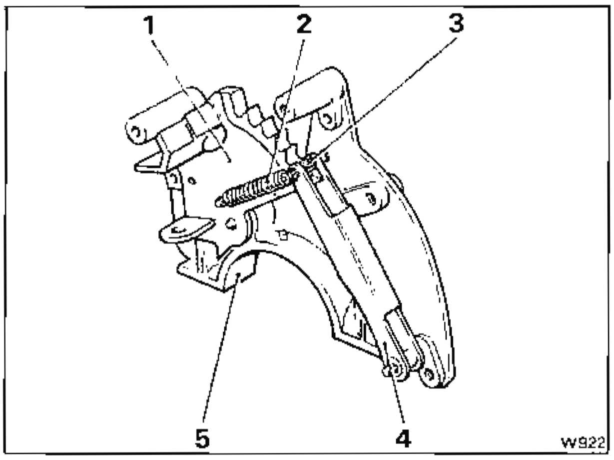


Fig. N4-4 Quadrant to rocking arm assembly
1 Gear selector quadrant
2 Tension spring – rocking arm (2)
3 Roller
4 Rocking arm
5 Base unit

the extreme positions of the lever are limited by the gate.

10. Fit the gear range selector loom/insulating plate by screwing it to the underside of the quadrant assembly.

When the unit is secured, check that the inside leg of the moving contact is positioned centrally across the supply contact and that the pressure is correct when a piece of 0,025 mm (0.001 in) carbon paper is 'nipped' between the contacts. At the extremities of its travel the hemispherical head must still touch the supply contact. **This adjustment is most important**, to ensure accurate spring weight during travel of the moving contact.

11. Each selection should then be made in turn, checking that the outside leg on the moving contact lines up correctly with each of the feed contacts.

12. Press the plastic filter cap over the bulb. Fit the indicator scale over the support bracket and secure with two self-tapping screws. The scale should drop onto the bracket and its lip must not be forced down. Connect the wire to the indicator bulb Lucar connector.

13. Feed the pointer under the indicator scale. Then, with intermediate (I) range selected, secure in position with a single screw and any original washers. Care must be taken not to mark either the pointer or indicator scale.

14. Check to ensure that the pointer is positioned correctly over the full gear range.

15. Fit the neutral start micro-switch loosely to the mounting plate and then fit it to the quadrant.

16. With the selector quadrant set in the neutral (N) position, adjust the micro-switch roller to the peak of the cam. This setting should automatically fix the park (P) position.

A battery powered test box, operating a buzzer or lamp, attached to the micro-switch connections in the plug, will indicate when a correct setting has been achieved.

Gear range selector unit - To fit

Fit the selector unit by reversing the procedure given for removal noting the following.

1. Ensure that the positioning dowel in the quadrant locates into the steering column. Also, that the two setscrews which secure the quadrant assembly to the column, passing through the clamping bracket and into the quadrant, are fitted with spring washers.
2. Take care when tightening the cowling retaining screws as the unit, being made of plastic, will crack if overstressed.

Steering column

Steering column – To remove

1. Remove the lower trim panel as described in Chapter S.
2. Remove the steering wheel, cowling, gear range selector lever, and direction indicator assembly as described in Section N4.
3. Slacken the two capscrews from the steering column upper mounting. Hold the tapping plate and washers, and then remove the capscrews. Collect the distance pieces, washers, etc., from the upper mounting.
4. Remove the two bolts which secure the steering column link to the lower steering unit linkage (see fig. N5-1).

Note Care must be taken not to use any impact force near to the steering rack unit, otherwise irreparable damage will result.

5. Remove the large circlip and washer from the engine compartment side of the toeboard (see fig. N5-3).
6. Disconnect both the horn (screw cap) and earth (Lucar) connections from the steering column.
7. From inside the car, support the column and remove the single capscrew from the lower column mounting. Retain the capscrew, washers, etc., but discard the nut.
8. With care, withdraw the steering column from the toeboard rubber grommet.

   Remove and discard the rubber grommet.
9. Inspect all components for wear or damage.

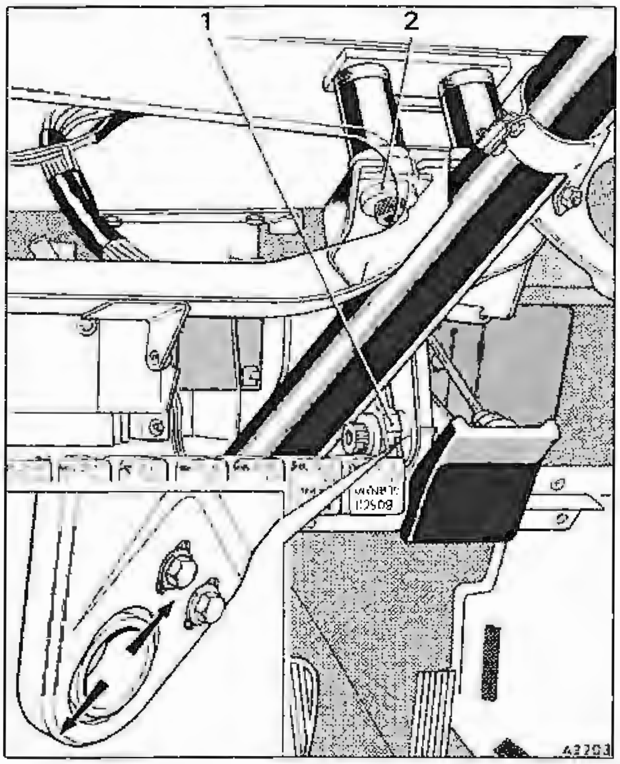


Fig. N5-2 Steering column in position
1 Lower mounting point
2 Upper mounting point

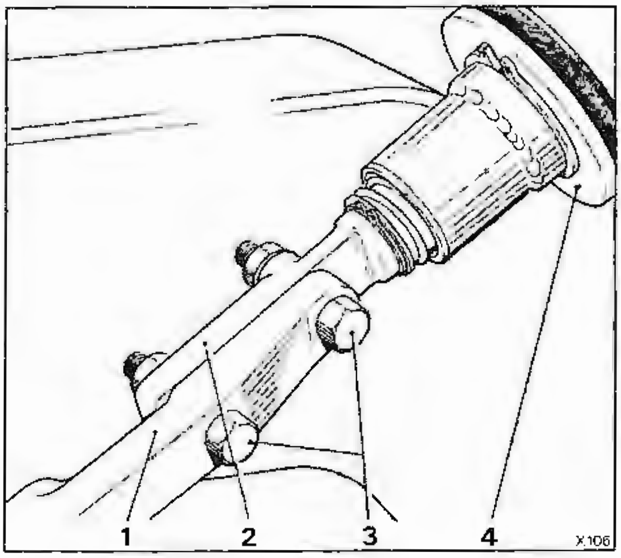


Fig. N5-1 Steering column link to linkage arm
1 Linkage arm
2 Steering column link
3 Securing nuts and bolts
4 Washer – toeboard

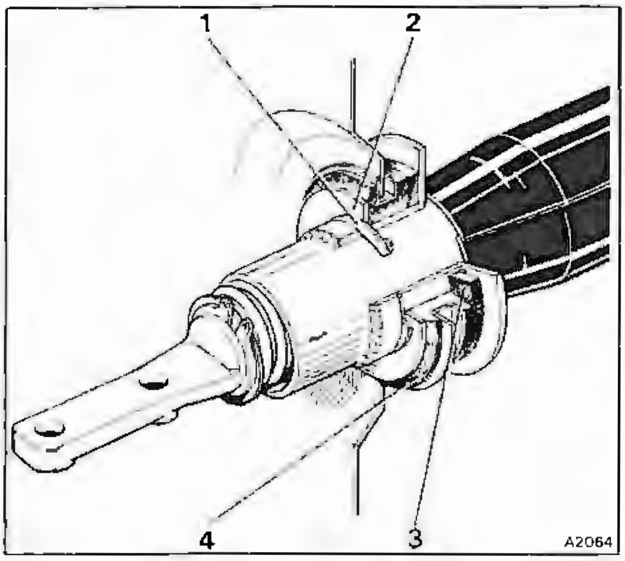


Fig. N5-3 Toeboard fixing
1 Circlip
2 Washer
3 Soft rubber washer
4 Bulkhead grommet

Steering column – To fit (see figs. N5-3 and N5-4)
Fit the steering column by reversing the procedure given for removal, noting the following.

1. Always fit a new rubber grommet and soft rubber washer to the toeboard aperture.
2. Ensure that when replacing the two upper capscrews, the spigot rubbers and inner spacer tube are not disturbed. Torque tighten to the figures quoted in Section N8.
3. On 1989 model year four door cars, an adjustable lower mounting may be fitted to the lower column support bracket (see fig. N5-2, inset). Adjust if necessary.
4. Fit a new nut to the lower mounting assembly. Torque tighten to the figures quoted in Section N8.

Steering link – To remove and dismantle
(see figs. N5-1 and N5-5)
The lower link unit comprises of an upper safety stalk, a bonded coupling, and a shaft with a universal joint at

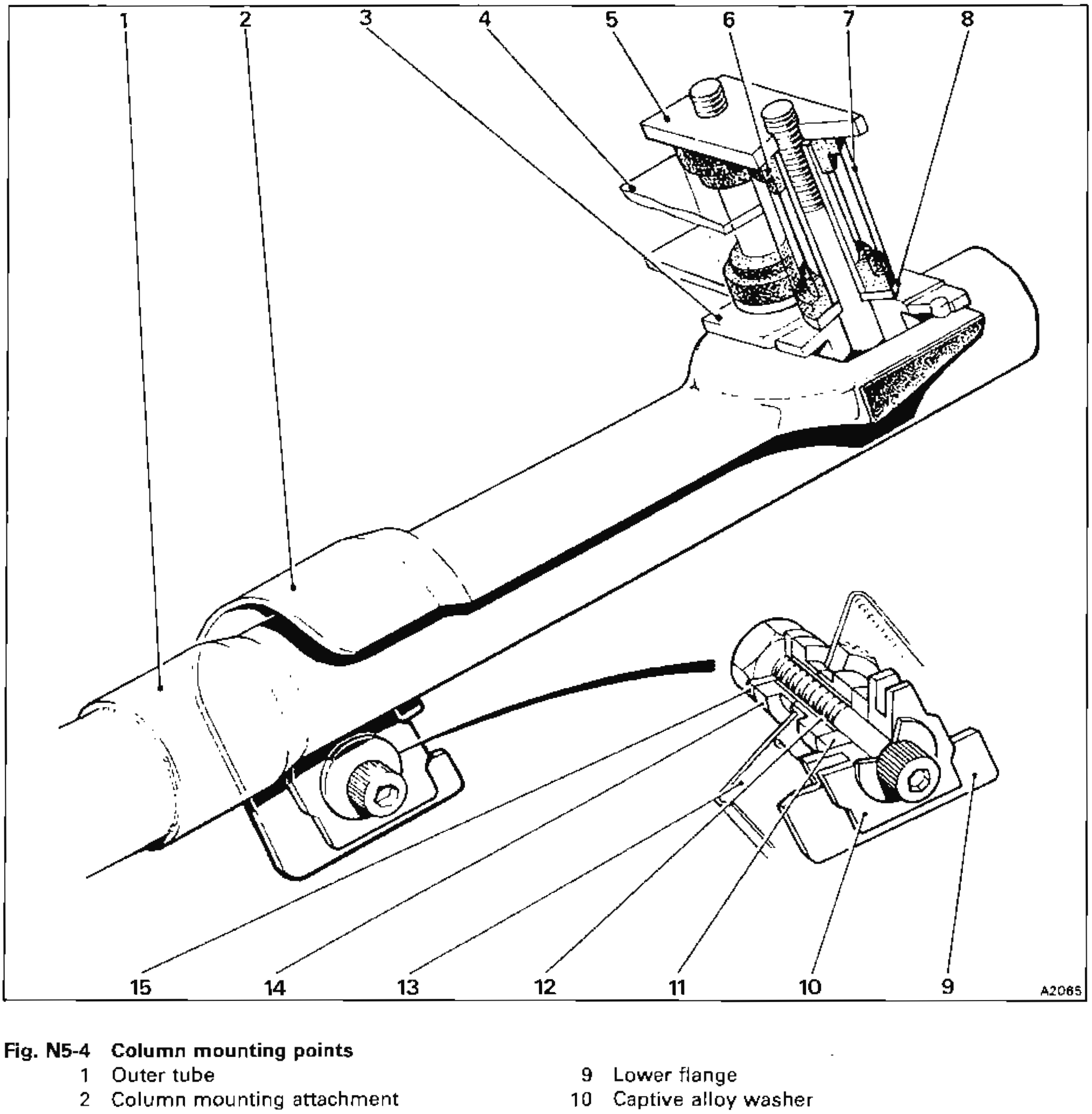


Fig. N5-4 Column mounting points

1 Outer tube
2 Column mounting attachment
3 Captive alloy washers (2)
4 Bulkhead support
5 Tapped plate
6 Flanged bush (Rubber)
7 Distance tube
8 Plain washer
9 Lower flange
10 Captive alloy washer
11 Plain washer
12 Distance tube
13 Bulkhead support and welded bush
14 Flanged bush (Rubber)
15 Plain washer

the upper end and splines at the lower end. The shaft connects to a lower universal joint, which in turn is secured to the pinion valve of the steering rack unit.

Note Do not use any impact force to remove a joint on or near to the steering unit, otherwise irreparable damage to the unit will result.

1. Disconnect the battery.
2. Chock the rear wheels.
3. Remove the two bolts securing the steering column link to the steering unit linkage arm.
4. Slacken and remove the pinch bolt securing the linkage arm onto the rack pinion.
5. Carefully remove the steering linkage from the pinion splines.

Cars not fitted with 'one-piece' lower linkage assembly

6. Remove the heatshields from the linkage, and inspect both the universal and bonded couplings.
7. Unscrew and remove the setscrews from the splined shaft coupling flange. Remove the shaft.
8. Remove the safety stalk from the bonded coupling.
9. Remove the pinch bolt which secures the lower universal coupling to the splined shaft. Remove the coupling from the shaft.
10. Inspect the safety stalk, splines, bonded coupling, universal couplings, and screw threads for wear. Replace any damaged components.

Cars fitted with 'one-piece' lower linkage assembly
The lower steering unit linkage is a 'one-piece' assembly and cannot be dismantled. Therefore, if a fault is suspected, the complete assembly must be replaced.

Steering link – To assemble and fit
(see figs. N5-1, N5-5, N5-6, and N5-7)
Cars not fitted with 'one-piece' lower linkage assembly

1. Fit the linkage arm to the bonded coupling.
2. Fit the safety stalk to the coupling. Line up the holes in the universal coupling flange with the safety stalk and coupling. Fit the two inserts into the universal coupling flange and secure the assembly using the setscrews, washers, and nuts. Torque tighten to the figures quoted in Section N8.
3. Fit the lower universal coupling to the splined shaft, ensuring that the flat on the splined end is in the correct relationship to the pinch bolt. Fit the pinch bolt, washer, and nut.
4. Fit both heatshields.

All cars

5. Ensure that the road wheels are in the straight ahead position. Using either centring plug RH 9119 or RH 12123 (as applicable), ensure that the steering rack is positioned centrally to the blanking plug hole.
6. Replace the blanking plug.
7. Ensure that the steering column link joint face is facing downwards.
8. Fit the steering wheel onto the splines (if removed), giving the nearest straight ahead position. Adjust to give the correct position by turning the wheel slightly (if necessary).

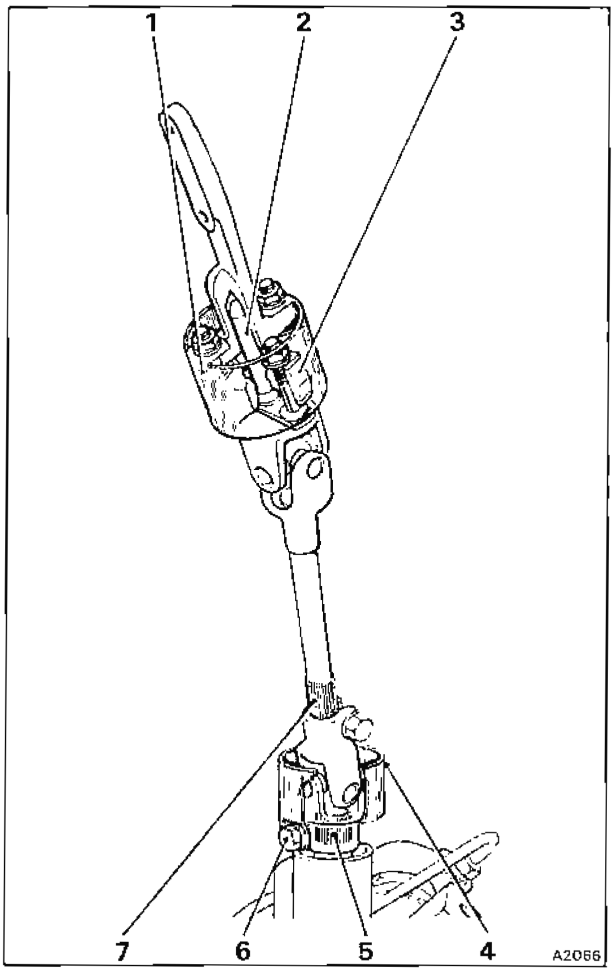


Fig. N5-5 Column to steering unit linkage
1 Heatshield
2 Safety stalk
3 Bonded coupling
4 Heatshield
5 Spline
6 Pinch bolt
7 Adjustable spline

9. Align the column link face to the lower linkage arm face (see fig. N5-1). Fit the splined coupling onto the pinion box spline. **Ensure that on 1989 model year cars the pinch bolt aligns with the flat on the spline.** Fit the pinch bolt, washers, and castellated nut; lightly tighten the nut.
10. Ensure that the two joint faces of the connecting links are parallel to each other. Any further adjustment must be made by repeating Operations 8 and 9.
11. Fit the two 'fitted' bolts into the underside of the steering column linkage (see fig. N5-1).

Note On cars not fitted with a 'one-piece' lower linkage, fit a nut only to the lower bolt (adjacent to the bonded coupling), and a nut and washer to the upper bolt (adjacent to the toeboard).
On cars fitted with a 'one-piece' linkage, fit nuts and washers to both bolts.

Torque tighten to the figures quoted in Section N8.

12. **On 1989 model year cars not fitted with a 'one-piece' lower linkage,** set the lower linkage coupling to the rack pinion, by lining up the shoulder of the lower yoke with the top of the pinion shaft (see fig. N5-6, A). Then, check to ensure that a gap of at least 0,50 mm (0.020 in) exists between the lower coupling shaft and the universal joint spider (see fig. N5-6, B). Adjust on the rack pinion shaft, if necessary.

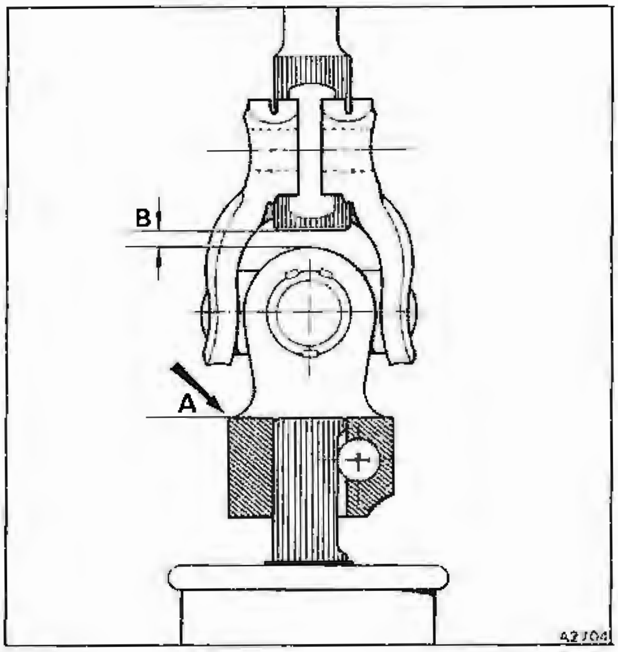


Fig. N5-6 Column to steering unit linkage (1989 model year cars not fitted with 'one-piece' lower linkage)

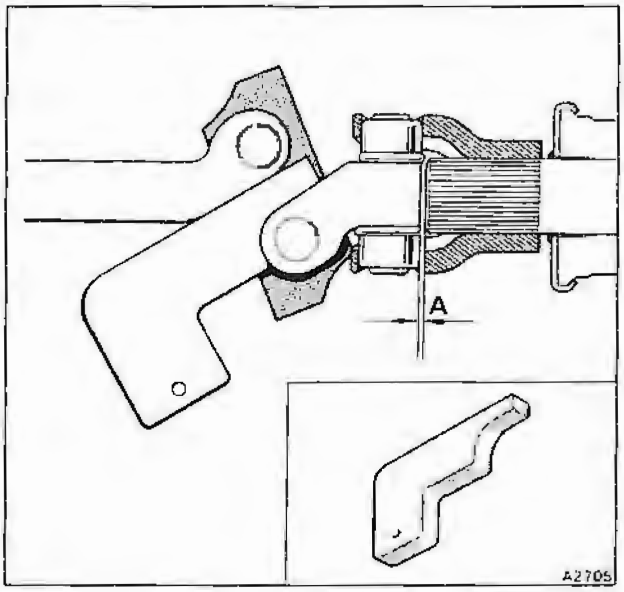


Fig. N5-7 Column to steering unit linkage (1989 model year cars fitted with 'one-piece' lower linkage)

Note It is important that neither the pinion shaft or lower coupling shaft contact the universal joint spider.

Torque tighten the lower pinch bolts and castellated nuts to the figures quoted in Section N8, utilizing the torque allowance to allow the fitting and securing of the new split pins.

13. **On 1989 model year cars fitted with a 'one-piece' lower linkage,** set the lower linkage coupling to the rack pinion using tool RH 12122 as follows.

a. Slide the lower yoke fully down on the rack input shaft spline.

b. Insert tool RH 12122 between the two pivots as shown in figure N5-7.

c. Slide the lower yoke up the input shaft until the tool is 'pinched' between the two pivots.

d. Tighten the lower pinch bolt.

e. Remove the tool RH 12122.

f. Check to ensure that a gap of at least 0,50 mm (0.020 in) exists between the top of the pinion input shaft and the lower pivot shaft (see fig. N5-7, A).

g. Torque tighten the pinch bolt to the figures quoted in Section N8, utilizing the torque allowance to allow the fitting and securing of a new split pin.

All cars

14. Fit and torque tighten the steering wheel to column nut, to between 34 Nm and 38 Nm (3,5 kgf m and 3,8 kgf m; 25 lbf ft and 28 lbf ft).

Steering linkage

Introduction
The track rod assemblies incorporate maintenance free ball joints, which are lubricated and sealed for life during manufacture. Therefore, if either of the ball joints is worn, the complete track rod has to be fitted.

The track rods which are 'handed' should be fitted with the adjusters inboard, the clamp bolts to the front of the car, and the bolt head uppermost (see fig. N6-1, inset B).

Track rods – To renew
1. Drive the car onto a ramp. Chock the rear road wheels.
2. Remove fuse A6 from fuse panel F2 on the main fuseboard. Then, raise the ramp to a convenient working height.
3. Remove the split pin and castellated nut from the inner and outer track rod ends.
4. **With the engine running**, turn the steering to full lock. Switch off the engine and release the inner ball-pin from its taper using tool RH 9710.

With the engine running, turn the steering to the opposite full lock. Switch off the engine and release the remaining inner ball-pin, again using tool RH 9710.

Withdraw the ball-pin(s) from the inner ball joint bracket.
5. Support the track rod assembly. Using tool RH 9710, release the outer ball-pin(s) from its taper.
6. Remove the track rods from beneath the car.
7. Inspect the track rod assembly and associated components for wear or damage.
8. Replace any components, if necessary.
9. Clean the tapers of the side steering levers, inner ball joint bracket, and ball-pin joints.
10. Reverse the procedure for assembly. Torque tighten the nuts to the figures quoted in Section N8.

Inner ball joint bracket – To renew
1. Drive the car onto a ramp. Chock the rear road wheels.

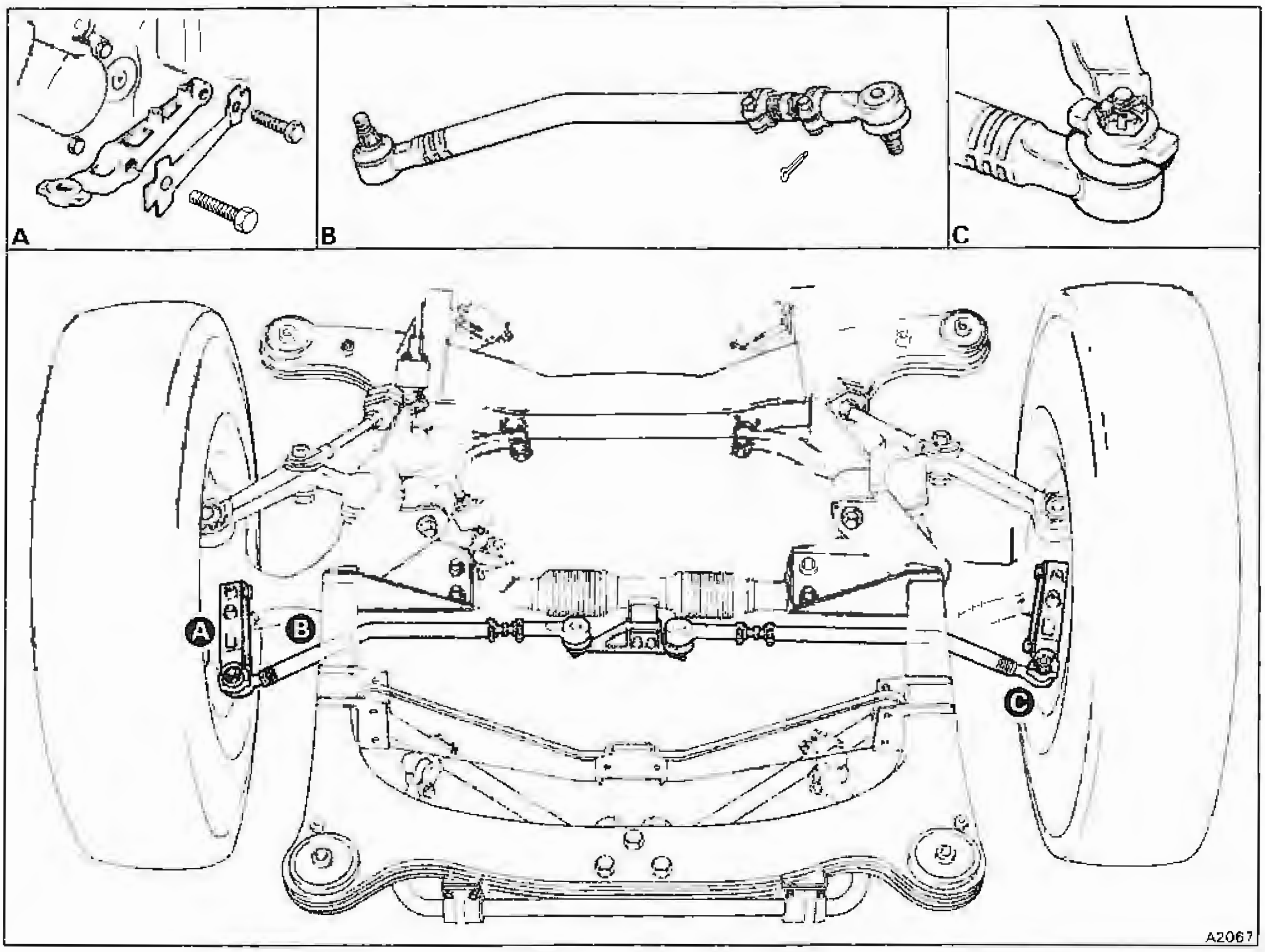


Fig. N6-1 Steering linkage

2. Disconnect the battery. Then, raise the ramp to a convenient working height.
3. Straighten the tab-washer tangs. Remove the bolts holding the inner ball joint bracket to the steering rack. When removing the bolts, care must be taken not to disturb the steering rack centre block oil seal.
4. Support the track rods either side of the inner ball joint bracket. Remove the split pin and castellated nut from the inner ball-pin assemblies.
5. Release the ball-pin from its taper using tool RH 9710.
6. Reverse the procedure for assembly, ensuring that a new tab-washer is fitted.

Torque tighten the nuts and bolts to the figures quoted in Section N8.

Side steering levers – To renew

1. Drive the car onto a ramp. Chock the rear road wheels.
2. Disconnect the battery. Then, raise the ramp to a convenient working height.
3. Carefully remove the hydraulic pipe mounting bracket from the side steering lever(s) and ease away from the working area.
4. Remove the split pin and castellated nut from the outer ball-pin assemblies.
5. Support the track rod(s).
6. Release the ball-pin from its taper using tool RH 9710. Withdraw the ball-pin from the side steering lever.
7. Straighten the tab-washer tangs. Remove the bolts holding the side steering levers to the stub axle.
8. Reverse the procedure for assembly, ensuring that a new tab-washer is fitted. Torque tighten the nuts and bolts to the figures quoted in Section N8.

Front wheel 'toe-in' – To adjust

1. Ensure the car is on a level surface and set the steering wheel in the straight ahead position.
2. Remove fuse A6 from fuse panel F2 on the main fuseboard.
3. Fit suitable checking equipment to the front wheels and check the 'toe-in' in accordance with the equipment manufacturer's instructions.

'Toe-in' setting 12'±5'.

If electronic checking equipment is not available, proceed as follows.

4. Move the car **forward** half a revolution of the road wheels.

Note Moving the car rearwards will give an incorrect reading.

5. Using optical equipment, take a reading.
6. Move the car **forward** a further half a revolution of the road wheels. Take a second reading using the optical equipment.
7. Taking the average of the two readings, will determine the 'toe-in' figure.
8. If a correction to the setting is required, slacken the two pinch bolts securing the track rod adjusters. Turn the adjusters to bring the wheels into the straight ahead (zero 'toe-in') position.
9. Turn the adjusters by equal amounts on each side of the car to give an overall 'toe-in' range of 12' ±5', with the car in a 'levelled' condition (see Chapter G).
10. Tighten the adjuster pinch bolts and again check the 'toe-in' as described in Operations 4 to 7 inclusive.
11. Finally, torque tighten the pinch bolts to the figures quoted in Section N8. Use the torque tolerance to enable new split pins to be fitted.

Fault diagnosis

Symptoms	Possible cause	Action
Steering pump and reservoir		
Hydraulic fluid leaks	1. Filler cap seal leaking due to fluid level too high, or air in fluid.	1. Check oil level and top-up if required. Bleed system of air by operating steering (engine running). Examine cap for damage or distortion.
	2. Faulty hose connections and/or perforated rubber.	2. Renew hoses.
	3. Flow control valve outlet 'O' ring, or pressure plate/end plate 'O' rings leaking.	3. Renew 'O' rings as necessary.
	4. Steering pump bearing oil seal leaking.	4. Renew seal. Examine shaft for wear or damage.
	5. Reservoir filler cap seal damaged.	5. Renew seal.
Momentary increase in effort when turning wheel quickly	1. Low fluid level in reservoir.	1. Check fluid level. Examine system for leaks. Top-up if required.
	2. Pump drive belts slipping.	2. Adjust pump drive belts. Renew belts if necessary.
	3. Heavy internal fluid leak.	3. Check pump outlet pressure. If pressure is low, renew combined flow control/relief valve. If pressure remains low, check system for internal leaks by dismantling the steering unit.
	4. Aerated fluid.	4. Renew fluid or allow system to stand for at least one hour.
Noisy system	1. Low fluid level.	1. Check for leaks. Fill the system with the approved fluid and bleed by operating the steering (engine running).
	2. Loose drive belts.	2. Adjust drive belts. Renew belts if necessary.
	3. Excessive back pressure due to partially blocked pipes or resistance to steering gear movement.	3. Locate restriction and correct as necessary.
	4. Faulty fluid cooler.	4. Renew cooler.
	5. Defective flow control valve.	5. Renew valve.
	6. Scored pressure plate.	6. Lap to remove light scoring. Renew heavily scored components.
	7. Vanes incorrectly fitted.	7. Fit vanes correctly, radiused ends to pump ring.
	8. Vanes sticking in rotor slots.	8. Free vanes by removing burrs, foreign matter, etc.
	9. Extreme wear on pump ring.	9. Renew pump ring, rotor, and vanes.
	10. Face of thrust plate scored.	10. Lap to remove light scoring. Renew rotor, vanes, and pump ring if rotor is heavily scored.
	11. Scored rotor.	11. Lap to remove light scoring. Renew heavily scored components.
	12. Aerated fluid.	12. Change fluid or allow system to stand for at least one hour.

Symptoms	Possible cause	Action
Steering		
Car pulls to one side	1. Front end geometry incorrect.	1. Check steering geometry.
	2. Pump drive belts slipping.	2. Adjust drive belts. Renew belts if necessary.
	3. Flow control valve sticking.	3. Examine flow control valve. Renew valve if necessary.
Heavy steering	1. Incorrect tyre pressures.	1. Check and correct tyre pressures.
	2. Tyre pull.	2. Check by fitting different tyres.
	3. Loose pump drive belts.	3. Adjust drive belts. Renew belts if necessary.
	4. Low fluid level in reservoir.	4. Examine system for leaks. Top-up if required.
	5. Insufficient fluid pressure.	5. Check the pump outlet pressure.
	6. Faulty or obstructed flow control valve.	6. Check and replace if necessary.
	7. Incorrect front wheel alignment (toe-in).	7. Check and adjust if necessary.
	8. Incorrect caster and/or camber angle.	8. Check and adjust if necessary.
	9. Distorted flexible coupling or defective universal joint (lower steering column).	9. Examine and renew if necessary.
	10. Triangle levers misaligned.	10. Check caster and camber angles.
	11. Front sub-frame distorted.	11. Check sub-frame for correct alignment. Correct or renew if necessary.
	12. Kinks in hoses.	12. Ensure correct run of hoses.
	13. Obstruction in hose. Inner casing of hose swollen, caused by overheated or wrong fluid.	13. Renew hose.
	14. Pressure loss in rack and pinion unit caused by worn P T F E seals and scored bores.	14. Overhaul unit.
	15. Leakage at pinion valve.	15. Overhaul unit.
Steering wheel		
Excessive play at the steering wheel	1. Steering wheel securing nut loose.	1. Tighten nut.
	2. Excessive play in the steering linkage.	2. Adjust steering linkage or renew parts if required.
	3. Insufficient pre-load.	3. Strip and rebuild steering unit.
	4. Defective bonded coupling.	4. Renew coupling.
	5. Worn universal joints in lower linkage.	5. Renew joints.
	6. Front wheel bearings incorrectly adjusted or worn.	6. Adjust bearings or renew if necessary.
Rack and pinion unit		
Oil leak from centre linkage	1. Convoluted seal clips loose.	1. Tighten clips.
	2. Damaged convoluted rubber boot(s).	2. Renew rubber boot(s).
	3. Defective centre seal.	3. Fit a new seal.
Hydraulic fluid leaks from hose connections and pipe unions	1. Loose hose connections or damaged 'O' rings.	1. Tighten hose connections. If tightening fails to cure the leak, examine hoses for cracks or damage. Renew 'O' rings or hoses if necessary.

Special torque tightening figures

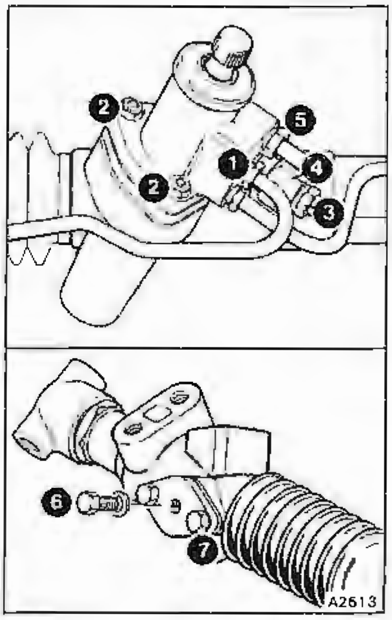
Introduction

This chapter contains the special torque tightening figures applicable to Chapter N.

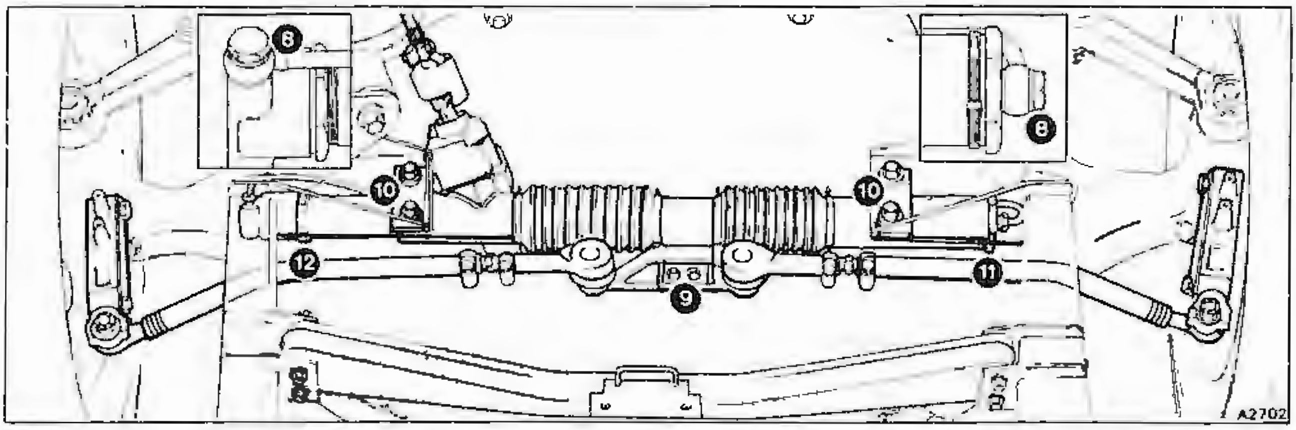
For standard torque tightening figures refer to Chapter P.

Components used during manufacture of the vehicle have different thread formations (metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews, it is important to ensure that the correct type and size of thread formation is used.

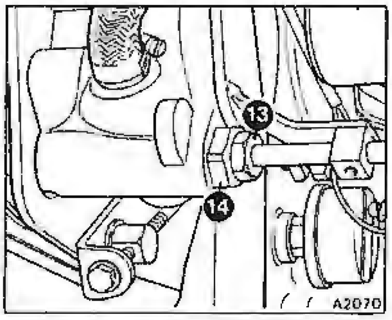
Section N2



Ref.	Component	Nm	kgf m	lbf ft
1	Steering rack to pinion valve pipe assemblies – male nut	23-27	2,4-2,7	17-20
2	Pinion valve housing – retaining nuts/setscrews	20-25	2,0-2,5	15-18
3	Pump to pinion valve housing – male nut	28-40	2,8-4,1	20-30
4	Anti-joggle valve assembly – housing	28-40	2,8-4,1	20-30
5	Pinion valve housing – male nut	28-40	2,8-4,1	20-30
6	Rack centring – blanking plug	7-11	0,7-1,1	5-8
7	Rack slipper cover plate – setscrews (1989 model year)	20-25	2,0-2,5	15-18
8	Steering rack – banjo bolts (1989 model year)	35-41	3,6-4,1	25-30
9	Inner ball joint bracket – setscrew	38-40	3,9-4,1	28-30
10	Steering rack mounting – setscrew	57-61	5,8-6,2	42-45
11	Steering rack – end plug	73-80	7,5-8,1	54-59
12	Steering rack – lock-nut	47-54	4,8-5,5	35-40

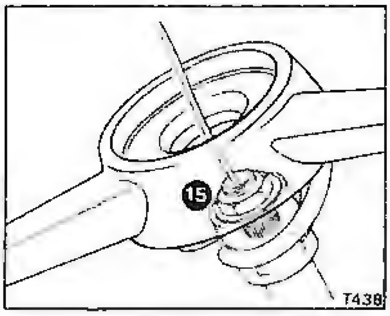


Section N3



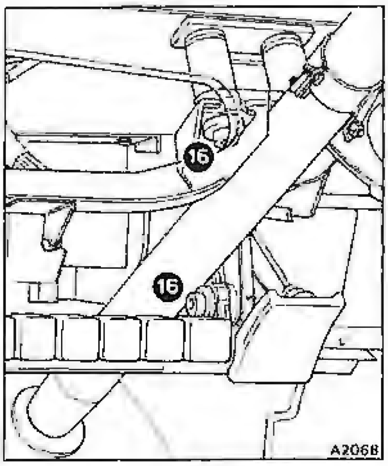
Ref.	Component	Nm	kgf m	lbf ft
13	Steering pump pressure pipe – union	28-40	2,8-4,1	20-30
14	Control valve outlet adapter	50-75	5,1-7,6	37-55

Section N4



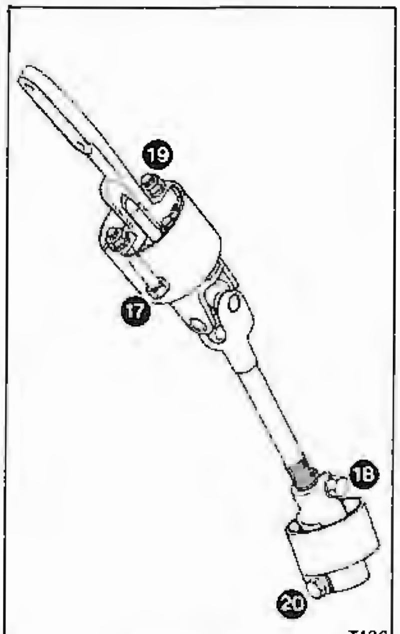
Ref.	Component	Nm	kgf m	lbf ft
15	Steering wheel – nut	34-38	3,5-3,8	25-28

Section N5



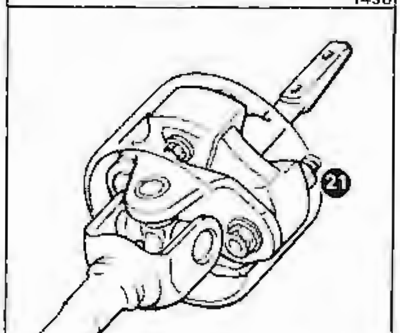
Ref.	Component	Nm	kgf m	lbf ft
16	Steering column mounting – Allen capscrew	29-32	2,9-3,3	21-24

Section N5 (continued)



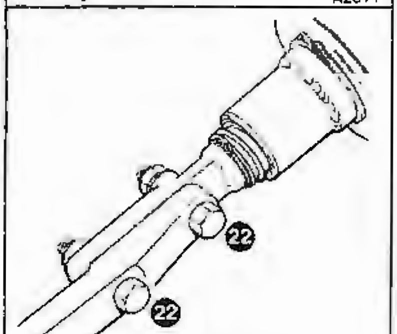
T436

Ref.	Component	Nm	kgf m	lbf ft
17	Bonded coupling to lower link – setscrew	22-24	2,2-2,4	16-18
18	Input shaft – adjusting spline pinch bolt	15-20	1,5-2,0	11-15
19	Heatshield to rubber coupling – lock-nut	18-20	1,8-2,0	13-15
20	Lower coupling to rack – pinch bolt (pre 1989 model year)	15-20	1,5-2,0	11-15
	Lower coupling to rack – pinch bolt (1989 model year)	15-20	1,5-2,0	11-15



A2071

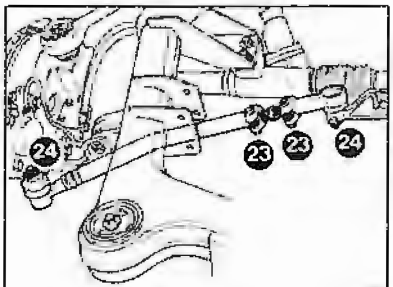
Ref.	Component	Nm	kgf m	lbf ft
21	Input shaft to bonded coupling – nut	22-24	2,2-2,4	16-18



X106

Ref.	Component	Nm	kgf m	lbf ft
22	Steering column linkage – fitted bolts	22-24	2,2-2,4	16-18

Section N6



X127

Ref.	Component	Nm	kgf m	lbf ft
23	Track rod clamping – castellated nut	45-54	4,6-5,5	33-40
24	Track rod ball-pin – castellated nut	60 (Then align split pin holes)	6,1	44

Steering racks

Retrospective fitting of the type fitted to 1989 model year cars onto pre 1989 model year cars

The type of steering rack fitted to 1989 model year cars can also be fitted to pre 1989 model year cars, using a special adapter kit. The parts affected are the steering rack and the lower steering column linkage.

Reference must also be made to TSD 4736, Product Support Information N3 and the Parts microfiche.

Procedure

1. Remove the existing rack and lower steering column linkage as described in the relevant sections of this manual.
2. Connect the new lower steering column linkage to the steering column by means of the fitted bolts provided in the kit.

Note On cars not fitted with a 'one-piece' lower linkage, fit a nut only to the lower bolt (adjacent to the bonded coupling), and a nut and washer to the upper bolt (adjacent to the toeboard).

On cars fitted with a 'one-piece' linkage, fit nuts and washers to both bolts.

3. Fit all setscrews and washers provided for the adapter blocks into position, in preparation for fitting the rack. Fit the adapter blocks loosely to the sub-frame (see fig. N9-1).
4. Ensure that the rack is positioned centrally and fit the centralizing tool RH 12123.
5. Fit the rack to the adapter blocks and support it loosely on the setscrews.
6. Centralize the steering wheel and position the lower steering column linkage onto the rack splines. Ensure that the flat on the splines aligns with the pinch bolt of the lower linkage. Remove the centring tool RH 12123.
7. Torque tighten all the setscrews securing the rack to the sub-frame, using the special spanner RH 12128 and torque wrench extensions RH 12124 and RH 12125 as necessary. Refer to Section N8 for the torque tightening figures.
8. Adjust the lower steering column linkage as described in Section N5.
9. Connect all ancillaries and adjust the steering wheel position if necessary.

Note A clearance of 9 mm (0.350 in) minimum must exist between the top of the track rod ends and the underside of the engine sump. If insufficient clearance exists, use the packing piece provided in the kit, under the front engine mount. Check the clearance again after fitting the packing piece.

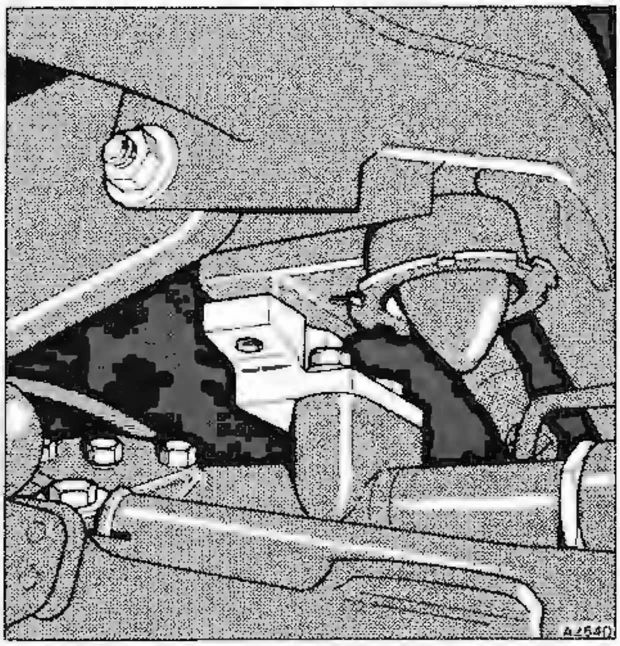


Fig. N9-1 Modified arrangement – adapter blocks to sub-frame

Workshop tools

Rack and pinion unit

RH 9112	Sizing tool (small) – PTFE scarf jointed bearing
RH 9113	Sizing tool (medium) – PTFE scarf jointed bearing
RH 9114	Sizing tool (large) – PTFE scarf jointed bearing
RH 9117	Applicator – PTFE rings and lower seal, pinion valve
RH 9118	Sizing tool – PTFE rings, pinion valve
RH 9119	Screwed location plug – Rack centring (pre 1989 model year)
RH 9120	Spline cover – Input shaft, upper and lower oil seals
RH 9121	Applicator – Input shaft, lower oil seal into carrier
RH 9122	Torque wrench extension – Steering rack anchorage (pre 1989 model year)
RH 9123	Torque arm – Checking pinion valve ball race pre-load; use with a spring balance (pre 1989 model year)
RH 9125	Spanner (open ended) – Torque wrench, rack lock-nut
RH 12122	Setting tool – 'One-piece' lower linkage (1989 model year)
RH 12123	Screwed location plug – Rack centring (1989 model year)
RH 12124/5	Torque wrench extensions – Steering rack anchorages (1989 model year)
RH 12128	Spanner – Steering rack anchorages (1989 model year rack to pre 1989 model year cars)
RH 12212	Clip pliers – Convoluted seals (1989 model year)
RH 12213	Removal tool – Fixed bearing carrier, rack bar
RH 12214	Fitting tool – Piston seals, rack bar

Steering pump

RH 9106	Fitting and extraction tool – Pulley

Steering linkage

RH 9710	Ball-pin taper breaker – Inner and outer ball-pins

Torque tightening figures

Contents

Contents	Sections Rolls-Royce Silver Spirit	Silver Spur	Corniche	Corniche II	Bentley Eight	Mulsanne	Turbo R	Continental
Contents and issue record sheet	P1	P1	P1	P1	P1	P1	P1	P1
Standard torque tightening figures	P2	P2	P2	P2	P2	P2	P2	P2

Printed in England

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections	P1	P2								
Page No.										
1	9/86	9/86								
2										
3	9/86									
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Standard torque tightening figures

Tighten all setscrews, full nuts, and half nuts to the figures given in the tables, **except** those components listed in the **special torque tightening** section within each Chapter.

Setscrews should be tightened to the figures quoted for full or castellated nuts.

Plated parts should have all burrs and foreign matter (e.g. grit, grease, and paint) removed from the abutment faces of the nuts, setscrews, washers, and components to ensure that the correct torque tightening figures are obtained.

The threads and abutment faces of **non-plated parts** should be smeared with engine oil before being fitted.

All unified nuts having an identification groove on one end, are to be fitted with the groove end away from the mating face.

Certain items should not be torque tightened and these are as follows.

1. Nuts which are locked by riveting
2. Wood screws
3. Hub assembly retaining nuts (front and rear)
4. All threads less than 2 B.A. (except items listed in the special torque tightening sections)

Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

Full nut

Size	Nm	kgf m	lbf ft
2 B.A.	6-6,5	0,6-0,7	48-60 lbf in
¼ in dia UNF 7⁄16 in A/F	11-13	1,2-1,4	8-10
5⁄16 in dia UNF ½ in A/F	22-24	2,2-2,4	16-18
⅜ in dia UNF 9⁄16 in A/F	39-43	4,0-4,4	29-32
7⁄16 in dia UNF ⅝ in and 11⁄16 in A/F	57-61	5,8-6,2	42-45
½ in dia UNF ¾ in A/F	82-88	8,3-8,9	60-65
⅝ in dia UNF ⅞ in A/F	116-122	11,6-12,4	85-90

Half nut

Size	Nm	kgf m	lbf ft
2 B.A.	3-4	0,3-0,4	30-36 lbf in
¼ in dia UNF 7⁄16 in A/F	7-9	0,7-0,9	5-7
5⁄16 in dia UNF ½ in A/F	18-20	1,8-2,0	13-15
⅜ in dia UNF 9⁄16 in A/F	30-33	3,0-3,4	22-25
7⁄16 in dia UNF ⅝ in and 11⁄16 in A/F	45-48	4,6-4,9	33-36
½ in dia UNF ¾ in A/F	65-70	6,7-7,1	48-52
⅝ in dia UNF ⅞ in A/F	99-105	10,1-10,7	73-78

Metric - Full nut

Size	Nm	kgf m	lbf ft
M6	11-13	1,2-1,3	8-10
M8	28-29	2,8-3,0	20-22
M10	56-59	5,7-6,0	41-44
M12	95-98	9,7-10,0	70-73
M16	240-249	24,5-25,4	177-184

Exhaust systems

Contents

Sections

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	Q1	Q2	Q3	Q4	Q5	Q6				
1	5/88	11/86	5/88	2/89	2/89	11/86				
2			5/88	5/88	2/89	11/86				
3	2/89		5/88	2/89	2/89					
4				5/88	2/89					
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Printed in England

Exhaust gas poisoning and First aid

Danger — Exhaust gas
Inhaling exhaust gas is dangerous.

If it is necessary to run the engine inside a building, always ensure that the exhaust gas is suitably piped to the outside.

First aid — Burns
Before commencing work on the exhaust always ensure that the system is not hot.

In the event of a skin burn, cold clean water should be run over the affected area and if necessary, a dry dressing temporarily applied.

A medical centre or doctor should be consulted as soon as possible after administering this emergency treatment.

11/86
Printed in England

Exhaust manifolds

Exhaust manifolds – To remove (see fig. Q3-1)
Cars other than Bentley Turbo R

1. Disconnect the battery and ensure that the usual workshop safety precautions are carried out.
2. Support the downtake pipes just forward of the front silencer.
3. Remove the clamps from around the downtake to manifold joint on both 'A' and 'B' bank. Free both joints.
4. Detach the air injection pipes (if fitted) from both manifolds.
   Blank off the pipes to prevent the ingress of dirt.
5. Remove the setscrews and distance pieces securing the manifolds to the cylinder heads after first bending back the tabs of the lock-plates. Withdraw the manifolds, then remove and discard the lock-plates.
6. Discard the gaskets fitted between the manifolds and the cylinder heads.
7. Blank off the ports in the cylinder heads to prevent the ingress of dirt and other foreign matter.

Exhaust manifolds – To inspect

1. Using medium grade emery cloth, lightly dress the manifold to downtake pipe joint.
2. Remove any scale on the manifold (to cylinder head) joint faces.
3. Check for distortion of the manifold (to cylinder head) joint faces using a straight edge.
4. Minor distortions can be corrected by rubbing the manifold joint faces across the cutting surface of medium grade emery cloth. The emery cloth should be secured to a surface table.

Note It is important that the manifold (to cylinder head) joint faces are flat, clean, and square.

Exhaust manifolds – To fit

To fit the manifolds reverse the procedure given for their removal, noting the following.

1. Ensure that all joint faces are free from scale and emery dust before assembly.
2. Lubricate all joint threads to ensure that the threads do not bind.
3. Smear the spherical seating faces and the grooves in the spherical clamps with either graphite lubricant or an assembly compound to assist in correct alignment.
4. Ensure that new lock-plates are fitted to the manifold securing setscrews.
5. All nuts and bolts should be torque tightened to the figures quoted in Section Q6 and Chapter P. Manifold setscrews must be tightened evenly, starting at the centre and working outwards (i.e. from side to side).
6. After the engine has run sufficiently to reach normal operating temperature, the manifold setscrews and spherical joint clamp nuts should be checked and if necessary, again tightened to the figures quoted in Section Q6 and Chapter P.
7. Ensure that the tabs of the manifold lock-plates are bent over.
8. If the exhaust manifold studs have to be replaced, refer to Section Q6.

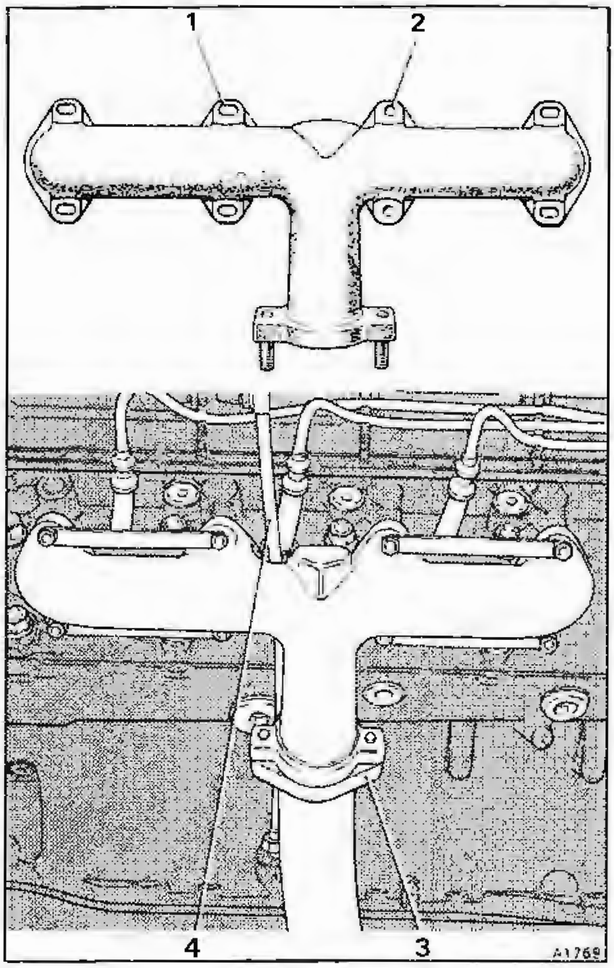


Fig. Q3-1 'B' bank exhaust manifold
Cars other than Bentley Turbo R
1 Elongated hole
2 Location hole
3 Exhaust clamp
4 Engine oil dipstick

Exhaust manifolds – To remove (see fig. Q3-2)
Bentley Turbo R – Prior to 1989 model year

1. Disconnect the battery and ensure that the usual workshop safety precautions are carried out.
2. Support the downtake pipe just forward of the front silencers.

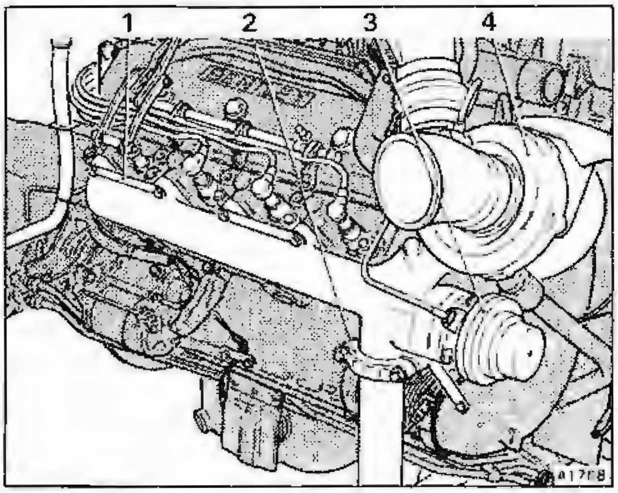


Fig. Q3-2 'A' bank exhaust manifold
Bentley Turbo R – Prior to 1989 model year
1 Manifold setscrew lock-plate
2 Connecting pipe clamp
3 Wastegate assembly
4 Turbocharger assembly

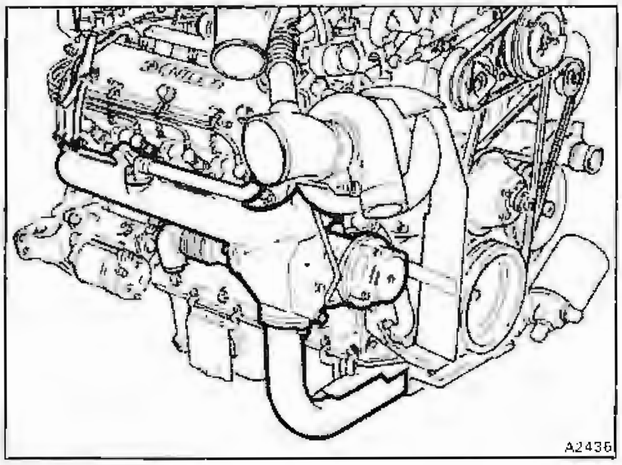


Fig. Q3-3 One piece exhaust manifold – 'A' bank
Bentley Turbo R – 1989 model year

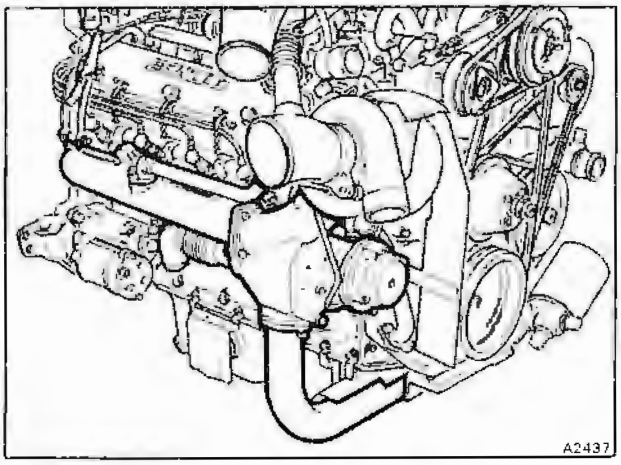


Fig. Q3-4 Split type exhaust manifold – 'A' bank
Bentley Turbo R – 1989 model year

3. Remove the clamps from the exhaust manifolds, securing the connecting pipe between 'A' and 'B' banks. Free the joints and remove the pipe.
4. Remove the nuts securing the turbocharger assembly to 'A' bank manifold. Collect the washers and then remove the turbocharger assembly. Take care not to damage the machined faces between the turbocharger and manifold.
5. Remove the wastegate assembly from 'A' bank manifold (see fig. Q3-2). Discard the 'O' ring.
6. Remove the setscrew securing the tie bar between 'A' bank manifold and the exhaust downtake pipe.
7. Remove the setscrews and distance pieces securing the manifolds to the cylinder heads after first bending back the tabs of the lock-plates. Withdraw the manifolds, then remove and discard the lock-plates.
8. Discard the gaskets fitted between the manifolds and the cylinder heads.
9. Blank off the ports in the cylinder heads to prevent the ingress of dirt and other foreign matter.

Bentley Turbo R – 1989 model year
One piece manifold (see fig. Q3-3)

1. Carry out Operations 1 to 5 (inclusive) as described for Turbo R cars prior to 1989 model year.
2. Detach the air injection pipes (if fitted) from both manifolds.
3. Remove the clamp securing the turbocharger by-pass pipe to the warm-up catalytic converter/front pipe asembly.
4. Remove the clamp securing the turbocharger by-pass pipe to the turbocharger end of the manifold. Free the joint and remove the pipe. Collect the sealing ring from the rear joint.
5. Carry out Operations 7 to 9 (inclusive) as described for Turbo R cars prior to 1989 model year.

Bentley Turbo R – 1989 model year
Split type manifold (see fig. Q3-4)

1. Carry out Operations 1 and 2 as described for Turbo R cars prior to 1989 model year.
2. Detach the air injection pipes (if fitted) from both manifolds.
3. Remove the nuts securing 'A' bank manifold to the turbocharger/wastegate mounting.
4. Carry out Operations 7 to 9 inclusive as described for Turbo R cars prior to 1989 model year.
5. Discard the sealing ring fitted between 'A' bank manifold and the turbocharger/wastegate mounting.

Exhaust manifolds – To inspect

1. Using medium grade emery cloth, lightly dress the manifold to connecting pipe joint faces.
2. Remove any scale on the manifolds (to cylinder head) joint faces.
3. Check for distortion of the manifold (to cylinder head) joint faces using a straight edge.
4. Minor distortions can be corrected by rubbing the manifold joint faces across the cutting surface of medium grade emery cloth. The emery cloth should be secured to a surface table.

Note It is important that the manifold (to cylinder head) joint faces are flat, clean, and square.

Exhaust manifolds – To fit

To fit the manifolds, reverse the procedure given for their removal, noting the following.

1. Ensure that all joint faces are free from scale and emery dust before assembly.
2. Smear the spherical seating faces and the grooves in the spherical clamps with either graphite lubricant or an assembly compound. This will assist in correct alignment.
3. All machined faces should be checked for flatness.

Important Under no circumstances should exhaust sealant (Firegum, etc.) be used between the exhaust manifolds and the turbocharger assembly.

4. Ensure that a new 'O' ring is fitted to the wastegate assembly.
5. Ensure that a new sealing ring is fitted between 'A' bank split type manifold and the turbocharger/ wastegate mounting.
6. Ensure that new lock-plates are fitted to the manifold securing setscrews.
7. All nuts and bolts should be torque tightened to the figures quoted in Section Q6 and Chapter P. Manifold setscrews must be tightened evenly, starting at the centre and working outwards (i.e. from side to side).
8. After the engine has been run sufficiently to reach normal operating temperature and has been allowed to cool, the manifold setscrews and spherical joint clamp bolts should be checked for tightness. If necessary, torque tighten to the figures quoted in Section Q6 and Chapter P.
9. Ensure that the tabs of the manifold lock-plates are bent over.
10. If the turbocharger assembly mounting studs, or exhaust manifold studs, have to be replaced, refer to Section Q6.

Exhaust pipes and silencers

Cars other than those incorporating a catalytic converter

Introduction
The exhaust system which is mounted beneath the right-hand side of the car comprises twin pipes and silencers.

On cars other than Bentley Turbo R, the system terminates with a single pipe from the rear silencer (see fig. Q4-1).

On Bentley Turbo R cars, twin pipes exit from the rear silencer (see fig. Q4-2).

Exhaust pipes and silencers – To remove
The exhaust system comprises a number of individual sections. These sections can be removed and replaced without the necessity of having to disturb the complete system.

1. Drive the car onto a ramp.
2. Disconnect the battery and ensure that the usual workshop safety precautions are carried out.
3. Raise the ramp.

Tailpipe finisher(s)

4. Unscrew the worm drive clip securing the tailpipe finisher to the exhaust and withdraw the finisher.

Rear silencer assembly

5. Locate the exhaust system joints forward of the final drive assembly.
6. Remove the nuts from the 'U' clamps, collect the washers and clamping plates. Withdraw the 'U' bolts.

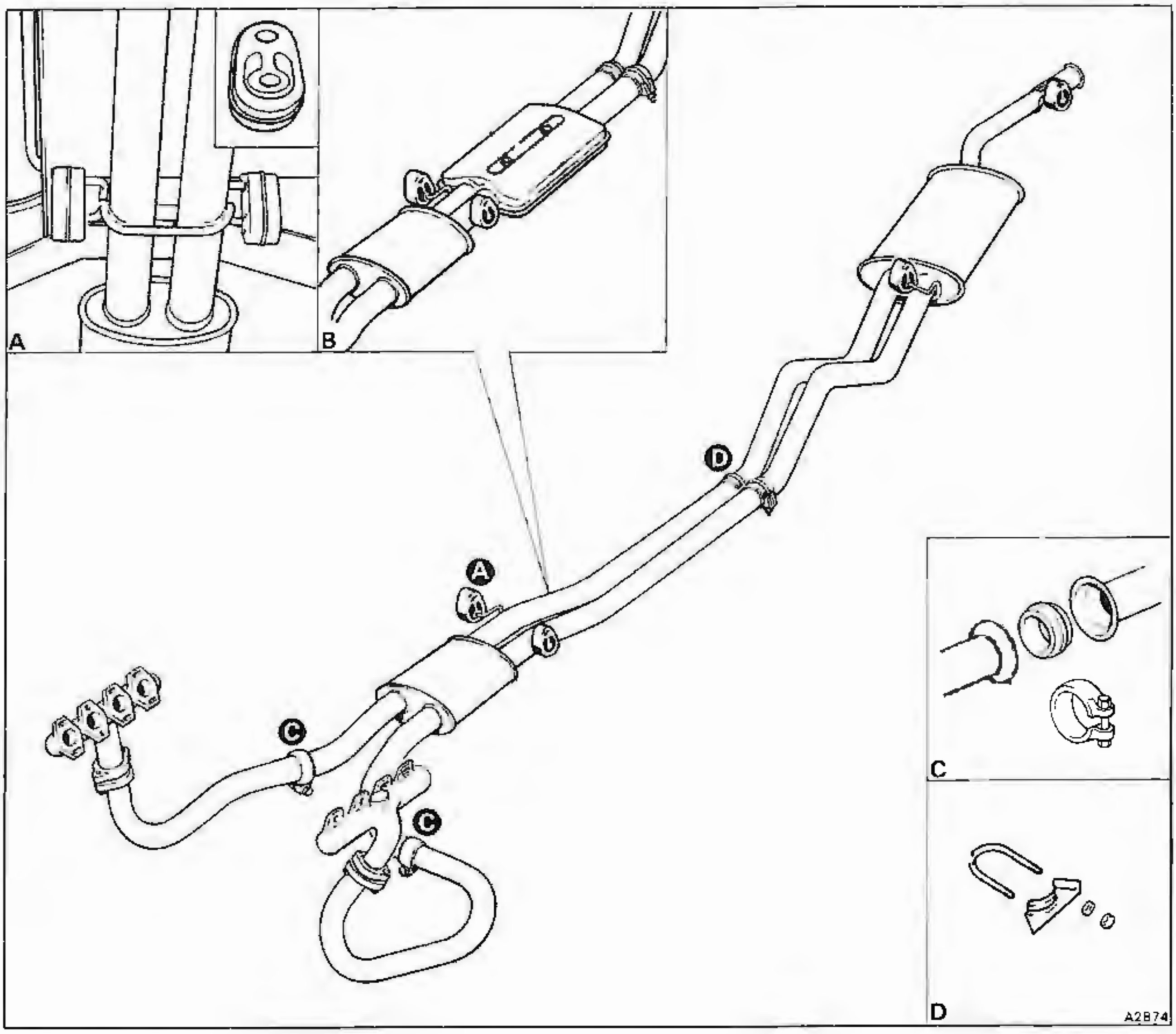


Fig. Q4-1 Exhaust system Cars other than Bentley Turbo R Inset B 1989 model year running change

7. Temporarily support the weight of the rear silencer assembly.
8. Disconnect the rear silencer assembly from the rubber hangers.
9. Remove the temporary support, twist the rear silencer assembly to 'break' the joint seals, then withdraw the assembly.

Front silencer assembly
10. Ensure that the weight of the front silencer assembly is temporarily supported.
11. Remove the nut(s) from the exhaust clamp(s) forward of the front silencer assembly. Collect the washer(s) and bolt(s), then free the clamp(s).
12. Discard the temporary support and withdraw the front silencer assembly, unhooking it from the rubber hangers. Collect the sealing ring(s) from the joint(s) as the silencer assembly is withdrawn.

Downtake pipes
Cars other than Bentley Turbo R
13. Ensure that the weight of the downtake pipes is temporarily supported.
14. Locate the downtake pipe to exhaust manifold joints. Remove the nuts from the joint clamps.
15. Discard the temporary supports and withdraw the downtake pipes.

Downtake pipe
Bentley Turbo R – Prior to 1989 model year
13. Ensure that the weight of the downtake pipe is temporarily supported.
14. Remove the nuts securing the exhaust to the rear of the engine, utilizing two tie bars. Remove the bolts and collect the washers.
15. Locate the downtake pipe joint beneath 'A' bank exhaust manifold. Remove the setscrews securing the outer half of the clamp. Collect the washers and free the clamp.
16. Remove the "T" bolt clamp connecting the exhaust downtake to the flexible bellows.
17. Discard the support and withdraw the downtake pipe.

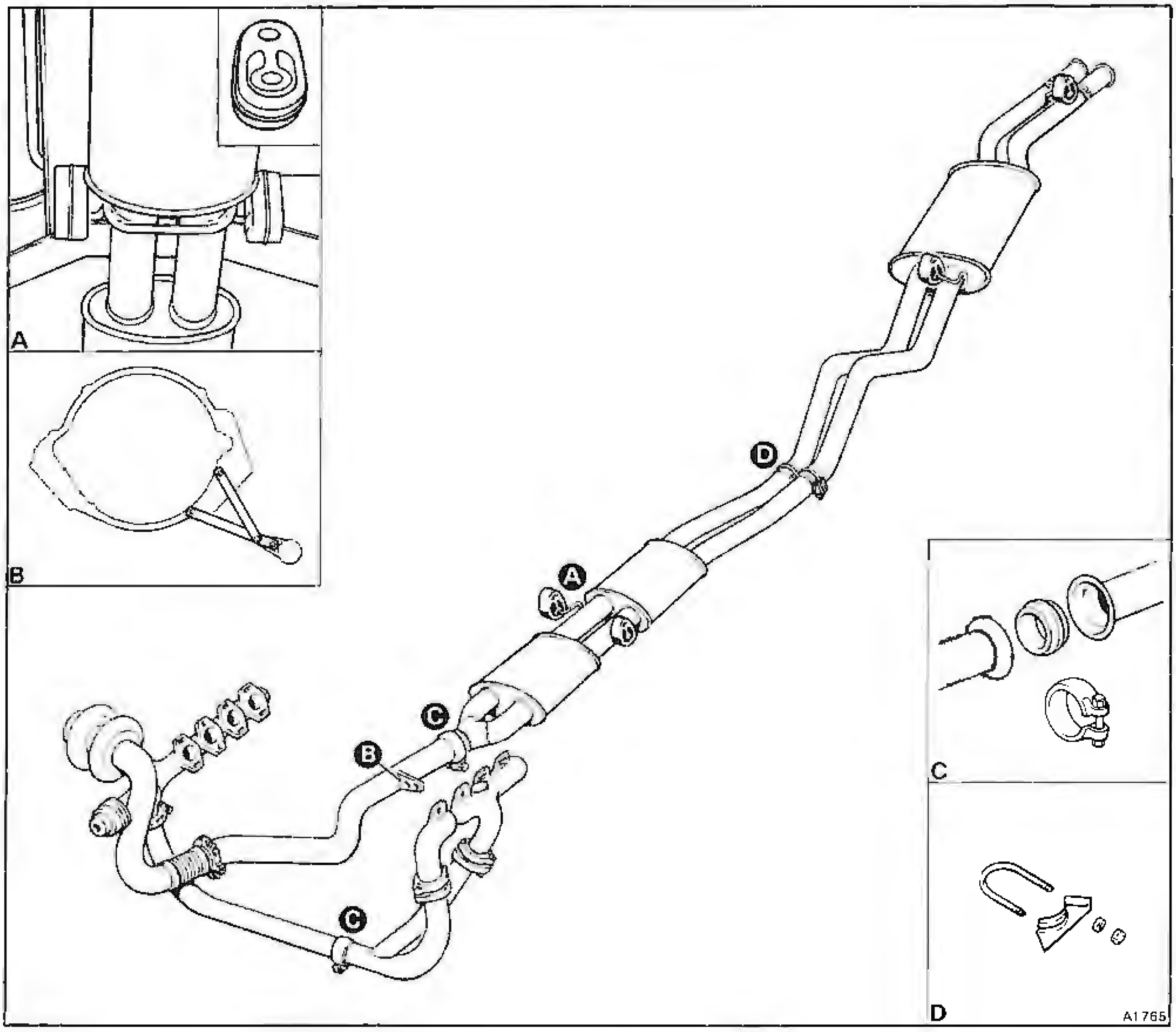


Fig. Q4-2 Exhaust system Bentley Turbo R – Prior to 1989 model year

Collector box and pipe assembly
Bentley Turbo R – 1989 model year

13. Ensure that the weight of the pipe assembly is temporarily supported.

14. Remove the nut from the exhaust clamp beneath 'A' bank exhaust manifold. Collect the washer and bolt, then free the clamp.

15. Discard the temporary support and withdraw the pipe assembly. Collect the sealing ring from the joint as the assembly is withdrawn.

Warm-up catalytic converter/front pipe assembly
Bentley Turbo R – 1989 model year
Remove the warm-up catalytic converter/front pipe assembly as described in TSD 4737 Engine Management Systems.

Exhaust pipes and silencers – To fit
To assemble, reverse the procedure given for removal, noting the following.

Prior to assembly

1. Ensure that the sliding joints are a good fit in their respective stub pipes to allow for adjustment.
2. All sealing rings and pipes must be thoroughly clean and free from scale. If necessary, these can be lightly dressed with fine emery cloth.
3. To ensure free movement of the joints for correct alignment of the components when assembling, the pipe flares and grooves in the joint clamps should be lightly smeared with either a graphite lubricant or Neverseez assembly compound.
4. Apply Neverseez assembly compound to all clamp bolt threads before assembly.
5. Any rubber hangers showing signs of wear, etc., should be replaced.

Upon assembly

1. The parts should be loosely assembled and then manoeuvred to give the best alignment (free from possible fouls), before the joints are tightened.

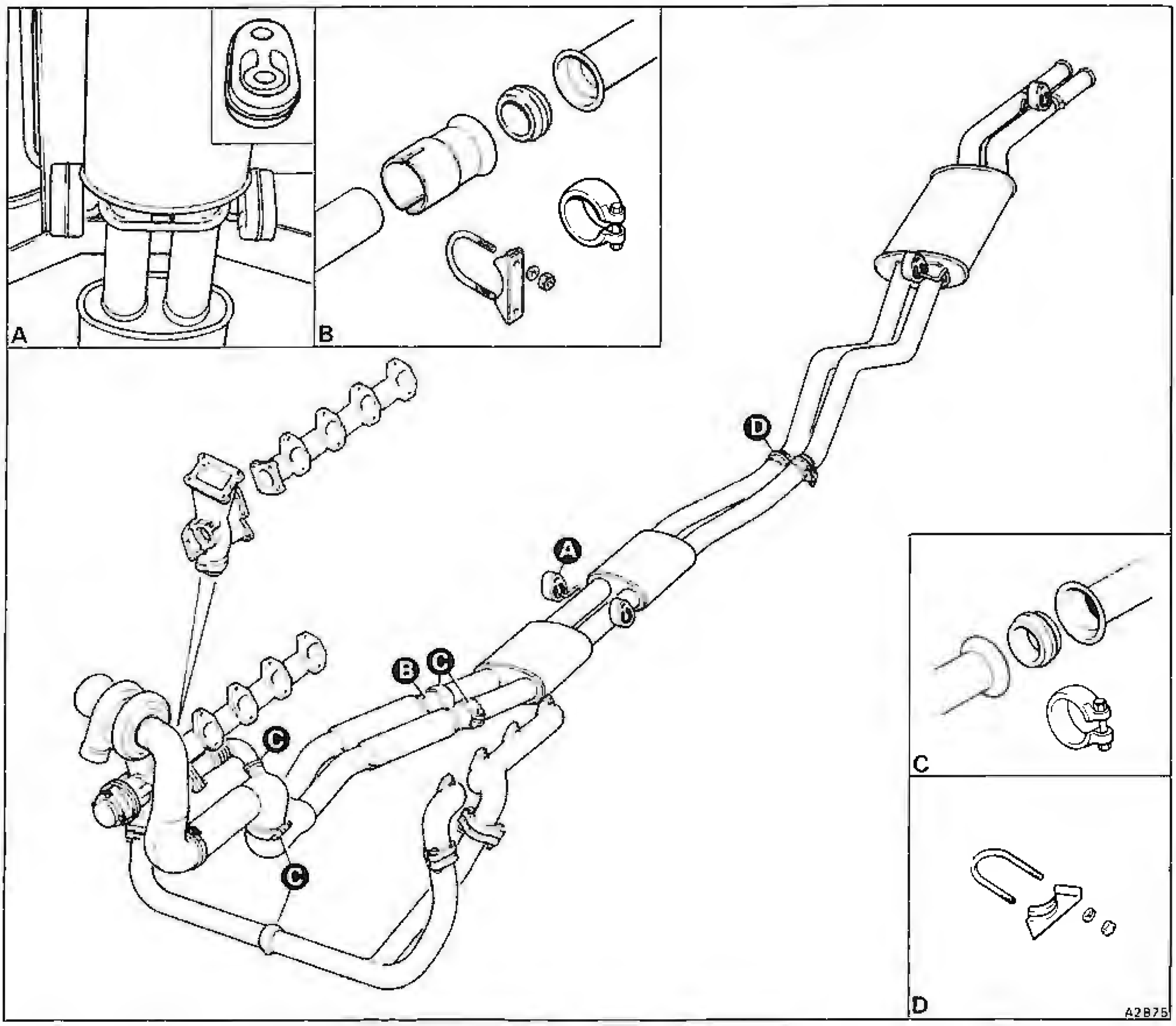


Fig. Q4-3 Exhaust system Bentley Turbo R – 1989 model year Inset B Running change

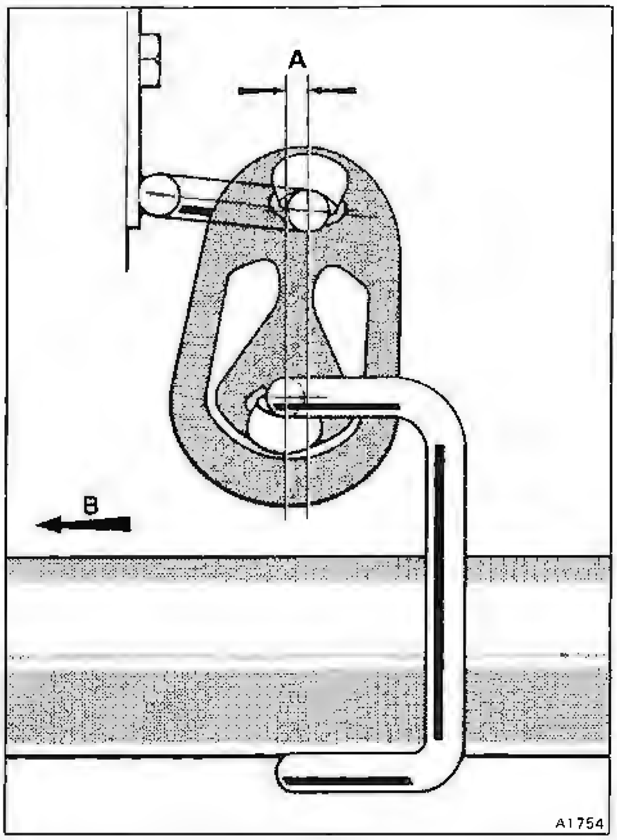


Fig. Q4-4 Exhaust mount offset
A 6 mm (0.236 in)
B Front of car

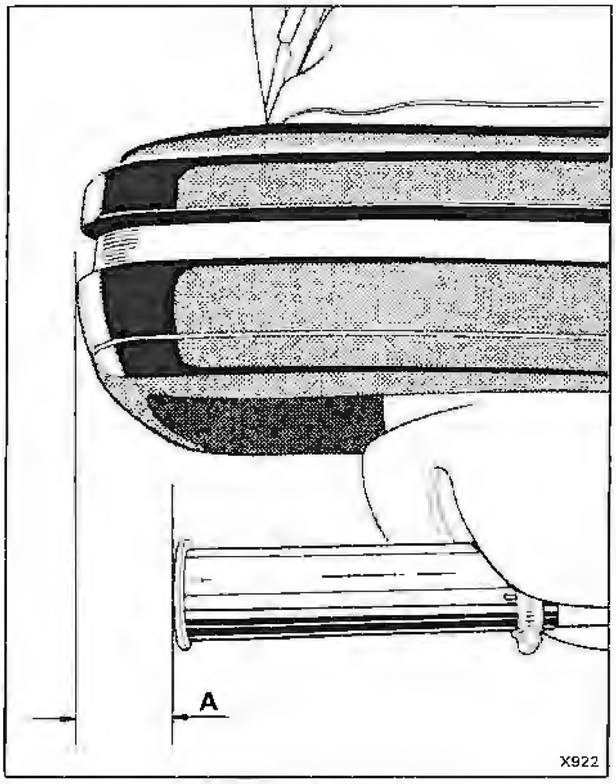


Fig. Q4-5 Tailpipe finisher setting
A 60 mm (2.364 in)

2. When setting clearances, ensure that the mounts are set 6 mm (0.236 in) forward of the mounting bracket to allow for expansion of the system (see fig. Q4-4).
3. Ensure that the tailpipe and finisher do not foul on the rear body moulding.
4. When the pipe runs are satisfactory, apply a sealant such as Holts Firegum into the ends of all straight tube joints. Ensure that the slots down the sides of the pipes are covered. Holts Firegum can also be smeared on the inside of the sliding joints.
5. The clamps on the sliding joints should be positioned so that the opening in the clamp is opposite to the slot in the pipe.
6. Torque tighten the Hymatic spherical clamps (with the clamp bolts in the vertical position) to the figures quoted in Section Q6.
7. Set the tailpipe finisher 60 mm (2.364 in) in from the outer edge of the bumper (see fig. Q4-5).

Exhaust pipes, silencers, and grass-fire shields

Cars incorporating a catalytic converter

Introduction
The exhaust system which is mounted beneath the right-hand side of the car, comprises twin pipes, catalytic converter(s), and rear silencer.

Note Refer to TSD 4737 Engine Management Systems for additional information relating to the Exhaust Emission Control System.

Cars conforming to a Japanese specification, have grass-fire shields fitted beneath the majority of the exhaust system as shown in figures Q5-1 and Q5-2.

Cars other than those conforming to a Japanese specification, have a grass-fire shield fitted beneath the catalytic converter only, as shown in figure Q5-3.

Grass-fire shields – To remove and fit

1. *On cars conforming to a Japanese specification,* start by removing the grass-fire shield forward of the rear silencer assembly. Then, work outwards, forwards, and rearwards.
2. *On cars other than those conforming to a Japanese specification,* remove the grass-fire shield fitted beneath the catalytic converter.
3. Check that the shields are in good condition and that no breaks or cracks have occurred in the mesh.

If damage to a shield has occurred, the shield must be discarded and a new one fitted.

4. Replace the shields by reversing the procedure for removal, noting the following.

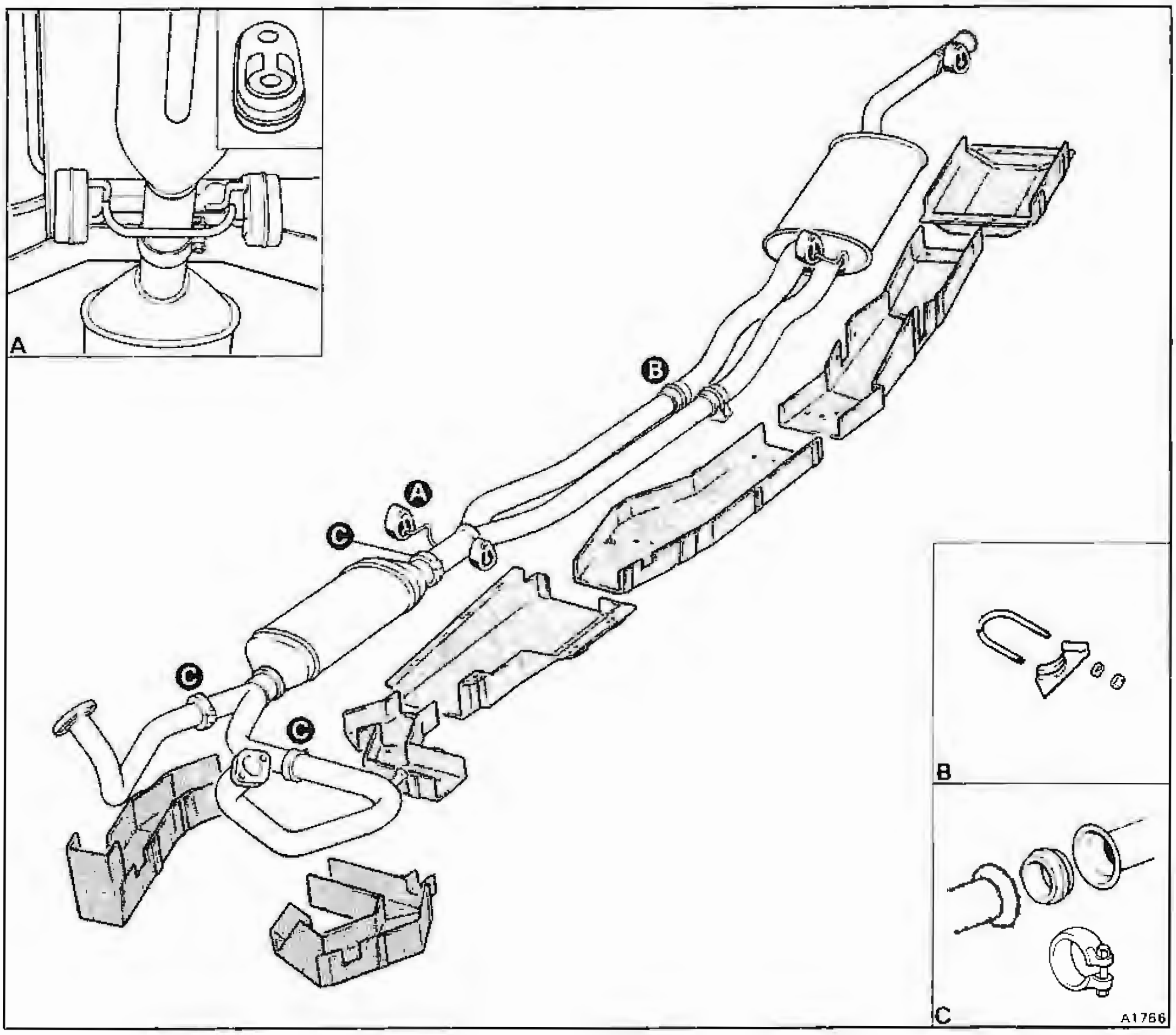


Fig. Q5-1 Exhaust system and grass-fire shields Naturally aspirated cars conforming to a Japanese specification

5. Refer to figures Q5-1 and Q5-2 for cars conforming to a Japanese specification.
6. Refer to figures Q5-3 and Q5-4 for cars other than those conforming to a Japanese specification.

Exhaust pipes and silencers – To remove

The exhaust system comprises of a number of individual sections. These sections can be removed and replaced without the necessity of having to disturb the complete system.

1. Drive the car onto a ramp.
2. Disconnect the battery and ensure that the usual workshop safety precautions are carried out.
3. Raise the ramp.

Tailpipe finisher(s)

4. Unscrew the worm drive clip securing the tailpipe finisher to the exhaust and withdraw the finisher.

Rear silencer assembly

5. Locate the exhaust system joints forward of the final drive assembly.
6. Remove the nuts from the 'U' clamps, collect the washers and clamping plates. Withdraw the 'U' bolts.
7. Temporarily support the weight of the rear silencer assembly.
8. Disconnect the rear silencer assembly from the rubber hangers.
9. Remove the temporary support, twist the rear silencer assembly to 'break' the joint seals, then withdraw the assembly.

Intermediate pipes

10. Ensure that the weight of the catalytic converter(s) is supported.
11. Temporarily support the weight of the intermediate pipe assembly.
12. Remove the nut from the exhaust clamp rearward of the catalytic converter. Collect the washer and bolt, then free the clamp.
13. Discard the temporary support and withdraw the

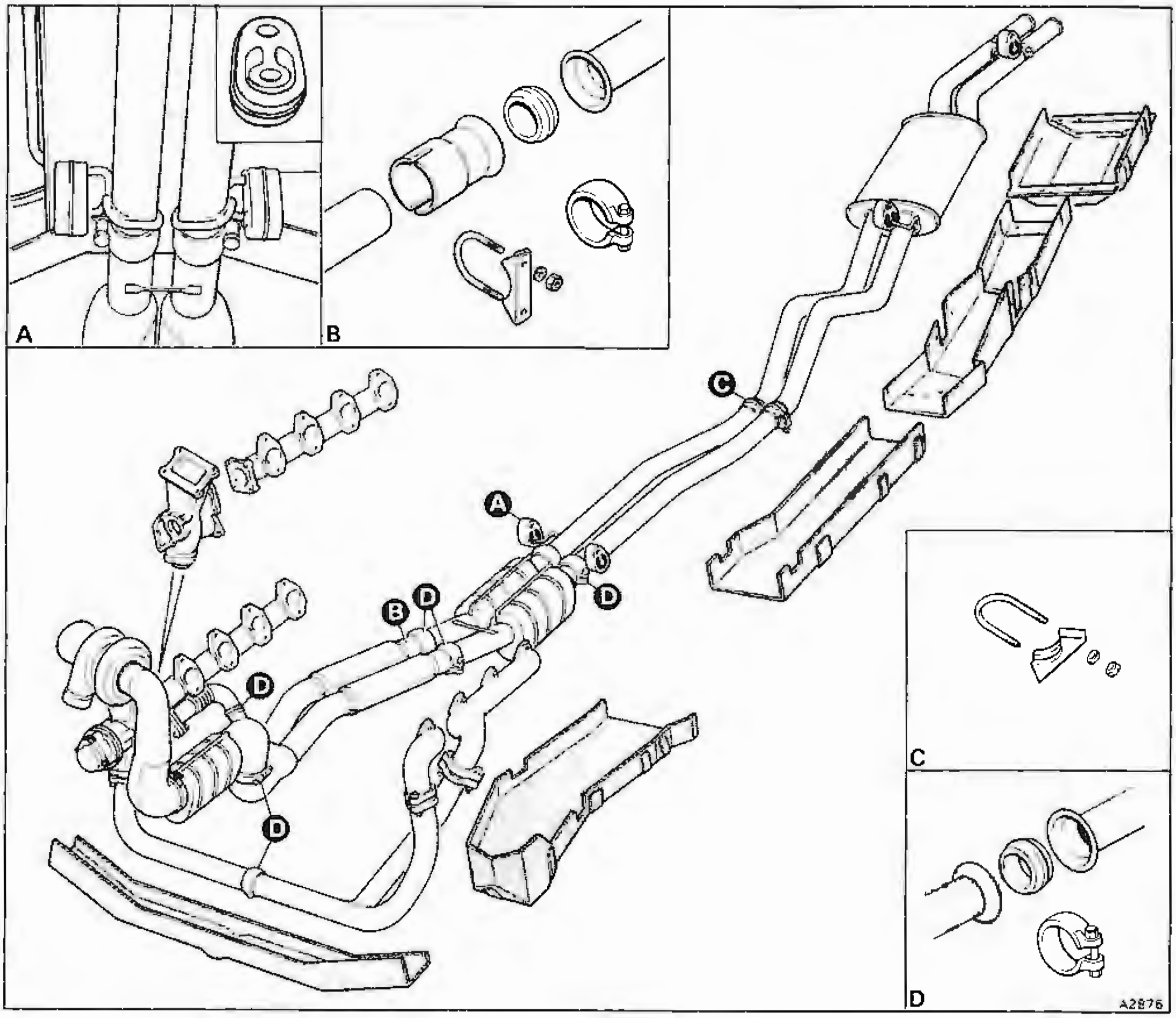


Fig. Q5-2 Exhaust system and grass-fire shields 1989 model year – Turbocharged cars conforming to a Japanese specification Inset B Running change intermediate pipe assembly, unhooking it from the rubber hangers. Collect the sealing ring from the joint as the pipe assembly is withdrawn.

Label the sealing ring for identification purposes.

Catalytic converter(s)

Remove the catalytic converter(s) as described in TSD 4737 Engine Management Systems.

Downtake pipes

Naturally aspirated cars

14. Ensure that the weight of the downtake pipes is temporarily supported.

15. Remove the clamp securing the exhaust gas recirculation (EGR) pipe (if fitted) to 'B' bank downtake.

16. Locate the downtake pipe to exhaust manifold joints. Remove the nuts from the joint clamps.

17. Discard the temporary supports and withdraw the downtake pipes.

Collector box and pipe assembly

Bentley Turbo R – 1989 model year

14. Ensure that the weight of the pipe assembly is temporarily supported.

15. Remove the nut from the exhaust clamp beneath 'A' bank exhaust manifold. Collect the washer and bolt, then free the clamp.

16. Discard the temporary support and withdraw the pipe assembly. Collect the sealing rings from the joints as the assembly is withdrawn.

Warm-up catalytic converter

Bentley Turbo R – 1989 model year

Remove the warm-up catalytic converter as described in TSD 4737 Engine Management Systems.

Exhaust pipes and silencers – To fit

To assemble, reverse the procedure given for removal, noting the following.

Prior to assembly

1. Ensure that the sliding joints are a good fit in their respective stub pipes to allow for adjustment.

2. All sealing rings and pipes must be thoroughly clean and free from scale. If necessary, these can be lightly dressed with fine emery cloth.

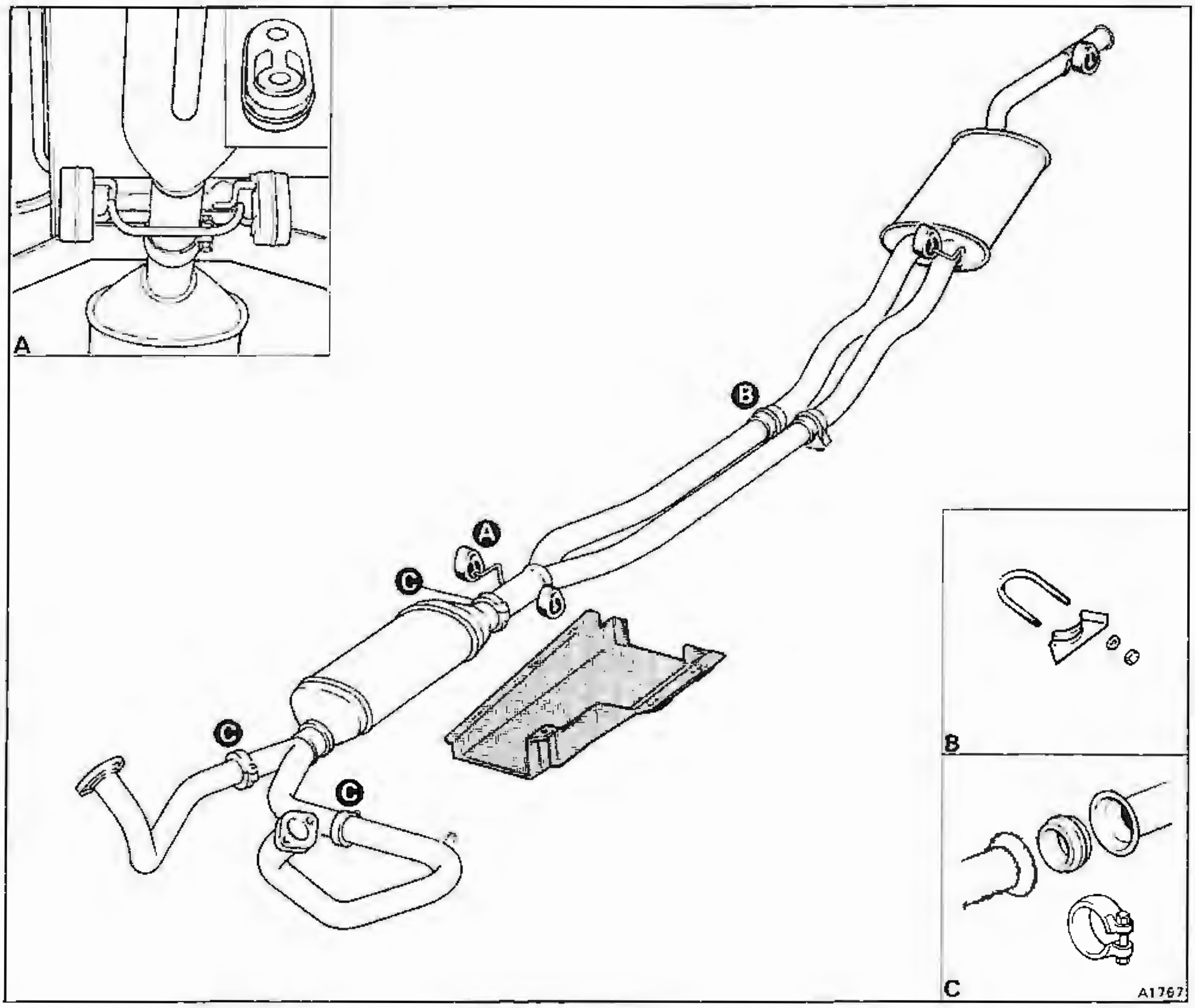


Fig. Q5-3 Exhaust system and grass-fire shield Naturally aspirated cars other than those conforming to a Japanese specification

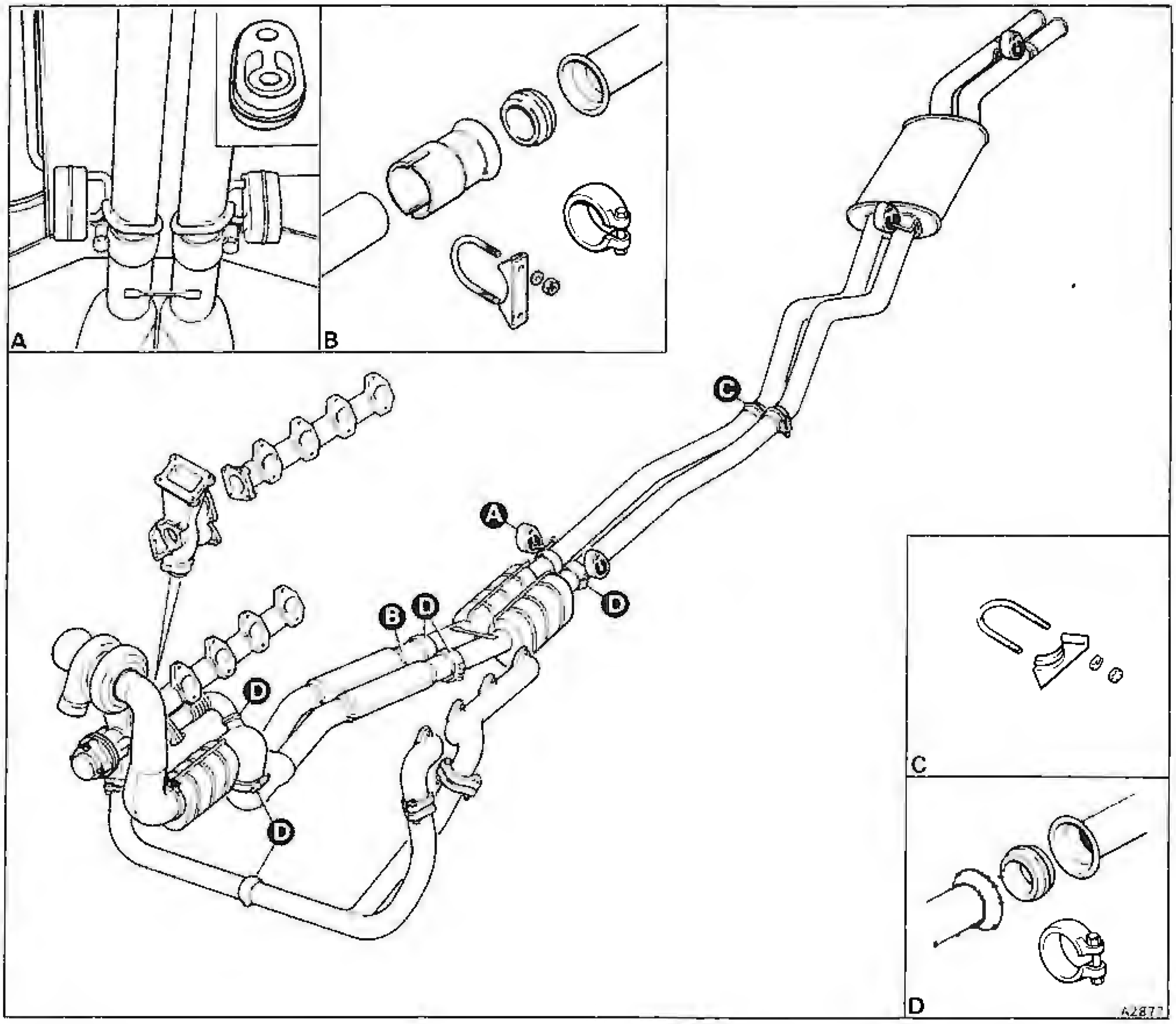


Fig. Q5-4 Exhaust system 1989 model year – Turbocharged cars other than those conforming to a Japanese specification   Inset B Running change

3. To ensure free movement of the joints for correct alignment of the components when assembling, the pipe flares and grooves in the joint clamps should be lightly smeared with either a graphite lubricant or Neverseez assembly compound.
4. Apply graphite lubricant or Neverseez to all clamp bolt threads before assembly.
5. Any rubber hangers showing signs of wear, etc., should be replaced.

Upon assembly
1. The parts should be loosely assembled and then manoeuvred to give the best alignment (free from possible fouls), before the joints are tightened.
2. When setting clearances, ensure that the mounts are set 6 mm (0.236 in) forward of the mounting bracket to allow for expansion of the system (see fig. Q4-4).
3. Ensure that the tailpipe and finisher do not foul on the rear body moulding.
4. When the pipe runs are satisfactory, apply a sealant such as Holts Firegum into the ends of all straight tube joints. Ensure that the slots down the sides of the pipes are covered.

Holts Firegum can also be smeared on the inside of the sliding joints.
5. Torque tighten the Hymatic spherical clamps (with the clamp bolt in the vertical position) to the figures quoted in Section Q6.
6. Set the tailpipe finisher 60 mm (2.364 in) in from the outer edge of the bumper (see fig. Q4-5).

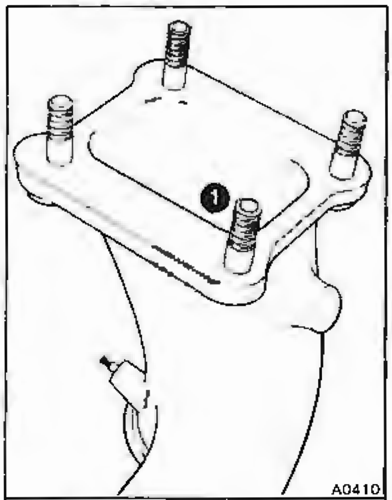
Special torque tightening figures

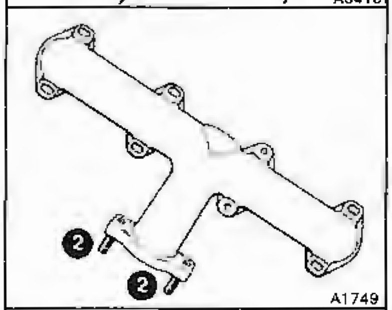
Introduction
This section contains the special torque tightening figures applicable to Chapter Q.

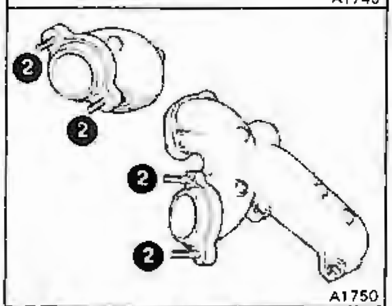
For standard torque tightening figures refer to Chapter P.

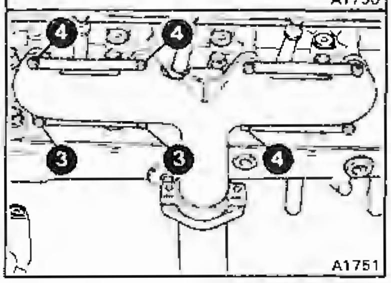
Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

Section Q3

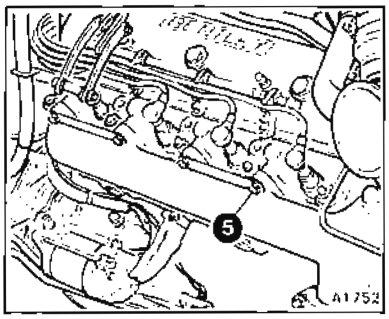




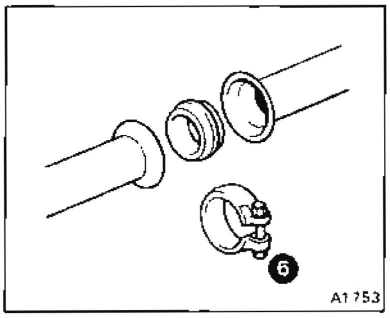




Ref.	Component	Nm	kgf m	lbf ft
1	Turbocharger assembly to exhaust manifold — stud 4 off	11-13	1,2-1,3	8-10
2	Downtake pipe to exhaust manifold — studs Naturally aspirated engines	11-13	1,2-1,3	8-10
	Turbocharged engines			
3	Exhaust manifold — setscrews 2 off (A3 and A4 lower) Naturally aspirated engines	19-21	2,0-2,2	14-16
4	Exhaust manifold — setscrews 14 off	32-33	3,2-3,4	23-25

Section Q3	Ref.	Component	Nm	kgf m	lbf ft
	5	Exhaust manifold — setscrews 16 off Turbocharged engines	19-21	2,0-2,2	14-16

Section Q4 and Q5

	6	Hymatic clamp — nut	25-27	2,5-2,7	18-20

Wheels and Tyres

Contents

Printed in England

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	R1	R2	R3	R4	R5					
1	7/87	5/88	8/87	5/88	5/87					
2		9/88	5/87	9/86						
3	5/89	5/88	9/86	5/88						
4		8/87		5/88						
5		5/89		9/88						
6		5/89		9/88						
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										

Wheels

Introduction
This section incorporates the removal and fitting procedure of individual wheels. If it is necessary to raise the complete car, reference must be made to Chapter A.

Rolls-Royce Silver Spirit, Silver Spur, Corniche, and Corniche II cars are fitted with 6JK × 15 heavy gauge pressed steel wheels.

Bentley Eight, Mulsanne, Mulsanne S, and Continental cars are fitted with 6½ J × 15 aluminium alloy wheels.

Bentley Turbo R cars are fitted with 7½ J × 15 aluminium alloy wheels.

The removal and fitting procedure is identical for each type of wheel, noting that on cars fitted with aluminium alloy wheels extra care must be taken to prevent damaging the surface coating of the wheels.

Refer to figure R2-1 for the car jacking positions. The car jack is stowed behind the trim panel situated at the front of the luggage compartment (see fig. R2-2).

Workshop safety
Never work beneath the car if it is only supported on a jack. Always ensure that car stands or blocks are used as a safety precaution.

Wheel trims – To remove and fit
One-piece wheel trim (see fig. R2-4, insets A and B).
To remove a wheel trim proceed as follows using the tommy bar provided in the tool kit.

Place the tommy bar in one of the positions indicated, noting the relationship between the removal points and the tyre valve. Then, whilst supporting the wheel trim, press the tommy bar towards the tyre. Do not twist the tommy bar as this could damage the wheel trim.

To fit a wheel trim, position it against the wheel ensuring that the tyre valve is aligned centrally with the hole in the trim. Then, strike the trim firmly with the heel of the free hand until it is seated on the wheel.

Two-piece wheel trim (see fig. R2-4, inset C).
The outer wheel trim is secured by eight equally spaced clips situated around its circumference. The inner wheel trim is a clip-on fit over three equally spaced protrusions on the road wheel.

To remove an outer wheel trim proceed as follows using the tommy bar provided in the tool kit.

Position the tommy bar as indicated, then press towards the tyre. Repeat this operation at several points around the circumference of the wheel until the trim is released. Do not twist the tommy bar as this could damage the wheel trim.

To remove an inner wheel trim, position the tommy bar as indicated. Then, whilst supporting the wheel trim, press the tommy bar in the direction indicated by the arrow.

To fit an inner or outer trim, position it against the wheel then strike it firmly with the heel of the free hand until it is seated on the wheel.

Lockable wheel trim (see fig. R2-4, inset D).
Each road wheel incorporates a locking wheel trim, the lock being concealed by a protective cover. A small tool for removing the cover and a key for the wheel trim lock are contained in a pocket on the inside of the tool stowage compartment trim flap (see fig. R2-2).

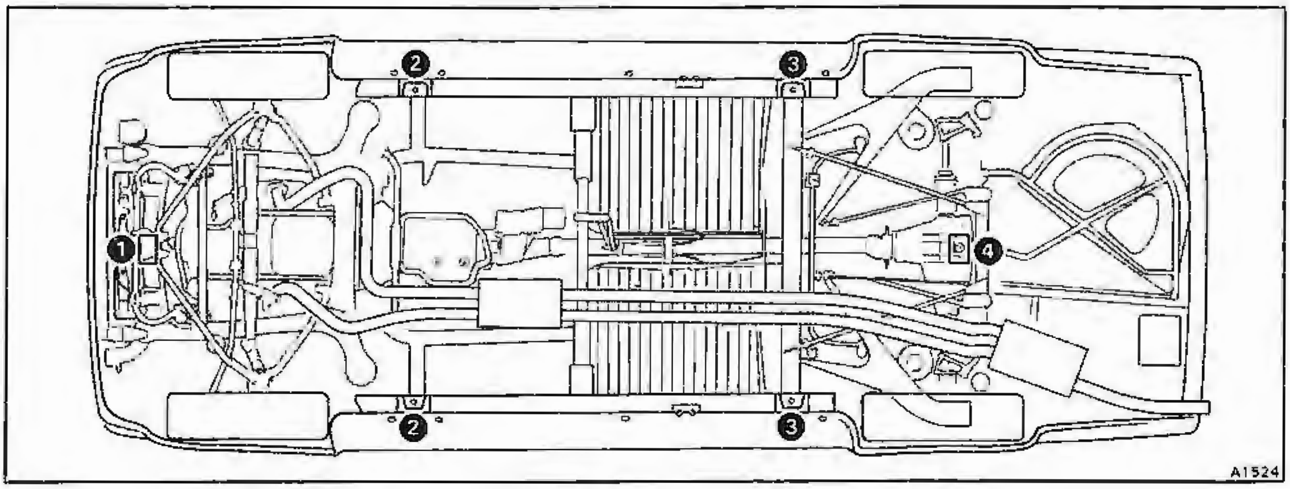


Fig. R2-1 Car jacking positions
1 Front jacking point using a trolley jack
2 Front jacking points using the car jack
3 Rear jacking points using the car jack
4 Rear jacking point using a trolley jack

Note When removing or fitting a wheel trim, extreme care must be taken to prevent damaging the surface coating of the trim and road wheel.

To remove a wheel trim proceed as follows.

1. Insert the removal tool through the holes in the lock cover, then pull the cover from its location. Note that the cover is retained to the wheel trim by a short strap.
2. Insert the key into the lock and turn it anti-clockwise a quarter of a turn. With the key in this position pull the trim from the wheel.

To fit a wheel trim proceed as follows.

1. Ensure that the rubber seal is correctly located around the circumference of the wheel trim.

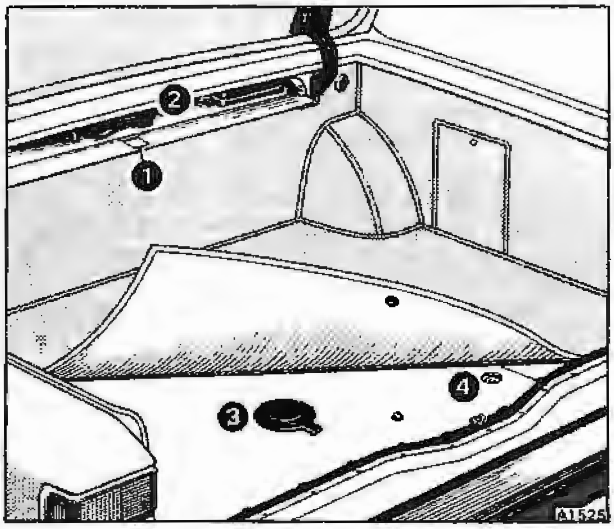


Fig. R2-2 Luggage compartment
1 Location of key and wheel trim removal tool
2 Tools stowage area
3 Rubber plug
4 Lowering bolt for spare wheel carrier

Fig. R2-3 Car jack correctly positioned
A Spigot on the jack head located in the jacking bracket

2. Locate the lower edge of the trim into its retaining channel in the wheel. Align the spigot on the rear of the trim with one of the recesses situated between the wheel nuts. Then, with the key in the unlocked position, firmly press the wheel trim into the centre of the wheel. Do not apply pressure to the head of the key. When the trim is fully inserted turn the key clockwise to the locked position and remove the key.
3. Press the lock cover into position, then return the key and removal tool to their stowage location.

Note The wheel trim locks should be lubricated, in accordance with the recommended service schedules, using BP Keenomax L3 lubricant. Ideally 2 ml of lubricant should be injected into each lock.

Alternatively the lubricant may be applied to the key and the key inserted into the lock several times. Lubricant should also be lightly applied to the rear of the lock and the latch.

Wheels – To remove

1. Position the car on a level surface and place the gear range selector lever in the park position.
2. Remove fuse A6 from fuse panel F2 on the main fuseboard.
3. Apply the parking brake.
4. Remove the wheel trim (see Wheel trims – To remove and fit).
5. Prior to raising the car, slacken the wheel nuts approximately half a turn.

Note Each wheel nut is marked with an arrow indicating the direction of its removal. Nuts on left-hand wheels have left-hand threads. Nuts on right-hand wheels have right-hand threads.

6. To raise the front of the car proceed as follows.

Chock the rear wheels.

Position a trolley jack under the front pivot mounting for the lower triangle levers on the sub-frame (see fig. R2-1, item 1). Place a piece of soft wood between the jack head and the mounting.

Alternatively, raise the car using one of the two front jacking points situated on the car underbody (see fig. R2-1, item 2) utilizing the car jack.

Release the nuts and remove the wheel.

7. To raise the rear of the car proceed as follows.

Chock the front wheels.

Position a trolley jack under the centre of the final drive casing (see fig. R2-1, item 4). Place a piece of soft wood between the jack head and the final drive casing. **Do not jack the car under the final drive crossmember.**

Alternatively, raise the car using one of the two rear jacking points situated on the car underbody (see fig. R2-1, item 3) utilizing the car jack.

Release the nuts and remove the wheel.

Wheels – To fit

Reverse the procedure given for removal noting the following.

1. Ensure that the spherical seatings of the nuts and wheel are not damaged.

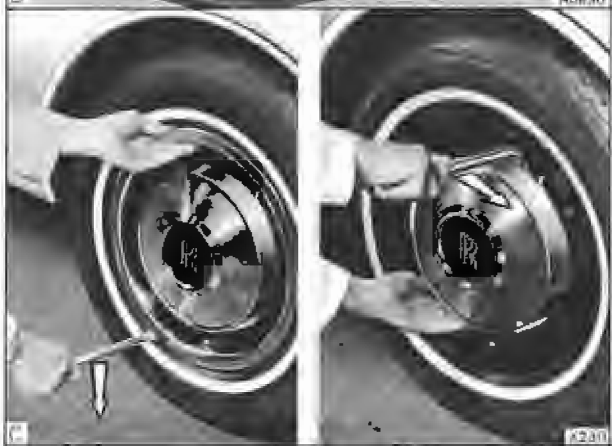
One-piece wheel trim

Prior to 1989 model year
Rolls-Royce Silver Spirit
Bentley Eight

1989 model year
Rolls-Royce Silver Spirit

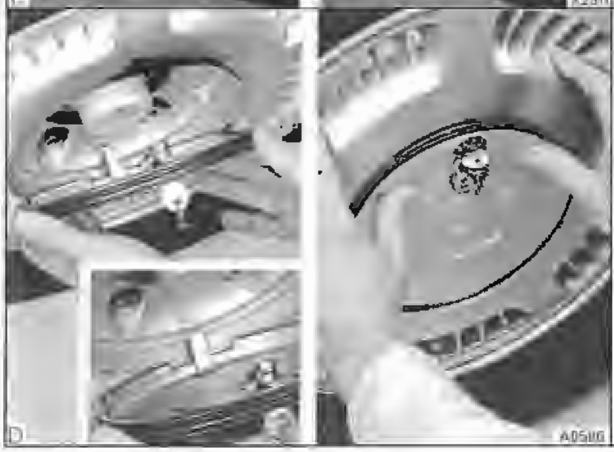
One-piece wheel trim

Rolls-Royce Silver Spur
Rolls-Royce Corniche II



Two-piece wheel trim

Rolls-Royce Corniche



Lockable wheel trim

Prior to 1989 model year
Bentley Mulsanne
Bentley Mulsanne S
Bentley Continental
Bentley Turbo R

1989 model year
Bentley Eight
Bentley Mulsanne S
Bentley Continental
Bentley Turbo R

Fig. R2-4 Wheel trim removal

2. Prior to fitting, lightly grease the spherical seats of the wheel nuts.

3. Fit the wheel and torque tighten the wheel nuts to between 61 Nm and 68 Nm (6 kgf m and 7 kgf m; 45 lbf ft and 50 lbf ft).

Failure to observe the torque figures can damage the spherical seating faces and cause difficulty in removing and fitting the wheel nuts.

Wheel and tyre balance

Wheels can be balanced using either a vertical or horizontal type of balancing machine.

The Dunlop adapter plate AP30 is designed for use in conjunction with the Dunlop balancing machine WBM20.

Balancing machines are also obtainable from Hofmann Balancing Techniques Limited, Carl Schenck

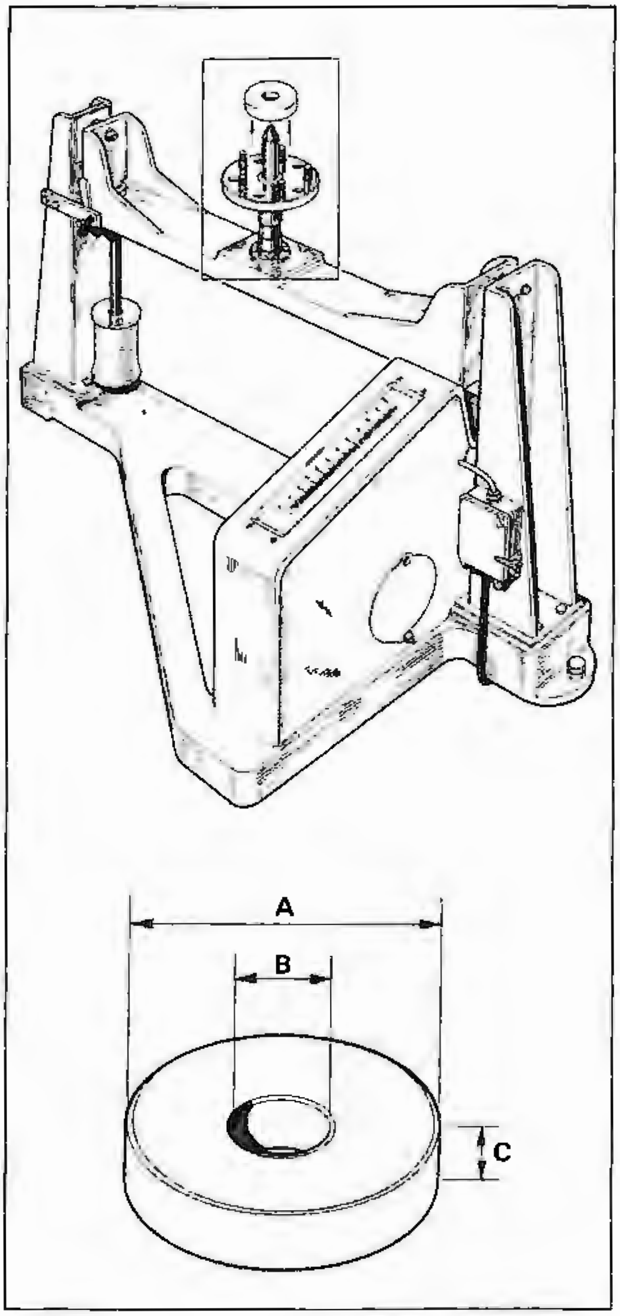


Fig. R2-5 Horizontal type of balancing machine with adapter for spigotted wheels

A 117,50 mm minus 0,05 mm (4.626 in minus 0.002 in)

B Bore to give 0,05 mm to 0,076 mm (0.002 in to 0.003 in) clearance on spindle

C 25,40 mm (1.0 in)

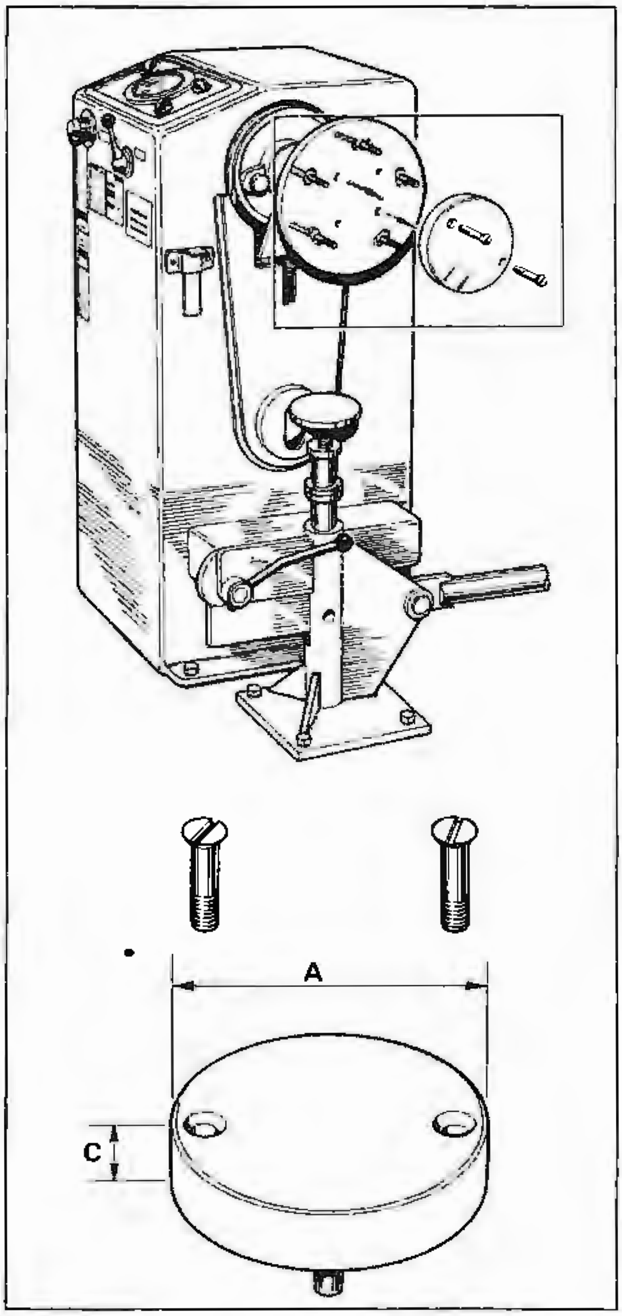


Fig. R2-6 Vertical type of balancing machine with adapter for spigotted wheels

A 117,50 mm minus 0,05 mm (4.626 in minus 0.002 in)

C 25,40 mm (1.0 in)

(UK) Limited and Leycock Engineering Limited.

If the specified balancing equipment is not available, reference should be made to figures R2-5 and R2-6. These illustrations show two types of small adapter collars which convert existing wheel balancing equipment for use on spigotted road wheels.

When fitting the adapter collar, it must be accurately centralized on the adapter plate.

The manufacturer's instructions must be observed when using the balancing equipment, and the following points noted.

1. Before balancing, ensure that the tyres are inflated to the correct cold inflation pressure (see Section R4).
2. When checking wheel balance on the car, it is essential that, after stopping the car the weight of the car is removed from the tyres as soon as possible. This prevents temporary 'flats' from forming on the tyres. No attempt should be made to balance wheels on which 'flats' have formed, as the static balance may be affected by as much as 720 g cm (10 oz in).
3. The static and dynamic balance of the wheels should be within 216 g cm and 360 g cm (3 oz in and 5 oz in) respectively.
4. Balance weights should be removed and fitted with a special tool supplied by the manufacturer of the wheel balancing machine. When fitting the weights to the rim, only sufficient force should be used to secure them; excessive force will only tend to slacken them.

Note On cars fitted with aluminium alloy road wheels, coated balance weights matching the surface finish of the wheels must be fitted. Extreme care must be taken when removing and fitting the balance weights to prevent damaging the surface coating of the wheel.

5. If an 'on-the-car' wheel balancing machine is available, it should be used to check the balance of the front wheels after they are fitted to the car. This type of balancing machine enables any small amount of run-out which exists in the tyre, wheel, hub, and brake disc to be removed.

Spare wheel – To remove (see fig. R2-8)

1. Remove the rubber access plug situated underneath the luggage compartment floor carpet (see fig. R2-2).
2. To release the spare wheel retainer (if fitted) proceed as follows.

On cars fitted with pressed steel wheels, turn the retainer locking arm to its horizontal position (see fig. R2-7, inset A). Then, press the retainer arm to its fully down position.

On cars fitted with aluminium alloy wheels, pull the retainer locking arm fully rearward (see fig. R2-7, inset B).

3. Using the wheel nut spanner and bar provided in the tool kit, turn the carrier lowering bolt (see fig. R2-2) anti-clockwise until further rotation is prevented.
4. If fitted, raise the hinged spare wheel access panel.
5. If a spare wheel carrier lifting tube is fitted (see fig. R2-8, item 1) proceed as follows.

Remove the protective cover from the lifting tube

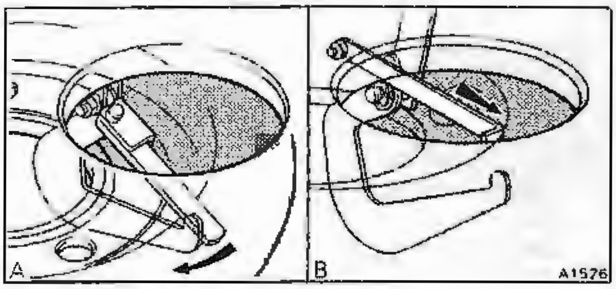


Fig. R2-7 Spare wheel retainers

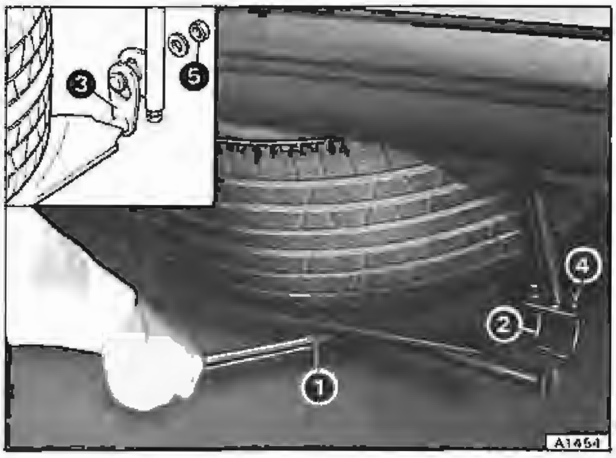


Fig. R2-8 Lowering the spare wheel and carrier adjustment

and insert the wheel nut spanner bar.

Lift the rear of the carrier sufficiently to either clear the support hook (item 2) or to allow the lowering tube to be disengaged from the slotted carrier support bracket (item 3).

Pivot the lowering tube assembly clear. Then, lower the rear of the carrier to the ground and remove the bar.

6. Slide the spare wheel from the carrier.

Spare wheel – To fit (see fig. R2-8)

Reverse the procedure given for removal noting the following.

1. When the carrier is fully raised, check that the spare wheel is securely clamped against the underside of the luggage compartment floor. If the wheel is not securely held, adjust the position of the carrier as follows.

Carriers fitted with a lifting tube.

Lower the carrier slightly by loosening the operating bolt two or three complete turns.

On carriers fitted with a support hook (item 2) proceed as follows.

Support the carrier. Then, raise the support hook by turning each adjusting nut (item 4) clockwise one or two complete turns.

Raise the carrier and check that the spare wheel is securely held. If necessary repeat the adjustment operation.

On carriers fitted with a slotted support bracket (item 3) proceed as follows.

Support the carrier. Then, loosen the support bolt securing nut (item 5). Move the carrier support bolt to a higher position within the adjustment slot. Then, tighten the securing nut.

Raise the carrier and check that the spare wheel is securely held. If necessary repeat the adjustment operation.

Carriers not fitted with a lifting tube.

Lower the carrier slightly by loosening the operating bolt two or three complete turns.

Support the carrier. Then, loosen the nut securing the rear of the carrier to the lowering tube. Move the carrier securing bolt to a higher position within the adjustment slot. Then, tighten the securing nut.

Raise the carrier and check that the spare wheel is securely held. If necessary repeat the adjustment operation.

2. Check that the spare wheel is positioned with the tyre valve aligned with the access hole in the luggage compartment floor.
3. Ensure that the spare wheel retainer (if fitted) passes through the centre of the wheel and is locked into position.

Tyres – General information

Introduction

Under no circumstances should tyres other than those approved in this Workshop Manual or in subsequent Product Support Information Sheets be fitted to the car, as this could have undesirable effects on the handling and stability of the car.

When new tyres have been fitted, speeds of 80 km/h (50 mile/h) should not be exceeded during the first 80 km (50 miles). For a further 724 km (450 miles) sustained speeds of 112 km/h (70 mile/h) or over must not be undertaken. Fast cornering, hard braking, and harsh acceleration must also be avoided. On completion of 800 km (500 miles), wheel and tyre balance should be checked and adjusted if necessary (see Section R2). In view of the high road speeds attainable, it is recommended that wheel balancing is carried out at regular intervals.

Tyre characteristics

On Bentley Turbo R cars fitted with Pirelli tyres, high speed driving followed by a prolonged period of parking, may result in a 'flat' forming on the tyres as they cool. This condition is not permanent, but is dependent upon the temperature that the tyres have attained during driving and the length of time the car is parked.

Upon commencement of driving it may take several miles for the temperature of the tyres to rise sufficiently for the 'flats' to disappear. While these flats are present, some harshness and vibration may be felt in the motor car.

Another characteristic of these tyres, is that they are sensitive to ridges and raised lines on the road surface which may result in steering pull. This is not abnormal and may increase slightly as the tyres become worn.

Tyre mixing

Where possible tyres should be fitted in complete sets e.g. five new 235/70 HR15 (HR70 HR15) steel braced tyres of the same make.

The mixing of different makes of tyres is not recommended. However, if the tyres are mixed, the new tyres must be fitted in pairs across the car, preferably at the rear.

New tyres should not be fitted to the front wheels in combination with rear tyres that have less than 3 mm (0.12 in) of tread remaining as rear end car stability could be affected.

Tyre – To remove

Cars fitted with pressed steel wheels.

1. Remove the dustcap and deflate the tyre by removing the valve core.
2. Using a suitable tyre removal/fitting machine, unseat each tyre bead in turn.

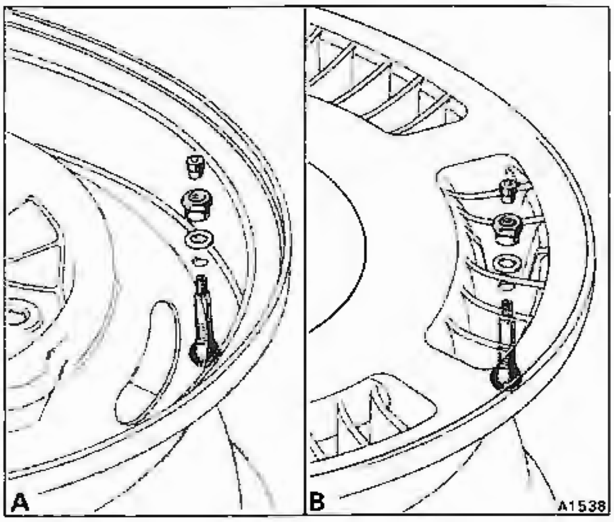


Fig. R3-1 Clamp-in tyre valves

3. Lubricate the wheel rim and tyre bead area on both sides of the wheel using bead lubricant Dunlop TBL 1, TBL 2, or Tip Top 593063 mounting paste.
4. Clamp the wheel in position with the inner rim uppermost. Then, roll off each tyre bead in turn and remove the tyre.

Tyre – To fit

Cars fitted with pressed steel wheels.

1. Inspect the wheel, removing any burrs, high spots, or scale, paying particular attention to the tyre bead seating areas.
2. Always fit a new clamp-in valve assembly.
3. Insert the valve into the hole in the wheel rim, then fit the valve securing nut and washer (see fig. R3-1). When fitting a new valve, **do not** use tyre bead lubricant or grease of any kind. Using a 14 mm (9/16 A/F) long reach socket, torque tighten the nut to between 2,9 Nm and 3,3 Nm (29,9 kgf cm and 33,4 kgf cm; 26 lbf in and 29 lbf in). **Do not overtighten.**
4. Lubricate the tyre beads, and the rim seat areas of the wheel using bead lubricant Dunlop TBL 1, TBL 2, or Tip Top 593063 mounting paste.
5. Fit the tyre to the wheel, ensuring that the force variation mark, indicated by a green paint spot on the sidewall, is aligned with the letter 'H' stamped on the wheel rim (see fig. R3-2).

Note Certain tyres are marked with a white paint spot. These tyres should be positioned with the white spot diametrically opposite the letter 'H' stamped on the wheel rim (see fig. R3-2). Any additional colour spot markings should be ignored as they are merely used by tyre manufacturers for inspection purposes.

6. To seat the tyre beads, inflate the tyre to a **maximum** of 2,1 bar (30 lbf/in²). If the tyre beads do not seat correctly, completely deflate the tyre and re-lubricate the tyre beads and rim seat areas of the wheel. Then, re-inflate the tyre.

7. Adjust the tyre to its correct running pressure (see Section R4). Check that the valve core does not leak, then fit the dustcap.

8. When the tyre is set to its correct pressure, it is advisable to re-check the tightness of the tyre valve securing nut.

Tyre – To remove

Cars fitted with aluminium alloy wheels.

The aluminium alloy road wheels fitted to Bentley Turbo R cars incorporate a 'safety hump' tyre bead location rim. The purpose of the 'safety hump' is to prevent the tyre beads from unseating in the event of sudden deflation.

To assist in the removal and fitting of a tyre, the height of the 'safety hump' is reduced at a point adjacent to the valve on the outer rim and diametrically opposite the valve on the inner rim (see fig. R3-3, arrowed).

When removing or fitting a tyre extreme care must be taken to prevent damaging the surface coating of the wheel.

To remove a tyre proceed as follows.

1. Remove the dustcap and deflate the tyre by removing the valve core.

2. Using a suitable tyre removal/fitting machine, (e.g. Corghi Artiglio Automatico or Repco model F68), unseat the outer bead of the tyre at a point adjacent to the valve. Then, progressively unseat the remainder of the bead circumference. Similarly, unseat the inner bead commencing at a point diametrically opposite the valve.

3. Lubricate the wheel rim and tyre bead area on both sides of the wheel using bead lubricant Dunlop TBL 1, TBL 2, or Tip Top 593063 mounting paste.

4. Clamp the wheel in position with the outer rim uppermost. Then, commencing at a point adjacent to the valve, roll off the outer bead. Similarly, roll off the inner bead and remove the tyre commencing at a point diametrically opposite the valve. Care must be taken to prevent damaging the tyre beads and the surface coating of the wheel. **Do not use tyre levers.**

Tyre – To fit

Cars fitted with aluminium alloy wheels.

1. Always fit a new clamp-in valve assembly.

2. Insert the valve into the rim, then fit the valve securing nut and washer (see fig. R3-1). When fitting a new valve, **do not** use tyre bead lubricant or grease of any kind. Using a 14 mm (9⁄16 A/F) long reach socket, torque tighten the nut to between 2,9 Nm and 3,3 Nm (29,9 kgf cm and 33,4 kgf cm; 26 lbf in and 29 lbf in). **Do not overtighten.**

3. Lubricate the tyre beads, and the rim seat areas of the wheel using bead lubricant Dunlop TBL 1, TBL 2, or Tip Top 593063 mounting paste.

4. Clamp the wheel to the tyre fitting machine with the outer rim uppermost.

5. Position the tyre on the wheel ensuring that the force variation mark on the tyre, indicated by a green spot on the sidewall, is adjacent to the valve. Then,

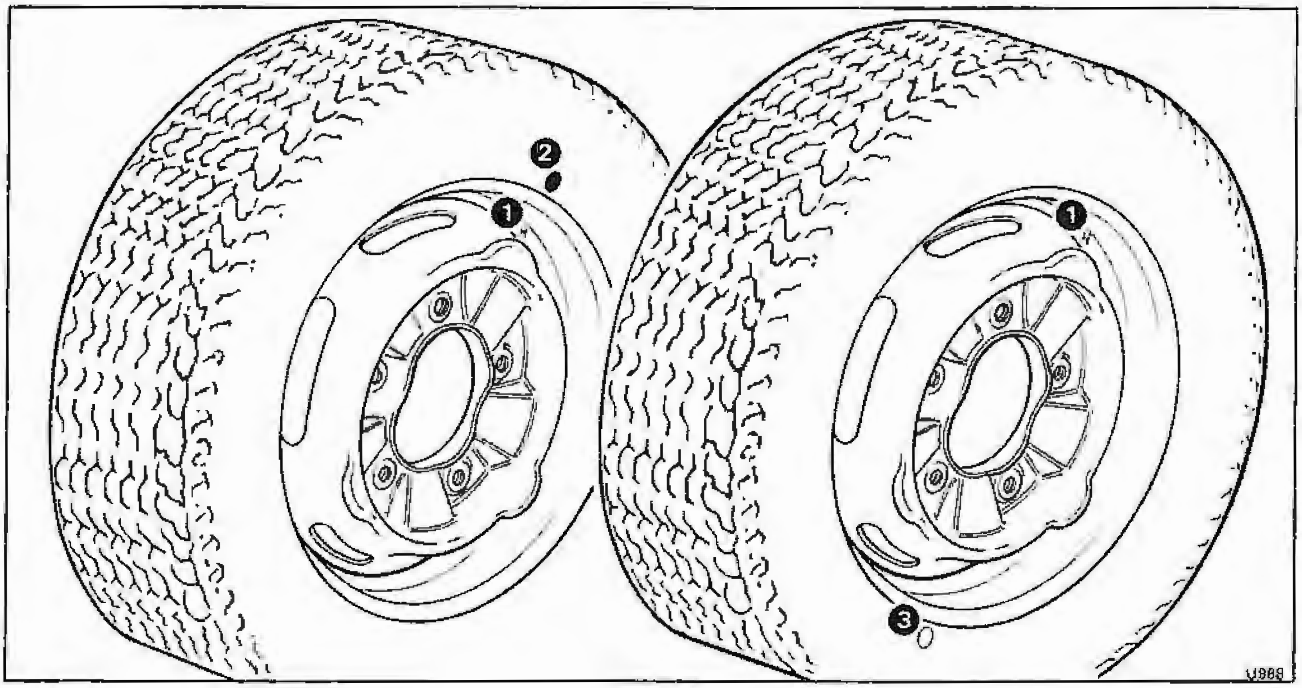


Fig. R3-2 Wheel and tyre alignment markings
1 'H' marking
2 Green spot marking
3 White spot marking

carefully roll each tyre bead in turn over the outer rim of the wheel taking care not to damage the tyre beads or the protective coating of the wheel. **Do not use tyre levers**.

6. To seat the tyre beads, inflate the tyre to a **maximum** of 2,75 bar (40 lbf/in^2). If the tyre beads do not seat correctly, completely deflate the tyre and re-lubricate the tyre beads and rim seat areas of the wheel. Then, re-inflate the tyre.

7. Adjust the tyre to its correct running pressure (see Section R4). Check that the valve core does not leak, then fit the dustcap.

8. When the tyre is set to its correct pressure, it is advisable to re-check the tightness of the tyre valve securing nut.

Note On Bentley Turbo R cars, Avon Turbospeed 255/65 tyres are fitted as standard. If they are replaced by tyres of a different size specification (e.g. Pirelli P7 275/55) it will be necessary to fit a new speedometer drive. Refer to Chapter T.

Tyre service

It is recommended that, to increase the life of any of the steel braced radial ply tyres approved by Rolls-Royce Motors, the positions of the tyres should be alternated front to rear on the same side of the car at 10 000 km (6000 miles). Do not change the tyres from one side of the car to the other.

If a tyre has been damaged or punctured, contact a tyre specialist. **Never attempt to carry out a temporary repair.**

If the sidewalls of the tyre are damaged, the tyre **must** be examined by a tyre specialist as damage to the fabric of a tyre renders it unsafe for further use.

Tyre wear

The wear pattern on partially worn steel braced radial ply tyres should be reasonably consistent across the full width of all primary grooves. The tyres should be alternated front to rear on the same side of the car after completing the **first** 10 000 km (6000 miles). Alternating the tyres in this manner assists in producing an even tyre wear pattern and should increase the tread life of the tyres by more than twenty percent.

When assessing tyre wear, the following points should also be noted.

1. The recommended tyre inflation pressures must be maintained as under-inflation is the most frequent cause of premature tyre failure. It is also important not to over-inflate as this can make the tyres more vulnerable to impact fractures.

2. The wear rate on the outer shoulders of the front and rear tyres which run on the kerb side of the road will be slightly greater than the outer shoulders of the other tyres, particularly if the car is driven on roads with a pronounced camber.

3. The higher the speed at which a car is driven through corners, the more the tyres will wear on the inner shoulders. The effects of hard cornering will be shown also by 'feathering' which occurs on the rib edges.

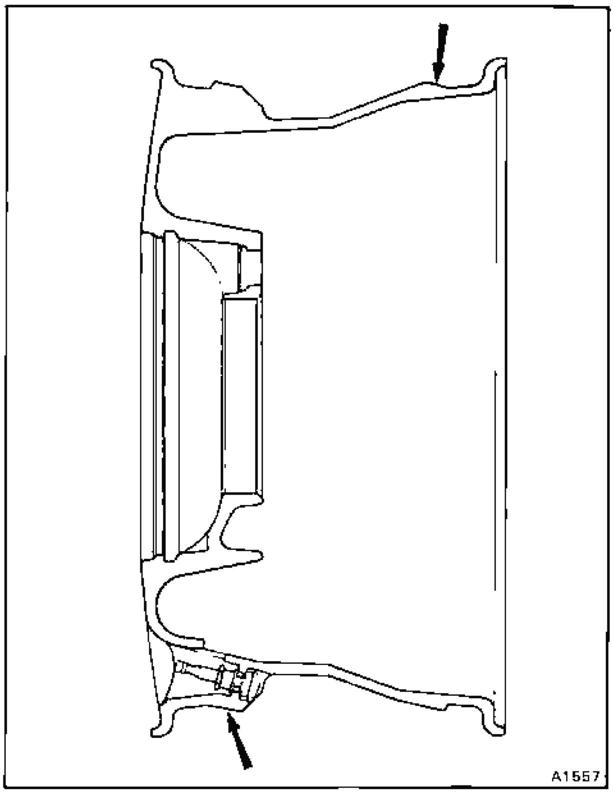


Fig. R3-3 Sectional view of Bentley Turbo R wheel

Tread wear indicators

Tread wear indicators are incorporated into the construction of the tyres. These indicators are integral moulded ribs spaced at frequent intervals around the circumference of the tyre and extend across the full width of the tyre tread in all primary grooves.

Tyres with badly worn treads are a safety hazard therefore, when a tyre has worn so that one or more of the indicators are flush with the tread, a new tyre is required.

It is important to note that the wet grip properties of a tyre rapidly deteriorate when the tread depth approaches that of the tread wear indicators.

Legal requirements

All Franchise Holders are advised to familiarize themselves with the legal requirements covering tyres and tyre wear for the country in which they operate. An example of a requirement which applies in the United Kingdom is as follows.

The original tyre tread pattern must be visible over the complete contact area of the tyre. Tread depth must not be less than 1 mm (0.039 in) in a continuous area extending to a minimum of 75% of the tread width and this must extend around the complete circumference of the tyre.

Remould tyres

Under no circumstances should any tyres be fitted which have been branded 'Regraded Quality', 'Remould Quality', or 'Seconds'; or those which have had the speed rating removed or altered.

Recommended tyres, tyre pressures, and snow chains

Recommended tyres

Tyre manufacturer	**Car model**	**Country**	**Tyre construction**	**Size**	**Speed rating**	**Sidewall markings**
Avon	Rolls-Royce Silver Spirit Rolls-Royce Silver Spur Rolls-Royce Corniche Rolls-Royce Corniche II Bentley Eight Bentley Mulsanne Bentley Mulsanne S Bentley Continental	Other than North America	Radial ply steel	235/70	VR	RR Turbosteel 70 235/70 VR15
		Other than North America	Radial ply steel	235/70	HR	RR Turbosteel 70 101H 235/70 HR15
	Bentley Turbo R	All markets	Radial ply steel	255/65	VR	RR Turbospeed CR27 255/65 VR15
Dunlop	Rolls-Royce Silver Spirit Rolls-Royce Silver Spur Rolls-Royce Corniche Rolls-Royce Corniche II Bentley Eight Bentley Mulsanne Bentley Mulsanne S Bentley Continental	Middle East, South Africa, Malaysia, and Singapore	Radial ply steel	235/70	HR	Dunlop SP Sport D7 235/70 HR15
Goodyear	Rolls-Royce Silver Spirit Rolls-Royce Silver Spur Rolls-Royce Corniche Rolls-Royce Corniche II Bentley Eight Bentley Mulsanne Bentley Mulsanne S Bentley Continental	Other than North America	Radial ply steel	235/70	VR	Goodyear Eagle NCT 70 235/70 VR15
		North America	Radial ply steel	235/70	HR	Goodyear NCT HR70 235/70 HR15
Michelin	Rolls-Royce Silver Spirit Rolls-Royce Silver Spur Rolls-Royce Corniche II Bentley Eight Bentley Mulsanne Bentley Mulsanne S Bentley Continental	North America	Radial ply steel	235/70	HR	Michelin XVS 235/70 HR15
Pirelli	Bentley Turbo R	United Kingdom, Europe, and the Middle East	Radial ply steel	275/55	VR	Pirelli P7R 275/55 VR15

Note The tyres listed above are available with the sidewalls in either black or black with a white band. The only exceptions are the Goodyear Eagle VR15 and the tyres recommended for the Bentley Turbo R, which are available with black sidewalls only.

Recommended winter tyres (Applicable to all countries)

Tyre manufacturer	Construction	Size	Sidewall	Tyre/Marking
Dunlop	Radial ply textile	205-15	Black	Dunlop Weathermaster SP44TT/L
Firestone	Radial ply steel	P225/75 – R15	White	Firestone Town & Country Snowbiter
Goodrich	Radial ply steel	P225/75 – R15	White	BF Goodrich MS Trailmaker
Michelin	Radial ply steel	HR78 – 15	White	Michelin X
Goodyear	Radial ply textile	HR70 – 15	Black with white band	Goodyear MS All Winter Radial

Tyre pressures and snow chains

Tyre manufacturer/ Tyre marking	Size	Tyre pressures		Maximum speed*	Snow chains
		Front	Rear		
Dunlop Weathermaster SP44TT/L	205 – 15	2,0 bar (28 lbf/in²) 2,2 bar (32 lbf/in²)	2,0 bar (28 lbf/in²) 2,2 bar (32 lbf/in²)	137 km/h (85 mile/h) 153 km/h (95 mile/h)	Union S2 3081 Union S2 3082 Rud Kantenspur 07 – 745 Rud Kantenspur 06 – 237 Rud Super Griefsteg S8143 Pewag Austro S/A77S Thiele Nordland Eifelspur Gruppe 351
Firestone Town & Country Snowbiter	P225/75 – R15	1,7 bar (24 lbf/in²)	2,0 bar (28 lbf/in²)	121 km/h (75 mile/h)	
BF Goodrich MS Trailmaker	P225/75 – R15	1,7 bar (24 lbf/in²)	2,0 bar (28 lbf/in²)	121 km/h (75 mile/h)	
Michelin X MS	HR78 – 15	1,7 bar (24 lbf/in²)	2,0 bar (28 lbf/in²)	161 km/h (100 mile/h)	
Goodyear MS All Winter Radial	HR70 – 15	1,7 bar (24 lbf/in²)	2,0 bar (28 lbf/in²)	137 km/h (85 mile/h)	

*Note – When studs are fitted the maximum speed should not exceed 121 km/h (75 mile/h)

Tyre pressures

To ensure the designed handling characteristics of the car are achieved, it is important to maintain the differential in tyre pressure between the front and rear wheels.

When checking tyre pressures, ensure that the tyres are cold.

After checking the tyre pressures, ensure that the valve caps are fitted, as they not only protect the valve from the ingress of water, but also provide a secondary air seal. Always ensure that a valve cap of the same metal as the valve stem is fitted. The fitting of a different metal cap will result in corrosion and prevent subsequent cap removal.

Spare tyre inflation

1. Lift up the carpet on the luggage compartment floor to expose the rubber plug (see fig. R2-2).
2. Remove the plug to gain access to the tyre valve.
3. Adjust the tyre pressure as necessary.

Rolls-Royce Silver Spirit and Silver Spur

Model year	Specification	Loading conditions	Tyre pressures
1987 onwards	*Cars other than those conforming to an Australian, Japanese, and North American specification*	Up to five occupants and 115 kg (250 lb) of luggage	Speeds up to 180 km/h (110 mile/h) Front 1,7 bar (24 lbf/in^2) Rear 2,0 bar (28 lbf/in^2) Sustained speeds in excess of 180 km/h (110 mile/h) Front 2,1 bar (30 lbf/in^2) Rear 2,4 bar (34 lbf/in^2)
	Cars conforming to an Australian and Japanese specification	Up to five occupants and 115 kg (250 lb) of luggage	Speeds up to 140 km/h (87 mile/h) Front 1,7 bar (170 kPa, 24 lbf/in^2) Rear 1,9 bar (190 kPa, 27 lbf/in^2) Sustained speeds in excess of 140 km/h (87 mile/h) Front 2,2 bar (220 kPa, 32 lbf/in^2) Rear 2,4 bar (240 kPa, 34 lbf/in^2)
	Cars conforming to a North American specification	Up to four occupants and 46 kg (100 lb) of luggage	Front 1,7 bar (24 lbf/in^2) Rear 2,0 bar (28 lbf/in^2)
		Up to five occupants and 135 kg (300 lb) of luggage	Front 1,8 bar (26 lbf/in^2) Rear 2,2 bar (32 lbf/in^2)

Rolls-Royce Corniche and Corniche II

Model year	Specification	Loading conditions	Tyre pressures
1987 onwards	*Cars other than those conforming to a Japanese and North American specification*	Up to four occupants and 100 kg (220 lb) of luggage	Speeds up to 180 km/h (110 mile/h) Front 1,7 bar (24 lbf/in^2) Rear 2,0 bar (28 lbf/in^2) Sustained speeds in excess of 180 km/h (110 mile/h) Front 2,1 bar (30 lbf/in^2) Rear 2,4 bar (34 lbf/in^2)
	Cars conforming to a Japanese and North American specification	Up to two occupants and 22 kg (50 lb) of luggage	Front 1,7 bar (24 lbf/in^2) Rear 2,0 bar (28 lbf/in^2)
		Up to four occupants and 115 kg (250 lb) of luggage	Front 1,8 bar (26 lbf/in^2) Rear 2,2 bar (32 lbf/in^2)

Bentley Mulsanne, Mulsanne S, and Bentley Eight

Model year	Specification	Loading conditions	Tyre pressures
1987 onwards	*Cars other than those conforming to an Australian, Japanese, and North American specification*	Up to five occupants and 115 kg (250 lb) of luggage	Speeds up to 180 km/h (110 mile/h) Front 1,7 bar (24 lbf/in^2) Rear 2,1 bar (30 lbf/in^2) Sustained speeds in excess of 180 km/h (110 mile/h) Front 2,1 bar (30 lbf/in^2) Rear 2,5 bar (36 lbf/in^2)
	Cars conforming to an Australian and Japanese specification	Up to five occupants and 115 kg (250 lb) of luggage	Speeds up to 140 km/h (87 mile/h) Front 1,7 bar (170 kPa, 24 lbf/in^2) Rear 1,9 bar (190 kPa, 27 lbf/in^2) Sustained speeds in excess of 140 km/h (87 mile/h) Front 2,2 bar (220 kPa, 32 lbf/in^2) Rear 2,4 bar (240 kPa, 34 lbf/in^2)
	Cars conforming to a North American specification	Up to four occupants and 46 kg (100 lb) of luggage	Front 1,7 bar (24 lbf/in^2) Rear 2,0 bar (28 lbf/in^2)
		Up to five occupants and 135 kg (300 lb) of luggage	Front 1,8 bar (26 lbf/in^2) Rear 2,2 bar (32 lbf/in^2)

Bentley Continental

Model year	Specification	Loading conditions	Tyre pressures
1987 onwards	*Cars other than those conforming to a Japanese and North American specification*	Up to four occupants and 100 kg (220 lb) of luggage	Speeds up to 180 km/h (110 mile/h) Front 1,7 bar (24 lbf/in^2) Rear 2,1 bar (30 lbf/in^2) Sustained speeds in excess of 180 km/h (110 mile/h) Front 2,1 bar (30 lbf/in^2) Rear 2,5 bar (36 lbf/in^2)
	Cars conforming to a Japanese and North American specification	Up to two occupants and 22 kg (50 lb) of luggage	Front 1,7 bar (24 lbf/in^2) Rear 2,0 bar (28 lbf/in^2)
		Up to four occupants and 115 kg (250 lb) of luggage	Front 1,8 bar (26 lbf/in^2) Rear 2,2 bar (32 lbf/in^2)

Bentley Turbo R Avon Turbospeed 255/65 tyres

Model year	Specification	Loading conditions	Tyre pressures
1987 onwards	*Cars other than those conforming to a European, Middle East, North American, and United Kingdom specification*	Up to four occupants and 22 kg (50 lb) of luggage	Speeds up to 210 km/h (130 mile/h) Front 2,1 bar (210 kPa, 30 lbf/in^2) Rear 2,6 bar (260 kPa, 37 lbf/in^2) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,1 bar (210 kPa, 30 lbf/in^2) Rear 2,6 bar (260 kPa, 37 lbf/in^2)
		Up to five occupants and 115 kg (250 lb) of luggage	Speeds up to 210 km/h (130 mile/h) Front 2,1 bar (210 kPa, 30 lbf/in^2) Rear 2,6 bar (260 kPa, 37 lbf/in^2) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,3 bar (230 kPa, 33 lbf/in^2) Rear 3,1 bar (310 kPa, 44 lbf/in^2)
	Cars conforming to a European, Middle East, and United Kingdom specification	Up to four occupants and 22 kg (50 lb) of luggage	Speeds up to 210 km/h (130 mile/h) Front 2,1 bar (30 lbf/in^2) Rear 2,6 bar (37 lbf/in^2) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,1 bar (30 lbf/in^2) Rear 2,6 bar (37 lbf/in^2)
		Up to five occupants and 115 kg (250 lb) of luggage	Speeds up to 210 km/h (130 mile/h) Front 2,1 bar (30 lbf/in^2) Rear 2,6 bar (37 lbf/in^2) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,5 bar (36 lbf/in^2) Rear 3,3 bar (48 lbf/in^2)
	Cars conforming to a North American specification	Up to four occupants and 22 kg (50 lb) of luggage	Speeds up to 210 km/h (130 mile/h) Front 2,1 bar (30 lbf/in^2) Rear 2,6 bar (37 lbf/in^2) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,1 bar (30 lbf/in^2) Rear 2,6 bar (37 lbf/in^2)
		Up to five occupants and 135 kg (300 lb) of luggage	Speeds up to 210 km/h (130 mile/h) Front 2,1 bar (30 lbf/in^2) Rear 2,6 bar (37 lbf/in^2) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,3 bar (33 lbf/in^2) Rear 3,1 bar (44 lbf/in^2)

Bentley Turbo R Pirelli P7 275/55 tyres

Model year	Specification	Loading conditions	Tyre pressures
1987 onwards	*All cars*	Up to four occupants and 90 kg (200 lb) of luggage	Speeds up to 210 km/h (130 mile/h) Front 2,0 bar (28 lbf/in^2) Rear 2,41 bar (35 lbf/in^2) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,0 bar (28 lbf/in^2) Rear 2,41 bar (35 lbf/in^2)
		Up to five occupants and 115 kg (250 lb) of luggage	Speeds up to 210 km/h (130 mile/h) Front 2,0 bar (28 lbf/in^2) Rear 2,41 bar (35 lbf/in^2) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,15 bar (31 lbf/in^2) Rear 2,9 bar (42 lbf/in^2)

Snow chains

In certain countries, notice should be taken of the regulations governing the use of snow chains, particularly regarding the following.

1. The road conditions in which the use of snow chains is allowed.
2. The maximum permitted speed in conditions of snow. When snow chains are fitted, a speed limit of 50 km/h (31 mile/h) must not be exceeded on snow free roads.
3. In certain countries, the use of snow chains is compulsory under certain conditions.

Note The snow chains recommended in this section **must not** be used on cars fitted with aluminium alloy road wheels.

When fitting snow chains the following points should be observed.

1. Always refer to the manufacturer's fitting and removal procedure. A leaflet providing these details is supplied with each kit.
2. If it is necessary to raise the car reference must be made to Section R2.
3. When plastic gloves are provided with a kit, always ensure that they are used.
4. The spare links supplied with a kit are only intended to permit emergency road side repairs to be carried out if a chain is damaged.
5. On all types of snow chains it is important to note that if the chains are fitted too tightly and the car is driven at fast speeds, or for long distances, on roads which are free from snow, irreparable damage to the tyres and the chains will occur.

Cleaning snow chains

To protect the chains against rust, wash in hot water and dry them as soon as possible after use.

Studded tyres

In certain countries, notice should be taken of the regulations governing the use of studded tyres, particularly regarding the following.

1. The number of studs.
2. The height of the protrusion of studs in the tyres.
3. The maximum permitted speed.

In countries where there is no legislation on the use of studded tyres, it is recommended that, on new tyres, stud protrusion from the tread should be between 1 mm and 2,50 mm (0.039 in and 0.098 in).

The following points should also be noted when fitting studded tyres.

1. Do not exceed a speed of 121 km/h (75 mile/h).
2. Always 'run-in' new studded tyres for approximately 322 km (200 miles) at a moderate speed.
3. All running wheels must be fitted with studs, as studded tyres fitted to one axle only can cause instability, for example, on braking, when decelerating on icy roads with studded tyres on the front axle only. Similarly, instability, particularly on bends, can occur with studded tyres on the rear axle only.
4. Heavy braking and rapid acceleration should be avoided.
5. Whenever possible a tyre should be studded from new, however, it is acceptable to stud a partially worn tyre provided that the studs do not protrude beyond 4 mm (0.157 in) when fitted. If this limit is exceeded, the tyre must be considered too worn to be successfully studded.
6. At the end of the winter season, the direction of rotation or the position of the wheel should be marked on each tyre. This is to ensure that the wheel is returned to its original position when re-fitted.

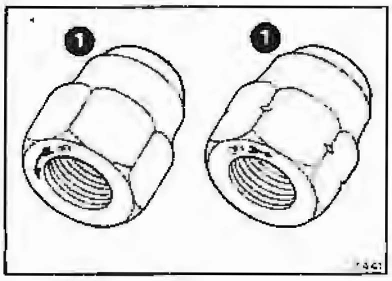
Special torque tightening figures

Introduction
This section contains the special torque tightening figures applicable to Chapter R.

For standard torque tightening figures refer to Chapter P.

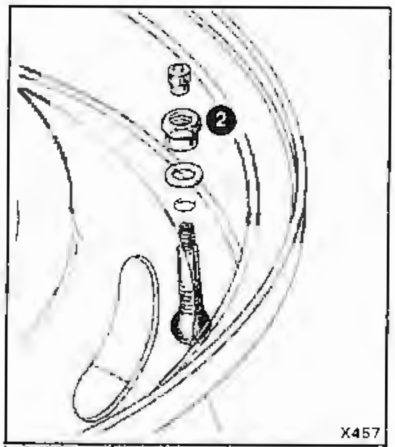
Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

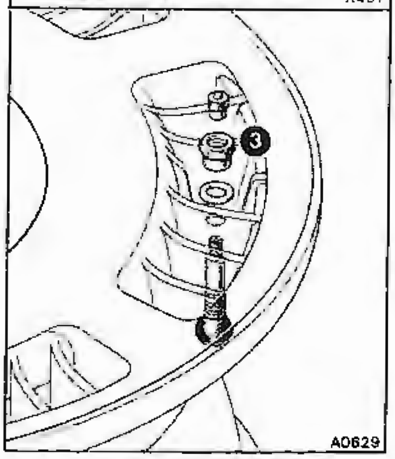
Section R2



Ref.	Component	Nm	kgf m	lbf ft
1	Road wheel nut	61-68	6-7	45-50

Section R3





Ref.	Component	Nm	kgf cm	lbf in
2	Tyre valve retaining nut (steel road wheels)	2,9-3,3	29,9-33,4	26-29
3	Tyre valve retaining nut (aluminium alloy road wheels)	2,9-3,3	29,9-33,4	26-29

Body

Contents
4 door cars

Contents
2 door cars

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections Page No.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	2/89	2/89	9/86	9/88	9/88	7/87	7/87	7/87	7/87	5/88
2		2/89	9/86	9/88						
3	5/89	2/89	9/86	9/88	9/88	9/86	5/88	5/87	5/88	5/88
4		2/89		9/88	9/88	9/86	5/88	9/86	9/86	5/88
5	5/89			9/88	9/88	9/86	5/88	9/86	9/86	5/88
6				9/88	9/88		5/88	9/86		5/88
7				9/88	9/88		5/88	9/86		5/88
8				9/88	9/88		5/88			5/88
9				9/88	9/88		5/88			5/88
10				9/88	9/88					
11				9/88	9/88					
12				9/88	9/88					
13				9/88	9/88					
14				9/88	9/88					
15				9/88	9/88					
16				9/88						
17										
18										
19										
20										
21										
22										
23										
24										

Sections Page No.	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
1	7/87	5/88	3/88	7/87	7/87	7/87	5/88	2/89	2/89	7/87
2		5/88						9/86		
3	9/86	11/86	3/88	9/88	11/86	11/86	9/88	12/88		3/87
4	9/86	11/86	12/88	9/86	8/87	11/86	9/88	5/88		3/87
5	9/86	11/86	3/88	9/86	8/87	11/86	2/88	5/88		3/87
6	9/86	11/86	3/88		8/87		2/88			3/87
7	9/86	11/86	3/88		11/86		2/88			3/87
8		5/88	3/88		5/88		2/88			3/87
9		5/88	3/88		11/86					3/87
10		5/88	3/88		11/86					3/87
11		5/88			11/86					3/87
12		5/88			11/86					3/87
13		5/88			11/86					
14		5/88			11/86					
15		5/89								
16		5/89								
17		5/89								
18										
19										
20										
21										
22										
23										
24										

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30
1	2/88	10/87	10/87	12/87	12/88	12/88		2/89		
2										
3	2/88	10/87	10/87	12/87	12/88	12/88		2/89		
4	2/88	10/87	10/87	12/87	12/88	12/88		2/89		
5	2/88	10/87	10/87	12/87	12/88	12/88		2/89		
6				12/87	12/88	12/88				
7						12/88				
8						12/88				
9						5/89				
10						5/89				
11						5/89				
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Sections / Page No.	S31	S32	S33							
1		2/89	2/89							
2		2/89								
3		2/89								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

General information

This section has been compiled to help Service Personnel understand the terminology associated with body and coachwork items of Rolls-Royce and Bentley motor cars.

Throughout this Chapter reference is made to the left-hand and right-hand sides of the car, this is determined when viewed from sitting in the driver's seat.

Prior to commencing work, reference **must be** made to Section S3 Safety procedures.

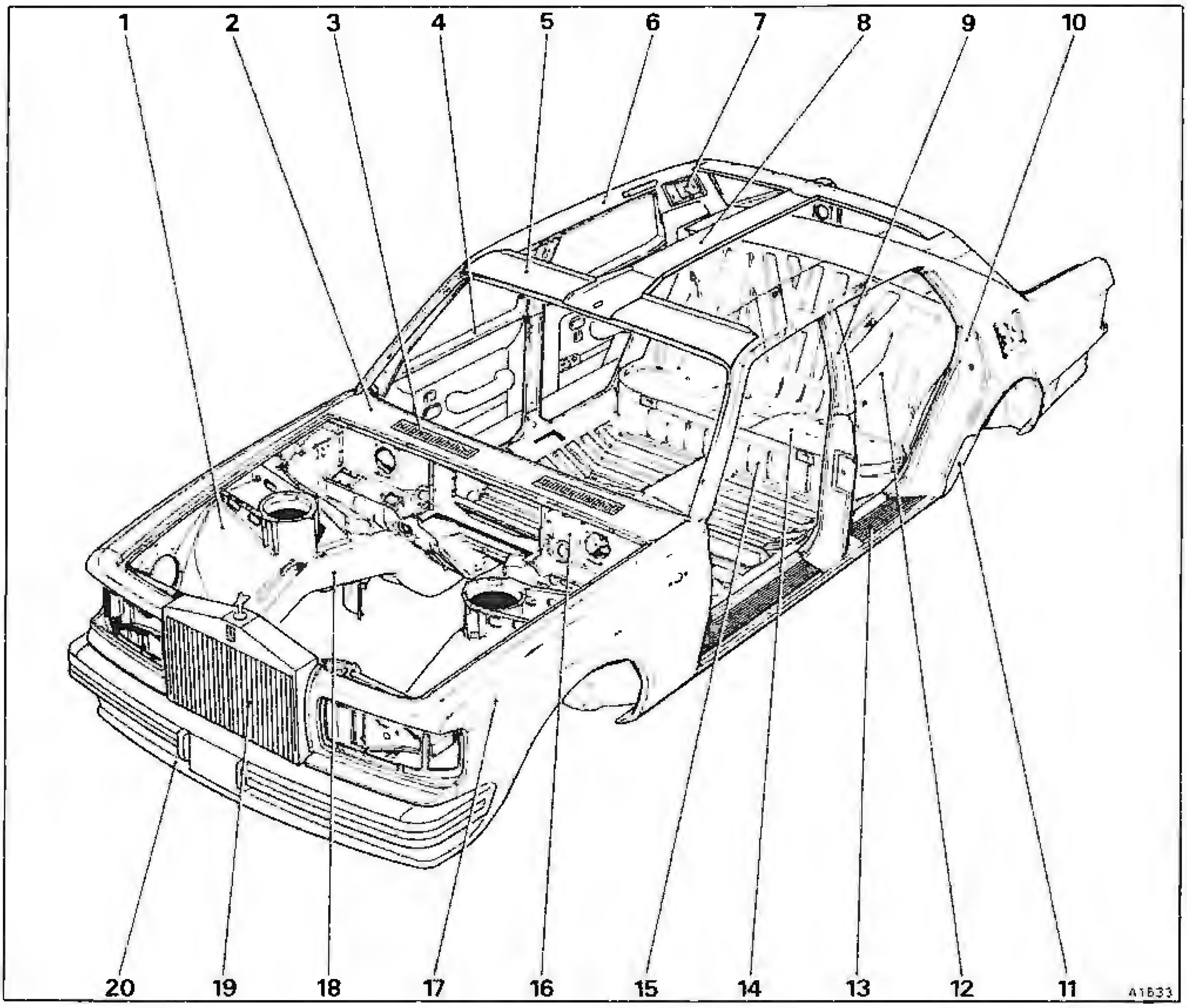


Fig. S2-1 Body terminology (four-door cars)

1 Inner wing valance panel
2 Scuttle panel
3 Air intake grille
4 Waist rail finisher
5 Front header trim panels
6 Cantrail and quarter trim panel
7 Companion frame
8 Centre roof trim panel
9 'BC' post panel
10 'D' post panel
11 Rear wheel-arch stoneguard
12 Rear squab panel
13 Sill treadrubbers
14 Rear seat pan
15 Heelboard
16 Bulkhead
17 Front wing panel
18 Longeron
19 Radiator shell
20 Air dam

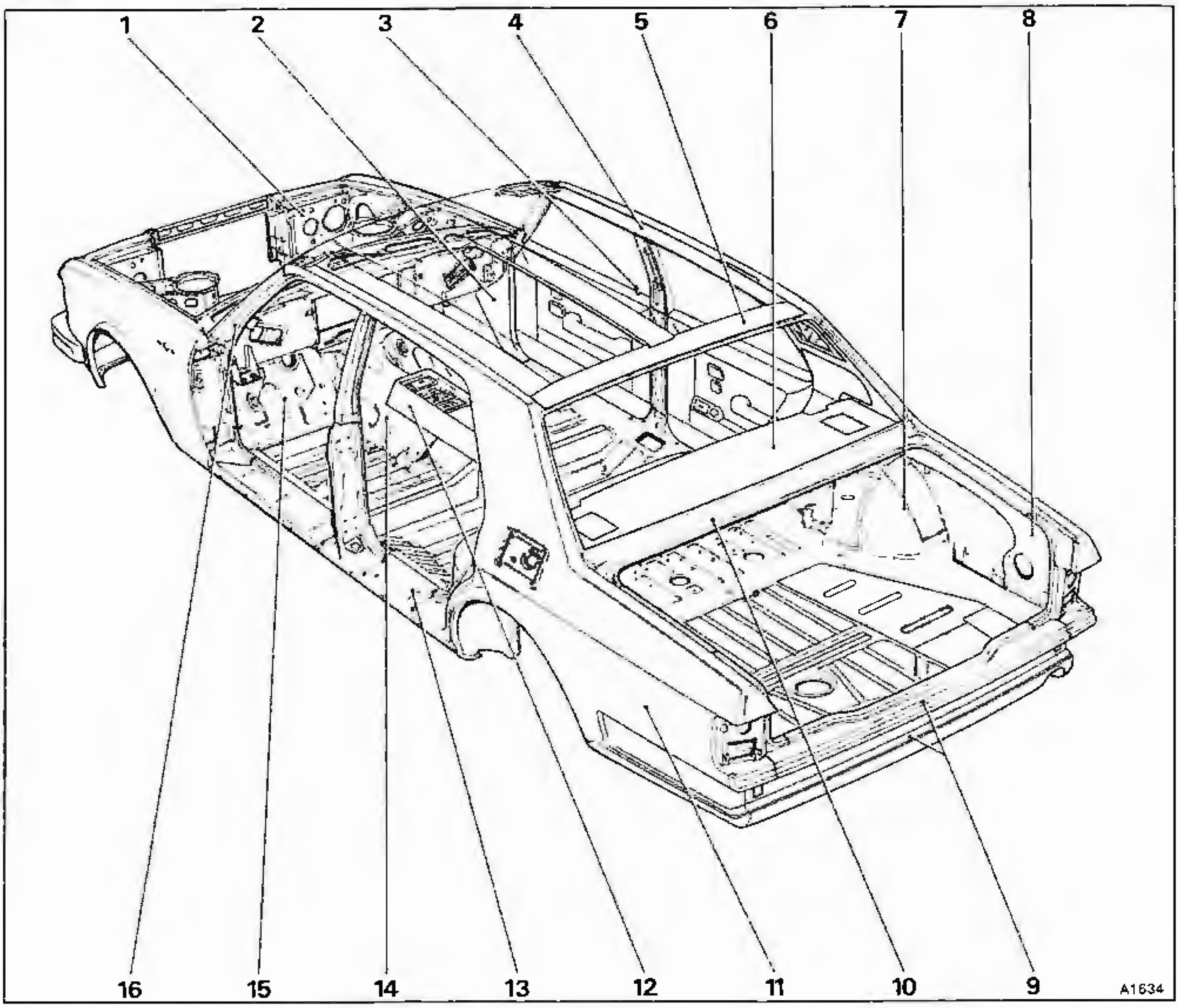


Fig. S2-2 Body terminology (four-door cars)

1 Diaphragm panel
2 Scuttle trim panel
3 Sill control button
4 Side header trim panel
5 Rear header trim panel
6 Parcel shelf
7 Wheel-arch panels
8 Inner wing panel
9 Rear lower panels
10 Rear decking panel
11 Rear wing or tonneau panel
12 Centre stowage bin
13 Sill panel
14 Transmission tunnel
15 Toeboard panel
16 'A' post panel

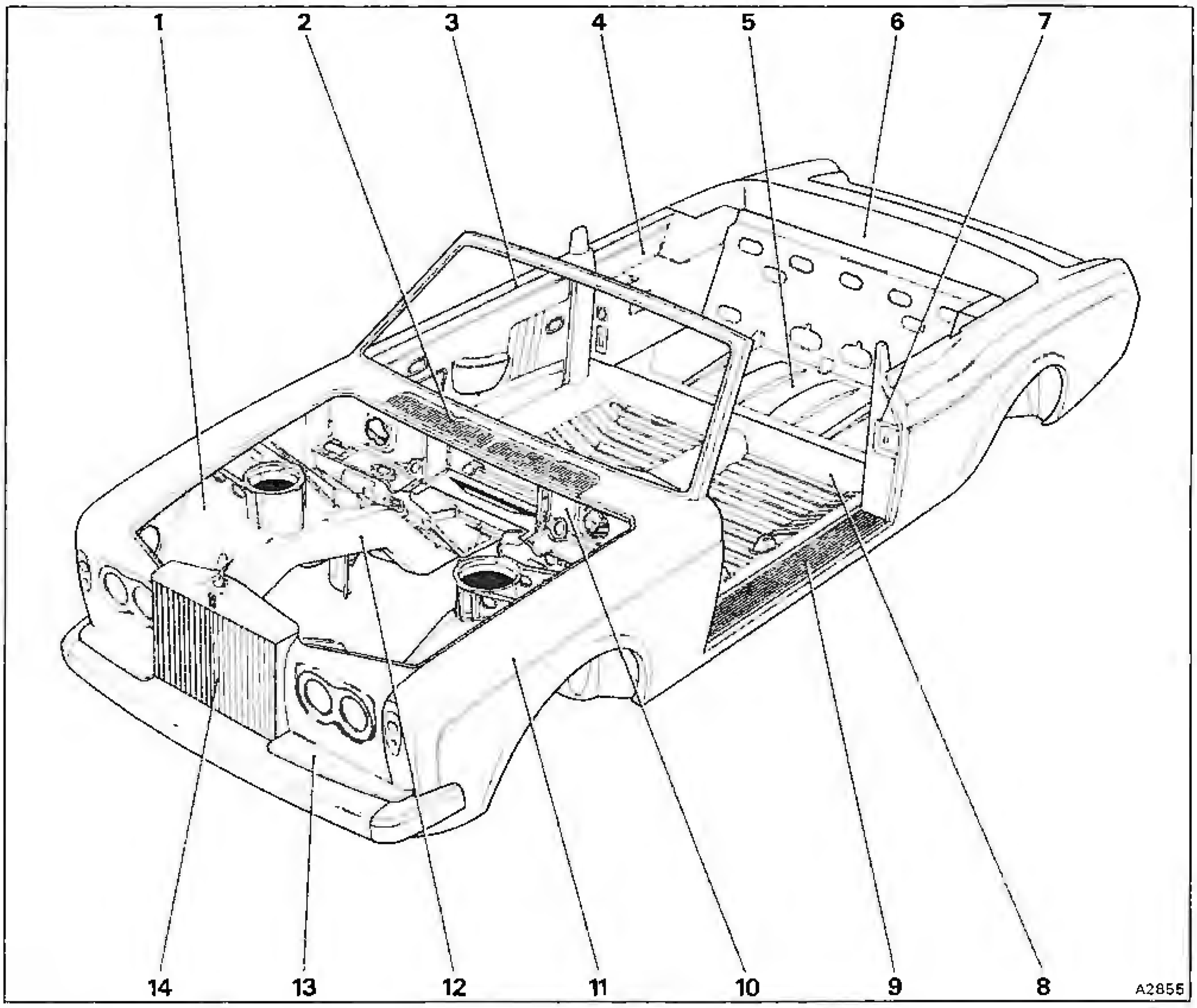


Fig. S2-3 Body terminology (two-door cars)

1 Inner wing valance panel
2 Air intake grille
3 Waist rail finisher
4 Rear quarter
5 Rear seat pan
6 Hoodwell
7 'B' post panel
8 Heelboard
9 Sill treadrubber
10 Bulkhead
11 Front wing panel
12 Longeron
13 Bumper fairing
14 Radiator shell

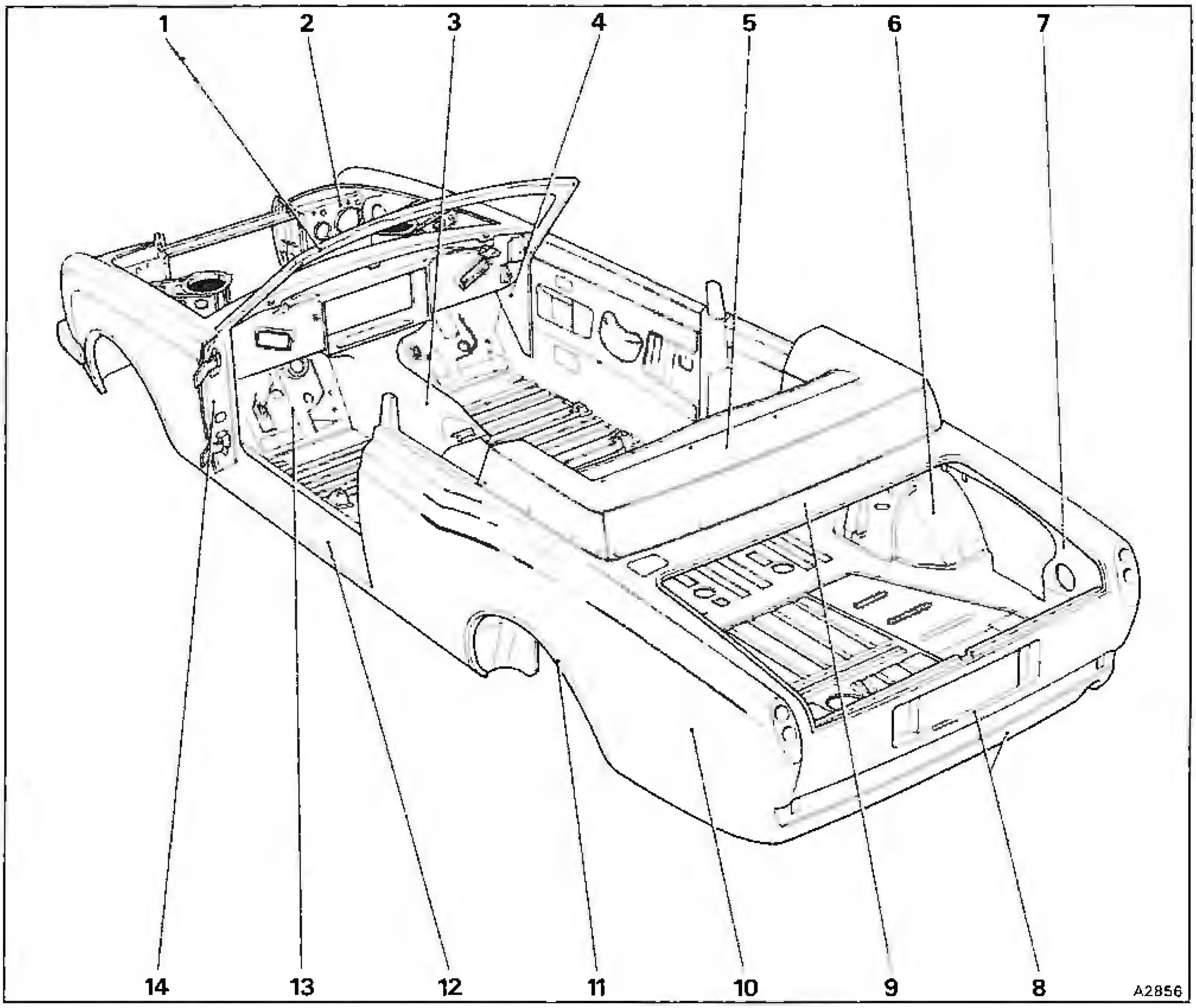


Fig. S2-4 Body terminology (two-door cars)

1 Header rail
2 Diaphragm panel
3 Transmission tunnel
4 Scuttle trim panel
5 Hood envelope
6 Wheel-arch panels
7 Inner wing panel
8 Rear lower panels
9 Rear decking panel
10 Rear wing or tonneau panel
11 Wheel-arch finisher
12 Sill panel
13 Toeboard panel
14 'A' post panel

Safety procedures

Always ensure that normal workshop safety precautions are carried out. In addition note the following.

Raising and supporting the car
Raising the front of the car
1. Position the car on a level surface and place the gear range selector lever in the park position.
2. Remove fuse A6 from fuse panel F2 on the main fuseboard.
3. Apply the parking brake.
4. Chock the rear road wheels.
5. To raise the front of the car, position a trolley jack under the front pivot mounting for the lower triangle levers on the sub-frame (see fig. S3-1). Place a piece of soft wood between the jack head and the mounting.

Raising the rear of the car
1. Position the car on a level surface and place the gear range selector lever in the park position.
2. Remove fuse A6 from fuse panel F2 on the main fuseboard.
3. Apply the parking brake.
4. Chock the front road wheels.
5. To raise the rear of the car, position a trolley jack under the centre of the final drive casing (see fig. S3-1). Place a piece of soft wood between the jack head and the final drive casing. **Do not jack the car under the final drive crossmember.**

Supporting the car
When raising the rear of the car to support on axle stands and/or wooden blocks, follow the procedure described previously, then remove the road wheels. Place stands under the positions shown in figure S3-1.

Similarly, raise the front of the car and support with axle stands and/or wooden blocks in the positions shown in figure S3-1. Remove the road wheels if necessary.

If the whole car is to be raised on stands and/or wooden blocks, the car body should also be supported using wooden sill blocks. The blocks should be placed under the jacking points on the car body (see fig. S3-1). The sill blocks should be produced to the dimensions shown in figure S3-2.

Welding
1. If welding is to be carried out in the vicinity of the fuel tank or fuel lines, it is important that the fuel system is completely drained. **Even small quantities of fuel remaining in the system can produce high levels of fuel vapour.**

If the fuel tank has been removed to facilitate welding, it is important that any open fuel lines are blanked off.
2. Prior to welding, all traces of body sealers should be removed from the weld area as they can create toxic gases and dangerous fumes when subjected to heat.

Before using electric welding equipment, ensure that both battery leads are disconnected. It is also recommended to unplug individual electrical units wherever possible i.e. the anti-lock braking system electronic control unit. Also ensure that the earth connection between the welding equipment and the body is as close as possible to the weld area.
3. When welding, it is essential that flameproof protective clothing and a face mask are worn. It is also recommended that a fume extractor is used.

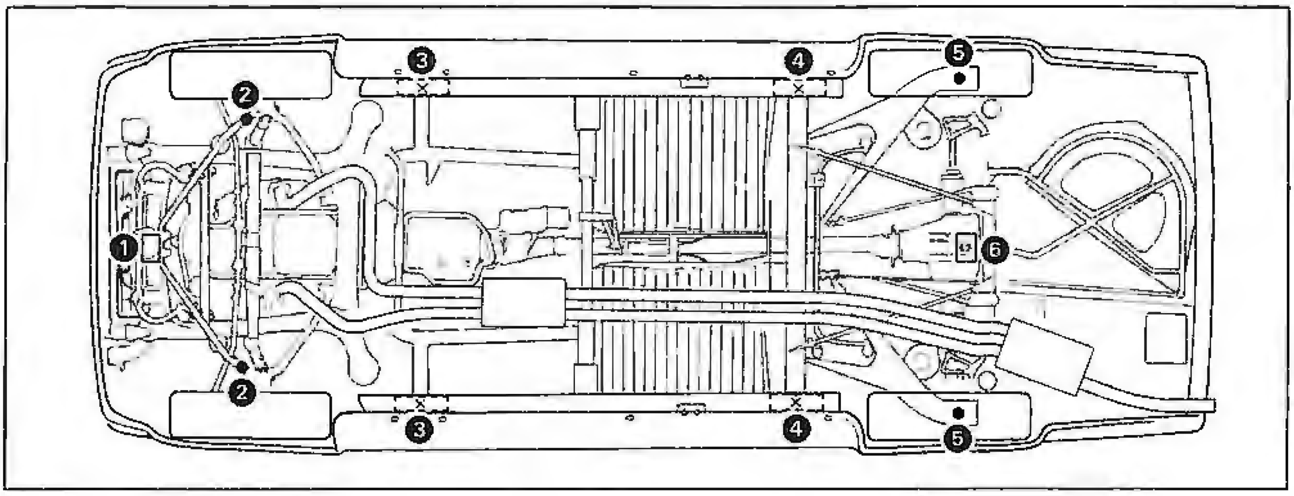


Fig. S3-1 Car jacking positions and support locations
1 Trolley jack position (front)
2 Car stand positions (front)
3 Sill block positions (front)
4 Sill block positions (rear)
5 Car stand positions (rear)
6 Trolley jack position (rear)

Ensure that the car is protected, where necessary, by fire resistant blankets and that suitable fire fighting equipment is readily available.

4. The lower areas of the 'A' and 'D' post panels incorporate urethane foam sound insulation. When using cutting or welding equipment in these areas, care must be taken to avoid inhaling the toxic gases created when the temperature exceeds 200°C (392°F).

Paint shop safety

The following safety procedures **must be** observed in order to reduce the risk of fire in areas where paints, solvents, and thinners are used or stored.

Solvent fumes

1. Display **'No Smoking'** and **'No Naked Flames'** signs and ensure that propane gas torches and welding equipment are not used in the vicinity of the paint area.
2. Fumes from spilled solvents/thinners, etc., can spread out over large areas and ignite. Therefore, any spillages should be cleared immediately.
3. Provide a good ventilation system to remove fumes.
4. Always replace the lid on any container immediately after use.

Static electricity

1. It is advisable, when pouring thinners and solvents, to connect the containers with electrically conductive wire and earth them.
2. If possible, earth all equipment in the paint shop.
3. Do not splash the thinners when pouring from one container to another. Always pour the thinners down the side of the container. Thinners allowed to free fall through the air can generate static electricity.
4. Do not use plastic containers for storage.

Spontaneous combustion

1. Some materials such as oils and certain paints, which have been cleared with cloth waste, oxidise so rapidly that sufficient heat is generated to cause ignition. Therefore, immediately after clearing any spillage, remove the cloth waste from the paint shop area.

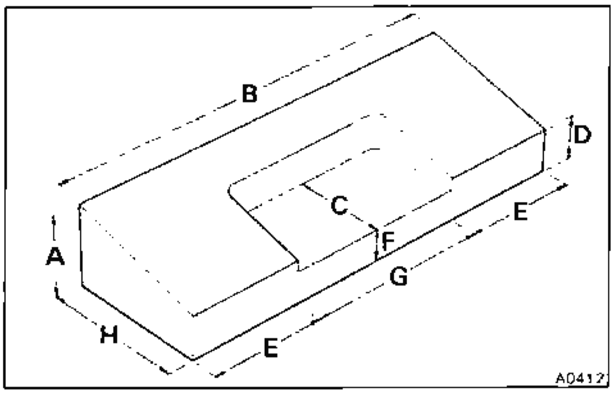


Fig. S3-2 Hardwood sill block

A	44,45 mm (1.750 in)
B	228,60 mm (9.0 in)
C	53,98 mm (2.125 in)
D	25,40 mm (1.0 in)
E	63,50 mm (2.50 in)
F	19,05 mm (0.750 in)
G	101,60 mm (4.0 in)
H	79,38 mm (3.125 in)

Cleaners, primers, and adhesives

Throughout this chapter references are made to various types of cleaners, primers, and adhesives. When using these **highly flammable** materials the manufacturer's instructions must be closely followed. In addition, the following precautions must be taken.

1. Always replace the lid on any container immediately after use.
2. Always store flammable materials in lockable metal cupboards.
3. Cleaners or adhesives must not be used in a confined or badly ventilated area.
4. The use of a suitable barrier cream and/or the use of rubber gloves is recommended.
5. Use a suitable antiseptic cleansing cream to remove any adhesive from the skin. **Do not use cleaning solvents.**

Genklene

Genklene is the I.C.I. trade name for trichloroethane. It possesses anaesthetic properties and the inhalation of high concentrations of vapour will cause drowsiness, headache, and giddyness. When using Genklene the following precautions must be taken.

1. Genklene should only be used in well ventilated areas.
2. Genklene should not be stored or carried in buckets or open containers. Any container used for storing Genklene must be clearly markad.
3. Genklene should be stored in lockable metal cupboards.
4. In the event of a major spillage, the area should be evacuated and then thoroughly ventilated.
5. Genklene should not be emptied into drains.
6. If possible, avoid skin contact with Genklene. It is a powerful solvent and will remove fat and oils from the skin; this could cause a skin disease such as dermatitis. If contact is likely, the use of a suitable barrier cream and rubber gloves is recommended.
7. When applying Genklene with a brush, it is essential that the eyes are protected with goggles.
8. Genklene should be used sparingly, cleaning only small areas at a time. Use a squeeze type bottle or a container with a spout for applying Genklene to a cloth. After use, cloths should be deposited into a closed container.
9. Take care while working in an inspection pit. Genklene vapour is heavier than air, therefore vapours may collect at low levels.
10. Do not smoke when using Genklene. Vapours exposed to high temperatures produce toxic gases. For similar reasons, Genklene should not be allowed near naked flames, hot surfaces, or welding arcs.

Warning Anyone suffering from over exposure to Genklene vapour should be moved into the fresh air and medical attention sought immediately. **Do not walk the patient.**

Boscoprene Adhesive 2402 (Parts 1 and 2)
The two parts of this adhesive should be mixed together in accordance with the manufacturer's instructions. Part 2 of Boscoprene Adhesive 2402 contains an isocyanate curing agent. When using this adhesive the following precautions must be taken.

1. Prior to commencing work, thoroughly wash your hands. Then, apply a suitable barrier cream. Clean rubber gloves should also be worn.
2. If the adhesive comes into contact with the skin, clean the affected area immediately with a suitable antiseptic cleansing cream, then wash thoroughly with soap and water. **Do not use cleaning solvents.** If prolonged contact has occurred, treat the affected area with diluted ammonia (1 part concentrated Ammonia SGO.880 to 9 parts water).
3. If the isocyanate is accidently splashed into the eye, **immediately** wash the eye thoroughly with water. Apply a drop of olive oil, then seek medical attention.
4. If the isocyanate is spilt onto clothing, treat with liquid decontaminant i.e. diluted ammonia (see Operation 2).
5. Any spillage of isocyanate should be immediately wiped up and the affected area treated with liquid decontaminant.
6. To dispose of any small quantities of waste isocyanate slowly add them to at least twenty times their volume of liquid decontaminant in an open container stirring slowly. Allow the mixture to stand for two hours after which it can be safely washed down the drain with large quantities of water.
7. If any isocyanate (Boscoprene Adhesive 2402, Part 2) is in the vicinity of a fire the following precautions **must be** taken.

a. If possible, move the isocyanate containers to a safe area.
b. If is not possible to move the containers, the possibility of injurious vapour must be anticipated and the area evacuated immediately.
c. Breathing apparatus resistant to isocyanate fumes must be used by anyone remaining in the affected area.
d. **All fire brigade personnel must be informed of the chemical hazard.**
e. Small fires are best extinguished with dry chemicals or carbon dioxide extinguishers. **Do not use water extinguishers**, as further heat is generated by the reaction of water with the isocyanate chemical.

Front doors

Contents

9/88
Printed in England

Contents

Front doors

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

On completion of any work carried out inside the door and prior to the fitting of the door trim, ensure that all loose debris, etc., is removed from the bottom of the door.

If special torque tightening figures are not specified, setscrews, bolts, etc., should be tightened to the standard figures quoted in Chapter P.

Safety procedures
The cleaners, primers, and adhesives referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Door trim – To remove and fit (see fig. S4-1)
1. Disconnect the battery.
2. Remove the screws and cup washers (item 1). Then, carefully unclip and remove the outer trim panel assembly.

Note On a number of early Bentley Eight cars, the lower carpeted trim panel is a separate item and should be unclipped to expose the outer trim panel securing screws. Release the screws, then unclip and remove the outer trim panel.

3. Remove the screws (item 2) securing the lower section of the arm rest, then disconnect the step lamp bulb unit.
4. Unscrew and remove the upper section of the arm rest.
5. Using a suitable tool, carefully ease the escutcheon covers (item 3) from the door handle and window lift switch(es). Then, unscrew and remove the escutcheons.
6. Remove the centre trim panel, threading the step lamp bulb unit through the panel.
7. To fit the door trim reverse Operations 1 to 6 inclusive.

Waist rail finisher – To remove (see fig. S4-1)
1. Remove the door trim.
2. Carefully prise out the plastic drive fastener (item 4). Release the moulded door seal from its retaining channel, adjacent to each end of the waist rail finisher. Then, remove the exposed screws (item 5).
3. Peel back the waterproof cover and slacken the lock-nut (item 6). Then, unscrew and remove the sill control button.
4. Remove the setscrews and washers (item 7), then lift-off the waist rail finisher.

Waist rail finisher – To fit (see fig. S4-1)
Reverse the removal procedure noting the following.

1. Check that the control button guide bush is seated correctly in the waist rail finisher and that it is secured by a Starlock washer (see inset A). Apply a small amount of silicone grease inside the guide bush.
2. With the sill control button in the locked position, adjust it to the dimension shown (see inset A). Then, tighten the lock-nut.

Waist rail finisher seals – To renew (see fig. S4-1)
1. Remove the waist rail finisher.
2. Using a suitable tool, remove the waist rail finisher to door glass seal (item 8) taking care not to damage the polished surface of the finisher.
3. Thoroughly clean the bonding surfaces of the waist rail finisher and the new seal using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
4. Apply an even coat of Dunlop S1127 Adhesive to the bonding surfaces of the finisher and the seal. Allow the adhesive to 'flash' dry (between 15 and 20 minutes). Then, bring the bonding surfaces together using maximum hand pressure.
5. The self-adhesive foam seals fitted to the finisher can be easily removed and renewed as necessary.

Door – To remove and fit (see fig. S4-1)
1. Disconnect the battery.
2. Remove the screws and cup washers (item 1). Then, carefully unclip and remove the outer trim panel assembly.

Note On a number of early Bentley Eight cars, the lower carpeted trim panel is a separate item and should be unclipped to expose the outer trim panel securing screws. Release the screws, then unclip and remove the outer trim panel.

3. Remove the rubber grommet (item 9). Peel back the waterproof cover to expose the door to hinge securing setscrews (item 10).
4. Unscrew and remove the carpeted scuttle panel. Then, disconnect the door loom plugs and sockets (see inset B).
5. With the help of an assistant, support the door and remove the setscrews and washers (item 10). Note the position and quantity of any spacing washers situated between the door hinges and the door.
6. Carefully remove the door, releasing the loom through the aperture in the 'A' post panel.
7. To fit the door reverse Operations 1 to 6 inclusive.

Door hinges – To remove and fit (see fig. S4-1)
1. Remove the door.
2. To facilitate assembly, mark the position of each door hinge in relation to the 'A' post panel.
3. Remove the setscrews and washers (item 11) securing the hinges to the 'A' post panel. An Allen key and extension bar will be required to remove the

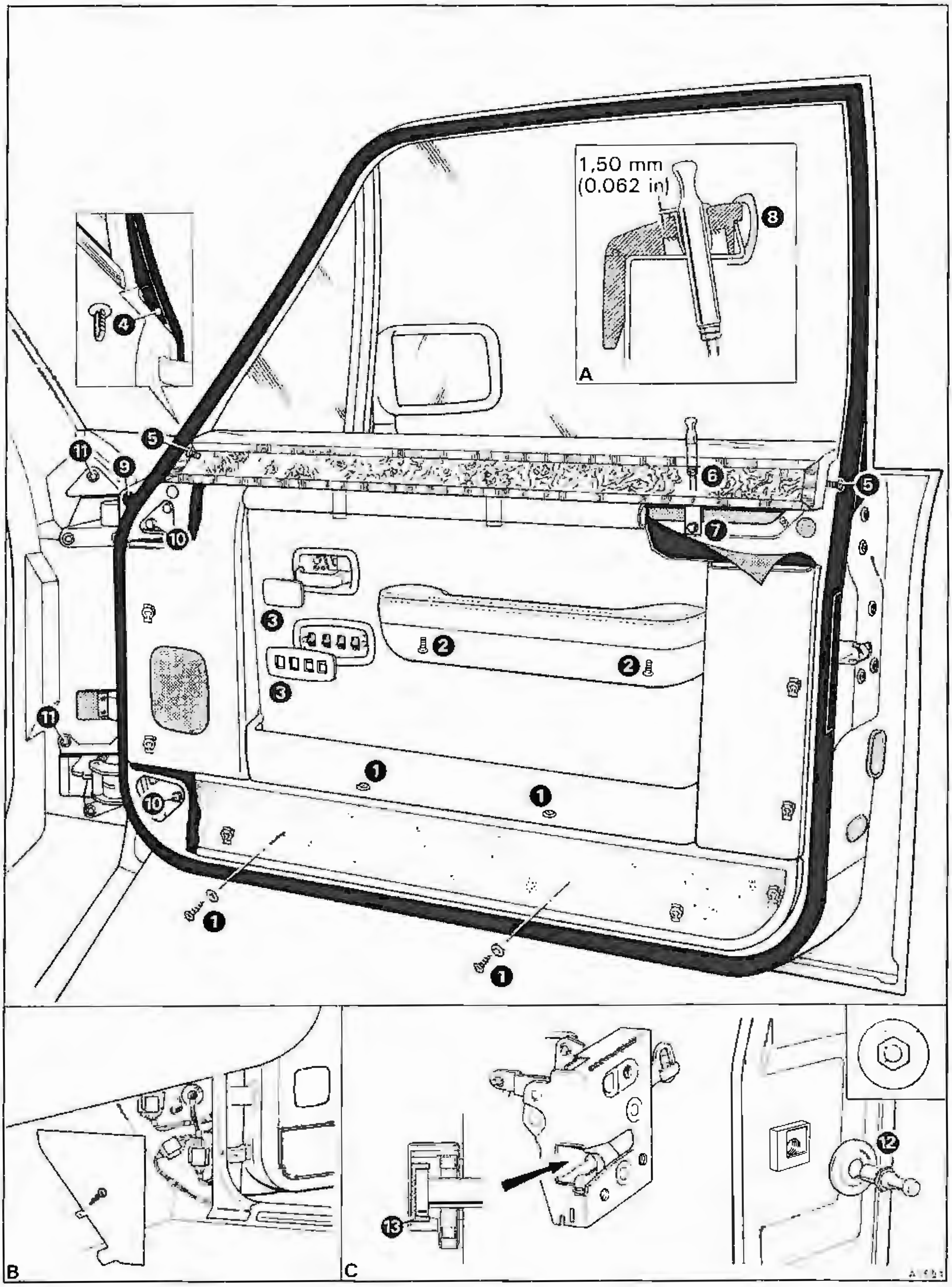


Fig. S4-1 Door trim and door to body mounting arrangement

setscrews and washers situated inside the 'A' post apertures.

4. Remove the door hinges.
5. To fit the door hinges reverse the removal procedure noting the following.

Lubricate all moving parts of the hinge check mechanism (except the cams) using a light mineral oil.

Torque tighten the hinge securing setscrews as follows.

	Nm	kgf m	lbf ft
Hexagonal headed –	23-34	2,3–3,4	17–25
Allen headed –	23-34	2,3–3,4	17–25

Door adjustment (see fig. S4-1)

1. Disconnect the battery.
2. Remove the screws and cup washers (item 1). Then, carefully unclip and remove the outer trim panel assembly.

Note On a number of early Bentley Eight cars, the lower carpeted trim panel is a separate item and should be unclipped to expose the outer trim panel securing screws. Release the screws, then unclip and remove the outer trim panel.

3. Remove the rubber grommet (item 9) and peel back the waterproof cover to expose the door to hinge securing setscrews (item 10).
4. Loosen the setscrews sufficiently to allow the door to be moved on its hinges.
5. Release the striker pin lock-nut (see inset C, item 12). Then, unscrew and remove the striker pin and washer.
6. Adjust the position of the door ensuring that the clearances between the door and the front wing, sill, and rear door panel are equal.
7. When the door is correctly positioned, torque tighten the door to hinge setscrews.
8. Fit the striker pin and washer, then attach the setting piece RH 9779 (item 13). The setting piece ensures that a suitable clearance exists between the end of the striker pin and the latch mechanism.
9. Position the striker pin in the lower outboard corner of the adjustment slot (see inset C). Then, finger tighten the lock-nut.
10. Slowly close the door until the latch is almost touching the striker pin. Screw the pin inwards or outwards until the setting piece (item 13) makes contact with the back of the latch mechanism (see inset C).
11. Open the door and remove the striker pin setting piece.
12. Ensure that the door latch claw mechanism is in the **unlocked** position. Then, keeping the exterior handle push button fully depressed, move the door into the closed position i.e. until the front door panel is flush with the rear door panel. This operation will set the striker pin in the correct position in relation to the latch mechanism.
13. Open the door. Using the special tool RH 9778 hold the striker pin in position and torque tighten the lock-nut to between 27 Nm and 33 Nm (2,8 kgf m and 3,3 kgf m; 20 lbf ft and 24 lbf ft).
14. Prior to closing the door check that the head of the striker pin does not foul the back of the latch or the claw mechanism.
15. Close the door, noting the following.

If the door rises or falls on the striker pin, loosen the lock-nut and adjust the vertical position of the pin.

If the door does not lie flush with the rear door, loosen the lock-nut and adjust the inboard/outboard position of the pin.

On completion, torque tighten the striker pin lock-nut to between 27 Nm and 33 Nm (2,8 kgf m and 3,3 kgf m; 20 lbf ft and 24 lbf ft).

Window lift mechanism – To remove and fit (see fig. S4-2)

Applicable to cars prior to 1989 model year

1. Remove the door trim (see Door trim – To remove and fit).
2. Peel back and remove the waterproof cover from the inner door panel.
3. Connect the battery and lower the door glass until the nylon guide (item 1) is visible through the large aperture in the inner door panel. Disconnect the battery.
4. Release the rubber strap securing the door looms to the window lift unit. Then, disconnect the window lift motor plug and socket (item 2).
5. Remove the retaining strap securing the top of the mechanism to the inner door panel (item 3).
6. Remove the nut and washer (item 4). Then, withdraw the bolt slightly allowing the guide plate to be moved sideways. Fit the nut and washer.
7. Push the tensioning spring (item 5) off the nylon guide. Then, carefully lever the guide clear of the window lift pick-up plate and remove.
8. Remove the Starlock washer and spacer (item 6). Support the glass channel assembly, then disengage the pivot arm from the window lift mechanism.
9. Manually raise the door glass assembly to the fully closed position and secure it to the door frame with masking tape.
10. Remove the rubber grommets (item 7) from the underside of the door to gain access to the mechanism securing setscrews.
11. Remove the exposed setscrews and washers (item 8). Then, withdraw the mechanism through the large aperture in the inner door panel.
12. To fit the window lift mechanism reverse the removal procedure noting the following.

Prior to securing the mechanism to the door, apply a small amount of Retinax 'A' grease, or its equivalent, to the mechanism securing setscrews (item 8).

Check that the rubber bump stop (item 9) is in position and that a new Starlock washer (item 6) is fitted when attaching the pivot arm to the window lift mechanism.

Ensure that the retaining strap (item 3) secures the guide plate but does not foul the window lift chain.

Wire guidance and door glass assembly – To remove (see fig. S4-2)

Applicable to cars prior to 1989 model year

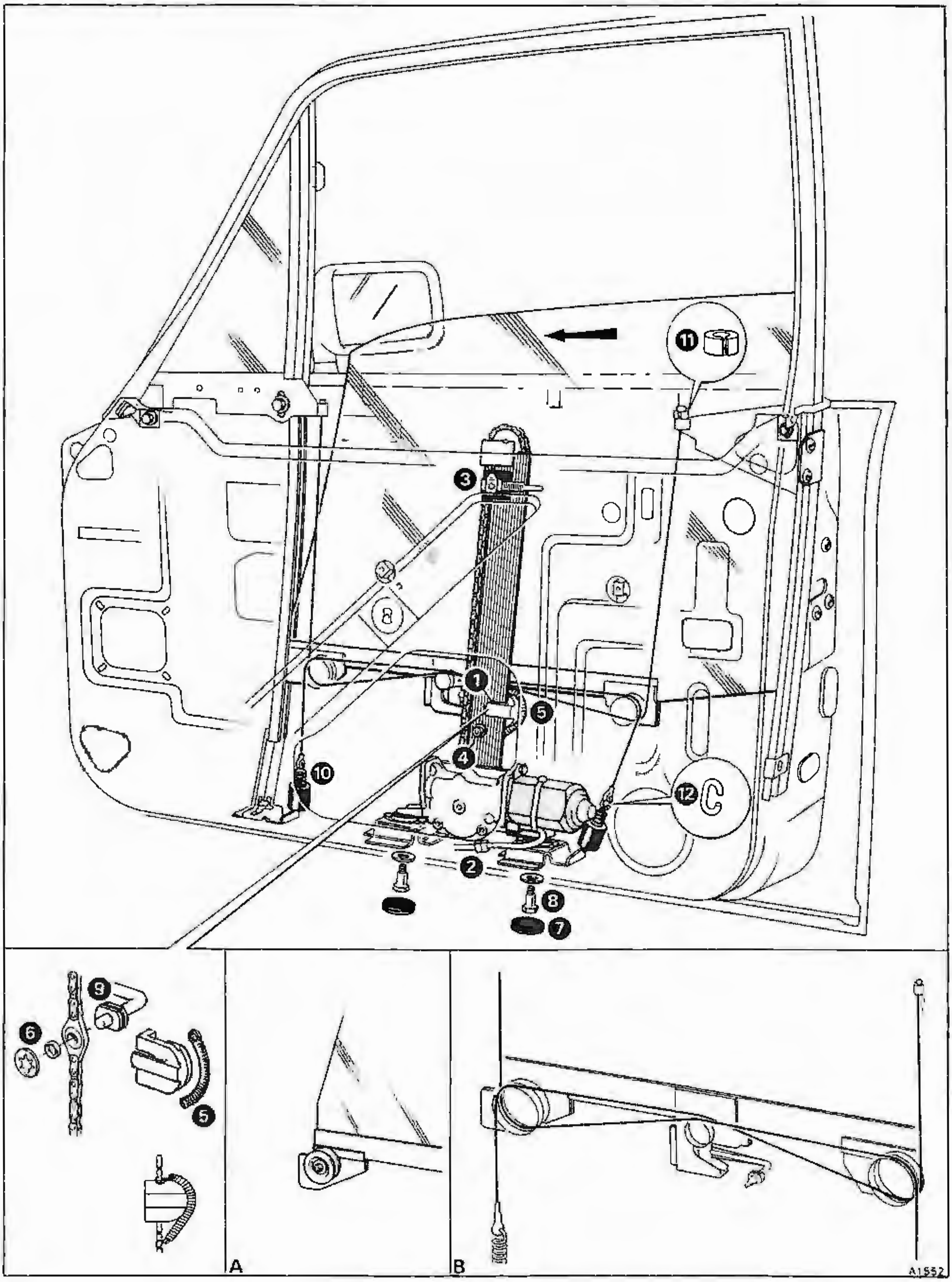


Fig. S4-2 Window lift mechanism, door glass, and wire guidance assembly and fittings
Applicable to cars prior to 1989 model year

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Connect the battery and lower the door glass until the nylon guide (item 1) is visible through the large aperture in the inner door panel. Disconnect the battery.
4. Remove the nut and washer (item 4). Then, withdraw the bolt slightly allowing the guide plate to be moved sideways. Fit the nut and washer.
5. Push the tensioning spring (item 5) off the nylon guide. Then, carefully lever the guide clear of the window lift pick-up plate and remove.
6. Remove the Starlock washer and spacer (item 6). Support the glass channel assembly, then disengage the pivot arm from the window lift mechanism.
7. Manually raise the door glass assembly to the fully closed position and secure it to the door frame with masking tape.
8. Using a long screwdriver, or a similar tool, release the tension from one of the guidance wires by extending the spring (item 10). Then, unhook the wire from its upper anchorage point and remove. Repeat this operation on the remaining guidance wire. Note that on left-hand doors an additional tensioning spring may be fitted between the window lift mechanism and the guidance wire.
9. Whilst supporting the door glass assembly remove the masking tape. Lower the forward edge of the glass until both sides are clear of the window frame channels. Lift the glass assembly out of the door.

Wire guidance and door glass assembly – To fit
(see fig. S4-2)
Applicable to cars prior to 1989 model year
Reverse the procedure given for removal noting the following.
1. When fitting a new door glass proceed as follows.
   Attach a strip of black Gosheron adhesive tape, or its equivalent, along the lower edge of the glass to the approximate depth of the glazing channel.
   Fit the glazing rubber over the glass. Then, position the channel level with the forward edge of the glass (see inset A) and press firmly into position.
   The channel should compress the glazing rubber ensuring a tight fit. If necessary, extra layers of adhesive tape may be added as packing between the glass and the glazing rubber. Ensure that the glass fits fully into the glazing channel.
2. Fit the guidance wires to the pulley system in the positions indicated in inset B.
3. Fit a new Starlock washer (item 6) when attaching the pivot arm to the window lift mechanism.
4. Prior to fitting the door trim, connect the battery and fully raise the door glass checking that it fits equally within both side channels of the door frame.
   If necessary, fine adjustment of the wire guidance system can be achieved by adding a spacer (item 11) and link (item 12) to the guidance wires in the positions shown. The arrow indicates the direction that the glass will move within the door frame as a result of this adjustment.

Window lift mechanism – To remove and fit
(see fig. S4-3)
Applicable to 1989 model year cars
1. Remove the door trim (see Door trim – To remove and fit).
2. Peel back and remove the waterproof cover from the inner door panel.
3. Connect the battery and lower the door glass until the window lift pick-up plate (item 1) is visible through the large aperture in the inner door panel. Disconnect the battery.
4. Release the rubber strap securing the door looms to the window lift unit. Then, disconnect the window lift motor plug and socket (item 2).
5. Support the door glass assembly, then remove the spring clip (item 3) from the pick-up shaft noting that a spring is fitted behind the retaining washer and could suddenly eject when the spring clip is withdrawn.
6. Disengage the window lift pick-up plate from the shaft noting that a compressed spring is fitted behind the rubber bump stop (item 4). Manually raise the door glass assembly to the fully closed position and secure it to the door frame with masking tape.
7. Remove the retaining strap securing the top of the mechanism to the inner door panel (item 5).
8. Remove the rubber grommets (item 6) from the underside of the door to gain access to the mechanism securing setscrews.
9. Remove the exposed setscrews and washers (item 7). Then, withdraw the mechanism through the large aperture in the inner door panel.
10. To fit the window lift mechanism reverse the removal procedure noting the following.
   Prior to securing the mechanism to the door, apply a small amount of Retinax 'A' grease, or its equivalent, to the mechanism securing setscrews (item 7).
   Ensure that the spring clip (item 3) is positioned in a horizontal plane to prevent a possible foul with the window lift gearbox casing.

Wire guidance and door glass assembly – To remove
(see fig. S4-3)
Applicable to 1989 model year cars
1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Connect the battery and lower the door glass until the window lift pick-up plate (item 1) is visible through the large aperture in the inner door panel. Disconnect the battery.
4. To facilitate assembly, mark the position of the pick-up shaft washer (item 8) in relation to the glazing channel mounting bracket.
5. Remove the nut and washer (item 9) securing the pick-up shaft to the glazing channel mounting bracket.
6. Support the door glass assembly, then disconnect the pick-up shaft from the glazing channel. Manually

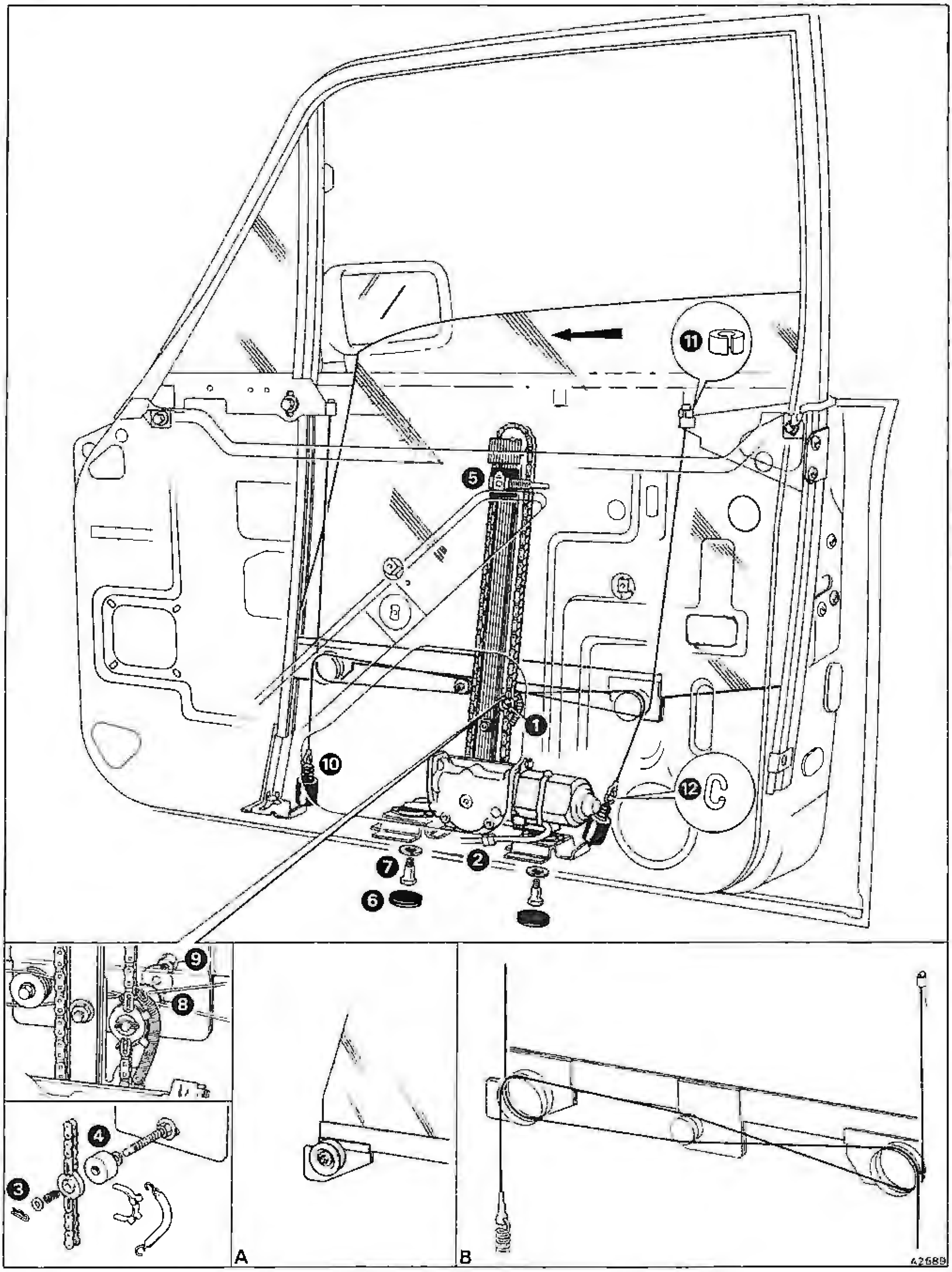


Fig. S4-3 Window lift mechanism, door glass, and wire guidance assembly and fittings
Applicable to 1989 model year cars

raise the door glass assembly to the fully closed position and secure it to the door frame with masking tape.
7. Using a long screwdriver, or a similar tool, release the tension from one of the guidance wires by extending the spring (item 10). Then, unhook the wire from its upper anchorage point and remove. Repeat this operation on the remaining guidance wire. Note that on left-hand doors an additional tensioning spring may be fitted between the window lift mechanism and the guidance wire.
8. Whilst supporting the door glass assembly remove the masking tape. Lower the forward edge of the glass until both sides are clear of the window frame channels. Lift the glass assembly out of the door.

Wire guidance and door glass assembly – To fit (see fig. S4-3)
Applicable to 1989 model year cars
Reverse the procedure given for removal noting the following.
1. When fitting a new door glass proceed as follows.
Attach a strip of black Gosheron adhesive tape, or its equivalent, along the lower edge of the glass to the approximate depth of the glazing channel.
Fit the glazing rubber over the glass. Then, position the channel level with the forward edge of the glass (see inset A) and press firmly into position.
The channel should compress the glazing rubber ensuring a tight fit. If necessary, extra layers of adhesive tape may be added as packing between the glass and the glazing rubber. Ensure that the glass fits fully into the glazing channel.
2. Fit the guidance wires to the pulley system in the positions indicated in inset B.
3. Prior to securing the pick-up shaft to the glazing channel mounting bracket align the correlation marks made during removal.
4. Prior to fitting the door trim, connect the battery and fully raise the door glass checking that it fits equally within both side channels of the door frame.
If necessary, fine adjustment of the wire guidance system can be achieved by adding a spacer (item 11) and link (item 12) to the guidance wires in the positions shown. The arrow indicates the direction that the glass will move within the door frame as a result of this adjustment.

Door frame – To remove (see fig. S4-4)
1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Remove the door glass (see Wire guidance and door glass assembly – To remove).
4. Carefully prise out the plastic drive fastener (item 1).
5. Carefully ease the door seal out of its retaining channel around the frame. Care must be taken not to stretch the seal during this operation.
6. Remove the door frame fixings (items 2, 3, 4, and 5) and tapping plates, etc. Then, withdraw the frame from the door noting the position and quantity of any frame to door spacing washers.
7. Inspect the glazing channel seal (item 6) and renew if necessary.

Door frame – To fit (see fig. S4-4)
Reverse the procedure given for removal noting the following.
1. Position the frame in the door. Then, lightly secure all of the frame to door fixings, replacing any previously removed spacing washers.
Carefully close the door and check that an equal clearance exists between the frame and the 'A' post, cantrail, and 'B' post. Also ensure that the door frame to cantrail landing dimensions are correct (see inset A).
If necessary, a small amount of vertical adjustment of the frame can be achieved by the fitting of spacing washers between the lower fixing points and the door.
2. When the frame is correctly positioned, torque tighten the fixings as follows.

	Nm	kgf m	lbf ft
(item 2) –	11-13	1,1–1,4	8–10
(item 3) –	22-24	2,2–2,5	16–18
(item 4) –	6-8	0,6–0,8	4.5–6
(item 5) –	6-8	0,6–0,8	4.5–6

3. Should any subsequent adjustment of the door frame be necessary, it is important that all of the fixing points are loosened before any attempt is made to move the frame.
4. Ensure that the window glass guides are in position on the frame (item 7). The guides simply clip into the frame underneath the glazing channel seal and can be easily adjusted or removed as necessary.

Fence moulding – To adjust (see fig. S4-4)
The fence moulding can be raised approximately 3 mm (0.125 in). This enables the top of the door to be repainted or the fence moulding seal to be renewed without the removal of the moulding.
1. To raise the fence moulding proceed as follows referring to inset B.
Insert a small sharp screwdriver, or a similar tool, under each end of the fence moulding in turn. Place a piece of rubber or felt between the screwdriver and the paintwork.
The moulding can now be carefully levered clear of the door top. **Do not lever directly onto the paintwork.**
2. To lower the fence moulding, tap into position using a suitable mallet. Ensure that the seal sits evenly along the full length of the moulding.

Fence moulding – To remove (see fig. S4-4)
1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Remove the door glass (see Wire guidance and door glass assembly – To remove).
4. Drill out the four pop rivets (item 8), then carefully remove the fence moulding.

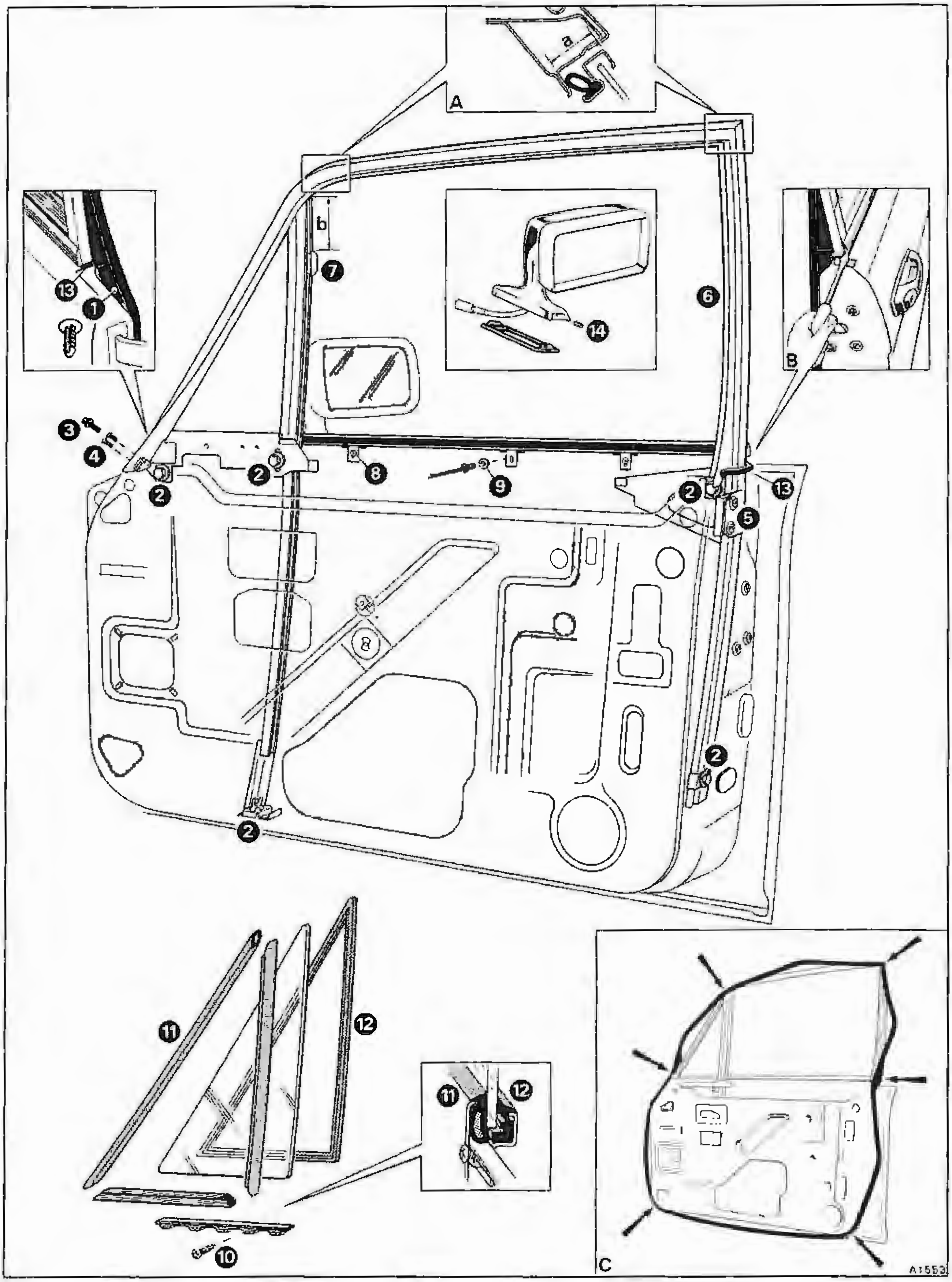


Fig. S4-4 Door frame, door to body seal, quarter glass sealing arrangement, and fittings

a 31,0 mm-33,0 mm (1.220 in-1.300 in) b 90,0mm (3.543 in) approximately

Fence moulding – To fit (see fig. S4-4)
Reverse the procedure given for removal noting the following.
1. Secure the fence moulding to the door using pop rivets and nylon bushes (item 9).
2. When fitting a fence moulding to a new door proceed as follows.
Place the moulding in position on the door retaining flange.
Align the moulding with each end of the door frame ensuring that the moulding lies flat along the top of the door.
To allow for vertical adjustment of the fence moulding, ensure that the pop rivet holes are drilled at the top of the elongated slots.

Quarter glass and seals – To remove (see fig. S4-4)
1. Remove the door frame.
2. Release the self-tapping screws (item 10). Then, remove the spacer from underneath the quarter glass.
3. Release the three sections of the inner seal (item 11). Then, ease the glass away from the outer moulded seal and slide it out of the frame.

Quarter glass and seals – To fit (see fig. S4-4)
1. If the moulded outer seal (item 12) is to be renewed proceed as follows.
Remove the seal noting that it is glued to the frame in each corner.
Thoroughly clean the glass channel area using a cloth moistened with Bostik Cleaner 6001.
Apply a small amount of Loctite 495 adhesive, or its equivalent, to each corner of the seal. Care must be taken to avoid the adhesive coming into contact with the visible surfaces of the seal or door frame.
Fit the moulded outer seal into the frame, ensuring that each corner is correctly positioned and that the outer lip of the seal fits over the frame channel as indicated.
2. Tape the edge of the inner fence moulding to prevent scratching the glass.
3. Lightly smear liquid soap along the bottom of the moulded outer seal, then slide the glass into the frame. Ensure that the glass fits fully into the rebate in the outer seal otherwise the inner seal sections will prove difficult to fit.
4. Check that the outer seal has not been disturbed, then fit wedges to hold the glass in position.
5. To fit the inner seal sections (item 11) proceed as follows.
Starting at the top corner of the frame, cut and fit the seal nearest to the main window glass. Ensure that the outer lip of the seal fits over the frame channel as indicated.
Similarly, fit the seal to the opposite channel and finally cut and fit the lower seal. Remove each wedge as the seals are fitted.
When fitted, the inner seals on the two upright door frame channels should not be visible when viewed through the glass.
6. Secure the spacer underneath the quarter glass, then fit the frame to the door (see Door frame – To fit).

Door to body seal – To remove and fit (see fig. S4-4)
1. Release the plastic drive fastener (item 1).
2. Carefully ease the door seal out of its retaining channel and progressively remove.
3. To fit the seal, begin by applying a light coating of Palm Grease lubricant to the base section of the seal. Apply the lubricant below the waist rail area of the door. **Do not** apply lubricant to the window frame or the upper half of the seal.

Note Petroleum jelly or Vaseline **must not** be used to lubricate the seal.

4. Loosely fit the seal to the door in the positions indicated (see inset C). Then, manoeuvre the seal into its retaining channel, taking care not to stretch the seal. A wooden or perspex wedge shaped tool with smooth edges will assist during this operation.

Note When fitting the seal, **do not** close the door. Failure to observe this could lead to permanent damage of the seal.

5. Fit the drive fastener (item 1).
6. Lightly dress the bulbous section of the seal with chalk or talcum powder. This will help the seal to slide into position when the door is closed. **Do not use grease or oil.**
7. Close the door. Then, check the frame to cantrail landing dimensions (see inset A). If it is necessary to adjust the position of the frame, reference must be made to Door frame – To fit.
8. When the seal is correctly positioned, the door should be left fully closed for a minimum of twelve hours. This allows the seal to assume a set position and reduces the possibility of the seal subsequently fouling when the door is closed.

Door frame end seals – To renew (see fig. S4-4)
1. Remove the door frame.
2. Remove the end seals (item 13) taking care not to damage the paintwork.
3. Thoroughly clean the bonding area of the door using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
4. Apply Bostik Primer 9252 to the bonding area of the door. Allow approximately one hour to dry.
5. Using abrasive paper roughen the bonding surface of the seal. Then, wipe the seal with Bostik Cleaner 6001. Allow to dry.
6. Apply Boscoprene Adhesive 2402 (parts 1 and 2) to the bonding surfaces of the door and the seal. Allow the adhesive to 'flash' dry (between 10 and 15 minutes). Then, bring the bonding surfaces together using maximum hand pressure.

Door mirror – To remove and fit (see fig. S4-4)
1. Disconnect the battery.
2. Ease the rubber flap from the end of the mirror base to expose the mirror retaining grubscrew (item 14).
3. Turn the screw anti-clockwise until the mirror

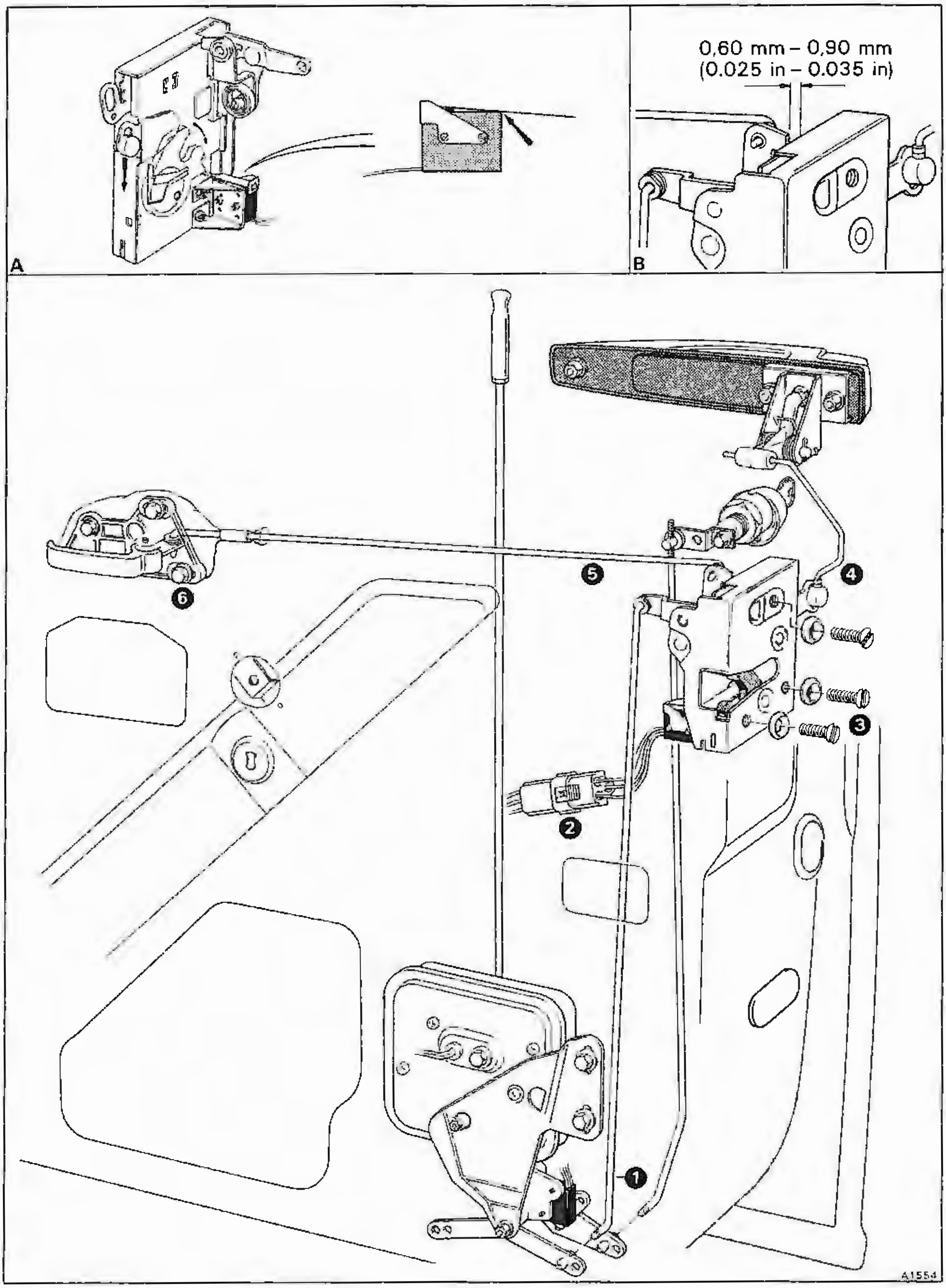


Fig. S4-5 Door latch, interior release handle, and fittings

assembly can be slid away from the door panel and clear of its mounting plate.

4. Disconnect the mirror loom plugs and sockets then remove the mirror assembly. Secure the sockets with masking tape to prevent them dropping inside the door.

5. To fit the door mirror assembly reverse the procedure given for removal noting the following.

When fitting the mirror, thread the loom into the door in a forwards direction, i.e. towards the front of the car. This avoids the possibility of the plug and socket fouling the window lift mechanism.

Door latch – To remove (see fig. S4-5)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Remove the door glass (see Wire guidance and door glass assembly – To remove).
4. Remove the door frame (see Door frame – To remove).
5. Disconnect the link rod (item 1) from the relay lever.
6. Disconnect the courtesy lamp micro-switch plug and socket (item 2).
7. Remove the three setscrews and washers (item 3) securing the latch to the door panel.
8. Lower the latch and disconnect the exterior handle control rod (item 4) from the plastic connector on the door latch. Note that a number of spacers are fitted to the control rod.
9. Manoeuvre the latch to disconnect the interior door handle control rod (item 5). Then, withdraw the latch and relay lever link rod from the door.
10. If necessary, unscrew and remove the courtesy lamp micro-switch from the latch.

Door latch – To fit (see fig. S4-5)

Reverse the procedure given for removal noting the following.

1. If the courtesy lamp micro-switch has been removed from the latch proceed as follows.

Move the claw mechanism of the latch into the 'door closed' position.

Loosely fit the micro-switch assembly to the latch using the screws, nuts, and shakeproof washers.

Release the claw mechanism into the 'door open' position. Then, adjust the position of the switch until the actuator lever is lightly touching the corner of the switch (see inset A, arrowed). Tighten the securing screws.

2. Place the latch and link rod assembly into the door, then connect the link rod (item 1) to the relay lever.

Note Wherever control rods have been disconnected, it is important that new Fastex bushes are fitted on assembly. This will ensure that the control rods are correctly secured.

3. Connect the interior door handle control rod (item 5).
4. Fit the exterior handle control rod (item 4), complete with the correct number of spacers, into the plastic connector on the latch.
5. Secure the latch to the door panel using three **new** M6 setscrews and washers. Torque tighten the setscrews to between 4,1 Nm and 6,1 Nm (0,4 kgf m and 0,6 kgf m; 3 lbf ft and 4.5 lbf ft). **This torque figure must not be exceeded.**
6. To check the operation of the interior and exterior handles refer to Interior and Exterior handles – To set.

Interior door handle – To remove and fit (see fig. S4-5)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the setscrews and washers (item 6) securing the handle base to the inner door panel.
3. Detach the open end of the polythene bag from the door and disconnect the control rod. Remove the handle.
4. When fitting the handle, ensure that the polythene bag is trapped between the handle base and the inner door panel. Also, check that the bag is secured to the control rod using a rubber sleeve.
5. For information on the correct setting of the interior door handle reference should be made to, Interior door handle – To set.

Interior door handle – To set (see fig. S4-5)

1. Loosen the setscrews (item 6) securing the handle base to the inner door panel.
2. Move the handle base forwards (i.e. away from the latch) until any free play is removed and the release handle returns fully against its stop.
3. With the handle in this position, move the handle base further forwards, against latch spring pressure, until the correct clearance is achieved between the lever and the latch body (see inset B). Then, tighten the setscrews.
4. With the door open, move the claw mechanism into the 'door closed' position and check the operation of the handle.

Never attempt to close the door with the latch mechanism in the 'door closed' position, or severe damage to the latch may result.

Exterior door handle – To remove and fit (see fig. S4-6)

1. Fully raise the door glass.
2. Remove the door trim (see Door trim – To remove and fit).
3. Remove the waist rail finisher (see Waist rail finisher – To remove).
4. Remove the three nuts and washers (item 1) securing the handle to the door. Carefully withdraw the handle and rubber gasket, taking care not to disturb the position of the push button lever/mounting plate assembly (item 2).
5. To fit the exterior door handle, reverse the procedure given for removal. For information on the setting of the push button overtravel reference should be made to, Exterior door handle push button – To set.

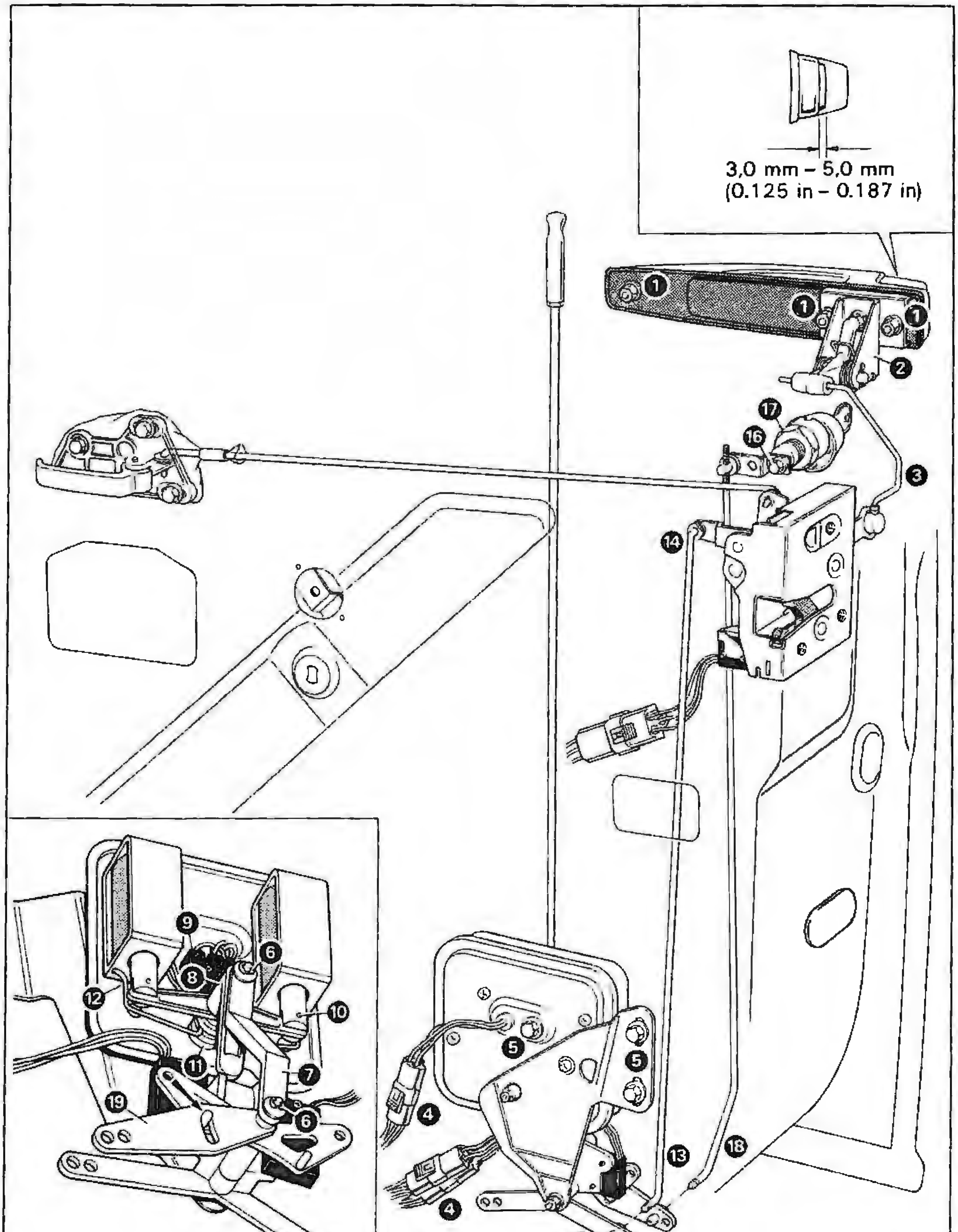


Fig. S4-6 Exterior door handle, solenoid assembly, private lock unit, and fittings

Exterior door handle push button – To set (see fig. S4-6)

1. With the door open, move the claw mechanism of the latch into the 'door closed' position.

Never attempt to close the door with the mechanism in this position, or severe damage to the latch may result.

2. Depress the push button and check that the latch operates correctly. The latch should operate with between 3 mm and 5 mm (0.125 in and 0.200 in) of push button overtravel.

To adjust the push button overtravel, it will be necessary to lower the door latch and amend the number of spacers on the exterior handle control rod (item 3). Refer to Door latch – To remove.

Solenoid assembly – To remove and dismantle (see fig. S4-6)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Remove the window lift mechanism (see Window lift mechanism – To remove).
4. Disconnect the link rods from the solenoid assembly.
5. Disconnect the plugs and sockets (item 4) from the solenoids and micro-switches.
6. Remove the setscrews and washers (item 5) securing the solenoid assembly to the door panel. Then, carefully manoeuvre the assembly clear of the door.
7. If it is necessary to replace a solenoid proceed as follows.

Remove the circlips and nylon washers (item 6).

Withdraw the tie piece (item 7) and drive lever (item 8). Then, unclip and remove the plastic solenoid cover.

Disconnect the solenoid leads from the terminal block (item 9).

Unscrew and remove the solenoid/connecting link assembly from the base plate. The solenoids can then be separated from the connecting link by removing the roll pins (item 10).

Solenoid assembly – To assemble and fit (see fig. S4-6)

1. Prior to fitting the solenoid/connecting link assembly to the base plate, ensure that two nylon spacers (item 11) are in position on the mounting shaft.
2. Loosely fit the solenoid/connecting link assembly to the base plate. Align the solenoids to give unrestricted movement of the connecting link, then tighten the solenoid securing screws. Check that the self-centring spring (item 12) is fitted correctly.
3. Connect the solenoid leads to the terminal block, then press the plastic solenoid cover into position.
4. Fit the drive lever and tie piece, then secure using circlips and nylon washers.
5. To fit the solenoid assembly to the door reverse the removal procedure, Operations 1 to 6 inclusive, noting that wherever link rods have been disconnected it is important that new Fastex bushes are fitted on assembly.

To set the position of the solenoid assembly in the door, reference should be made to Solenoid assembly – To adjust.

Solenoid assembly – To adjust (see fig. S4-6)

1. Loosen the three setscrews (item 5) securing the solenoid assembly to the door panel.
2. Disconnect the link rod (item 13) from the relay lever.
3. Press the door lock lever (item 14) down into the unlocked position.
4. Move the relay lever (item 15) down sufficiently to take up any free play.
5. Adjust the height of the solenoid assembly until the link rod (item 13) aligns with the hole in the relay lever. If there are two holes in the relay lever, align the link rod with the inner hole. Tighten the solenoid assembly securing screws.
6. Connect the link rod to the relay lever, noting that wherever link rods have been disconnected it is important that new Fastex bushes are fitted on assembly.

Private lock – To remove (see fig. S4-6)

1. Fully raise the door glass.
2. Remove the door trim (see Door trim – To remove and fit).
3. Remove the waist rail finisher (see Waist rail finisher – To remove).
4. Remove the balance lever retaining nut (item 16), noting the position and quantity of any spacing washers. Manoeuvre the balance lever and control rod assembly clear of the private lock.
5. Remove the large nut and spacer (item 17) securing the private lock to the door, then withdraw the lock.

Private lock – To fit (see fig. S4-6)

Reverse the procedure given for removal noting the following.

1. Prior to assembly, apply Keenomax C3 waterproof grease, or its equivalent, to the private lock spacer. Fit the spacer with the drain slots facing towards the outer door panel.
2. Ensure that the key slot is vertical, then secure the private lock and spacer to the door using the large nut.
3. Attach the balance lever/control rod assembly and spacing washers. Check that the lever is clear of the door reinforcement beam and that at least one spacer is fitted between the lever and its securing nut.
4. Check that the door locks and unlocks smoothly. If adjustment is necessary, reference should be made to Key and sill control button adjustment.

Key and sill control button adjustment (see fig. S4-6)

1. Set the private lock key slot vertical, then remove the key.

2. Press the sill control button down into the locked position.
3. Disconnect the private lock control rod (item 18) from the transfer lever.
4. Move the transfer lever (item 19) down until it comes into contact with the peg on the sill control lever (arrowed). Ensure that the remaining levers do not move.
5. Turn the private lock control rod, in a clockwise or anti-clockwise direction, until the rod aligns with the hole in the transfer lever. If there are two holes in the transfer lever, align the control rod with the inner hole.
6. Connect the control rod to the transfer lever, noting that wherever rods have been disconnected it is important that new Fastex bushes are fitted on assembly.
7. Check that the door locks and unlocks smoothly when operated by the sill control button and the key. Ensure that the extra force required to activate the micro-switches is equal in both the lock and unlock directions. Operation of the micro-switches can be identified by listening for the 'click' as they activate.

Checking the centralized door locking system

Operation	Check
Sill control button in up position.	Door opens from interior handle and exterior push button.
Door closed and sill control button in down position.	Door cannot be opened from exterior push button. Operation of the interior handle raises the control button and opens the door.
Door open and sill control button in down position.	Sill control button self-cancels and unlocks when door is closed (exterior push button not depressed).
	Door remains locked when closed (exterior push button depressed).
Sill control button pressed further down against spring pressure.	All doors and luggage compartment lock.
Sill control button in up position then lifted further against spring pressure.	All doors unlock. (Luggage compartment will unlock only if the selector switch situated in the facia stowage compartment is in the 'Auto' position).
Turn key (towards the rear of the car) to lock position.	Door locks.
Turn key further against spring pressure.	All doors and luggage compartment lock.
Turn key (towards front of the car) to unlock position.	Door unlocks.
Turn key further against spring pressure.	All doors unlock. (Luggage compartment will unlock only if the selector switch situated in the facia stowage compartment is in the 'Auto' position).

Rear doors

Contents

Rear doors

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

On completion of any work carried out inside the door and prior to the fitting of the door trim, ensure that all loose debris, etc., is removed from the bottom of the door.

If special torque tightening figures are not specified, setscrews, bolts, etc., should be tightened to the standard figures quoted in Chapter P.

Safety procedures
The cleaners, primers, and adhesives referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Door trim – To remove and fit (see fig. S5-1)
1. Disconnect the battery.
2. Remove the screws (item 1) securing the lower section of the arm rest, then disconnect the step lamp bulb unit.
3. Unscrew and remove the upper section of the arm rest.
4. Remove the screws and cup washers (if fitted). Then, carefully unclip the outer trim panel, disconnect the cigar lighter leads, and remove the panel.

Note On a number of early Bentley Eight cars, the lower carpeted trim panel is a separate item and should be unclipped to expose the outer trim panel securing screws. Release the screws, then unclip and remove the outer trim panel.

5. Using a suitable tool, carefully ease the escutcheon covers (item 2) from the door handle and window lift switch. Then, unscrew and remove the escutcheons.
6. Unscrew and remove the centre trim panel, threading the step lamp bulb unit through the panel.
7. To fit the door trim reverse Operations 1 to 6.

Waist rail finisher – To remove (see fig. S5-1)
1. Remove the door trim.
2. Release the moulded door seal from its retaining channel, adjacent to each end of the waist rail finisher. Then, remove the exposed screws (item 3).
3. Peel back the waterproof cover and slacken the lock-nut (item 4). Then, unscrew and remove the sill control button.
4. Remove the setscrews and washers (item 5), then lift-off the waist rail finisher.

Waist rail finisher – To fit (see fig. S5-1)
Reverse the removal procedure noting the following.
1. Check that the control button guide bush is seated correctly in the waist rail finisher and that it is secured by a Starlock washer (see inset A). Apply a small amount of silicone grease inside the guide bush.
2. With the sill control button in the locked position, adjust it to the dimension shown (see inset A). Then, tighten the lock-nut.

Waist rail finisher seals – To renew (see fig. S5-1)
1. Remove the waist rail finisher.
2. Using a suitable tool, remove the waist rail finisher to door glass seal (item 6) taking care not to damage the polished surface of the finisher.
3. Thoroughly clean the bonding surfaces of the waist rail finisher and the new seal using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
4. Apply an even coat of Dunlop S1127 Adhesive to the bonding surfaces of the finisher and the seal. Allow the adhesive to 'flash' dry (between 10 and 15 minutes). Then, bring the bonding surfaces together using maximum hand pressure.
5. The self-adhesive foam seals fitted to the finisher can be easily removed and renewed as necessary.

Door – To remove and fit (see fig. S5-1)
1. Disconnect the battery.
2. Remove the door trim.
3. Peel back the waterproof cover, then disconnect the door loom plug and socket (item 7). Withdraw the bright coloured keeper bar from the socket. Then, using a suitable thin rod, disengage the spring clips securing each cable connector. To ensure correct assembly, note the position of each cable as it is removed from the socket. Tape the cable connectors together to provide easy removal from the door.
4. Remove the spring clip (item 8) from the door check strap. Tap out the pivot pin, release the check strap and remove the rubber seal.
5. To facilitate assembly, mark the position of each door hinge in relation to the 'C' post panel.
6. With the help of an assistant, support the door and remove the setscrews and washers (item 9).
7. Remove the door, carefully withdrawing the door loom.
8. To fit the door reverse the removal procedure noting the following.

Lubricate all moving parts of the check mechanism (except the cams) using a light mineral oil.

Torque tighten the hinge to 'C' post panel setscrews to between 23 Nm and 34 Nm (2,3 kgf m and 3,4 kgf m; 17 lbf ft and 25 lbf ft).

Door adjustment (see fig. S5-1)
The door can be set further inboard or outboard by adjusting the position of the hinges on the 'C' post panel.

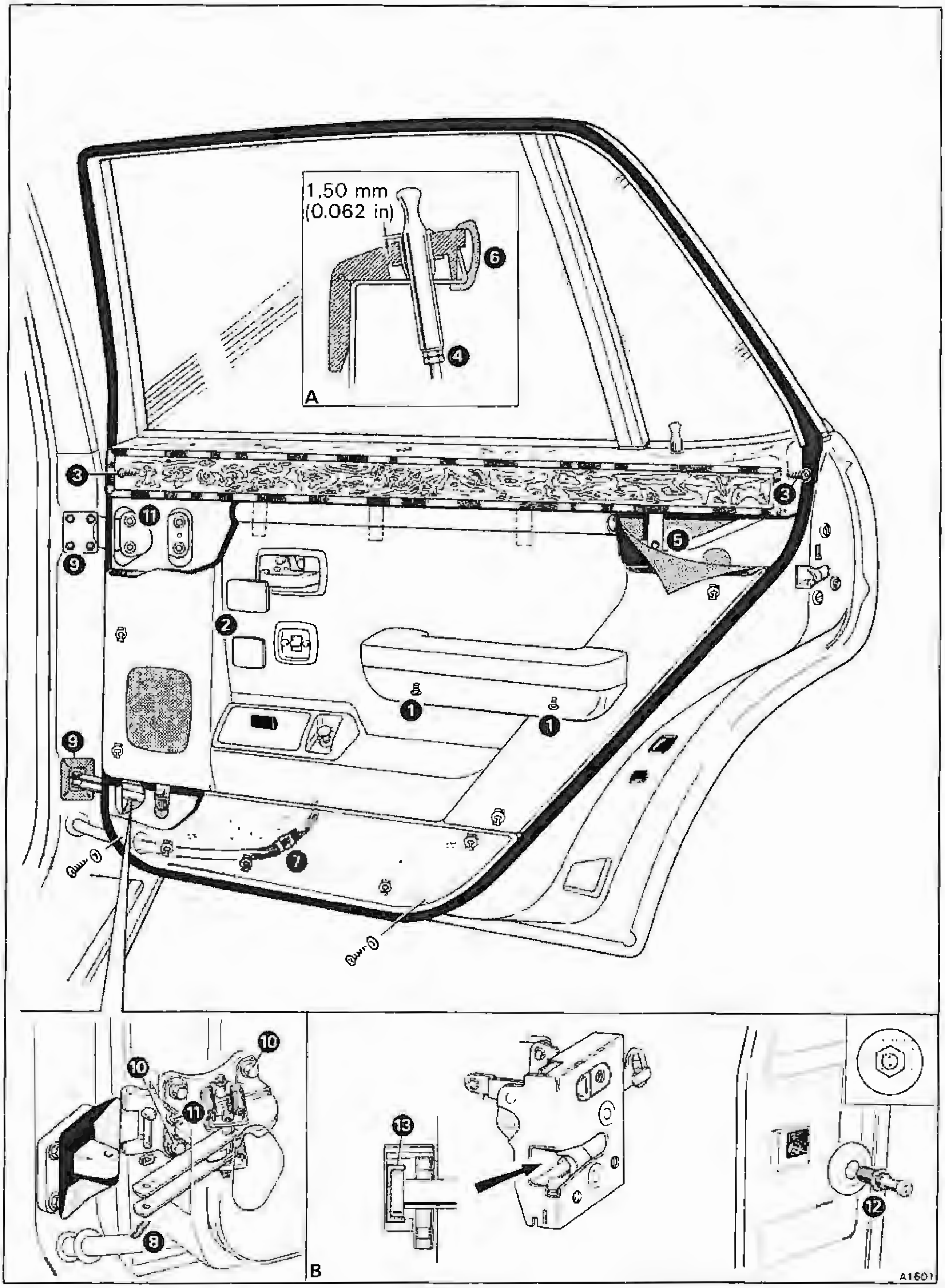


Fig. S5-1 Door trim and door to body mounting arrangement

If it is necessary to set the door further forwards or rearwards, proceed as follows.

1. Remove the door trim.
2. Remove the spring clip (item 8) from the door check strap. Tap out the pivot pin and release the check strap.
3. Peel back the waterproof cover.
4. Release the setscrews and washers (item 10), then remove the check mechanism from the door.
5. Loosen the hinge to door securing setscrews (item 11) sufficiently to allow the door to be moved on its hinges.
6. Release the striker pin lock-nut (see inset B, item 12). Then, unscrew and remove the striker pin and washer.
7. Adjust the position of the door ensuring that the clearances between the door and the rear wing, sill, and front door panel are equal.
8. When the door is correctly positioned, torque tighten the door to hinge setscrews.
9. Fit the striker pin and washer, then attach the setting piece RH 9779 (item 13). The setting piece ensures that a suitable clearance exists between the end of the striker pin and the latch mechanism.
10. Position the striker pin in the lower outboard corner of the adjustment slot (see inset B). Finger tighten the lock-nut.
11. Slowly close the door until the latch is almost touching the striker pin. Screw the pin inwards or outwards until the setting piece (item 13) makes contact with the back of the latch mechanism (see inset B).
12. Open the door and remove the striker pin setting piece.
13. Ensure that the door latch claw mechanism is in the **unlocked** position. Keeping the exterior handle push button fully depressed, move the door into the closed position i.e. until the rear door panel is flush with the rear wing panel. This operation will set the striker pin in the correct position in relation to the latch mechanism.
14. Open the door, then using the special tool RH 9778 hold the striker pin in position and torque tighten the lock-nut to between 27 Nm and 33 Nm (2,8 kgf m and 3,3 kgf m; 20 lbf ft and 24 lbf ft).
15. Prior to closing the door check that the head of the striker pin does not foul the back of the latch or the claw mechanism.
16. Close the door, noting the following.

If the door rises or falls on the striker pin, loosen the lock-nut and adjust the vertical position of the pin.

If the door does not lie flush with the rear wing panel, loosen the lock-nut and adjust the inboard/outboard position of the pin.

On completion, torque tighten the striker pin lock-nut to between 27 Nm and 33 Nm (2,8 kgf m and 3,3 kgf m; 20 lbf ft and 24 lbf ft).

Window lift mechanism – To remove and fit
(see fig. S5-2)
Applicable to cars prior to 1989 model year

1. Remove the door trim.
2. Peel back and remove the waterproof cover from the inner door panel.
3. Connect the battery and lower the door glass until the nylon guide (item 1) is visible through the large aperture in the inner door panel. Disconnect the battery.
4. Release the rubber strap securing the door looms to the window lift unit. Then, disconnect the window lift motor plug and socket (item 2).
5. Remove the retaining strap securing the top of the mechanism to the inner door panel (item 3).
6. Remove the nut and washer (item 4). Then, withdraw the bolt slightly allowing the guide plate to be moved sideways. Fit the nut and washer.
7. Push the tensioning spring (item 5) off the nylon guide. Then, carefully lever the guide clear of the window lift pick-up plate and remove.
8. Remove the Starlock washer and spacer (item 6). Support the glass channel assembly, then disengage the pivot arm from the window lift mechanism.
9. Manually raise the door glass assembly to the fully closed position and secure it to the door frame with masking tape.
10. Remove the rubber grommets (item 7) from the underside of the door to gain access to the mechanism securing setscrews.
11. Remove the exposed setscrews and washers (item 8). Then, withdraw the mechanism through the large aperture in the inner door panel.
12. To fit the window lift mechanism reverse the removal procedure noting the following.

Prior to securing the mechanism to the door, apply a small amount of Retinax 'A' grease, or its equivalent, to the mechanism securing setscrews (item 8).

Check that the rubber bump stop (item 9) is in position and that a new Starlock washer (item 6) is fitted when attaching the pivot arm to the window lift mechanism.

Ensure that the retaining strap (item 3) secures the guide plate but does not foul the window lift chain.

Wire guidance and door glass assembly – To remove
(see fig. S5-2)
Applicable to cars prior to 1989 model year

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Connect the battery and lower the door glass until the nylon guide (item 1) is visible through the large aperture in the inner door panel. Disconnect the battery.
4. Remove the nut and washer (item 4). Then, withdraw the bolt slightly allowing the guide plate to be moved sideways. Fit the nut and washer.
5. Push the tensioning spring (item 5) off the nylon guide. Then, carefully lever the guide clear of the window lift pick-up plate and remove.
6. Remove the Starlock washer and spacer (item 6). Support the glass channel assembly, then disengage the pivot arm from the window lift mechanism.
7. Manually raise the door glass assembly to the

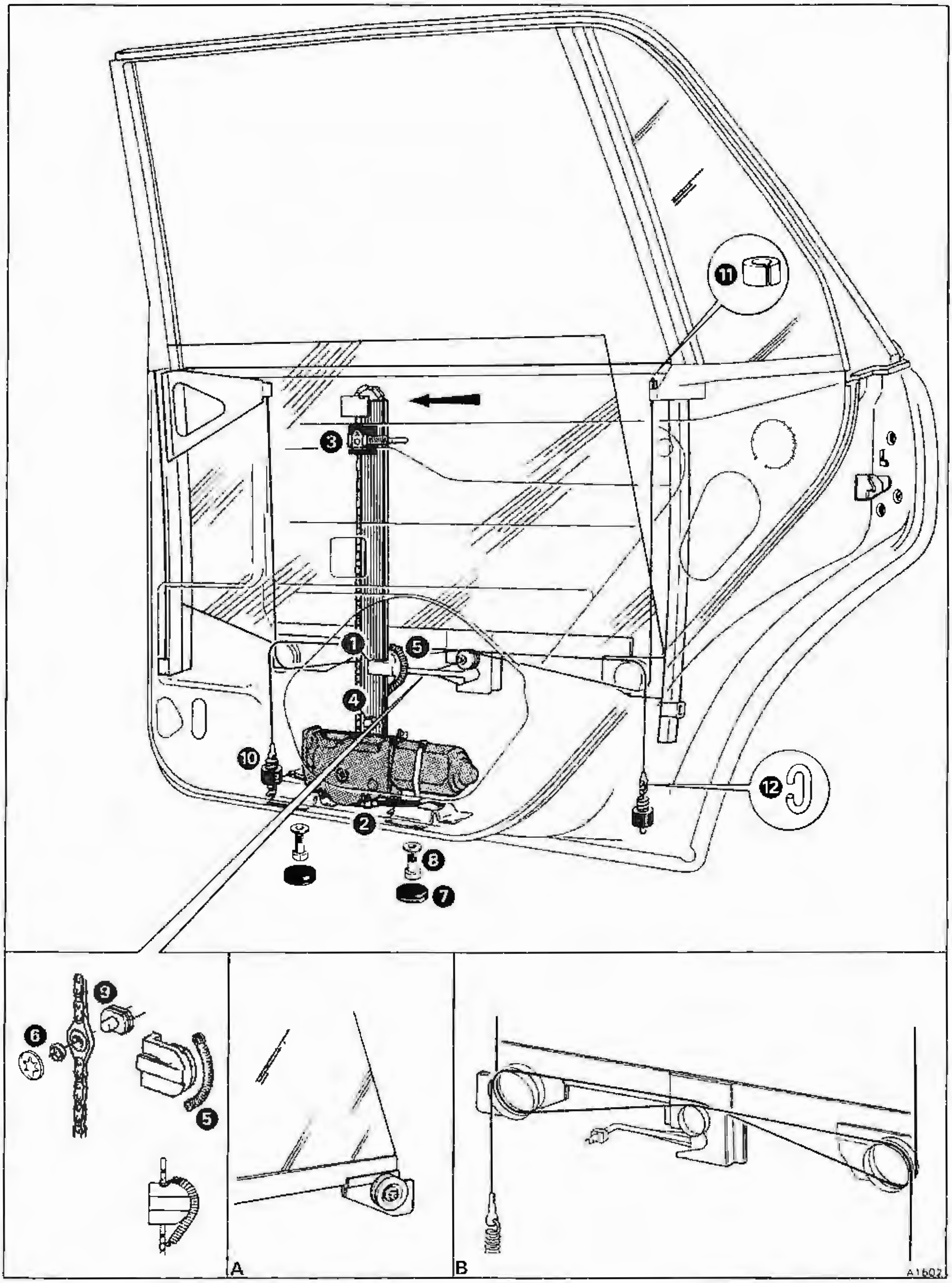


Fig. S5-2 Window lift mechanism, door glass, and wire guidance assembly and fittings
Applicable to cars prior to 1989 model year

fully closed position and secure it to the door frame with masking tape.

8. Using a long screwdriver, or a similar tool, release the tension from one of the guidance wires by extending the spring (item 10). Then, unhook the wire from its upper anchorage point and remove. Repeat this operation on the remaining guidance wire.

9. Whilst supporting the door glass assembly remove the masking tape. Lower the rear edge of the glass until both sides are clear of the window frame channels. Lift the glass assembly out of the door.

Wire guidance and door glass assembly – To fit
(see fig. S5-2)
Applicable to cars prior to 1989 model year
Reverse the procedure given for removal noting the following.

1. When fitting a new door glass proceed as follows.
   Attach a strip of black Gosheron adhesive tape, or its equivalent, along the lower edge of the glass to the approximate depth of the glazing channel.
   Fit the glazing rubber over the glass. Then, position the channel level with the rear edge of the glass (see inset A) and press firmly into position.
   The channel should compress the glazing rubber ensuring a tight fit. If necessary, extra layers of adhesive tape may be added as packing between the glass and the glazing rubber. Ensure that the glass fits fully into the glazing channel.
2. Fit the guidance wires to the pulley system in the positions indicated in inset B.
3. Fit a new Starlock washer (item 6) when attaching the pivot arm to the window lift mechanism.
4. Prior to fitting the door trim, connect the battery and fully raise the door glass checking that it fits equally within both side channels of the door frame.
   If necessary, fine adjustment of the wire guidance system can be achieved by adding a spacer (item 11) and link (item 12) to the guidance wires in the positions shown. The arrow indicates the direction that the glass will move within the door frame as a result of this adjustment.

Window lift mechanism – To remove and fit
(see fig. S5-3)
Applicable to 1989 model year cars

1. Remove the door trim (see Door trim – To remove and fit).
2. Peel back and remove the waterproof cover from the inner door panel.
3. Connect the battery and lower the door glass until the window lift pick-up plate (item 1) is visible through the large aperture in the inner door panel. Disconnect the battery.
4. Release the rubber strap securing the door looms to the window lift unit. Then, disconnect the window lift motor plug and socket (item 2).
5. Support the door glass assembly, then remove the spring clip (item 3) from the pick-up shaft noting that a spring is fitted behind the retaining washer and could suddenly eject when the spring clip is withdrawn.
6. Disengage the window lift pick-up plate from the shaft noting that a compressed spring is fitted behind the rubber bump stop (item 4). Manually raise the door glass assembly to the fully closed position and secure it to the door frame with masking tape.
7. Remove the retaining strap securing the top of the mechanism to the inner door panel (item 5).
8. Remove the rubber grommets (item 6) from the underside of the door to gain access to the mechanism securing setscrews.
9. Remove the exposed setscrews and washers (item 7). Then, withdraw the mechanism through the large aperture in the inner door panel.
10. To fit the window lift mechanism reverse the removal procedure noting the following.
    Prior to securing the mechanism to the door, apply a small amount of Retinax 'A' grease, or its equivalent, to the mechanism securing setscrews (item 7).
    Ensure that the spring clip (item 3) is positioned in a horizontal plane to prevent a possible foul with the window lift gearbox casing.

Wire guidance and door glass assembly – To remove
(see fig. S5-3)
Applicable to 1989 model year cars

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Connect the battery and lower the door glass until the window lift pick-up plate (item 1) is visible through the large aperture in the inner door panel. Disconnect the battery.
4. To facilitate assembly, mark the position of the pick-up shaft washer (item 8) in relation to the glazing channel mounting bracket.
5. Remove the nut and washer (item 9) securing the pick-up shaft to the glazing channel mounting bracket.
6. Support the door glass assembly, then disconnect the pick-up shaft from the glazing channel. Manually raise the door glass assembly to the fully closed position and secure it to the door frame with masking tape.
7. Using a long screwdriver, or a similar tool, release the tension from one of the guidance wires by extending the spring (item 10). Then, unhook the wire from its upper anchorage point and remove. Repeat this operation on the remaining guidance wire.
8. Whilst supporting the door glass assembly remove the masking tape. Lower the rear edge of the glass until both sides are clear of the window frame channels. Lift the glass assembly out of the door.

Wire guidance and door glass assembly – To fit
(see fig. S5-3)
Applicable to 1989 model year cars
Reverse the procedure given for removal noting the following.

1. When fitting a new door glass proceed as follows.
   Attach a strip of black Gosheron adhesive tape, or its equivalent, along the lower edge of the glass to the approximate depth of the glazing channel.

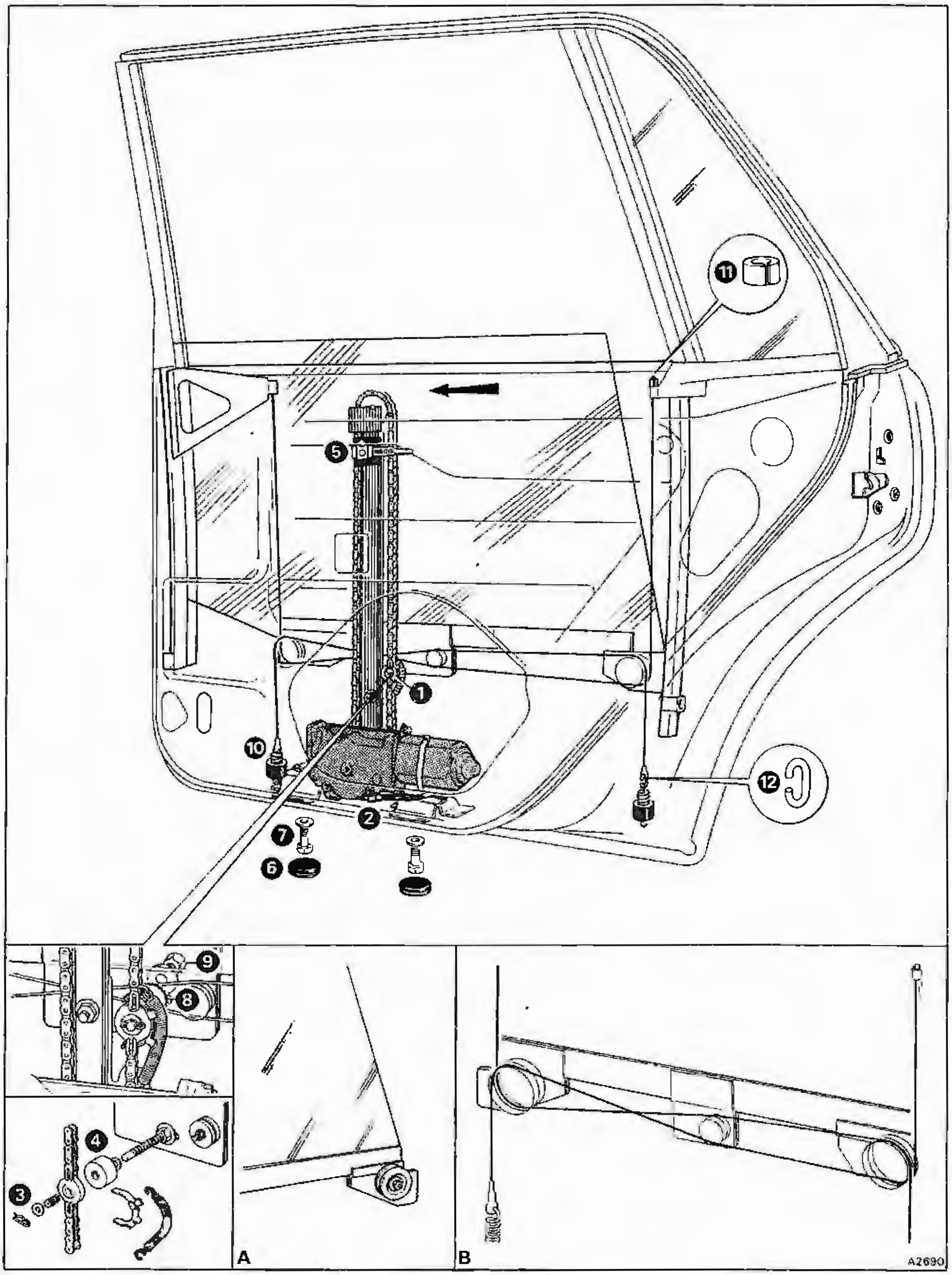


Fig. S5-3 Window lift mechanism, door glass, and wire guidance assembly and fittings
Applicable to 1989 model year cars

Fit the glazing rubber over the glass. Then, position the channel level with the rear edge of the glass (see inset A) and press firmly into position.

The channel should compress the glazing rubber ensuring a tight fit. If necessary, extra layers of adhesive tape may be added as packing between the glass and the glazing rubber. Ensure that the glass fits fully into the glazing channel.

2. Fit the guidance wires to the pulley system in the positions indicated in inset B.

3. Prior to securing the pick-up shaft to the glazing channel mounting bracket align the correlation marks made during removal.

4. Prior to fitting the door trim, connect the battery and fully raise the door glass checking that it fits equally within both side channels of the door frame.

If necessary, fine adjustment of the wire guidance system can be achieved by adding a spacer (item 11) and link (item 12) to the guidance wires in the positions shown. The arrow indicates the direction that the glass will move within the door frame as a result of this adjustment.

Door frame – To remove (see fig. S5-4)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Remove the door glass (see Wire guidance and door glass assembly – To remove).
4. Carefully ease the door seal out of its retaining channel around the frame. Care must be taken not to stretch the seal during this operation.
5. Remove the door frame fixings (items 1 and 2) tapping plates, etc. Withdraw the frame from the door noting the position and quantity of any frame to door spacing washers.
6. Inspect the glazing channel seal (item 3) and renew if necessary.

Door frame – To fit (see fig. S5-4)

Reverse the procedure given for removal noting the following.

1. Position the frame in the door. Then, lightly secure all of the frame to door fixings, replacing any previously removed spacing washers.

Carefully close the door and check that an equal clearance exists between the frame and the 'C' post, cantrail, and 'D' post. Also ensure that the door frame to cantrail landing dimensions are correct (see inset A).

2. When the frame is correctly positioned, torque tighten the fixings as follows.

	Nm	kgf m	lbf ft
(item 1) –	11-13	1,1–1,4	8–10
(item 2) –	11-13	1,1–1,4	8–10

3. Should any subsequent adjustment of the door frame be necessary, it is important that all of the fixing points are loosened before any attempt is made to move the frame.

4. Ensure that the window glass guides are in position on the frame (item 4). The guides simply clip into the frame underneath the glazing channel seal and can be easily adjusted or removed as necessary.

Fence moulding – To adjust (see fig. S5-4)

The fence moulding can be raised approximately 3 mm (0.125 in). This enables the top of the door to be re-painted or the fence moulding seal to be renewed without the removal of the moulding.

1. To raise the fence moulding proceed as follows referring to inset B.

Insert a small sharp screwdriver, or a similar tool, under each end of the fence moulding in turn. Place a piece of rubber or felt between the screwdriver and the paintwork.

The moulding can now be carefully levered clear of the door top. **Do not lever directly onto the paintwork.**

2. To lower the fence moulding, tap it into position using a suitable mallet. Ensure that the seal sits evenly along the full length of the moulding.

Fence moulding – To remove (see fig. S5-4)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Remove the door glass (see Wire guidance and door glass assembly – To remove).
4. Drill out the five pop rivets (item 5), then carefully remove the fence moulding.

Fence moulding – To fit (see fig. S5-4)

Reverse the procedure given for removal noting the following.

1. Secure the fence moulding to the door using pop rivets and nylon bushes (item 6).

2. When fitting a fence moulding to a new door proceed as follows.

Place the fence moulding in position on the door retaining flange.

Align the fence moulding with each end of the door frame ensuring that the moulding lies flat along the top of the door.

To allow for vertical adjustment of the fence moulding, ensure that the pop rivet holes are drilled at the top of the elongated slots.

Quarter glass and seals – To remove (see fig. S5-4)

1. Remove the door frame.
2. Release the self-tapping screws (item 7), then remove the spacer from underneath the quarter glass.
3. Release the three sections of the inner seal (item 8). Then, ease the glass away from the outer moulded seal and slide it out of the frame.

Quarter glass and seals – To fit (see fig. S5-4)

1. If the moulded outer seal (item 9) is to be renewed proceed as follows.

Remove the seal noting that it is glued to the frame in each corner.

Thoroughly clean the glass channel area using a cloth moistened with Bostik Cleaner 6001.

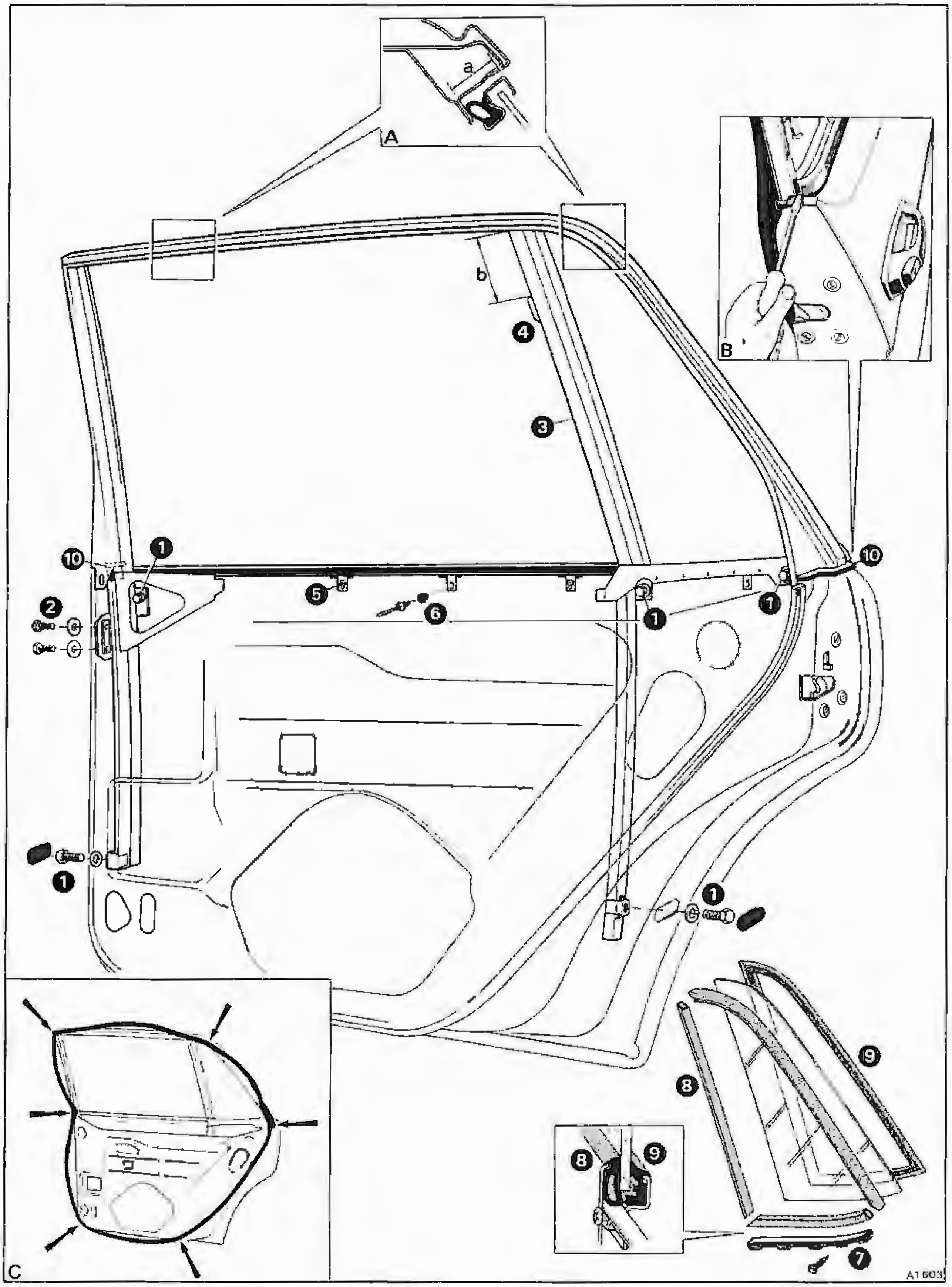


Fig. S5-4 Door frame, door to body seal, quarter glass sealing arrangement, and fittings

a 31,0 mm-33,0 mm (1.220 in-1.300 in) b 95,0 mm (3.740 in) approximately

Apply a small amount of Loctite 495 adhesive, or its equivalent, to each corner of the seal. Care must be taken to avoid the adhesive coming into contact with the visible surfaces of the seal or door frame.

Fit the moulded outer seal into the frame, ensuring that each corner is correctly positioned and that the outer lip of the seal fits over the frame channel as indicated.

2. Tape the edge of the inner fence moulding to prevent scratching the glass.
3. Lightly smear liquid soap along the bottom of the moulded outer seal, then slide the glass into the frame. Ensure that the glass fits fully into the rebate in the outer seal otherwise the inner seal sections will prove difficult to fit.
4. Check that the outer seal has not been disturbed, then fit wedges to hold the glass in position.
5. To fit the inner seal sections (item 8) proceed as follows.

Starting at the top corner of the frame, cut and fit the seal nearest to the main window glass. Ensure that the outer lip of the seal fits over the frame channel as indicated.

Similarly, fit the seal to the opposite channel and finally cut and fit the lower seal. Remove each wedge as the seals are fitted.

When fitted, the inner seals on the two upright door frame channels should not be visible when viewed through the glass.

6. Secure the spacer underneath the quarter glass, then fit the frame to the door (see Door frame – To fit).

Door to body seal – To remove and fit (see fig. S5-4)

1. Carefully ease the door seal out of its retaining channel and progressively remove.
2. To fit the seal, begin by applying a light coating of Palm Grease lubricant to the base section of the seal. Apply the lubricant below the waist rail area of the door. **Do not** apply lubricant to the window frame or to the upper half of the seal.

Note Petroleum jelly or Vaseline **must not** be used to lubricate the seal.

3. Loosely fit the seal to the door in the positions indicated (see inset C). Then, manoeuvre the seal into its retaining channel, taking care not to stretch the seal. A wooden or perspex wedge shaped tool with smooth edges will assist during this operation.

Note When fitting the seal, **do not** close the door. Failure to observe this could lead to permanent damage of the seal.

4. Lightly dress the bulbous section of the seal with chalk or talcum powder. This will help the seal to slide into position when the door is closed. **Do not use grease or oil.**
5. Close the door. Then, check the frame to cantrail landing dimensions (see inset A). If it is necessary to adjust the position of the frame, reference must be made to Door frame – To fit.
6. When the seal is correctly positioned, the door should be left fully closed for a minimum of twelve hours. This allows the seal to assume a set position and reduces the possibility of the seal subsequently fouling when the door is closed.

Door frame end seals – To renew (see fig. S5-4)

1. Remove the door frame.
2. Remove the end seals (item 10) taking care not to damage the paintwork.
3. Thoroughly clean the bonding area of the door using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
4. Apply Bostik Primer 9252 to the bonding area of the door. Allow approximately one hour to dry.
5. Using abrasive paper roughen the bonding surface of the seal. Then, wipe the seal with Bostik Cleaner 6001. Allow to dry.
6. Apply Boscoprene Adhesive 2402 (parts 1 and 2) to the bonding surfaces of the door and the seal. Allow the adhesive to 'flash' dry (between 10 and 15 minutes). Then, bring the bonding surfaces together using maximum hand pressure.

Door latch – To remove (see fig. S5-5)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove).
3. Disconnect the link rod (item 1) from the relay lever.
4. Disconnect the courtesy lamp micro-switch plug and socket (item 2).
5. Remove the three setscrews and washers (item 3) securing the latch to the door panel.
6. Lower the latch and disconnect the exterior handle control rod (item 4) from the plastic connector on the latch. Note that a number of spacers are fitted to the control rod.
7. Manoeuvre the latch to disconnect the interior door handle control rod (item 5). Then, withdraw the latch and relay lever link rod from the door.
8. If necessary, unscrew and remove the courtesy lamp micro-switch from the latch.

Door latch – To fit (see fig. S5-5)

Reverse the procedure given for removal noting the following.

1. If the courtesy lamp micro-switch has been removed from the latch proceed as follows.

Move the claw mechanism of the latch into the 'door closed' position.

Loosely fit the micro-switch assembly to the latch using the screws, nuts, and shakeproof washers.

Release the claw mechanism into the 'door open' position. Then, adjust the position of the switch until the actuator lever is lightly touching the corner of the switch (see inset A, arrowed). Tighten the securing screws.

2. Place the latch and link rod assembly into the door, then connect the link rod (item 1) to the relay lever.

Note Wherever control rods have been disconnected, it is important that new Fastex bushes are fitted

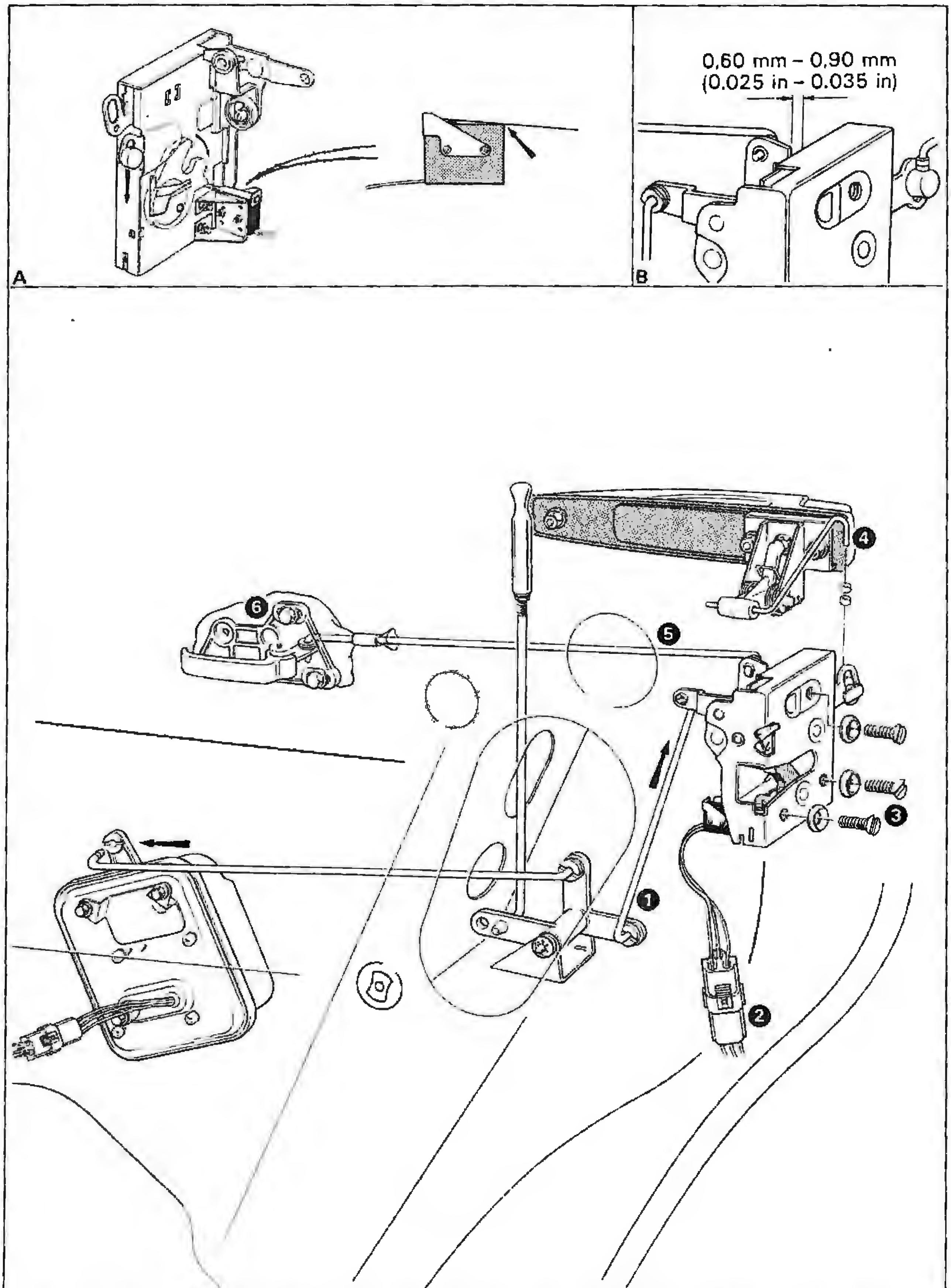


Fig. S5-5 Door latch, interior release handle, and fittings

9/88

on assembly. This will ensure that the control rods are correctly secured.

3. Connect the interior door handle control rod (item 5).

4. Fit the exterior handle control rod (item 4), complete with the correct number of spacers, into the plastic connector on the latch.

5. Secure the latch to the door panel using three **new** M6 setscrews and washers. Torque tighten the setscrews to between 4,1 Nm and 6,1 Nm (0,4 kgf m and 0,6 kgf m; 3 lbf ft and 4.5 lbf ft). **This torque figure must not be exceeded.**

6. To check the operation of the interior and exterior handles refer to Interior and Exterior handles – To set.

Interior door handle – To remove and fit
(see fig. S5-5)

1. Remove the door trim (see Door trim – To remove and fit).

2. Remove the setscrews and washers (item 6) securing the handle base to the inner door panel.

3. Detach the open end of the polythene bag from the door and disconnect the control rod. Remove the handle.

4. When fitting the handle, ensure that the polythene bag is trapped between the handle base and the inner door panel. Also, check that the bag is secured to the control rod using a rubber sleeve.

5. For information on the correct setting of the interior door handle reference should be made to, Interior door handle – To set.

Interior door handle – To set (see fig. S5-5)

1. Loosen the setscrews (item 6) securing the handle base to the inner door panel.

2. Move the handle base forwards (i.e. away from the latch) until any free play is removed and the release handle returns fully against its stop.

3. With the handle in this position, move the handle base further forwards, against latch spring pressure, until the correct clearance is achieved between the lever and the latch body (see inset B). Then, tighten the setscrews.

4. With the door open, move the claw mechanism into the 'door closed' position and check the operation of the handle.

Never attempt to close the door with the mechanism in the 'door closed' position, or severe damage to the latch may result.

Exterior door handle – To remove and fit
(see fig. S5-6)

1. Fully raise the door glass.

2. Remove the door trim (see Door trim – To remove and fit).

3. Remove the waist rail finisher (see Waist rail finisher – To remove).

4. Remove the three nuts and washers (item 1) securing the handle to the door. Carefully withdraw the handle and rubber gasket, taking care not to disturb the position of the push button lever/mounting plate assembly (item 2).

5. To fit the exterior door handle, reverse the procedure given for removal. For information on the setting of the push button overtravel reference should be made to, Exterior door handle push button – To set.

Exterior door handle push button – To set
(see fig. S5-6)

1. With the door open, move the claw mechanism of the latch into the 'door closed' position.

Never attempt to close the door with the mechanism in this position, or severe damage to the latch may result.

2. Depress the push button and check that the latch operates correctly. The latch should operate with between 3 mm and 5 mm (0.125 in and 0.200 in) of push button overtravel.

To adjust the push button overtravel, it will be necessary to lower the door latch and amend the number of spacers on the control rod (item 3). Reference should be made to Door latch – To remove.

Solenoid assembly – To remove and dismantle
(see fig. S5-6)

1. Remove the door trim (see Door trim – To remove and fit).

2. Remove the waist rail finisher (see Waist rail finisher – To remove).

3. Disconnect the relay lever link rod (item 4) from the solenoid assembly.

4. Disconnect the plug and socket (item 5) from the solenoids.

5. Remove the setscrews and washers (item 6) securing the solenoid assembly to the door panel. Then, carefully manoeuvre the assembly clear of the door.

6. If it is necessary to replace a solenoid proceed as follows.

Remove the circlip and nylon washer (item 7).

Withdraw the drive lever (item 8). Then, unclip and remove the plastic solenoid cover.

Disconnect the solenoid leads from the terminal block (item 9).

Unscrew and remove the solenoid/connecting link assembly from the base plate. The solenoids can then be separated from the connecting link by removing the roll pins (item 10).

Solenoid assembly – To assemble and fit
(see fig. S5-6)

1. Loosely fit the solenoid/connecting link assembly to the base plate. Align the solenoids to give unrestricted movement of the connecting link, then tighten the solenoid securing screws.

2. Connect the solenoid leads to the terminal block, then press the plastic solenoid cover into position.

3. Fit the drive lever and secure with a circlip and nylon washer.

4. To fit the solenoid assembly to the door reverse the removal procedure, Operations 1 to 5 inclusive, noting that wherever link rods have been disconnected it is important that new Fastex bushes are fitted on assembly.

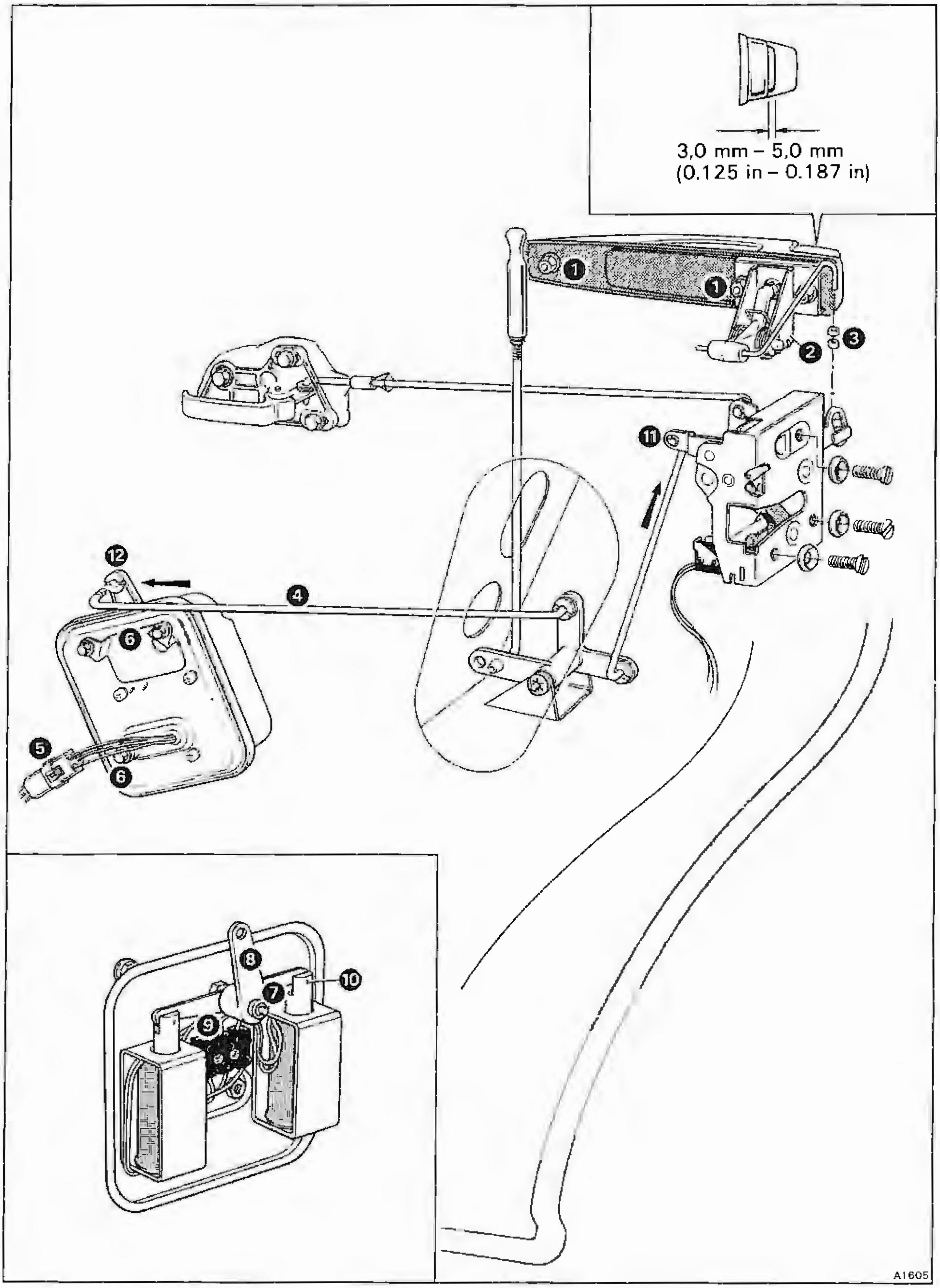


Fig. S5-6 Exterior door handle, solenoid assembly, and fittings

To set the position of the solenoid assembly in the door, reference should be made to Solenoid assembly – To adjust.

Solenoid assembly – To adjust (see fig. S5-6)

1. Loosen the three setscrews (item 6) securing the solenoid assembly to the door panel.
2. Disconnect the relay lever link rod (item 4) from the drive lever on the solenoid assembly.
3. Move the door latch lever (item 11) and the solenoid drive lever (item 12) into the 'door locked' position.
4. Adjust the position of the solenoid assembly until the link rod (item 4) aligns with the hole in the solenoid drive lever. Tighten the solenoid assembly securing screws.
5. Connect the link rod to the drive lever, noting that wherever link rods have been disconnected it is important that new Fastex bushes are fitted on assembly.

Checking the door locking system

Operation	Check
Sill control button in up position. Child safety lever disengaged (up).	Door opens from interior handle and exterior push button.
Sill control button in up position. Child safety lever engaged (down).	Door opens from exterior push button. Door cannot be opened from the interior handle.
Door closed. Sill control button in down position. Child safety lever in disengaged (up) or engaged (down) position.	Door cannot be opened from the interior handle or the exterior push button.
Door open. Sill control button in down position. Child safety lever in disengaged (up) or engaged (down) position.	Door remains locked when closed (exterior push button depressed or free).

Bonnet

Contents

Printed in England

Bonnet

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

Bonnet – To remove (see fig. S6-1)
1. Disconnect the battery.
2. Raise the bonnet.
3. Disconnect the bonnet lamp loom (item 1).
4. Cut and discard the plastic cable ties securing the bonnet lamp loom (item 2).
5. To facilitate assembly, mark the position of each hinge in relation to the bonnet.
6. With the help of an assistant, support the bonnet and remove the bonnet to hinge setscrews and washers (item 3). Note that an earth bonding strap is secured under one of the setscrews. Remove the bonnet.

Bonnet – To fit
Reverse the procedure given for removal noting the following.
1. Prior to tightening the bonnet securing setscrews, align the marks made during removal.
2. Check that the bonnet to body clearances are equal and that the bonnet opens and closes without difficulty. If necessary, adjust the position of the catch plates situated on the bonnet.
3. *On cars conforming to a North American specification,* ensure that the protrusions on the bonnet retention brackets align with their respective holes in the brackets situated on the bulkhead.

Bonnet hinges – To remove and fit (see fig. S6-1)
1. Remove the bonnet.
2. To facilitate assembly, mark the position of each hinge in relation to the body.
3. To gain access to the bonnet hinge upper fixing, it will be necessary to remove the headlamp unit (Refer to Electrical Manual TSD 4701, Section 10).
Remove the exposed setscrew and washer (item 4).
4. Release the setscrew and washer (item 5) then remove the hinge.
5. To fit the hinges reverse the procedure given for removal.

Bonnet catch mechanism – To remove and fit (see fig. S6-2)
1. Disconnect the battery.
2. Raise the bonnet.
3. Unscrew and remove the windscreen wiper mechanism cover (item 1).
4. Remove the springs situated at either end of the countershaft (item 2).

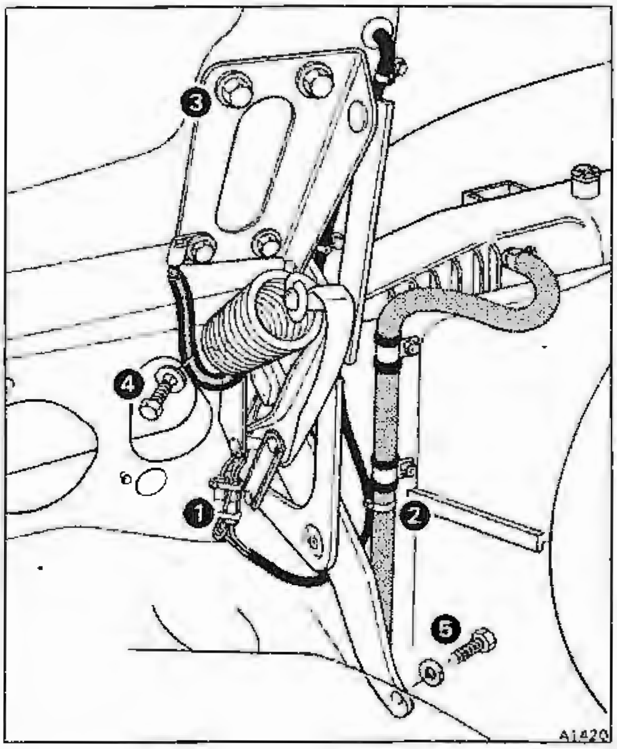


Fig. S6-1 Bonnet and hinge mounting arrangement

5. Unclip and straighten the looped end of the bonnet release cable. Loosen the grub screw (item 3) and release the cable from the retainer.
6. To facilitate assembly, mark the position of each guide plate in relation to its mounting bracket.
7. Remove the guide plate securing setscrews and washers (item 4). Note that an earth bonding strap and a number of suppressors are secured under one of the setscrews.
8. Carefully manoeuvre the countershaft clear of the wiper mechanism and remove.
9. To fit the catch mechanism, reverse the procedure given for removal noting the following.
Do not attempt to close the bonnet until the release cable has been fitted and set (see Bonnet release cable – To renew, Operations 7 to 11 inclusive).

Bonnet release cable – To renew (see fig. S6-2)
1. Disconnect the battery.
2. Raise the bonnet.
3. Unclip and straighten the looped end of the bonnet release cable. Loosen the grub screw (item 3) and release the cable from the retainer.
4. Remove the screws and washers (item 5) then lower the parking brake trim panel and release the Lucar connectors from the footwell lamp. Remove the panel.

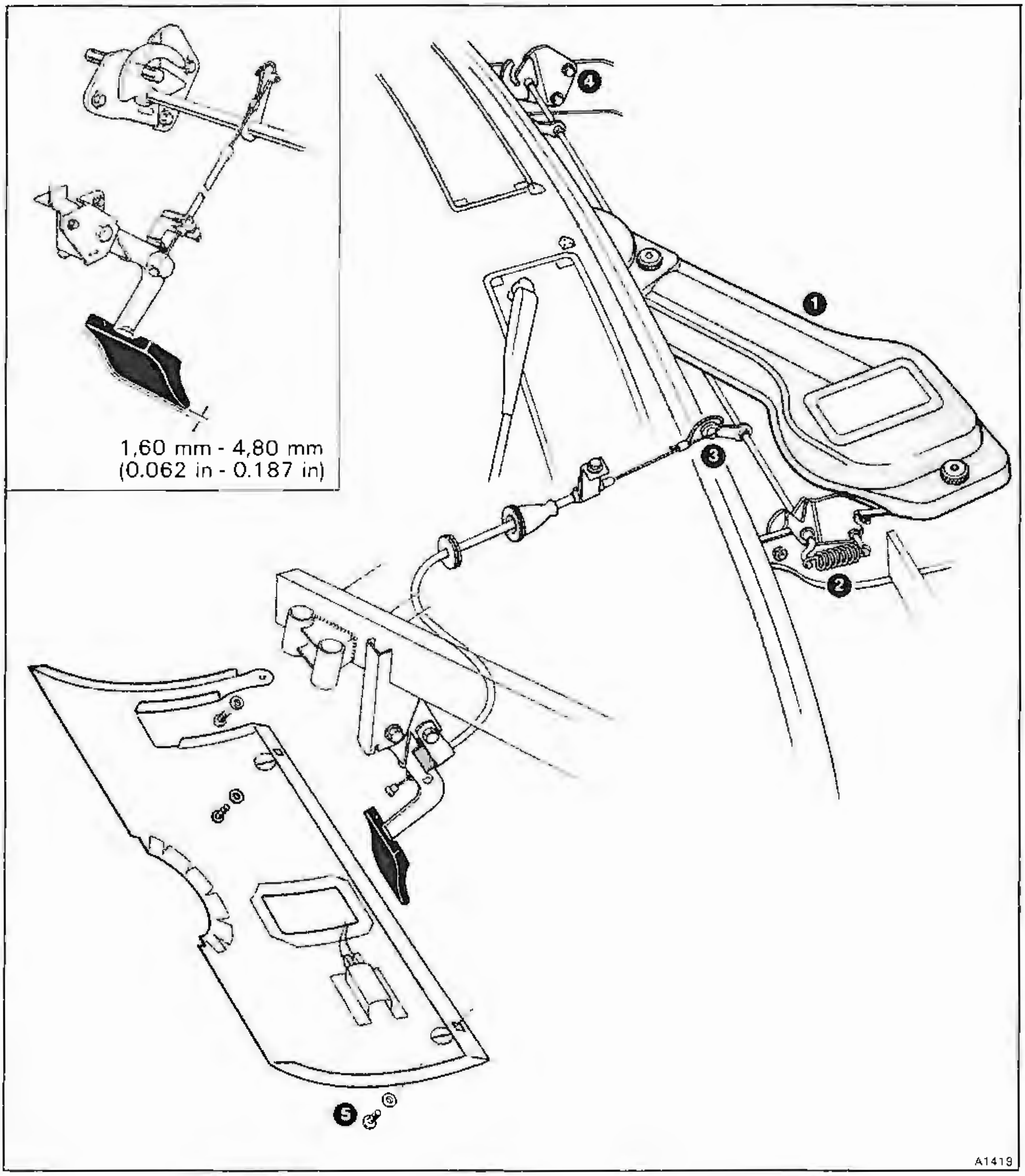


Fig. S6-2 Bonnet release mechanism

5. Completely withdraw the bonnet release cable, pulling it through the pivot on the release handle.
6. Lightly smear the new cable with Rocol MTS 1000 grease, or its equivalent. Carefully feed the cable into position through the release handle pivot and outer sheath.
7. Place a length of 6,35 mm (0·250 in) diameter bar in the guide plate, then carefully move the countershaft into the 'bonnet closed' position (see inset).
8. Thread the release cable through the retainer in the countershaft until the nipple end of the cable fits into the pivot on the release handle. Then, tighten the grub screw.
9. Check that there is between 1,6 mm and 4,8 mm (0·062in and 0·187 in) of free movement in the release handle (see inset). This movement is measured from

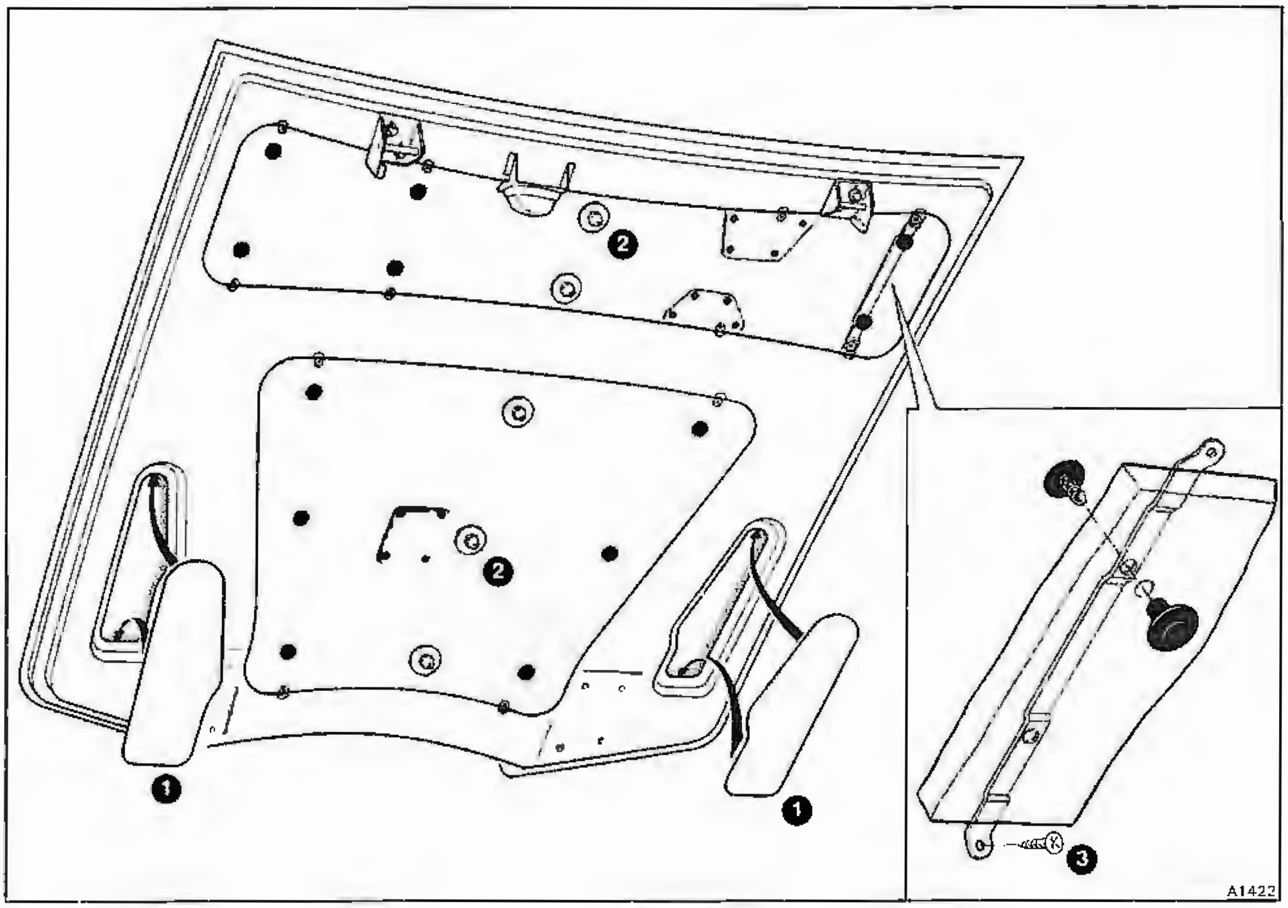


Fig. S6-3 Bonnet pads

the handle resting on its rubber stop to the point when it begins to operate the countershaft. If necessary, loosen the grub screw and adjust the cable.
10. Loop the excess cable and clip into position approximately 38 mm (1·50 in) from the retainer.
11. Remove the length of bar from the guide plate and operate the bonnet release lever. Check that the countershaft moves into the 'bonnet open' position, and that the release handle returns to its stop when released.
12. Check that the bonnet opens and closes without difficulty. If necessary, adjust the position of the catch plates situated on the bonnet.

Bonnet pads – To remove and fit (see fig. S6-3)
1. The small bonnet pads (item 1) are simply wedged behind the inner panel and can be easily removed.
2. To remove the large bonnet pads proceed as follows.
Remove the domed nuts and large washers (item 2).
Release the self-tapping screws (item 3) and remove the pads. It may be necessary to loosen the bonnet lamp mounting bracket to facilitate removal of the rear bonnet pad.
3. If the bonnet pads are to be renewed, separate the plastic fasteners and remove the metal straps (see inset).
4. To fit the bonnet pads reverse the procedure given for removal.

Bonnet seals – To renew
1. The bonnet seals are simply a push-on fit over the scuttle panel and front wing flanges and can be easily removed and refitted, taking care not to damage the paintwork.

Luggage compartment lid

Contents

7/87
Printed in England

Luggage compartment lid

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

Safety procedures
The cleaner and adhesive referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Luggage compartment lid carpet – To renew
(see fig. S7-1)
1. Disconnect the battery.
2. Unscrew and lower the centre trim panel (item 1). Disconnect the Lucar connectors from the luggage compartment lamp and remove the panel. Note the position of the leads to ensure correct assembly.
3. Release the rear lamp access panels by turning the fasteners (item 2) through 90°. Carefully unclip the lower edge of the panels and remove.
4. Unscrew and remove the hinge cover trim (item 3).
5. If fitted, carefully prise the drive fasteners from the edge of the carpet.
6. Using a suitable scraper, completely remove the carpet taking care not to damage the finished paintwork.
7. Thoroughly clean the bonding surface of the lid using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
8. Apply an even coat of Apollo Adhesive AX2344 to the underside of the new carpet and to the inner panel of the luggage compartment lid. Allow five minutes for the adhesive to 'flash' dry.
9. With the help of an assistant, align the carpet and press firmly into position. Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.
10. Fit the removed panels by reversing the procedure given for removal.

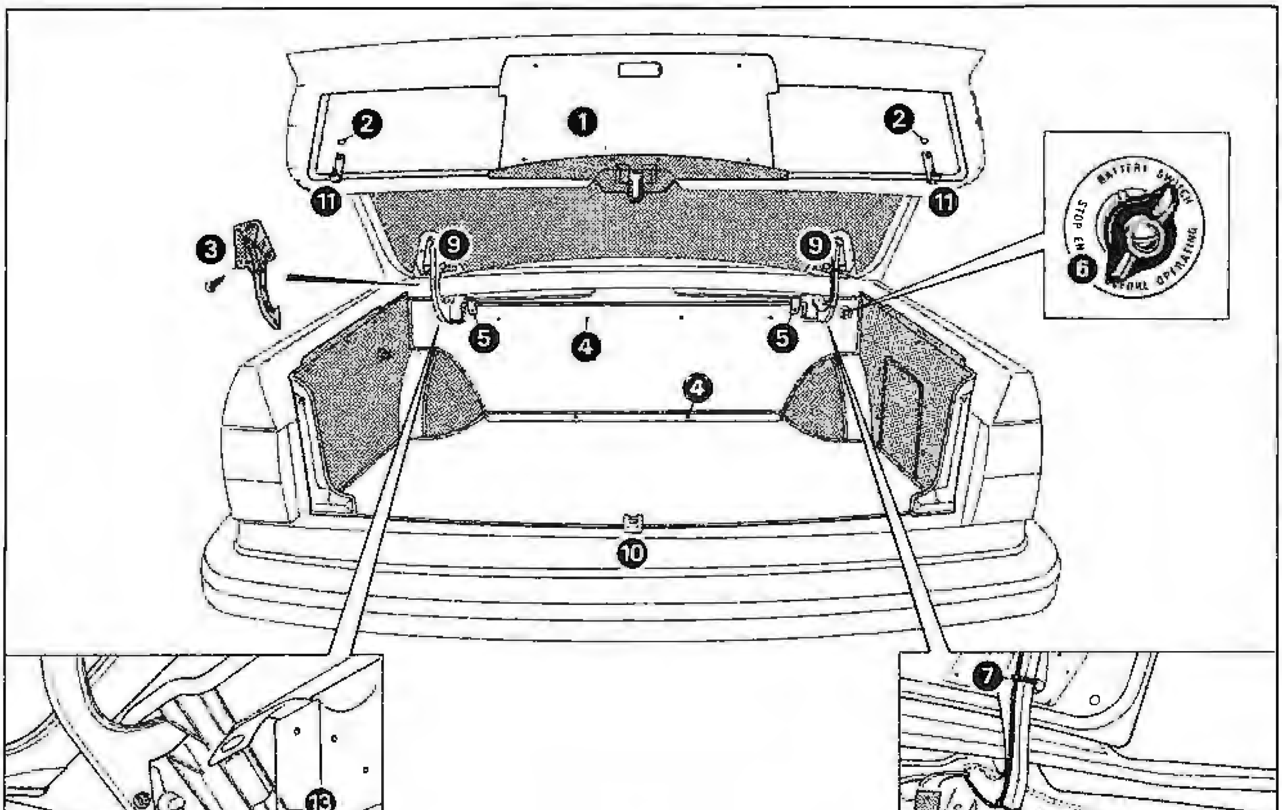


Fig. S7-1 Luggage compartment lid trim and hinge mounting arrangement

Luggage compartment lid – To remove
(see fig. S7-1)
1. Disconnect the battery.
2. Unscrew and remove the hinge cover trim (item 3).
3. To remove the luggage compartment front trim panel proceed as follows.

Remove the screws and cup washers (item 4) situated along the top and bottom of the panel.

Release the two press fasteners (item 5).

Remove the battery master switch knob (item 6) by releasing the centre screw, ring nut, and instruction plate.

Remove the front trim panel.

4. Cut and discard the cable ties (item 7) securing the electrical loom to the right-hand luggage compartment lid hinge.
5. Disconnect the loom plug and socket (item 8), then manoeuvre the loom clear of the hinge mounting area.
6. To facilitate assembly, mark the position of each hinge in relation to the luggage compartment lid.
7. With the help of an assistant, support the luggage compartment lid and remove the setscrews and washers (item 9). Note the position and quantity of any shims situated between the hinges and the luggage compartment lid. Remove the lid.

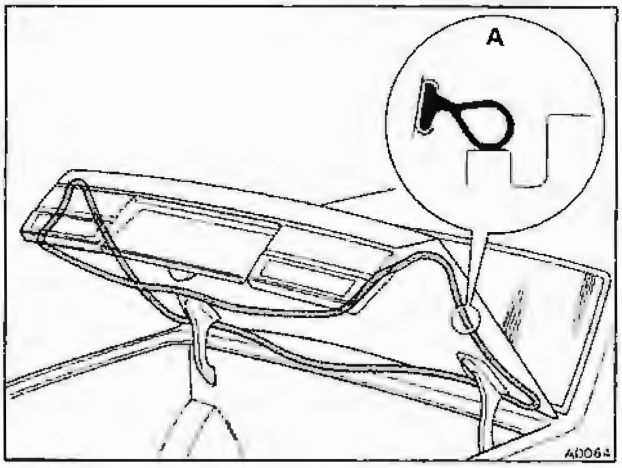


Fig. S7-2 Luggage compartment lid seal

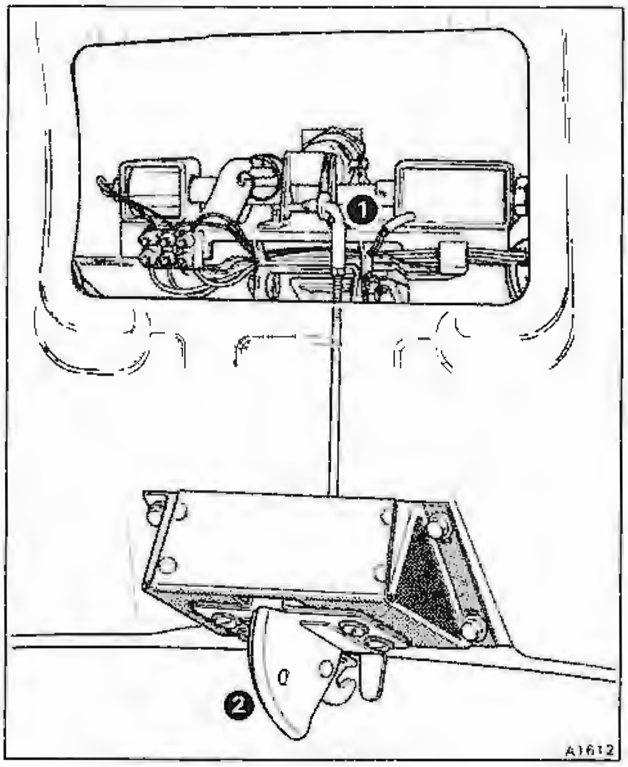


Fig. S7-3 Latch mechanism

Luggage compartment lid – To fit (see fig. S7-1)
Reverse the procedure given for removal noting the following.
1. Prior to tightening the luggage compartment lid securing setscrews align the marks made during removal.
2. Using a pencil, mark the position of the latch striker (item 10). Then, release the securing setscrews and washers and remove the latch striker.
3. Carefully close the luggage compartment lid and check that the clearances between the lid and the body are equal. Adjust if necessary, then tighten the setscrews.
4. Fit the striker. Check that the lid can be opened and closed without difficulty. Ensure that the lid lies flush with the rear wing panels when closed. If necessary, adjust the vertical position of the striker.
5. Ensure that the overtravel stops (item 11) are correctly positioned, allowing approximately 2 mm (0.078 in) of luggage compartment lid overtravel. The overtravel stops prevent the paintwork from being damaged if the lid is closed using excessive force.
6. Check that the luggage compartment lock solenoids, centralized door locking micro-switches, and all the bulbs in the rear lamp clusters are operating correctly.

Hinges – To remove (see fig. S7-1)
1. Remove the luggage compartment lid (see Luggage compartment lid – To remove).
2. Release the lock-nut (item 12) then remove the luggage compartment lamp switch from its mounting bracket situated on the left-hand hinge. Note the number of spacing washers situated between the mounting bracket and the switch.
3. Carefully prise open the clips securing the hinge torsion bars to the underside of the rear decking panel.
4. Release the setscrews and washers (item 13) securing the hinges to the body. Remove the hinges.

Hinges – To fit
Reverse the procedure given for removal noting the following.
1. Ensure that the hinge securing setscrews are replaced in their original positions. The shorter 'Allen' headed setscrews fit closest to the luggage compartment lid.
2. Check that the correct number of spacing washers are replaced between the switch and the mounting bracket.

Seal – To remove and fit

1. Carefully pull out a section of the seal and progressively remove it from its retaining channel.
2. To fit the seal, start by applying a light coating of Palm grease, or its equivalent, to the base section of the seal.
3. Loosely fit the moulded corners of the seal into position on the luggage compartment lid (see fig. S7-2).
4. Ensure that the seal is positioned with the narrower fitting flange upwards (see fig. S7-2, inset A).
5. Starting in a central position below the latch mechanism, carefully press the seal into the retaining channel. A wooden or perspex wedge shaped tool with smooth edges will assist during this operation. Care must be taken not to stretch the seal or damage the paintwork.

Latch mechanism – To remove (see fig. S7-3)

1. Disconnect the battery.
2. Unscrew and lower the centre trim panel (see fig. S7-1, item 1). Disconnect the Lucar connectors from the luggage compartment lamp and remove the panel.
3. Disconnect the latch mechanism control rod from the release lever (see fig. S7-3, item 1).
4. To facilitate assembly, mark the position of the latch mechanism (item 2) in relation to its mounting bracket.
5. Remove the four setscrews and washers securing the latch mechanism. Then, withdraw the latch mechanism/control rod assembly from the luggage compartment lid.

Latch mechanism – To fit

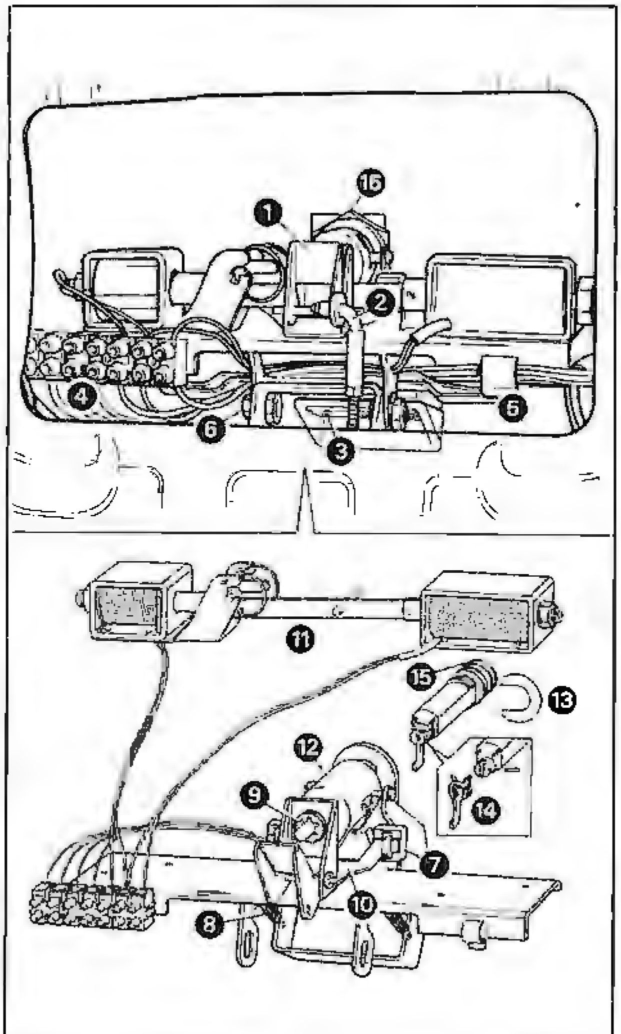
Reverse the procedure given for removal noting the following.

1. Wherever control rods have been disconnected, it is important that new Fastex bushes are fitted on assembly. This will ensure that the rods are correctly secured.
2. Prior to tightening the screws securing the latch align the marks made during removal.
3. Before closing the luggage compartment lid, check that the latch is released when the handle is operated (see Lock mechanism – To set).

Lock mechanism – To remove and dismantle

Cars fitted with the lock mechanism incorporating a metal release lever (see fig. S7-4, item 1).

1. Disconnect the battery.
2. Unscrew and lower the centre trim panel (see fig. S7-1, item 1). Disconnect the Lucar connectors from the luggage compartment lamp and remove the panel.
3. Disconnect the latch mechanism control rod from the release lever on the lock mechanism (see fig. S7-4, item 2).
4. Drill out the pop rivets (item 3) which secure the luggage compartment lid release handle. Then, remove the retaining plate, handle, and rubber seal.
5. Disconnect the electrical leads (item 4) at the terminal block. Note the colour and position of the leads to ensure correct assembly.



A1610

Fig. S7-4 Lock mechanism (incorporating a metal release lever)

6. Release the loom from the clip situated on the lock mechanism mounting bracket (item 5).
7. Remove the two bolts, nuts, and washers (item 6) securing the lock mechanism. Then, carefully withdraw the mechanism from the luggage compartment lid.
8. Loosen the two screws securing each micro-switch (item 7) then remove the switches from the guide bracket lugs.
9. Remove the release trigger springs (item 8).
10. Remove the Starlock washer (item 9) from the actuator spigot.
11. Disconnect the solenoid and micro-switch leads at the terminal block. Note the colour and position of the leads to ensure correct assembly.
12. Remove the screws and spring washers securing the guide bracket (item 10) and the solenoid assemblies. Withdraw the guide bracket clear of the actuator spigot. Then, remove the bracket together with the solenoid/connecting link assembly (item 11) from the lock mounting bracket. The solenoids can then be separated from the connecting link by removing the roll pins.

13. Manoeuvre the actuator (item 12) clear of the release lever pins and private lock drive arm.
14. Remove the circlip (item 13) and withdraw the private lock/drive arm assembly. Tap out the roll pin and remove the drive arm/centralizing spring assembly (item 14).

Lock mechanism – To assemble and fit
Cars fitted with the lock mechanism incorporating a metal release lever (see fig. S7-4, item 1).
1. To ensure the correct operation of the lock mechanism, a new Starlock washer (item 9) and private lock sealing rings (item 15) should be fitted on assembly.
2. Locate the drive arm/centralizing spring assembly into the slot in the private lock unit. Ensure that the spring legs are positioned between the pins protruding from the lock unit. Secure the drive arm/centralizing spring assembly using a roll pin.
3. Fit the private lock/drive arm assembly to the mounting bracket and secure with a circlip.
4. Using the key, turn the drive arm to approximately 45°. Manoeuvre the actuator into position over the drive arm and release lever pins.
5. Slide the guide bracket (item 10) into position on the actuator spigot and loosely fasten to the lock mounting bracket.
6. Position the solenoid/connecting link assembly and loosely fasten to the lock mounting bracket. Ensure that the connecting link pin engages with the slot in the actuator. Align the solenoids to give unrestricted movement of the connecting link, then tighten the securing screws.
7. Check that the guide bracket is square to the lock mounting bracket and that the actuator spigot slides freely through the guide bracket bush. Tighten the securing screws.
8. Attach the release trigger springs.
9. Fit the micro-switch assemblies to the guide bracket lugs. Position the switches so that the private lock drive arm makes contact with each switch when the key is turned approximately 45° from the vertical position, both clockwise and anti-clockwise. Tighten the micro-switch securing screws.
10. With the actuator in the unlocked position, place a 0,20 mm (0.007 in) feeler gauge between the release lever stops and the lock mounting bracket (see fig. S7-5, item 1). Locate the Starlock washer (item 2) over the actuator spigot and push it firmly up to the bush in the guide bracket. Remove the feeler gauge.
11. Prior to fitting the mechanism to the luggage compartment lid apply a small amount of Palm grease, or its equivalent, to the private lock sealing rings.

Manoeuvre the mechanism into position then secure using the bolts, nuts, and washers (see fig. S7-4, item 6). Check that the private lock mounting bracket is firmly seated against the large nut (item 16).
12. Before closing the luggage compartment lid, check that the lock catch is released when the trigger is operated (see Lock mechanism – To set).
13. Check that the luggage compartment lock solenoids, centralized door locking micro-switches, and all the bulbs in the rear lamp clusters are operating correctly.

Lock mechanism – To remove and dismantle
Cars fitted with the lock mechanism incorporating a plastic release lever (see fig. S7-6, item 1).
1. Disconnect the battery.
2. Unscrew and lower the centre trim panel (see fig. S7-1). Release the Lucar connectors from the luggage compartment lamp and remove the panel.
3. Disconnect the latch mechanism control rod (see fig. S7-6, item 2) from the release lever on the lock mechanism.
4. Using a countersunk drill, carefully remove the pop rivet heads (item 3) securing the luggage compartment lid release handle. Take care not to drill through the handle or irreparable damage to the release trigger will result.
5. Remove the screws securing the terminal block (item 4), then disconnect the solenoid and micro-switch leads. Note the colour and position of the leads to ensure correct assembly.
6. Release the electrical leads from the clip (item 5).
7. Remove the two bolts, nuts, and washers (item 6) securing the lock mechanism. Then, carefully withdraw the mechanism from the luggage compartment lid.
8. Loosen the two screws securing each micro-switch (item 7), then withdraw the switches from the shield lugs.
9. Loosen the lock-nut and remove the adjustable stop (item 8).
10. Remove the screws and spring washers securing the shield (item 9). Lift the interrupter (item 10) to allow the shield to be removed, taking care not to overstress the interrupter return spring.
11. If necessary, remove the interrupter/release lever assembly by removing one of the Starlock washers (item 11) and withdrawing the pivot pin. The interrupter can be separated from the release lever by removing the Starlock washer (item 12). Ensure that the interrupter

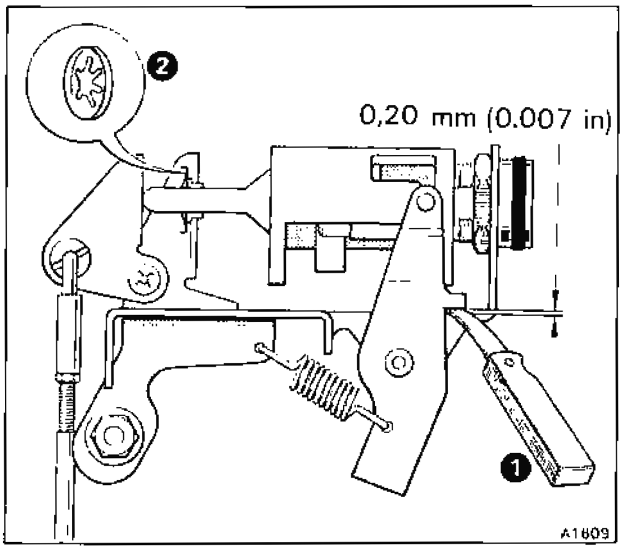


Fig. S7-5 Setting the lock actuator

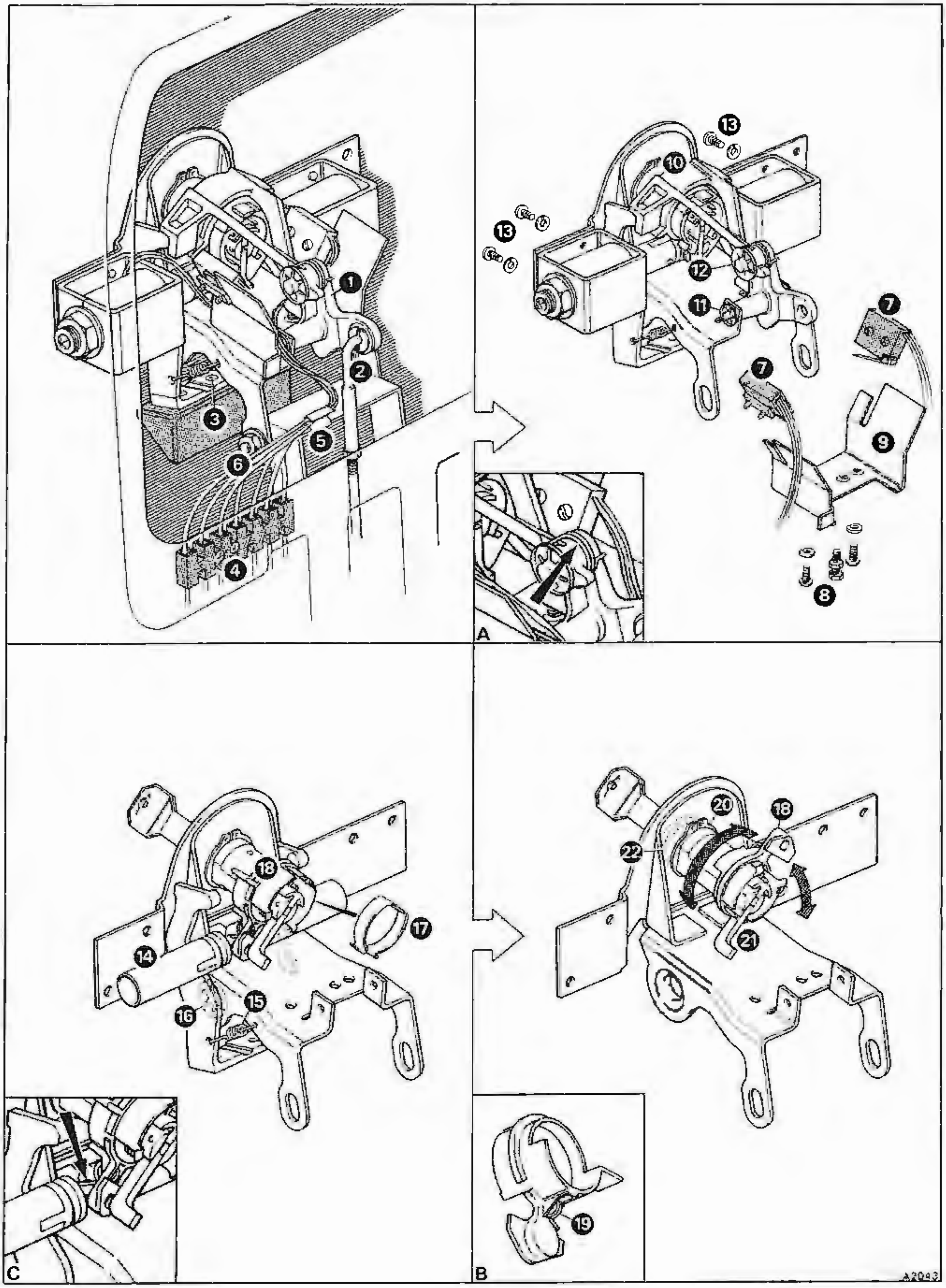


Fig. S7-6 Lock mechanism (incorporating a plastic release lever)

return spring is fitted as shown in inset A.

12. Remove the screws and spring washers (item 13), then withdraw both solenoids from the plungers.

13. Using the key, turn the private lock drive arm to approximately 45° allowing the plunger/connecting link assembly (item 14) to be removed.

14. If it is necessary to remove the luggage compartment lid release trigger, unhook the return springs (item 15) and remove the Starlock washers (item 16). Then, carefully disengage the release trigger from the mounting bracket.

15. Unhook and remove the saddle spring (item 17).

16. To remove the saddle/toggle spring assembly (item 18) proceed as follows.

Using the key, turn the private lock drive arm to approximately 45°.

Turn the saddle/toggle spring assembly through 180° and withdraw it over the drive arm.

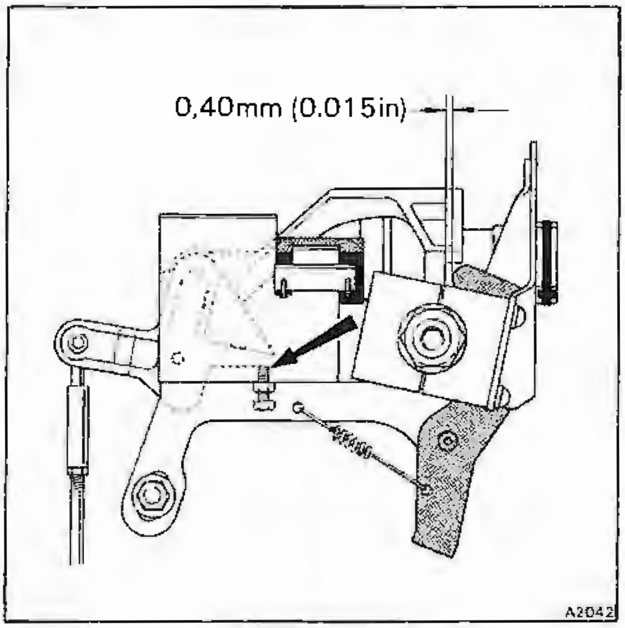


Fig. S7-7 Setting the lock interrupter

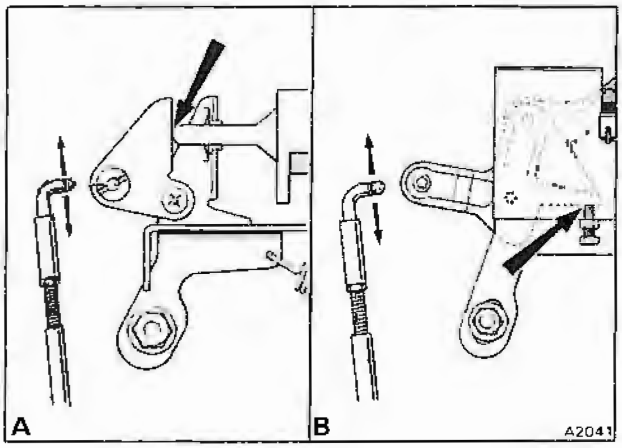


Fig. S7-8 Setting the lock mechanism

17. Inspect the toggle spring (item 19) and renew if necessary. The toggle spring should be fitted as shown in inset B.

18. Remove the circlip (item 20) then withdraw the private lock/drive arm assembly. If necessary, tap out the roll pin and remove the drive arm/centralizing spring assembly (item 21).

Lock mechanism – To assemble and fit

Cars fitted with the lock mechanism incorporating a plastic release lever (see fig. S7-6, item 1).

1. To ensure the correct operation of the lock mechanism, new private lock sealing rings (item 22) and Starlock washers (if removed) should be fitted on assembly.

2. Locate the drive arm/centralizing spring assembly into the slot in the private lock unit. Ensure that the spring legs are positioned between the pins protruding from the lock unit. Secure the drive arm/centralizing spring assembly using a roll pin.

3. Fit the private lock/drive arm assembly to the mounting bracket and secure with a circlip.

4. To fit the saddle/toggle spring assembly (item 18) proceed as follows.

Using the key, turn the private lock drive arm to approximately 45°.

Invert the saddle/toggle spring assembly and hook it over the drive arm. Push the saddle/toggle spring assembly onto the lock barrel and turn through 180°.

5. Fit the release trigger using new Starlock washers (item 16), and attach the trigger return springs (item 15). Note that the shorter hook ends of the springs fit into the holes in the mounting bracket.

6. Using the key, turn the private lock drive arm to approximately 45° allowing the plunger/connecting link assembly to be positioned behind the saddle. Ensure that the boss on the saddle engages with the recess in the solenoid plunger connecting link. Apply a small amount of Keenomax C3 grease, or its equivalent, to the solenoid connecting link. Check that the toggle spring (item 19) is fitted as shown in inset C.

7. Fit the solenoids to the plunger/connecting link assembly and loosely attach to the mounting bracket. Align the solenoids to give unrestricted movement of the plungers, then tighten the securing screws.

8. Attach the saddle spring (item 17).

9. Pass the shield (item 9) underneath the interrupter, taking care not to overstress the interrupter return spring. Loosely attach the shield to the mounting bracket. Align the shield square with the mounting bracket, then tighten the securing screws.

10. Loosely fit the micro-switches to the shield lugs. Position the switches so that the private lock drive arm operates each switch when the key is turned approximately 45° from the vertical position, both clockwise and anti-clockwise. Note that the drive arm should deflect the saddle spring (item 17) prior to operating the switches. Tighten the micro-switch securing screws.

11. Fit the adjustable stop (item 8). Ensure that the release lever is touching the stop. Then, adjust the stop until a clearance of 0,38 mm (0.015 in) exists between

the interrupter and the release handle spigots (see fig. S7-7). Tighten the adjustable stop lock-nut.

12. Prior to fitting the mechanism to the luggage compartment lid apply a small amount of Palm grease, or its equivalent, to the private lock sealing rings.

13. Manoeuvre the mechanism into position then secure using the bolts, nuts, and washers (item 5). Check that the lock mechanism is pressed firmly against the lock cover securing nut.

14. Clip the electrical leads into position, ensuring that they are kept clear of the adjustable stop and any moving parts.

15. Connect the electrical leads from the solenoids and micro-switches to the terminal block.

16. Fit a new Fastex bush to the release lever and connect the latch mechanism control rod (item 2).

17. Prior to closing the luggage compartment lid, check that the latch pawl is released when the handle is operated (see Lock mechanism – To set).

18. Connect the battery, then check that the luggage compartment lock/unlock solenoids and centralized door locking micro-switches are operating correctly.

Lock mechanism – To set

With the luggage compartment lid in the raised position, move the latch pawl to the 'locked' position. Pull the luggage compartment release handle and check that the latch pawl becomes disengaged; allowing it to pivot freely. If the latch does not disengage proceed as follows referring to figure S7-8.

1. Disconnect the latch mechanism control rod from the release lever on the lock mechanism.

2. Depending upon the type of lock mechanism fitted, ensure that the release lever is touching either the actuator spigot (see inset A, arrowed) or the adjustable stop (see inset B, arrowed).

3. Fit a new Fastex bush to the release lever. Then, loosen the control rod lock-nut and adjust the length of the rod until it aligns with the hole in the bush. Connect the control rod and tighten the lock-nut.

Hinged lock cover – To remove and fit (see fig. S7-9)

Applicable to all Rolls-Royce cars; also applicable to Bentley cars prior to 1989 model year.

1. To gain access to the hinged lock cover securing nut, it will be necessary to remove the lock mechanism (see Lock mechanism – To remove and dismantle).

2. Remove the securing nut (item 1) and retaining plate. Carefully withdraw the lock cover and fibre washer (item 2).

3. To fit the lock cover reverse the removal procedure noting the following.

To prevent damage to the paintwork, attach a layer of transparent adhesive tape to the landing surface of the lock cover magnet.

Winged badge and hinged lock cover – To remove and fit (see fig. S7-9)

Applicable to 1989 model year Bentley cars.

1. To remove the winged badge (item 1) proceed as follows.

To gain access to the badge securing nuts, unscrew

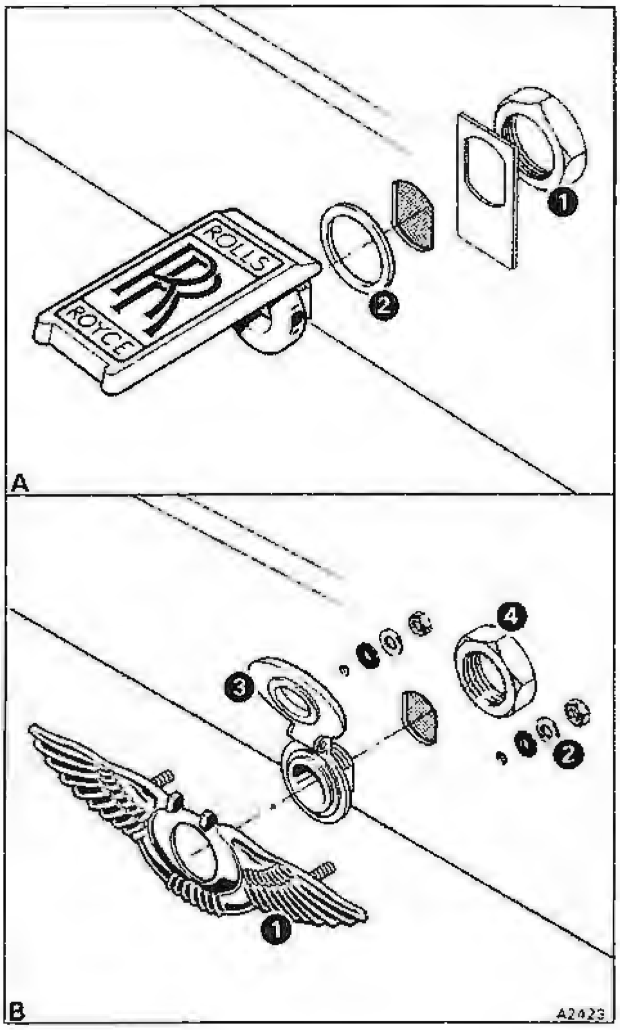


Fig. S7-9 Hinged lock covers

A Applicable to all Rolls-Royce cars; also applicable to Bentley cars prior to 1989 model year

B Applicable to 1989 model year Bentley cars

and lower the centre trim panel (see fig. S7-1, item 1).

Remove the badge securing nuts, plain washers, and sealing washers (item 2).

Lift the hinged lock cover (item 3) and carefully remove the winged badge.

2. To remove the hinged lock cover proceed as follows.

Remove the winged badge.

To gain access to the lock cover securing nut, it will be necessary to remove the lock mechanism (see Lock mechanism – To remove and dismantle).

Remove the securing nut (item 4). Carefully withdraw the retaining collar and hinged lock cover.

3. To fit the lock cover and winged badge reverse the removal procedure noting the following.

To prevent water ingress, apply a small amount of Bostik Seelastik, or its equivalent, to the retaining collar and the base of the badge securing studs prior to fitting.

Windscreen

Contents

	Pages				
	Rolls-Royce		Bentley		
	Silver Spirit	Silver Spur	Eight	Mulsanne / Mulsanne S	Turbo R

Windscreen

Introduction

Prior to commencing work, ensure that a suitably prepared area is available upon which to lay items of trim that have been removed.

When replacing a windscreen, it is essential that a high level of attention to detail is observed. This is especially important during the cleaning and priming of the windscreen aperture and glass.

Safety procedures

The cleaners, primers, and adhesives referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Windscreen – To remove

1. Disconnect the battery.
2. Raise the bonnet.
3. Fit front wing covers RH2684. Protect exposed paintwork in the vicinity of the windscreen with clean felt or a similar material.
4. To remove the windscreen wiper arm assemblies proceed as follows referring to figure S8-1.

   Unclip the plastic covers and remove the wiper arm securing nuts (item 1).

   Loosen the Allen headed setscrew (item 2). Then, using extractor tool RH9623 carefully remove each wiper arm assembly.
5. Unscrew and remove the air intake grilles (item 3) and foam filters (if fitted).
6. Remove the four setscrews (item 4).
7. Loosen the setscrews (item 5). Then, lift the front of the scuttle panel slightly and pull it forward to disengage the rear retaining clips. Disconnect the windscreen washer hoses and remove the panel.
8. Unscrew and remove the four brackets (item 6) situated along the lower edge of the windscreen.
9. Unscrew and remove the interior rear view mirror. On cars fitted with a cellular telephone, unclip the microphone mounted on the mirror stem and unplug the electrical lead.

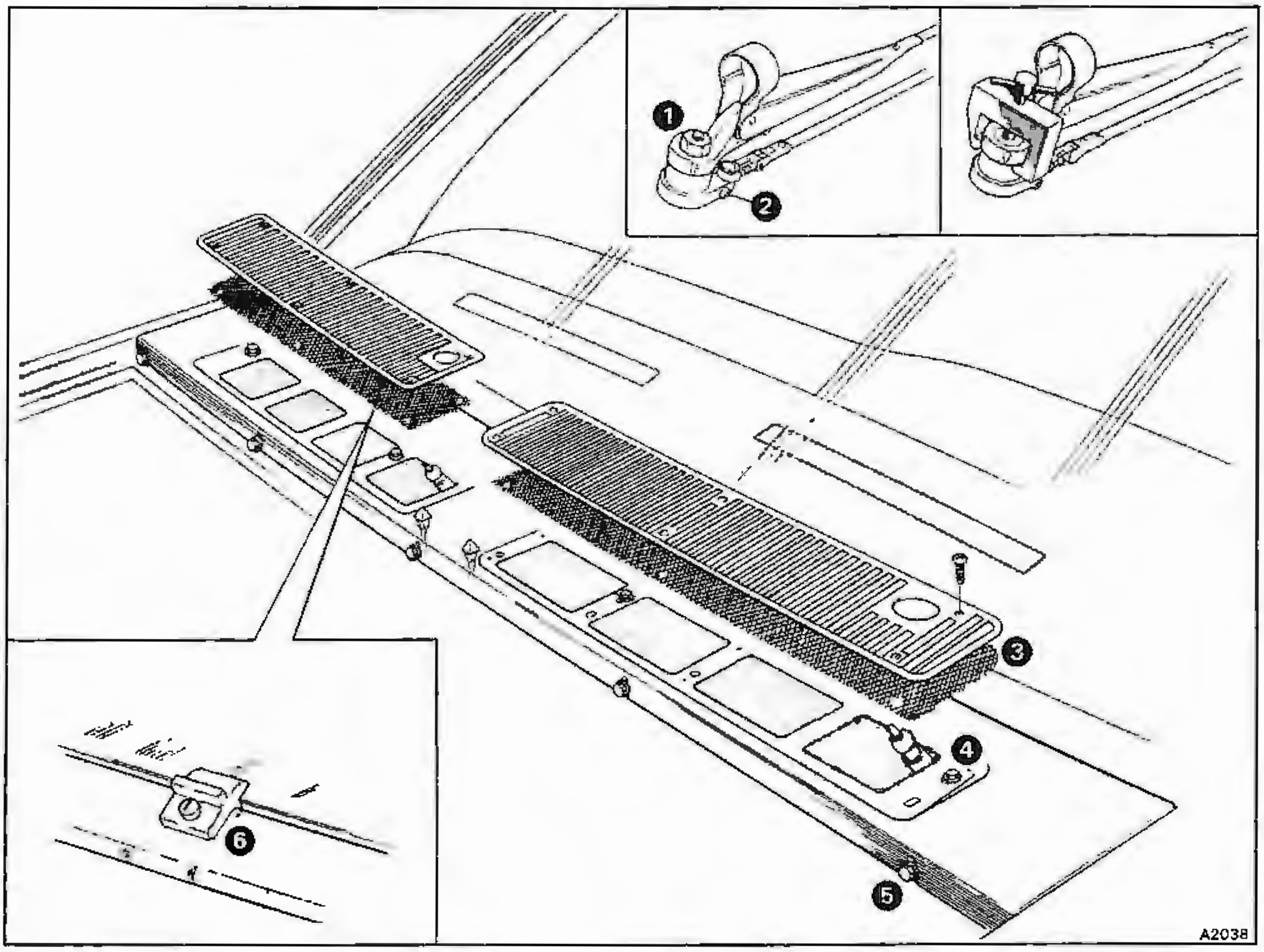


Fig. S8-1 Air intake grilles and scuttle panel

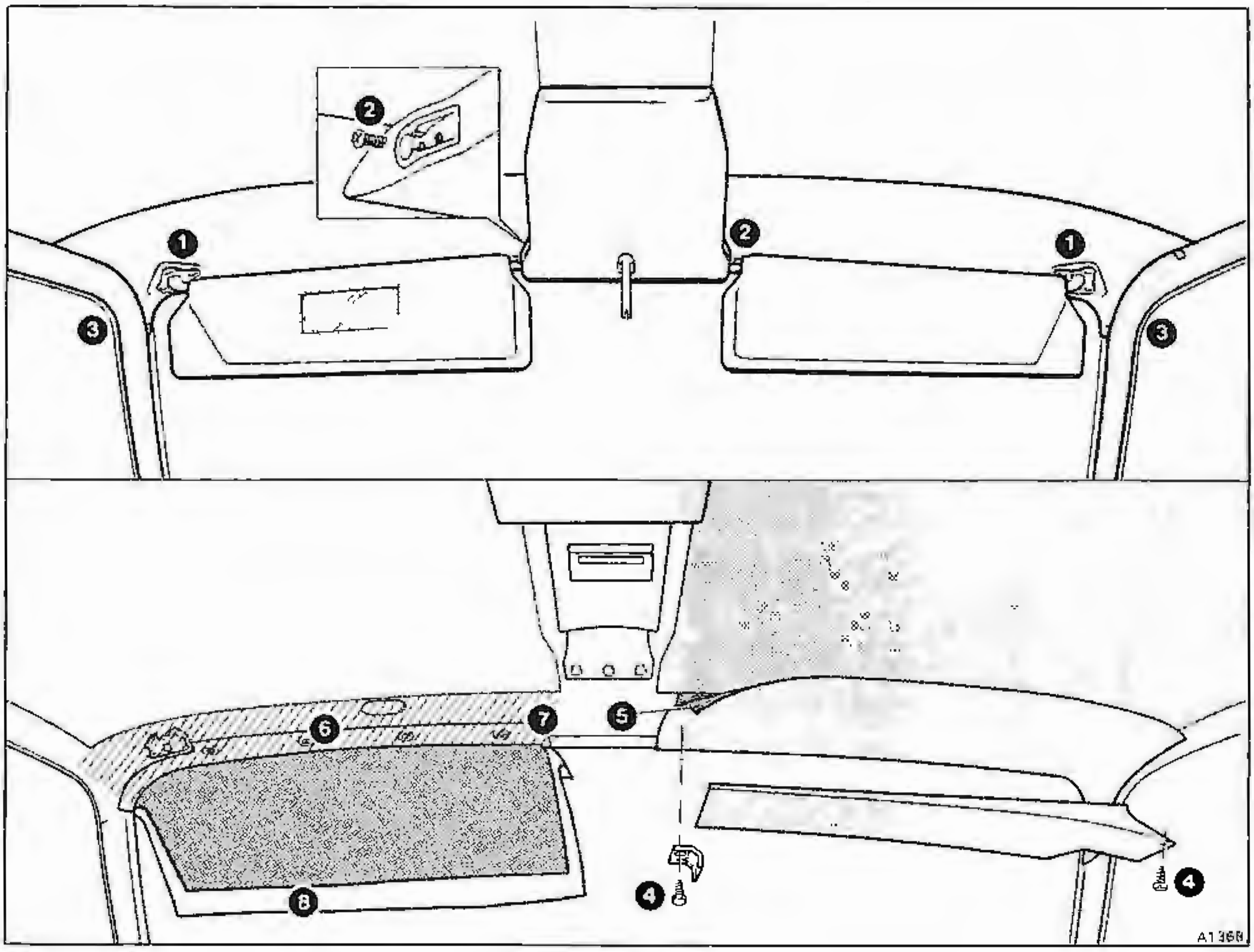


Fig. S8-2 Windscreen interior trim

10. Pull the sun visors from their inboard retaining clips. Release the screws and remove the sun visors (see fig. S8-2, item 1).
11. Remove the screws (item 2). Slide back the centre header trim panel and release the Lucar connector (if fitted) from the passenger side visor retaining clip. Remove the trim panel.
12. Remove the flexible outer covers from the coat hooks situated on the cantrail trim panels. Unscrew the coat hooks and remove the stainless steel trim finishers.
13. Unclip and remove the 'A' post/cantrail trim panel (item 3).
14. Release the screws (item 4) and remove the visor clip retaining brackets and header trim panels.
15. Carefully separate the glued edge of the header trim cloth and foam (item 5) from the headlining material. Remove the exposed self-tapping screws and washers (item 6), then remove the header trim pieces.
16. Remove the top roll and demister panel (see Section S15). Protect the exposed instrument board area from the ingress of dirt, debris, etc., using a suitable cover.
17. Remove the self-tapping screws securing the windscreen finisher retention plates to the 'A' post panels (see fig. S8-3, item 1). Also, remove the nut and washer (item 2) from the finisher retention hook situated in the centre of the upper windscreen flange.
18. Carefully lever the finisher/seal assembly clear of the windscreen. Care must be taken to avoid damaging the paintwork or chrome finisher during this operation.
19. From inside the car, peel back and remove the spacing/finisher seal (item 3) from around the windscreen aperture flange.
20. To release the windscreen from its aperture proceed as follows using windscreen removal knife RH9637.

Attach suction pads to the outer surface of the windscreen.

From outside the car, insert the blade of the tool through the sealing compound and behind the glass (see fig. S8-3, inset A).

With an assistant applying steady pressure to the inside of the glass, cut through the sealing compound by pulling the knife slowly around the complete periphery of the windscreen.

When the windscreen is free, lift it clear of the aperture using the suction pads. Rest the windscreen,

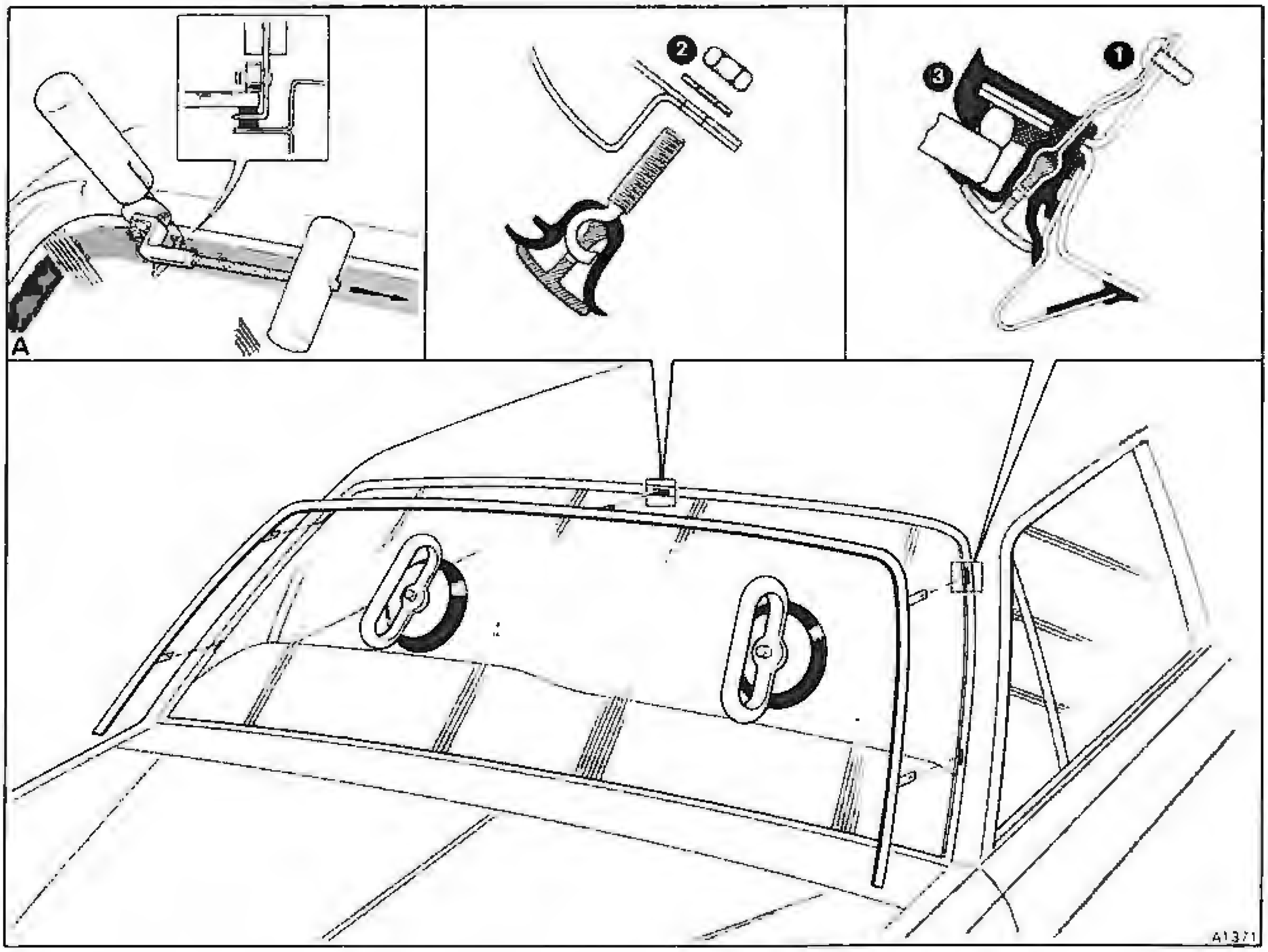


Fig. S8-3 Windscreen sealing arrangement

interior surface uppermost, on a suitably prepared work surface.

21. If the windscreen removal knife RH9637 is not available, the windscreen may be removed by adopting the following procedure.

Attach suction pads to the outer surface of the windscreen.

From inside the car, pierce a hole through the sealing compound. Obtain a length of strong flexible wire, then thread one end of the wire through the hole in the sealing compound.

Attach small pieces of wood to each end of the wire to act as handles.

With an assistant holding the interior handle and applying steady pressure to the glass, firmly pull the exterior handle so that the wire cuts through the sealing compound. Repeat this cutting action, using long steady pulls, until the windscreen is free.

Lift the windscreen clear of the aperture using the suction pads. Rest the windscreen, interior surface uppermost, on a suitably prepared work surface.

Windscreen – To fit

1. Using a plastic or wooden scraper, remove all traces of sealing compound from the windscreen aperture flange. Then, using a cloth moistened with Genklene, thoroughly clean the flenge area. Ensure that Genklene does not come into contact with finished paintwork.

2. Clean the spacing/finisher seal with Genklene. Allow to dry.

If fitting the original seal, ensure that all traces of adhesive are removed using a cloth moistened with Bostik Cleaner 6001. Allow to dry.

3. Apply Dunlop Adhesive S1558 to the bonding surfaces of the spacing/finisher seal and windscreen aperture flange. Allow between five and twenty minutes for the adhesive to 'flash' dry. Then, bring both surfaces together using maximum hand pressure. Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

4. Using a cloth moistened with Genklene, thoroughly clean the interior edge of the windscreen. Allow to dry. Using a brush evenly apply Butyl strip primer, to a width of 7 mm (0.275 in), around the edge of the glass i.e. the area of the windscreen that will come into contact with the Butyl strip.

Similarly, apply primer to the windscreen aperture flange. Allow five minutes for the primer to dry.

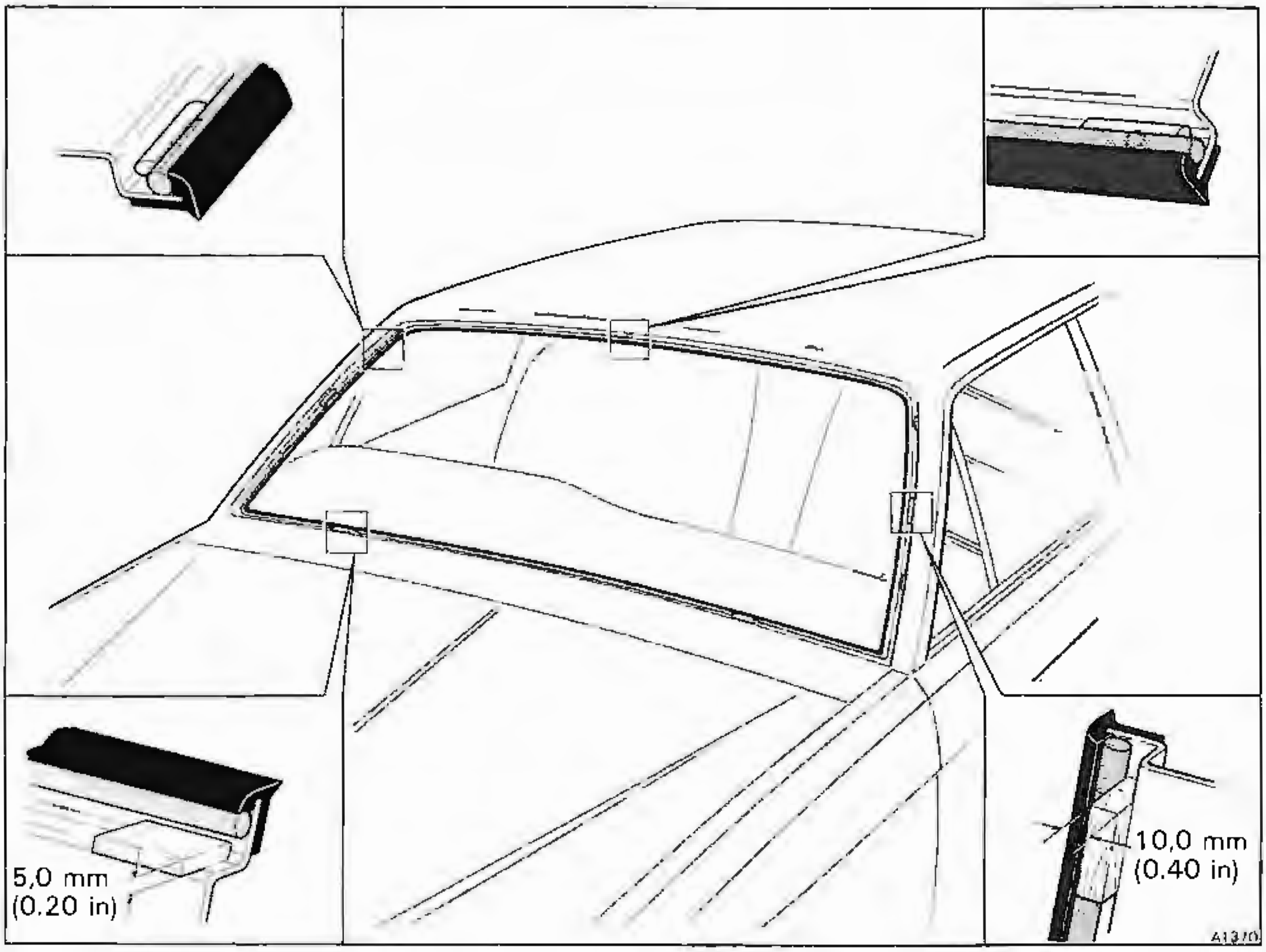


Fig. S8-4 Position of windscreen sealing compound and spacing blocks

Important 3M Primer XC 5892 **must only** be used with 3M Scotch Seal Butyl strip. Similarly, DRG Kwikseal Primer 6559 **must only** be used with DRG Kwikseal 1769 Butyl strip.

3M Primer **must not** be used with Kwikseal Butyl strip, or vice-versa.

5. Starting in the lower corner of an 'A' post, carefully unroll and press the Butyl strip lightly into position on the primed area of the windscreen aperture. Cut a separate length of Butyl strip for the lower windscreen flange, butting it against the 'A' post strips. Ensure that the Butyl strip is positioned against the spacing/ finisher seal (see fig. S8-4). Do not remove the backing paper at this stage.

6. Place two 5 mm (0.20 in) thick hardwood spacing blocks into the bottom of the windscreen aperture. Also, position one 10 mm (0.40 in) thick spacing block half way up each 'A' post (see fig. S8-4).

7. Remove the backing paper from the Butyl strip, taking care not to displace or touch the strip.

8. With the help of an assistant, fit the windscreen as follows.

Using suction pads, lift the windscreen and carefully position the lower edge into the aperture; resting it on the spacing blocks.

Centralize the windscreen between the spacing blocks situated on each 'A' post. Do not touch the primed edge of the glass as this will contaminate the primer and prevent correct adhesion.

Firmly press the windscreen onto the Butyl strip using maximum hand pressure.

Remove the 'A' post spacing blocks. Remove any excess Butyl from the recess around the glass using a plastic or wooden scraper.

9. Thoroughly clean the finisher/seal assembly using a cloth moistened with Genklene.

If it is necessary to fit a new windscreen finisher seal, proceed as follows.

Remove and discard the old seal.

Carefully cut the new seal to accept the four finisher retention plates and pierce a hole for the retention hook.

Fit the seal to the finisher, threading the retention plates and hook through the seal.

10. Using either Arbomast Autograde sealant or Seelastik, apply four beads, each 6,40 mm (0.250 in) in diameter and 76 mm (3.0 in) long, over the retention slots in each 'A' post. Also, apply a 20 mm (0.80 in) long bead over the hole for the retention hook (see fig. S8-4).

11. With the help of an assistant, lift the finisher/seal assembly into position. Thread the retention plates through the slots in each 'A' post and pass the retention hook through the hole in the upper flange.

12. Firmly press the finisher/seal assembly into position on the glass. Align the holes in the retention plates with the holes in the 'A' post panels. Secure using self-tapping screws. Fit the nut and washer to the retention hook. Lightly tighten the nut.

13. Remove the lower spacing blocks, then screw the brackets into position along the lower edge of the windscreen.

14. Test the windscreen for leaks by applying water under pressure. If a leak is detected, note its position then remove the necessary part and repeat the fitting procedure.

15. Fit the top roll and demister panel (see Section S15).

16. To fit the header trim pieces proceed as follows referring to figure S8-2.

Using the self-tapping screws and washers (item 6), secure the trim pieces to the header panel.

Apply Apollo Adhesive AX 2344 to the header panel covering an area approximately 75 mm (3.0 in) wide. Refer to cross-hatched area (item 7). Allow five minutes for the adhesive to 'flash' dry, then press the foam panel (item 8) firmly into position.

Apply Apollo Adhesive AX 2344 to the roof headlining material adjacent to the edge of the foam panel. Cover an area approximately 25 mm (1.0 in) wide. Similarly, cover an area on the header trim piece material. Allow five minutes for the adhesive to 'flash' dry. Then, keeping the trim piece material taut, press firmly into position.

Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

17. Fit the remaining trim panels by reversing the procedure given for removal.

Rear window

Contents

7/87
Printed in England

Rear window

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

Safety procedures
The cleaners referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Rear window – To remove
1. Disconnect the battery.
2. Lift out the rear seat cushion.
3. Remove the rear head rests.
4. Remove the rear seat squab (see Section S13).
5. Unclip and remove the seat belt covers (see fig. S9-1, item 1).
6. Remove the seat belt anchorage bolts situated on the rear squab panel. Release the webbing from the seat belt guides and carefully allow the belts to retract into the reel mechanisms.
7. If fitted, release the front of the trimmed stop lamp unit from the retaining clip (item 2). Carefully raise the front of the lamp unit and pull it forward slightly to disengage the rear retaining lugs. Unplug the electrical lead to the lamp and remove the stop lamp unit.
8. Ease the front of the parcel shelf (item 3) slightly upwards and carefully remove.
9. To remove the rear cantrail/quarter panel proceed as follows.

Using a suitable flat bladed tool, carefully ease the front of the companion frame (if fitted) out of its recess (item 4).

Release the Lucar connectors, noting the position of the leads to ensure correct assembly, then remove the companion frame.

Pull down the spring loaded grab handle (item 5)

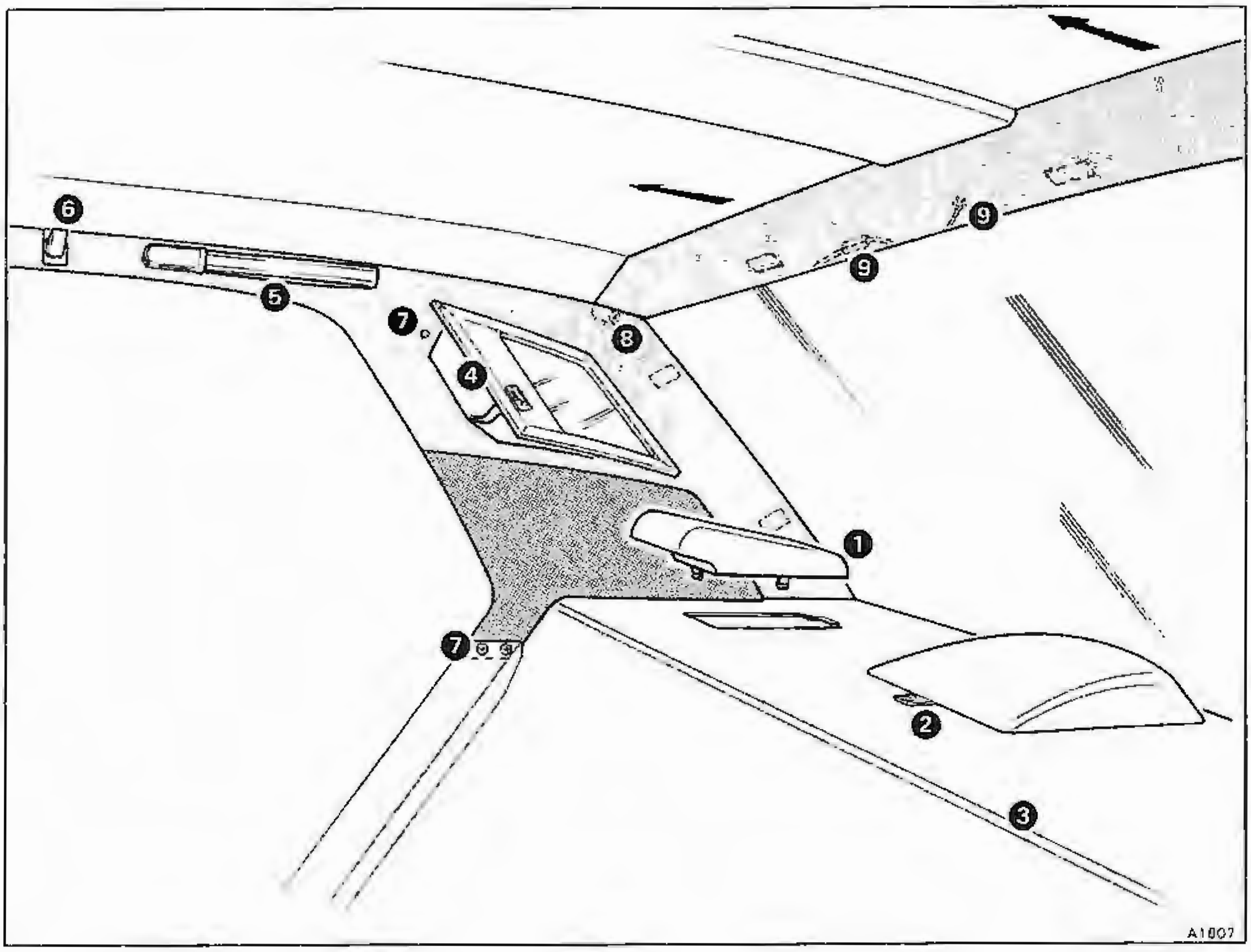


Fig. S9-1 Rear window interior trim

to expose the retaining screws. Release the screws and remove the handle.

Remove the flexible outer cover from the coat hook situated on the cantrail trim panel (item 6). Unscrew the coat hook and remove the stainless steel trim finisher.

Release the self-tapping screws (item 7) and remove the cantrail/quarter panel by pulling it forward to disengage the rear retaining brackets. On Bentley Eight cars release the Lucar connectors from the interior/map lamp switch, noting the position of the leads to ensure correct assembly.

10. Release the self-tapping screw (item 8) from each end of the header trim panel. Remove the panel by pulling it forward to disengage the rear retaining brackets.

11. Disconnect the rear window demister leads situated on the header rail (item 9). On cars fitted with a cellular telephone, unscrew the aerial lead connection from the glass mounted aerial.

12. Protect the exterior paintwork in the vicinity of the rear window with clean felt or a similar material.

13. Using a flat bladed tool, carefully ease the chrome finisher out of the rear window seal. Repeat this operation at various points around the seal until the finisher is released.

14. From inside the car, ease the lip of the seal over the body aperture flange (see fig. S9-2). A small steel rule or a similar tool will assist during this operation. Start in the top corners and work towards the centre, simultaneously applying pressure to the glass. An assistant will be required to support the glass/seal assembly as it is pushed out of the aperture. Avoid sharp blows as this may damage the glass or paintwork. A steady pressure is all that is required.

15. Rest the removed glass/seal assembly, external surface uppermost, onto a suitably prepared work surface. Remove the seal from the glass.

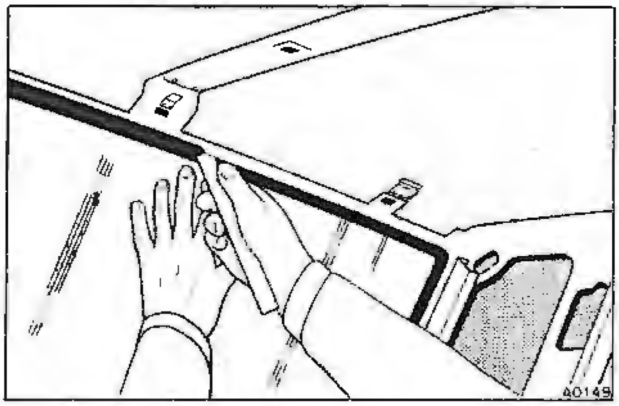


Fig. S9-2 Rear window removal

Rear window – To fit

1. Using a plastic or wooden scraper, remove all traces of sealing compound from the rear window aperture flange. Then, completely remove the layer of black waterproof tape. Thoroughly clean the flange area using a cloth moistened with Genklene. Allow to dry. **Extreme care must be taken to avoid Genklene coming into contact with finished paintwork.**

2. Apply a layer of black waterproof tape to the aperture flange (see fig. S9-3, inset A). The tape should be turned over the edge of the flange for approximately 12,70 mm (0.50 in).

3. If the original window and/or seal is to be fitted ensure that all traces of sealing compound are removed using a cloth moistened with Bostik Cleaner 6001. The seal should be examined closely for any sign of damage. If in doubt always fit a new seal.

4. If a new seal is to be fitted proceed as follows.

Fit the seal to the upper edge of the glass and mark the position of the two demister leads.

Remove the seal, then pierce two 3,17 mm (0.125 in) holes through the rubber (see fig. S9-3, inset B). Fit the seal to the glass, threading the demister leads through the holes in the rubber.

5. Apply a small amount of Palm Grease, or its equivalent, to the base of the chrome finisher i.e. the

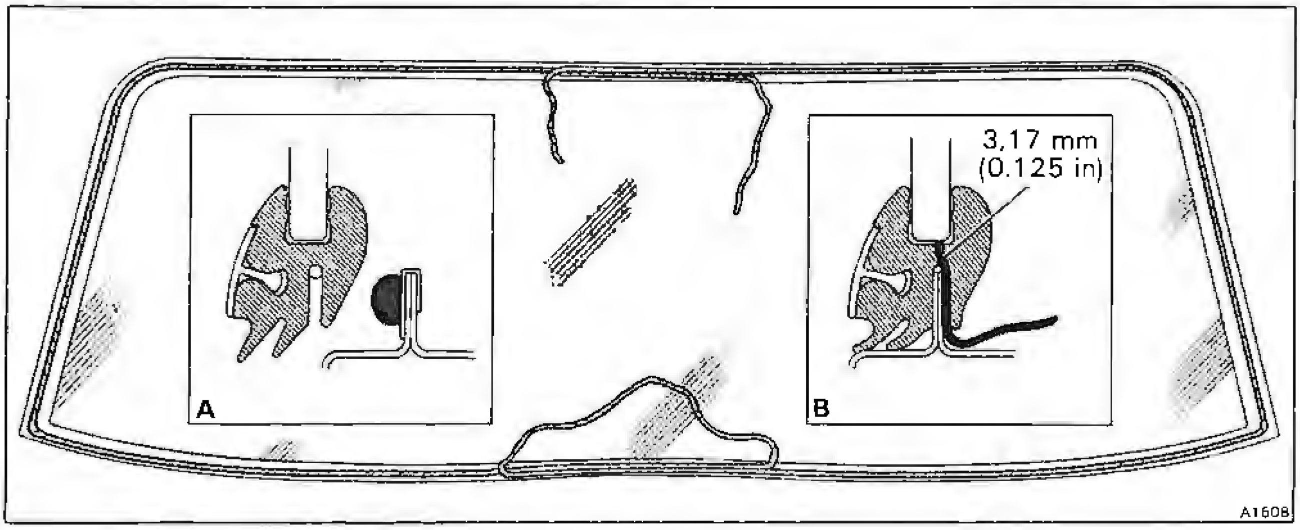


Fig. S9-3 Position of cord and sealing arrangement

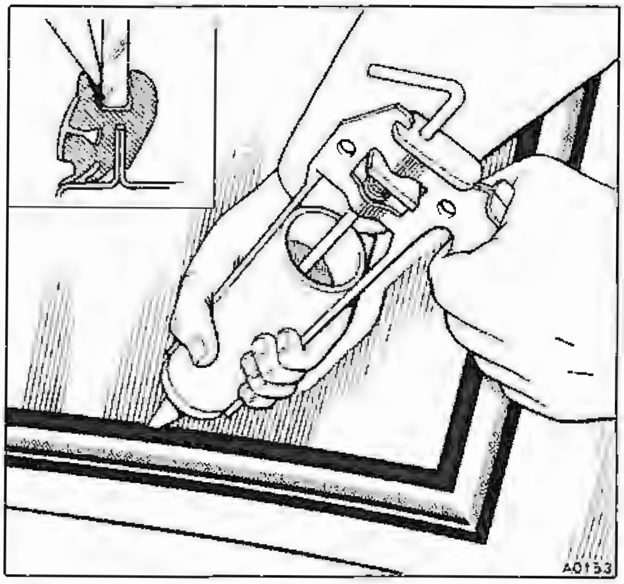


Fig. S9-4 Applying sealant between the seal and the glass

section of the finisher that fits into the seal.
Position the finisher centrally, then press into the seal starting in the centre and working outwards.
6. Turn the window over so that the internal surface is uppermost. Thread a length of cord around the inside lip of the seal (see fig. S9-3). Leave a loop in the cord at the bottom of the window and overlap the two ends of the cord at the top. Secure the loose ends of the cord and the demister leads to the glass with masking tape.
7. Using a sealant cartridge gun, run a continuous 6 mm (0.250 in) diameter bead of Arbomast Autograde Sealant or Seelastik around the window aperture flange (see fig. S9-3, inset A). Apply an additional bead of sealant to each lower corner area of the aperture.
8. With the help of an assistant, position the glass/seal/finisher assembly with the lower edge seated in the aperture. Using a rubber mallet, apply several sharp blows around the seal/finisher area starting in the centre of the upper edge. The window should then be seated inside the aperture.
9. From inside the car, remove the masking tape securing the cord and demister leads.
10. With an assistant applying steady pressure to the exterior of the glass, carefully pull the looped cord at the bottom of the window so that the seal is drawn over the aperture flange. Pull the cord alternately to the right and left, along the bottom of the window and half-way up each side. Similarly, pull each end of the cord along the top of the window until the cord is completely removed. Ensure that the seal is fitted over the flange at all points around the aperture.
11. From outside the car, check that the seal/finisher is seated flush against the body. If necessary apply further pressure with a rubber mallet.
12. Carefully ease back the seal and insert the nozzle of a sealant cartridge gun between the seal and the glass. Then, apply a continuous bead of Arbomast Autograde Sealant or Seelastik into the glass channel (see fig. S9-4). On cars fitted with an Everflex roof, apply a 100 mm (4.0 in) long bead of Sikaflex sealant between the seal and the body directly below both roof seams.
13. Remove any excess sealant from the interior and exterior of the glass using a cloth moistened with Bostik Cleaner 6001.
14. On cars fitted with a glass mounted telephone aerial, it will be necessary to fit a new aerial base assembly if the rear window has been renewed. Once glued in position the aerial base cannot be successfully removed and refitted.
15. Connect the demister leads.
16. Test the window for leaks by applying water under pressure. If the sealing is satisfactory, fit the rear window trim by reversing the procedure given for removal.

Bumpers

Contents

5/88
Printed in England

Bumpers

Introduction
Each bumper assembly is constructed around an aluminium beam. Attached to the upper surface of the beam is a stainless steel/painted finisher. Rubber mouldings are fixed to the front face of the beam and abut with two moulded rubber side pieces. Sectional stainless steel finishing strips are recessed into the mouldings. These strips are retained by studs which are secured through the aluminium beam and side rubber mouldings. Small stainless steel trim pieces cover the finishing strip abutment joints.

On cars other than those conforming to a North American specification, each bumper is mounted to the car by two brackets. The outer end of each bracket is secured to an adapter which is bolted to the aluminium beam. The inner ends of the brackets are bolted to the longerons at the front and rear of the car.

On cars conforming to a North American

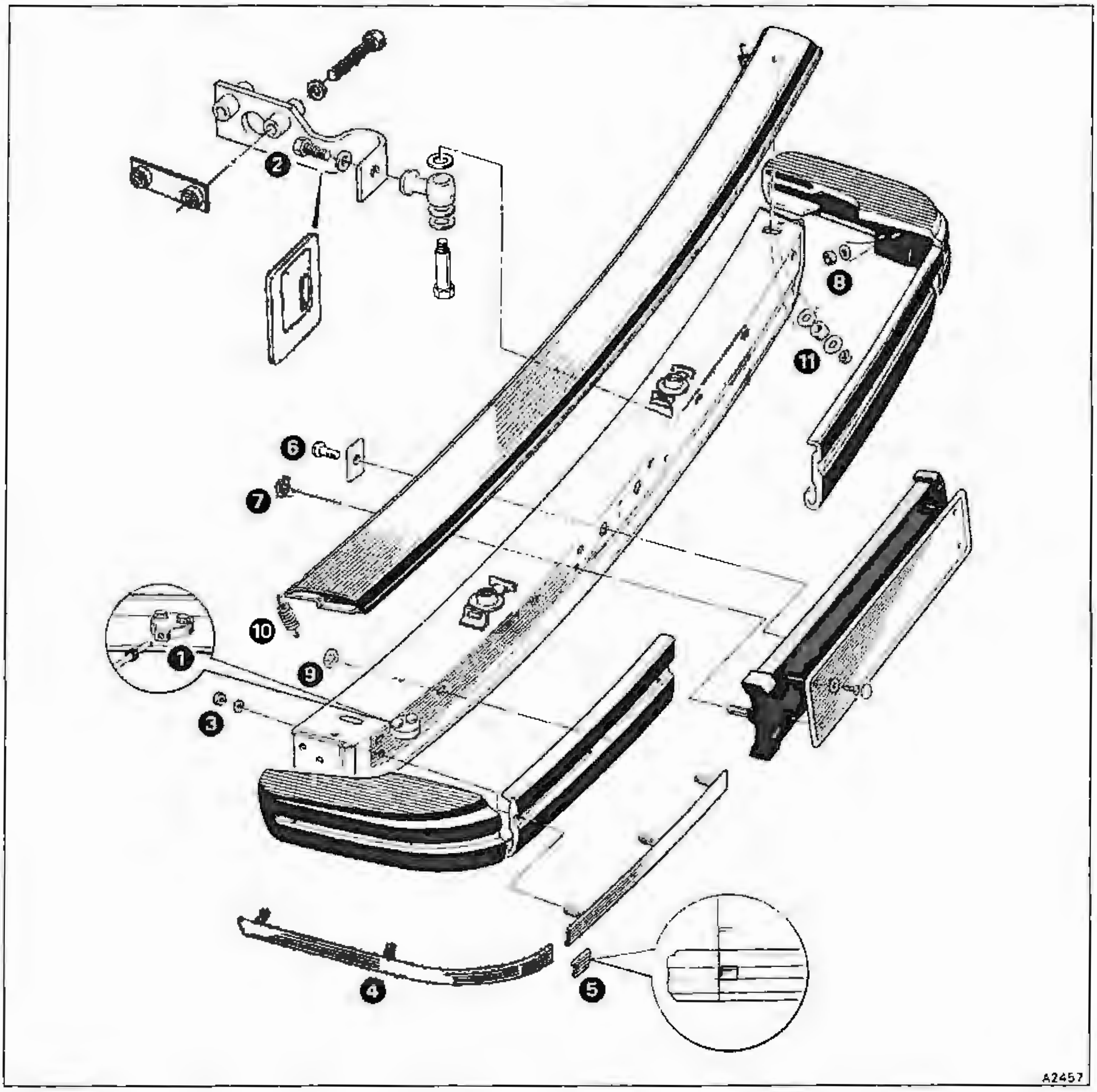


Fig. S10-1 Front bumper assembly (incorporating a rectangular type number plate)

specification, each bumper is mounted to the car by two energy absorption units. The outer end of each unit houses an adapter which is bolted, via a Metalastik bush, to the aluminium beam. The inner ends of the absorption units are bolted to the longerons at the front and rear of the car.

Prior to commencing work, a suitably prepared area should be made available where work can be carried out on a removed bumper assembly.

Front bumper assembly – To remove and fit
(see fig. S10-1)
Cars other than those conforming to a North American specification

1. Disconnect the battery.
2. Remove the air dam and snow shields (see Section S12).
3. To release the air conditioning ambient sensor (item 1) from the lower right-hand side of the bumper beam proceed as follows.

   Remove the setscrew, washers, and nut securing the cable tie to the bumper beam.

   Withdraw the sensor from its mounting block and secure it safely until the bumper is refitted.
4. To disconnect the headlamp power wash hoses proceed as follows referring to figure S10-2.

   If the power wash jets are the type shown in inset A, release the securing clip (item 1) and disconnect the hose.

   If they are of the type shown in inset B proceed as follows.

   Depress the jet cover securing clip (item 1). Then, tilt the cover to release its front retaining clip and remove.

   Remove the self-tapping screws (item 2). Lift the jet assembly to expose the hose securing clip. Release the clip and disconnect the hose.
5. With the help of an assistant, support the bumper and remove the bolts and washers (item 2) securing the bumper beam adapters to the mounting brackets. Then, carefully withdraw the bumper assembly.
6. If it is necessary to remove the bumper mounting brackets from the longerons proceed as follows.

   Note that on 1989 model year Bentley Turbo R cars it will be necessary to remove the intercooler matrix to gain access to the right-hand mounting bracket (refer to TSD 4737 Engine Management Systems Manual).

   If necessary, disconnect the electrical leads to the horns.

   Remove the two bolts, washers, and tapping plate securing each mounting bracket to the longeron. Note that the horn mounting bracket may be secured under one of the bolts on the left-hand mounting bracket.

   Withdraw the mounting brackets and aperture seals.
7. To fit the bumper assembly reverse the removal procedure noting the following.

   Ensure that the power wash hoses are not twisted or positioned in a way that could restrict washer fluid flow. Pack the ambient sensor mounting block with silicone grease, then slide the sensor into position and fit the rubber grommet. Secure the sensor lead to the bumper beam.

Front bumper assembly – To remove and fit
(see fig. S10-3)
Cars conforming to a North American specification

1. Disconnect the battery.
2. Remove the air dam and snow shields (see Section S12).
3. To release the air conditioning ambient sensor (item 1) from the lower right-hand side of the bumper beam proceed as follows.

   Remove the setscrew, washers, and nut securing the cable tie to the bumper beam.

   Withdraw the sensor from its mounting block and secure it safely until the bumper is refitted.
4. To disconnect the headlamp power wash hoses (if fitted) proceed as follows referring to figure S10-2.

   If the power wash jets are the type shown in inset A, release the securing clip (item 1) and disconnect the hose.

   If they are of the type shown in inset B proceed as follows.

   Depress the jet cover securing clip (item 1), then tilt the cover to release its front retaining clip and remove.

   Remove the self-tapping screws (item 2). Lift the jet assembly to expose the hose securing clip. Release the clip and disconnect the hose.
5. With the help of an assistant, support the bumper and remove the bolts, washers, and tapping plates (item 2) securing the energy absorption units to the longerons. Note that on 1989 model year Bentley Turbo R cars it will be necessary to remove the intercooler matrix to gain access to the right-hand mounting bracket (refer to TSD 4737 Engine Management Systems Manual).
6. Carefully withdraw the bumper assembly and aperture seals.
7. If new energy absorption units are to be fitted proceed as follows.

   Set each unit to the correct length by turning the piston rod adjusting nut (item 3) clockwise or anti-clockwise. The length of the unit is measured from the centre of the adapter to the centre of the outer mounting bolt hole (see dimension A).

   When the length of the unit has been set, apply a small amount of Casco MLF 13 thread locking compound to the adjusting nut.

   Apply silicone grease to the exposed threaded section of the piston rod, and protect the outer surface of the absorption unit with a light oil or grease.
8. To fit the bumper assembly reverse the removal procedure noting the following.

   Ensure that the power wash hoses (if fitted) are not twisted or positioned in a way that could restrict washer fluid flow.

   Pack the ambient sensor mounting block with silicone grease, then slide the sensor into position and fit the rubber grommet. Secure the sensor lead to the bumper beam.

Front bumper (incorporating a rectangular type number plate) – To dismantle (see fig. S10-1)

1. Remove the bumper assembly (see Front bumper assembly – To remove).

2. Loosen the front finishing strip retaining nut closest to each side moulding (item 3).
3. Release the nuts and washers securing each side finishing strip (item 4). Then, remove the strips and trim pieces (item 5).
4. Unscrew the clamping plates (item 6), release the Starlock washers (item 7), and remove the number plate surround.
5. Release the retaining nuts and washers, then remove both front finishing strips.
6. Release the nuts and washers (item 8) then remove the side mouldings.
7. Release the Starlock washers (item 9) and remove both front mouldings.
8. Unhook the springs (item 10) from the finisher.
9. Release the nuts, plain washers, and rubber washers (item 11) then remove the finisher.
10. If it is necessary to remove the bumper mounting adapters from the beam, note the position and quantity of any spacing washers situated between the adapters and the beam.

Front bumper (incorporating a rectangular type number plate) – To assemble (see fig. S10-1)
Reverse the dismantling procedure noting the following.
1. Prior to fitting the adapters to the beam ensure that the spacing washers are in their correct positions.
2. Prior to fitting the finisher, apply Tectyl 175 corrosion prevention material to the areas of the aluminium beam that will come into contact with the finisher and power wash jet mounting brackets. This will prevent corrosion caused by the contact of dissimilar metals.
3. To ensure adequate retention of the front mouldings and the number plate surround, new Starlock washers should be fitted on assembly.
4. When fitting the finishing strips, apply a small amount of Keenomax C3 grease, or its equivalent, between the mild steel finishing strip retaining washers and the aluminium bumper beam. This will prevent corrosion caused by the contact of dissimilar metals.

Take care not to overtighten the finishing strip retaining nuts.

Front bumper (incorporating a square type number plate) – To dismantle (see fig. S10-3)
1. Remove the bumper assembly (see Front bumper assembly – To remove).
2. Loosen the front finishing strip retaining nut closest to each side moulding (item 4).
3. Release the nuts and washers securing each side finishing strip (item 5). Then, remove the strips and trim pieces (item 6).
4. *On cars conforming to a North American specification,* release the Starlock washers and remove the overriders (item 7).
5. Release the retaining nuts and washers, then remove both front finishing strips. Note that *on cars conforming to a Japanese specification* a small stainless steel trim piece is fitted over the inboard end of each finishing strip (item 8).

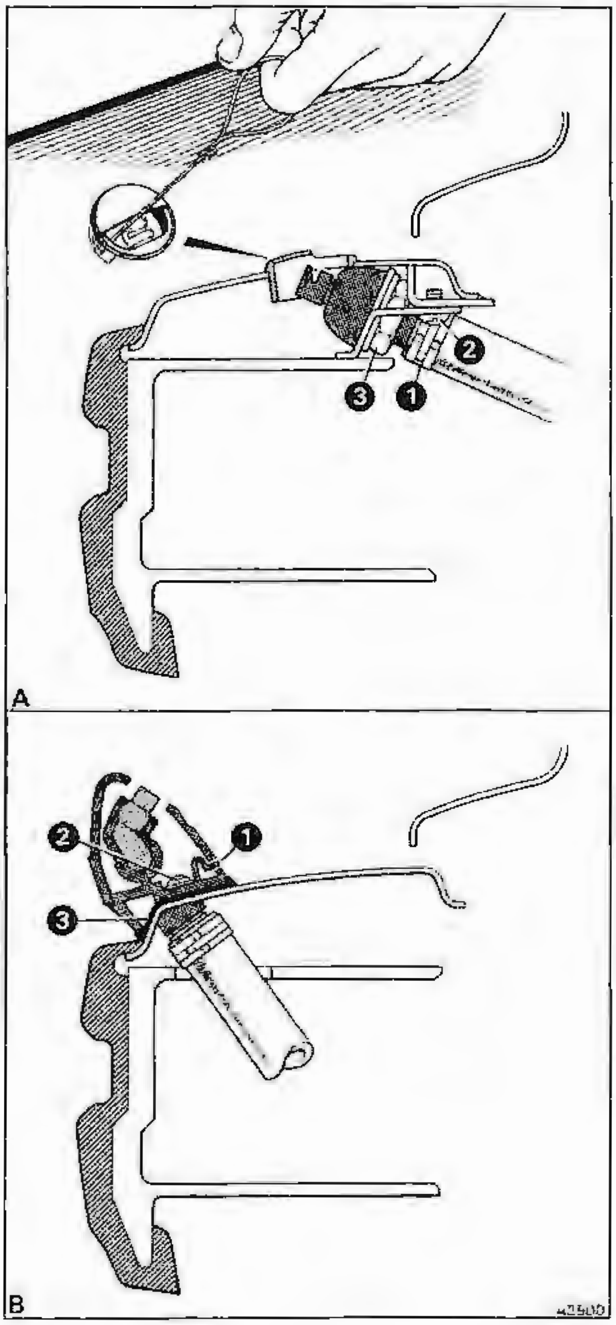


Fig. S10-2 Headlamp power wash jets

6. Release the nuts and washers (item 9), then remove the side mouldings.
7. Release the Starlock washers (item 10) and remove both front mouldings.
8. Unscrew and remove the number plate. Then, remove the backing plate (item 11) by releasing the screws situated underneath the bumper beam. Also remove the nut and bolt securing the front of the plate to the beam.
9. Remove the backing plate to bumper beam rubber moulding.
10. Unhook the springs (item 12) from the finisher.
11. Release the nuts, plain washers, and rubber

washers (item 13) then remove the finisher.
12. If it is necessary to remove the bumper mounting adapters/absorption units from the beam note the position and quantity of any spacing washers situated between the adapters and the beam.

Front bumper (incorporating a square type number plate) – To assemble (see fig. S10-3)
Reverse the dismantling procedure noting the following.
1. Prior to fitting the adapters/absorption units to the beam ensure that the spacing washers are in their correct positions.
2. Prior to fitting the finisher, apply Tectyl 175 corrosion prevention material to the areas of the aluminium beam that will come into contact with the finisher, power wash brackets, and number plate bracket. This will prevent corrosion caused by the contact of dissimilar metals.
3. To ensure adequate retention of the front mouldings and overriders, new Starlock washers should be fitted on assembly.
4. When fitting the finishing strips, apply a small amount of Keenomax C3 grease, or its equivalent, between the mild steel finishing strip retaining washers and the aluminium bumper beam. This will prevent corrosion caused by the contact of dissimilar metals.
Take care not to overtighten the finishing strip retaining nuts.

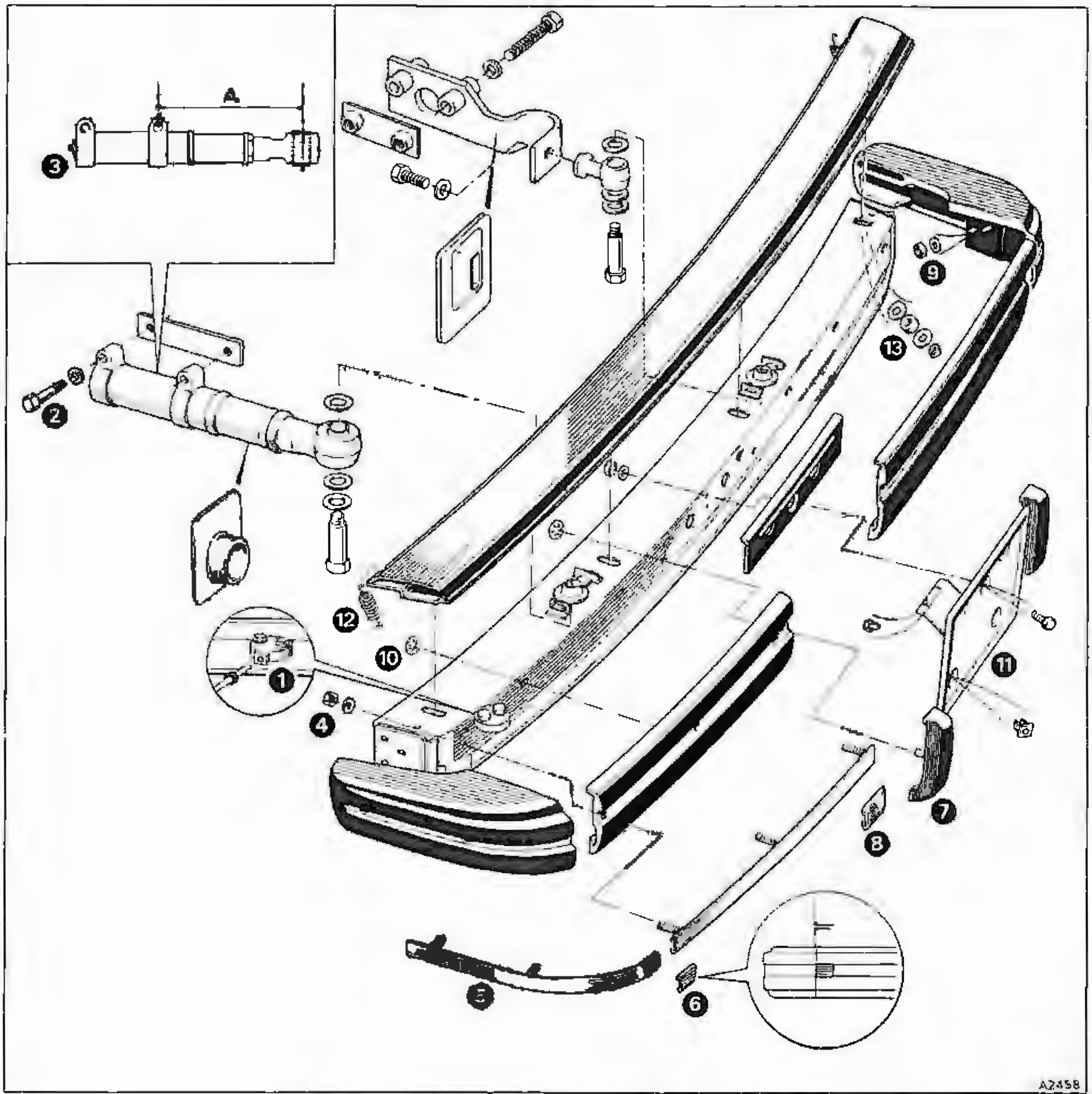


Fig. S10-3 Front bumper assembly (incorporating a square type number plate)
A 204 mm – 205 mm (8.031 in – 8.071 in)

Headlamp power wash jets – To remove and fit
(see fig. S10-2)

1. To remove the power wash jets shown in inset A proceed as follows.

Remove the bumper finisher (see Front bumper – To dismantle).

Invert the finisher and remove the two screws (item 2) securing each power wash jet mounting bracket.

Release the jet lock-nut (item 3) and remove the jet.

To fit the jet reverse the removal procedure.

2. To remove the power wash jets shown in inset B proceed as follows.

Depress the jet cover securing clip (item 1), then tilt the cover to release its front retaining clip and remove.

Remove the self-tapping screws (item 2).

Lift the jet assembly to expose the hose securing clip. Release the clip and disconnect the hose. Using

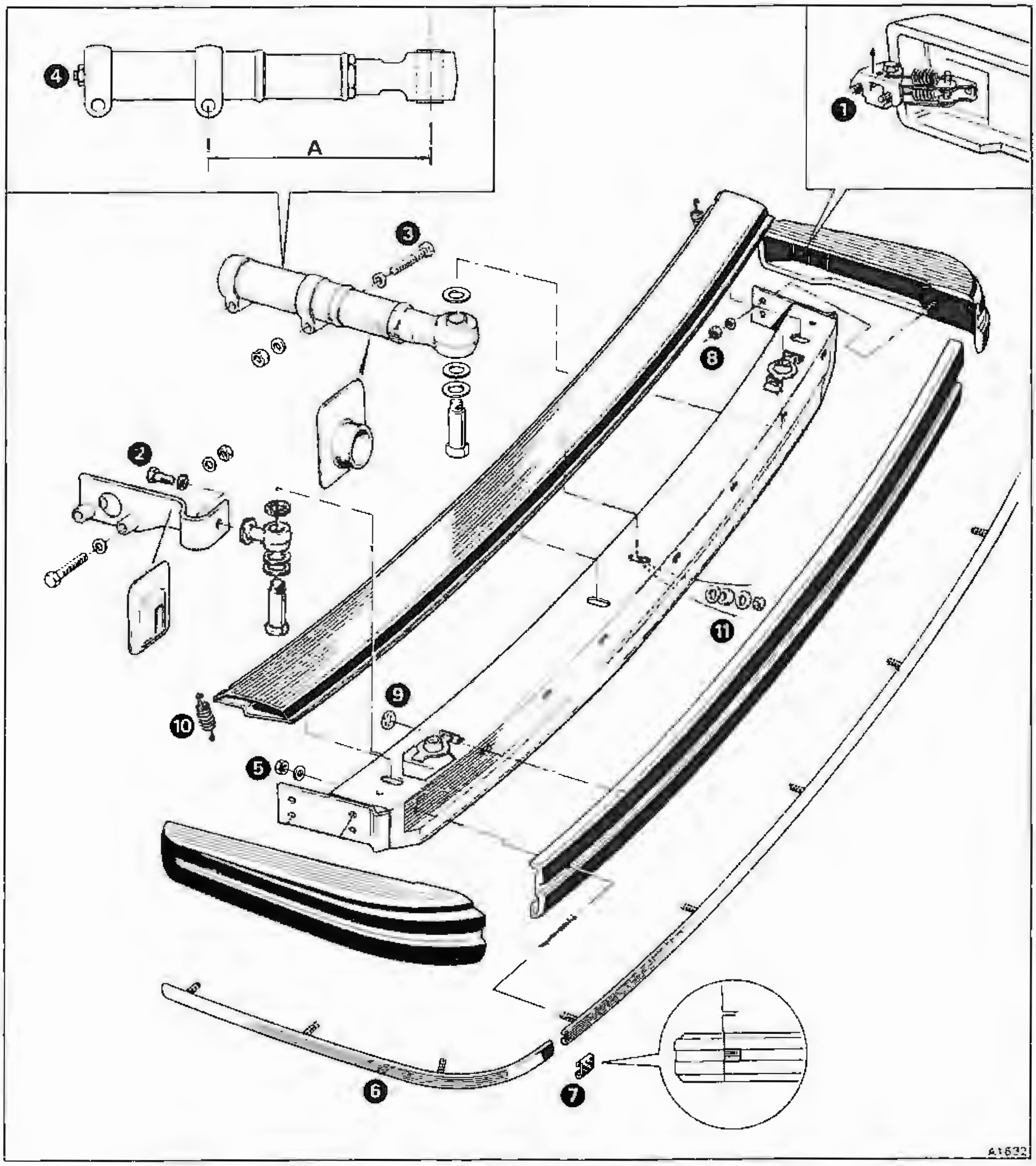


Fig. S10-4 Rear bumper assembly
A 204 mm – 205 mm (8.031 in – 8.071 in)

masking tape, secure the hose to the bumper finisher until the jet assembly is refitted.

To fit the jet reverse the removal procedure ensuring that the rubber seal (item 3) is positioned between the jet assembly and the bumper finisher.

Headlamp power wash jets – To adjust (see fig. S10-2)

1. To adjust the power wash jets shown in inset A it will be necessary to remove the jet covers as follows.

Obtain a length of thin wire and at one end form a 5mm (0.20 in) right angle bend. Loop the remaining end of the wire to form a handle.

Thread the wire hook inside the jet cover. Release each of the retaining legs in turn and remove the cover.

Using a suitable tool, align the jet nozzle so that the washer fluid strikes the centre of the headlamp lens. Care must be taken to avoid damaging the bumper finisher during this operation. Note that the power wash system will only operate when the headlamps are switched on.

Replace the jet covers.

2. The power wash jets shown in inset B can be adjusted by simply aligning each jet nozzle so that the washer fluid strikes the centre of each headlamp lens. Note that the power wash system will only operate when the headlamps are switched on.

Rear bumper assembly – To remove and fit
(see fig. S10-4)
Cars other than those conforming to a North American specification

1. Loosen the setscrews (item 1) securing each side moulding pivot bracket, then lift the side moulding slightly until the bracket is clear of the body.
2. With the help of an assistant, support the bumper and remove the bolts and washers (item 2) securing the bumper beam adapters to the mounting brackets. Then, carefully withdraw the bumper assembly.
3. If it is necessary to remove the bumper mounting brackets release the two bolts, nuts, and washers securing each bracket to the longeron. Then, withdraw the mounting brackets and aperture seals.
4. To fit the bumper assembly reverse the procedure given for removal.

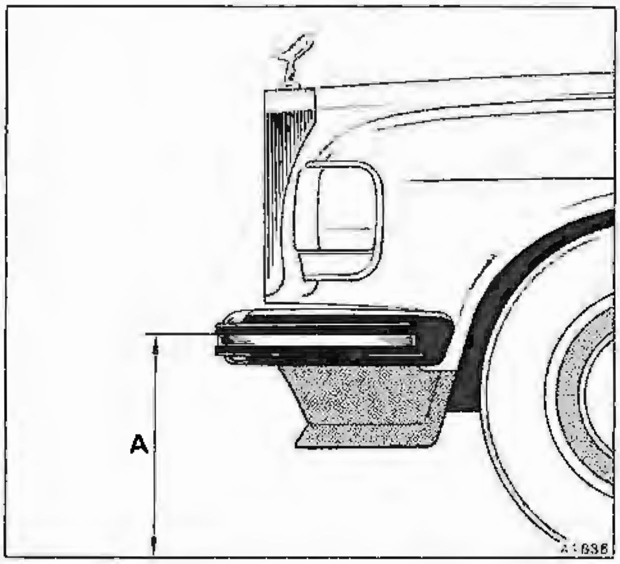


Fig. S10-5 Bumper height
A 445 mm (17.52 in) minimum

Rear bumper assembly – To remove and fit
(see fig. S10-4)
Cars conforming to a North American specification

1. Loosen the setscrews (item 1) securing each side moulding pivot bracket. Then, lift the side moulding slightly until the bracket is clear of the body.
2. With the help of an assistant, support the bumper and remove the bolts, nuts, and washers (item 3) securing the energy absorption units to the longerons. Then, carefully withdraw the bumper assembly and aperture seals.
3. If new energy absorption units are to be fitted proceed as follows.

Set each unit to the correct length by turning the piston rod adjusting nut (item 4) clockwise or anti-clockwise. The length of the unit is measured from the centre of the adapter to the centre of the outer mounting bolt hole (see dimension A).

When the length of the unit has been set, apply a small amount of Casco MLF 13 thread locking compound to the adjusting nut.

Apply silicone grease to the exposed threaded section of the piston rod, and protect the outer surface of the absorption unit with a light oil or grease.

4. To fit the bumper assembly reverse the procedure given for removal.

Rear bumper – To dismantle (see fig. S10-4)

1. Remove the bumper assembly (see Rear bumper assembly – To remove).
2. Loosen the front finishing strip retaining nut closest to each side moulding (item 5).
3. Release the nuts and washers securing each side finishing strip (item 6). Then, remove the strips and trim pieces (item 7).
4. Release the retaining nuts and washers, then remove the front finishing strip.
5. Release the nuts and washers (item 8) then remove the side mouldings.
6. Release the Starlock washers (item 9) and remove the front moulding.
7. Unhook the springs (item 10) from the finisher.
8. Release the nuts, plain washers, and rubber washers (item 11) then remove the finisher.
9. If it is necessary to remove the bumper mounting adapters/absorption units from the beam note the position and quantity of any spacing washers situated between the adapters and the beam.

Rear bumper – To assemble (see fig. S10-4)
Reverse the dismantling procedure noting the following.

1. Prior to fitting the adapters/absorption units to the beam ensure that the spacing washers are in their correct positions.
2. Prior to fitting the finisher, apply Tectyl 175 corrosion prevention material to the areas of the

aluminium beam that will come into contact with the finisher. This will prevent corrosion caused by the contact of dissimilar metals.

3. To ensure adequate retention of the front moulding, new Starlock washers should be fitted on assembly.

4. When fitting the finishing strips, apply a small amount of Keenomax C3 grease, or its equivalent, between the mild steel finishing strip retaining washers and the aluminium bumper beam. This will prevent corrosion caused by the contact of dissimilar metals.

Take care not to overtighten the finishing strip retaining nuts.

Bumper height – To check (see fig. S10-5)

1. Position the car on a level surface.
2. Ensure that the tyres are inflated to the correct pressures (see Chapter R).
3. Prior to measuring the bumper height, prepare the car by adopting either of the following procedures.

a. Fill the fuel tank.

b. Place the gear range selector lever in the park position and switch on the ignition. If the Low fuel warning panel illuminates, add 77 kg (170 lb) of ballast to the luggage compartment. The ballast should be positioned as near as possible to the fuel tank trim panel.

If the warning panel fails to illuminate when the car is gently rocked, drain the fuel from the tank until the warning panel does illuminate. Then, add the specified ballast to the luggage compartment.

Switch off the ignition.

4. Measure the front and rear bumper height to the position indicated in figure S10-5.
5. If the bumper height is below the specified minimum limit proceed as follows.

To eliminate suspension stiffness as a possible cause of incorrect bumper height, drive the car both forwards and in reverse two or three times then bring the car gently to rest. Check the bumper height.

If the bumper is within 1,58 mm (0.062 in) of the minimum height, the adapter to bumper beam mounting bolts should be removed and the spacing washer combination altered to produce an acceptable position.

Note If the bumper is fitted with energy absorption units and the type of power wash jets shown in figure S10-2, inset A, a clearance of approximately 5mm (0.20 in) must exist between the top of the bumper finisher and the front wing panels. This clearance will allow the bumper to retract without damaging the power wash jet covers.

6. If the bumper height of the car is still below the minimum limit, check the standing height of the car and adjust if necessary (see Chapter H).

Everflex roof trim

Contents

	Pages				
	Rolls-Royce		Bentley		
	Silver Spirit	Silver Spur	Eight	Mulsanne / Mulsanne S	Turbo R
Introduction	S11-3	S11-3	S11-3	S11-3	S11-3
Safety procedures	S11-3	S11-3	S11-3	S11-3	S11-3
Everflex roof trim – To remove	S11-3	S11-3	S11-3	S11-3	S11-3
Everflex roof trim – To fit	S11-5	S11-5	S11-5	S11-5	S11-5

Printed in England

Everflex roof trim

Introduction
When fitting an Everflex roof, it is essential that strict cleanliness is maintained and a high level of attention to detail observed.

Prior to commencing work, it should be noted that a number of special tools will be required. A stretching jig and windscreen/rear window aperture pegs will also have to be manufactured. The various tools needed, and the specification of the stretching jig and wooden pegs are shown in figure S11-2.

Safety procedures
The cleaners, primers, and adhesives referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Everflex roof trim – To remove (see fig. S11-1)
1. Disconnect the battery.
2. Remove the rear window and associated trim (see Rear window – To remove, Section S9).
3. Remove the windscreen and associated trim (see Windscreen – To remove, Section S8).
4. Remove the nut (item 1) and spacer securing each badge. Remove both badges.
5. Unscrew and remove both 'BC' post finishers (item 2).
6. Unscrew and remove both door aperture finisher joining pieces (item 3).
7. Unscrew and remove the front and rear door aperture finishers and seals (item 4).

Note On standard wheelbase cars, the stainless steel door aperture finishers are replaced by brass strips. These strips are screwed to the underside of the front and rear door apertures concealing the edge of the Everflex material.

8. To remove the tonneau mouldings (item 5) proceed as follows.

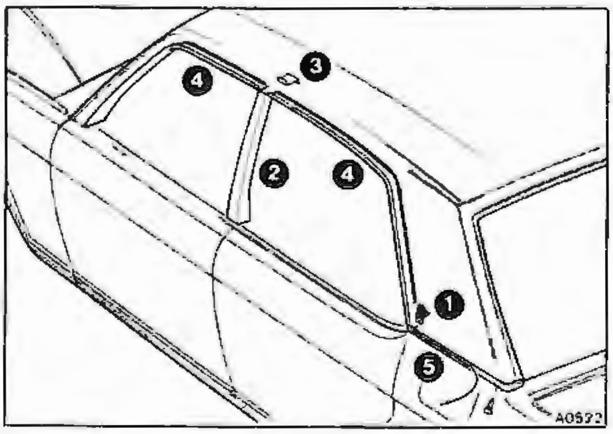


Fig. S11-1 Removal of the Everflex roof trim

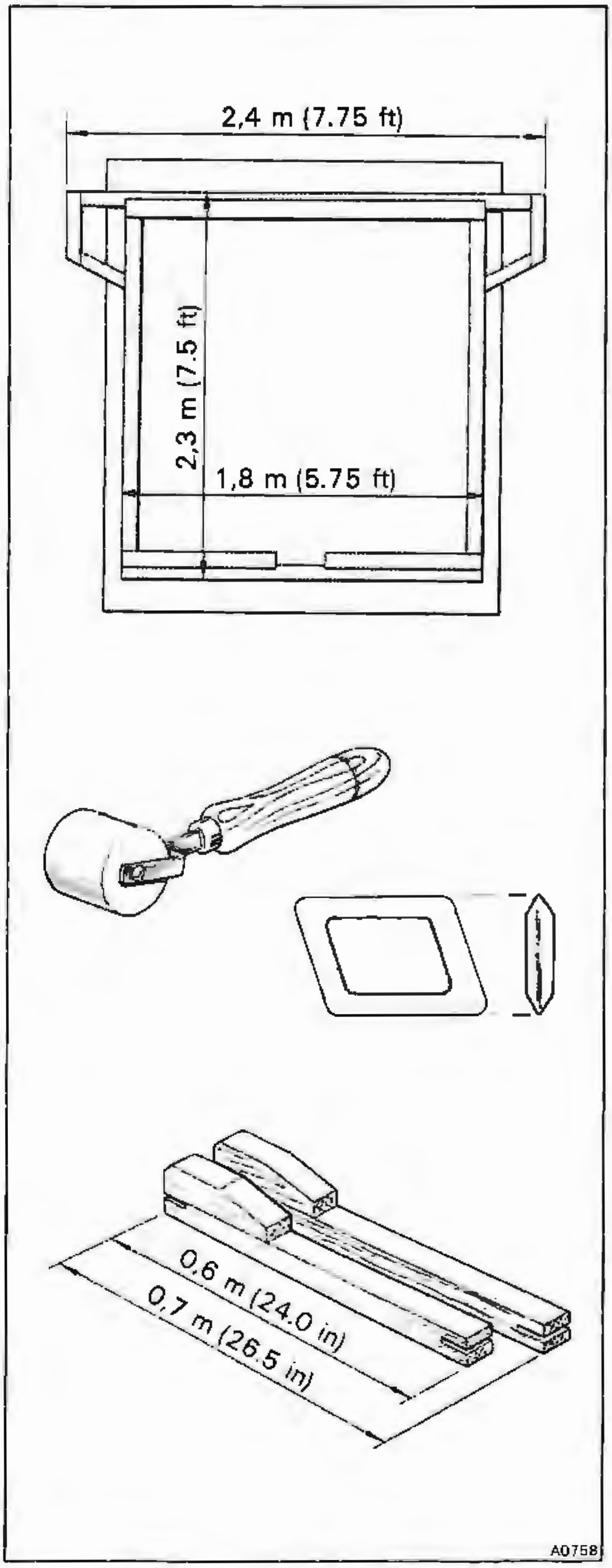
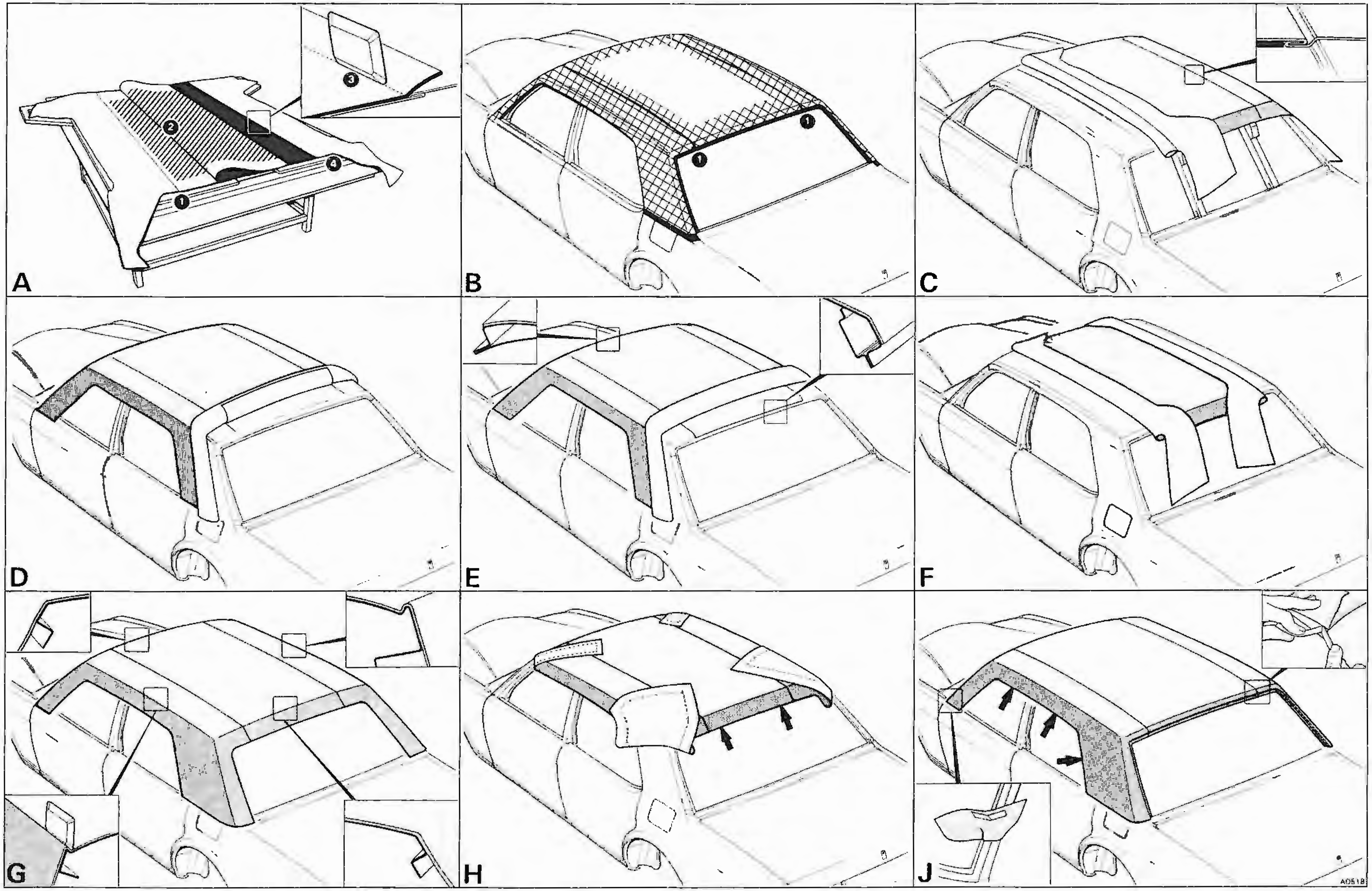


Fig. S11-2 Stretching jig and tools

Figure S11-3

Fitting of the Everflex roof trim



Dunlop L107 adhesive   Bostik Primer 9252   Boscoprene 2402 adhesive

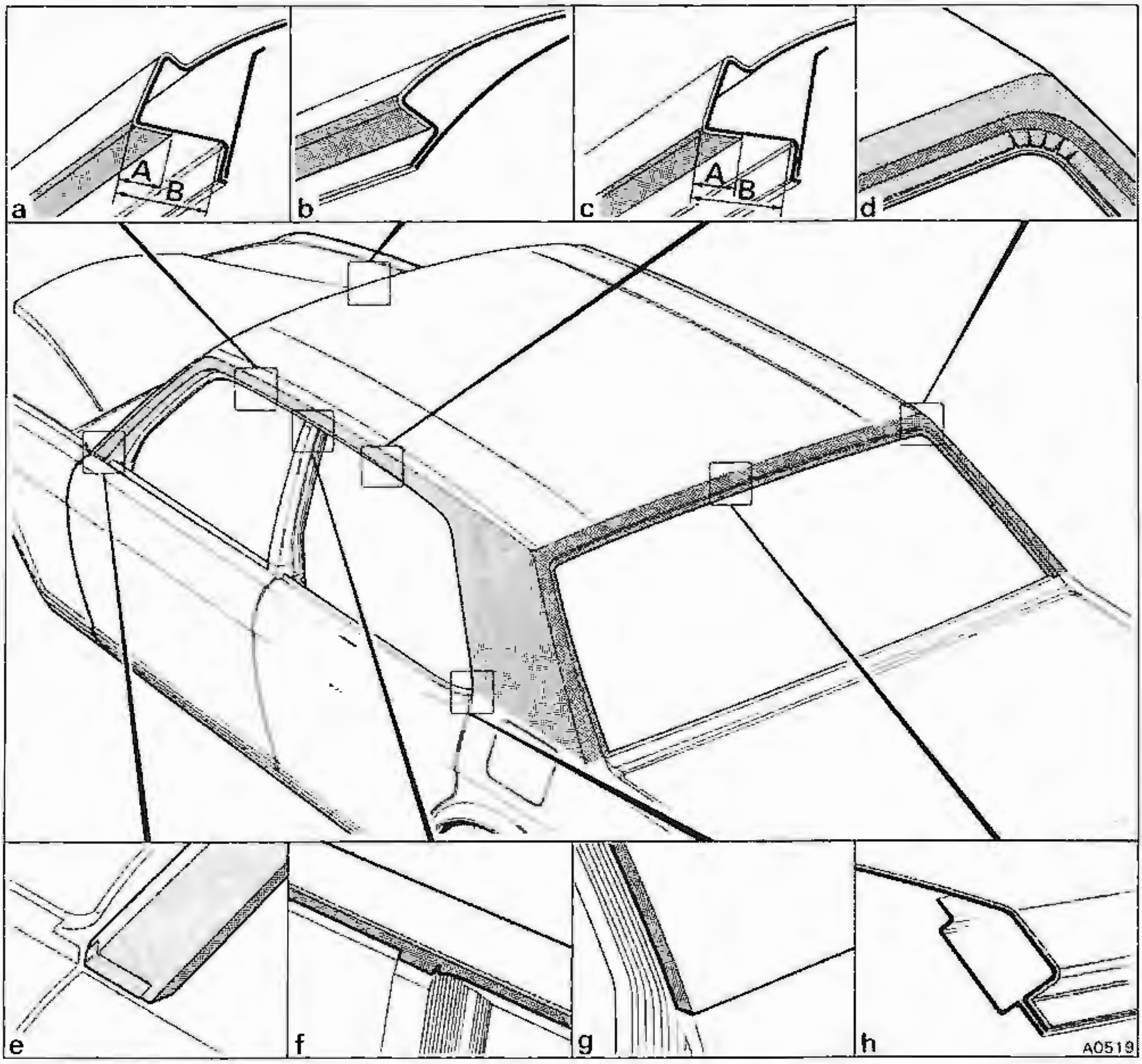


Fig. S11-4 Everflex roof trim
A 19,0 mm (0·75 in) approximately – Long wheelbase cars
B 44,5 mm (1·75 in) approximately – Standard wheelbase cars

Using a small screwdriver or similar tool, release the Everflex material and rubber insert from within each moulding.

Release the self-tapping screws and remove both mouldings.

9. Starting at the base of each 'A' post, completely peel the Everflex material from the car.

Everflex roof trim – To fit (see fig. S11-3)

1. Protect all the surrounding paintwork, except the area vacated by the Everflex material, with masking tape and clean felt or similar materials.
2. Completely remove the old adhesive from the roof panel, tonneau sides, and 'A' post panels using 180 grit wet or dry abrasive paper. Take care not to rub through the paintwork. Ensure that all areas of the roof, etc., where bonding is to take place are clean and dry.
3. Using a stretching jig similar to the one shown in figure S11-2, centralize and tack the four corners of the Everflex centre panel, outer surface upwards, to the frame. Ensure that the centre panel is lightly tensioned, then tack the Everflex side panels to the frame.
4. Wipe the outer surface of the Everflex material with a clean lint free cloth. Any creases in the material must be removed by applying warm air from a suitable heat source.

Refer to figure S11-3, inset A.
5. Place the frame, outer surface downwards, onto a suitable cloth covered bench. Then, apply a sealing coat of Boscoprene 2402 adhesive (parts 1 and 2) to both stitched seams in the areas indicated (item 1).
6. Position the Union Cloth flat on a suitable bench. Apply Dunlop L107 adhesive to within approximately 10 cm (4.0 in) of the front and rear of the cloth (item 2).

Similarly, apply Dunlop L107 adhesive to the centre panel of the Everflex material i.e. the area between the stitched seams.

Allow the adhesive to 'flash' dry (between 10 and 15 minutes). Then, with the help of an assistant, centralize and press the Union Cloth into position on the Everflex centre panel.
7. Using a hardwood grooving tool, similar to the one shown in figure S11-2, press the Union Cloth into position along the inside of both stitched seams (item 3).
8. Using a trimming knife, cut the Union Cloth exactly to the inside of the stitched seams, taking care not to damage the Everflex material.
9. Apply a sealing coat of Boscoprene 2402 adhesive (parts 1 and 2) to the Everflex side panels (item 4).

Refer to inset B.
10. Apply Bostik Primer 9252 to the previously prepared roof panel in the areas indicated. Allow at least one hour to dry.
11. Using a pencil, extend the roof panel styling lines to the rear window and windscreen apertures (item 1).

Refer to inset C.
12. Position wooden supports, similar to those shown in figure S11-2, in the rear window and windscreen apertures.
13. Remove the Everflex material from the stretching jig and place on the roof panel.
14. Align the stitched seams with the pencilled guide lines on the rear window aperture. Then, tack the corners of the Everflex centre panel to the wooden supports.

Similarly, align and tack the centre panel to the windscreen aperture supports, ensuring that the material is lightly tensioned.
15. Fold back the side panels to expose the roof panel styling lines and the Everflex stitched seams. Apply Boscoprene 2402 adhesive (parts 1 and 2) to the areas indicated.

Allow the adhesive to 'flash' dry.
16. Align the stitched seams parallel with the roof panel styling lines and press firmly into position. Using a tool similar to the one shown in figure S11-2, roll the styling line areas of the roof to ensure adhesion.

Refer to inset D.
17. Remove the wooden supports from the rear window and windscreen apertures.
18. Fold back the rear of the Everflex and Union Cloth. Apply Boscoprene 2402 adhesive (parts 1 and 2) to the roof panel and Union Cloth in the areas indicated. Allow the adhesive to 'flash' dry.

Refer to inset E.
19. Keeping the Union Cloth taut, press firmly onto the roof panel. Then, trim the cloth parallel with the inside of the rear window aperture.
20. Apply Boscoprene 2402 adhesive (parts 1 and 2) to the Everflex centre panel and Union Cloth as indicated. Allow the adhesive to 'flash' dry. Then, keeping the Everflex material taut, press firmly into position. Do not cut off the excess material at this stage.
21. Repeat Operations 18, 19, and 20 on the windscreen aperture.

Refer to inset F.
22. Fold back the Everflex side panels and apply Boscoprene 2402 adhesive (parts 1 and 2) to the areas indicated. Allow the adhesive to 'flash' dry. Then, keeping the Everflex material taut, press into position on the roof side panels.

Refer to inset G.
23. Using a hardwood grooving tool, carefully work the Everflex material into the rain channel.

Fold the Everflex material over onto the outer face of the cantrail and bond into position.
24. At this stage leave the Everflex material for at least sixteen hours to allow the adhesive to cure.

Refer to inset H.
25. Using a soft pencil, roughly mark the overhanging Everflex material as indicated.
26. To facilitate the fitting of the rear window, it is necessary to remove the double thickness of material from both stitched seams.

Unpick the seams on the overhanging Everflex material up to the rear window aperture as indicated (see inset J). Then, using a trimming knife, carefully remove the extra thickness of material. Tie off the last stitch on the underside of the Everflex material.
27. To facilitate fitting, make a series of small cuts in the Everflex material at both top corners of the rear window aperture. Ensure that the cuts do not extend further than those shown in figure S11-4, inset d.
28. Apply Boscoprene 2402 adhesive (parts 1 and 2) to the rear window aperture (arrowed), tonneau panels, and the corresponding Everflex material. Allow the adhesive to 'flash' dry. Then, keeping the material taut, press it firmly into position on the tonneau panels and around the rear window aperture. The hardwood grooving tool will assist during this operation.
29. Trim the excess Everflex material from around the rear window aperture as shown in figure S11-4, inset h.

Refer to inset J.
30. Carefully trim the Everflex material to fit around the upper 'BC' post (see fig. S11-4, inset f).
31. Apply Boscoprene 2402 adhesive (parts 1 and 2) to the underside of the cantrails, upper 'D' post panels (arrowed), and the corresponding Everflex material. Allow the adhesive to 'flash' dry. Then, keeping the material taut, press firmly into position.
32. To facilitate the fitting of the windscreen, it is necessary to remove the double thickness of material from both stitched seams.

Unpick the seams on the overhanging Everflex material up to the windscreen aperture. Then, using a trimming knife, carefully remove the extra thickness of material. Tie off the last stitch on the underside of the Everflex material.

33. Apply Boscoprene 2402 adhesive (parts 1 and 2) to the top of the windscreen aperture and to the corresponding Everflex material. Allow the adhesive to 'flash' dry. Then, keeping the material taut, press firmly into position along the top of the windscreen aperture. The hardwood grooving tool will assist during this operation.

34. Apply Boscoprene 2402 adhesive (parts 1 and 2) to both 'A' posts, up to approximately 10 cm (4.0 in) from the base of each post. Also apply the adhesive to the corresponding Everflex material (see fig. S11-3, inset H). Allow the adhesive to 'flash' dry. Then, keeping the material taut, press it firmly into position on the 'A' posts; also around the sides of the windscreen and front door apertures. The hardwood grooving tool will assist during this operation.

35. To fit the brass 'A' post finishing strips proceed as follows referring to inset J.

Fold back the Everflex material from the base of each 'A' post.

Fit the brass strip around the base of each 'A' post, parallel with the top edge of the front door panel.

Trim the overhanging Everflex material from the base of the 'A' post, approximately 12 mm (0.50 in) below the brass strip.

Apply Boscoprene 2402 adhesive (parts 1 and 2) to the brass strip and the bottom edge of the corresponding Everflex material. Allow the adhesive to 'flash' dry.

Holding the brass strip in position, press the Everflex material firmly onto the base of the 'A' post. Fold back the Everflex material together with the brass strip. The strip is now in its correct position.

Apply Boscoprene 2402 adhesive (parts 1 and 2) to the brass strip and the edge of the Everflex material i.e. the area below the brass strip. Allow the adhesive to 'flash' dry. Then, cut and fold the Everflex material into position on the brass strip.

Apply Boscoprene 2402 adhesive (parts 1 and 2) to the lower area of the 'A' post and to the corresponding Everflex material. Allow the adhesive to 'flash' dry. Then, keeping the material taut, press firmly into position on the 'A' post.

36. Trim the excess Everflex material from around the windscreen aperture as shown in figure S11-4, inset b.

37. Trim the excess Everflex material from around the front and rear door apertures to the dimensions shown in figure S11-4, insets a and c.

38. Trim the excess Everflex material from the tonneau panels, ensuring that the cut edge of the material will be covered by the tonneau moulding but will not show beneath it.

39. Refit the items previously removed by reversing the removal procedure noting the following.

Prior to fitting the tonneau mouldings and badges, apply a thin bead of Bostik Seelastik to the rear face of each. Use black Seelastik on cars fitted with dark coloured Everflex and cream Seelastik on cars fitted with light coloured Everflex.

40. Ensure that the roof is thoroughly cleaned. Remove any excess adhesive using a clean lint free cloth moistened with Genklene. **Extreme care must be taken to avoid Genklene coming into contact with the paintwork.**

41. Using a clean lint free cloth or sponge, apply a protective coating of Everflex Top Dressing to all areas of the Everflex. This gives the roof a glossy appearance and prevents dirt becoming trapped in the grain of the Everflex material. Allow the Top Dressing to dry for fifteen minutes then apply a second coat.

If any of the liquid is spilt on the paintwork it must be removed before it dries.

Clean the cloth or sponge and any container used by rinsing them with water.

42. Using a clean lint free cloth, apply Barbour Thornproof Waterproof Dressing to both stitched seams. Ensure that the Waterproof Dressing is thoroughly worked into the stitch holes in the seams.

Exterior fittings

Contents

5/88
Printed in England

Contents

Exterior fittings

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

Safety procedures
The cleaner, primers, and adhesive referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Radiator shell – To remove (see fig. S12-1)
1. Raise the bonnet.
2. Support the radiator shell, then remove the Allen headed setscrews and washers (item 1).
3. Lift the shell to disengage the lower mounting pegs (item 2). Remove the radiator shell taking care not to damage the paintwork.

Radiator shell – To fit (see fig. S12-1)
Reverse the procedure given for removal noting the following.
1. Check the condition of the rubber grommets (item 3) situated in the lower mounting brackets. Renew if necessary.
2. After fitting the radiator shell, carefully close the bonnet and check the shell to bonnet alignment. Adjust if necessary.

Rolls-Royce radiator shell – To dismantle
(see fig. S12-2)
Cars other than those fitted with a retractable mascot.
1. Remove the radiator shell.
2. Protect the polished surface of the radiator shell with masking tape. Then, place it face downwards onto a suitably covered bench.
3. Slacken the Allen headed setscrew (item 1) until the mascot assembly can be withdrawn from the shell.

Warning If a chrome finisher button (item 2) is fitted care must be taken when unscrewing the setscrew (item 1). A spring is situated underneath the button and could suddenly eject the button as the setscrew is released.

4. Unscrew and remove the radiator shell lower mounting brackets (item 3).
5. To remove the radiator vane assembly proceed as follows.

Drill out the two pop rivets (item 4). Then, remove the screws (item 5) securing the radiator vanes to the shell.

Carefully withdraw the vane assembly from the shell.

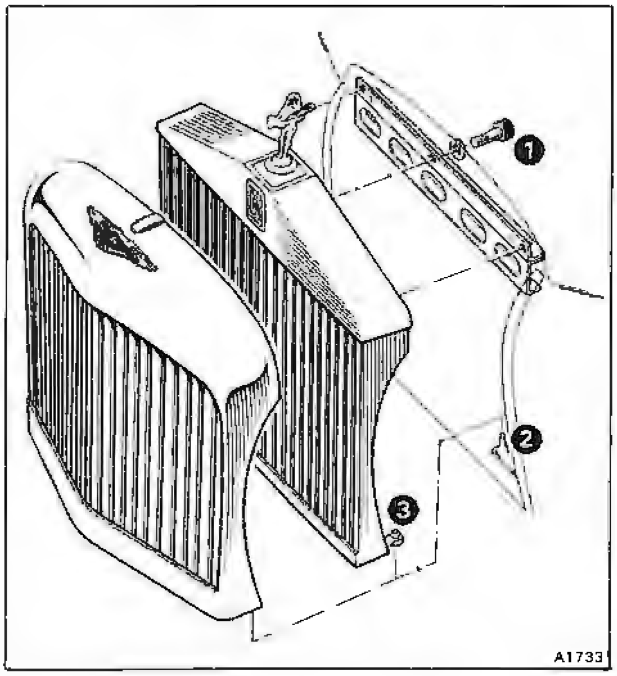


Fig. S12-1 Radiator shell mounting arrangement

Rolls-Royce radiator shell – To assemble
(see fig. S12-2)
Cars other than those fitted with a retractable mascot.
If the original radiator vane assembly is to be refitted reverse the procedure given for dismantling.

If a new radiator vane assembly is to be fitted proceed as follows.
1. Position the vane assembly centrally in the radiator shell.
2. Secure the bottom of the vane assembly using the setscrews (item 5).
3. Using the shell to body Allen headed setscrews (item 6) temporarily secure the top of the vane assembly to the radiator shell.
4. Using the existing holes in the radiator shell backplate as a guide, drill two 3,17 mm (0.125 in) clearance holes through the radiator vane upper bearing plate (item 4).
5. To prevent corrosion, treat any bare metal with etching primer and a suitable air-drying paint.
6. Secure the top of the vane assembly to the radiator shell using two 3,17 mm (0.125 in) diameter pop rivets.
7. Remove the Allen headed setscrews (item 6).

Rolls-Royce radiator shell – To dismantle
(see fig. S12-3)
Cars fitted with a retractable mascot.
1. Remove the radiator shell.
2. Protect the polished surface of the radiator shell

with masking tape. Then, place it face downwards onto a suitably covered bench.

3. With the mascot retract mechanism in the raised position, remove the nut and washer (item 1). Then, withdraw the mascot assembly.

4. Unscrew and remove the radiator shell lower mounting brackets (item 2).

5. To remove the radiator vane/retract mechanism assembly proceed as follows.

Retract the mechanism.

Drill out the two pop rivets (item 3). Then, remove the screws (item 4) securing the radiator vanes to the shell.

Carefully withdraw the vane/retract mechanism assembly from the radiator shell.

Rolls-Royce radiator shell – To assemble
(see fig. S12-3)
Cars fitted with a retractable mascot.
If the original radiator vane assembly is to be refitted reverse the procedure given for dismantling.

If a new radiator vane assembly is to be fitted proceed as follows.

1. Transfer the mascot retract mechanism to the new radiator vane assembly (see Retract mechanism – To dismantle and assemble).

2. Position the vane/retract mechanism assembly centrally in the radiator shell. Carefully ease the mascot plinth lugs (item 5) over the guide bracket. Secure the bottom of the vane assembly using the setscrews (item 4).

3. Using the shell to body Allen headed setscrews (item 6) temporarily secure the top of the vane assembly to the radiator shell.

4. Using the existing holes in the radiator shell backplate as a guide, drill two 3,17 mm (0.125 in) clearance holes through the radiator vane upper bearing plate (item 3).

5. To prevent corrosion, treat any bare metal with etching primer and a suitable air-drying paint.

6. Secure the top of the vane assembly to the radiator shell using two 3,17 mm (0.125 in) diameter pop rivets.

7. Remove the Allen headed setscrews (item 6).

8. With the retract mechanism in the raised position, fit the mascot assembly.

Ensure that the mascot is positioned centrally with the hole in the mascot plinth. If necessary, retract the mascot and adjust the position of the mechanism by releasing the setscrews securing it to the radiator vane upper bearing plate.

9. To set the retract mechanism overtravel stop proceed as follows.

Retract the mascot.

Release the lock-nut (item 7). Then, adjust the length of the overtravel stop until the wing tip of the

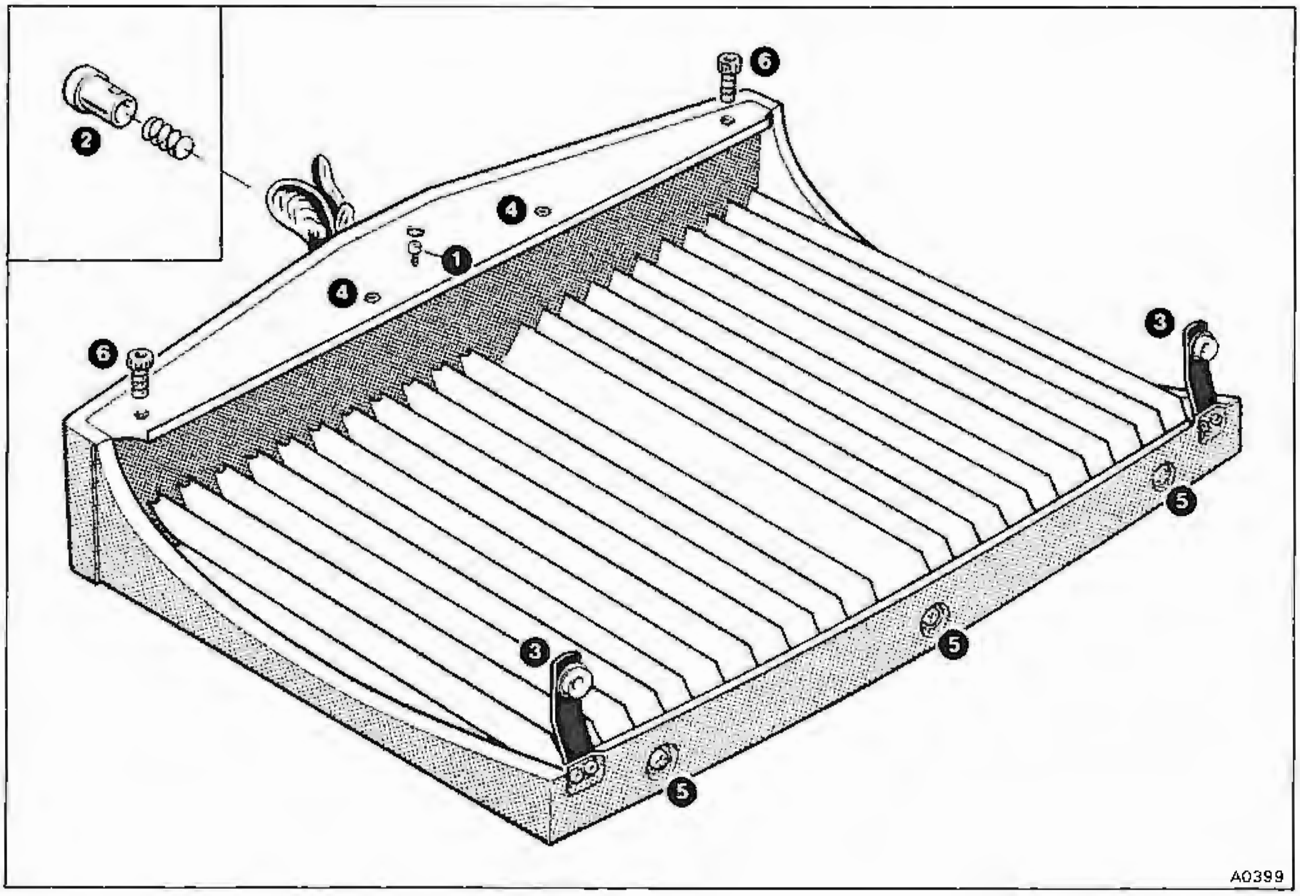


Fig. S12-2 Radiator shell (non-retractable mascot)

mascot protrudes a maximum of 10 mm (0.393 in) above the surface of the radiator shell (see dimension A).

Tighten the lock-nut.

10. Check that the retract mechanism operates when the mascot is moved forwards, rearwards, or deflected from side to side.

Mascot retract mechanism – (Hydraulic damper) – To dismantle and assemble (see fig. S12-4)

1. Dismantle the radiator shell.
2. Slacken the setscrew (item 1), then remove the mascot plinth and spring assembly (item 2).
3. Remove the bolt (item 3), spring, and nut securing the damper to the upper mounting plate.
4. Remove the setscrews (item 4), clamping plate, and washer securing the retract mechanism to the radiator vane assembly. Withdraw the mechanism.
5. To remove the damper proceed as follows.

   With the mechanism in the retracted position, release the circlip (item 5).

   Remove the pivot pin. Note the position and quantity of any spacing washers situated between the operating lever and the clevis jaw of the damper.

   Remove the damper.
6. Unhook the retract spring (item 6) from the mascot spring container link arms.
7. Unhook and remove the pawl spring (item 7).

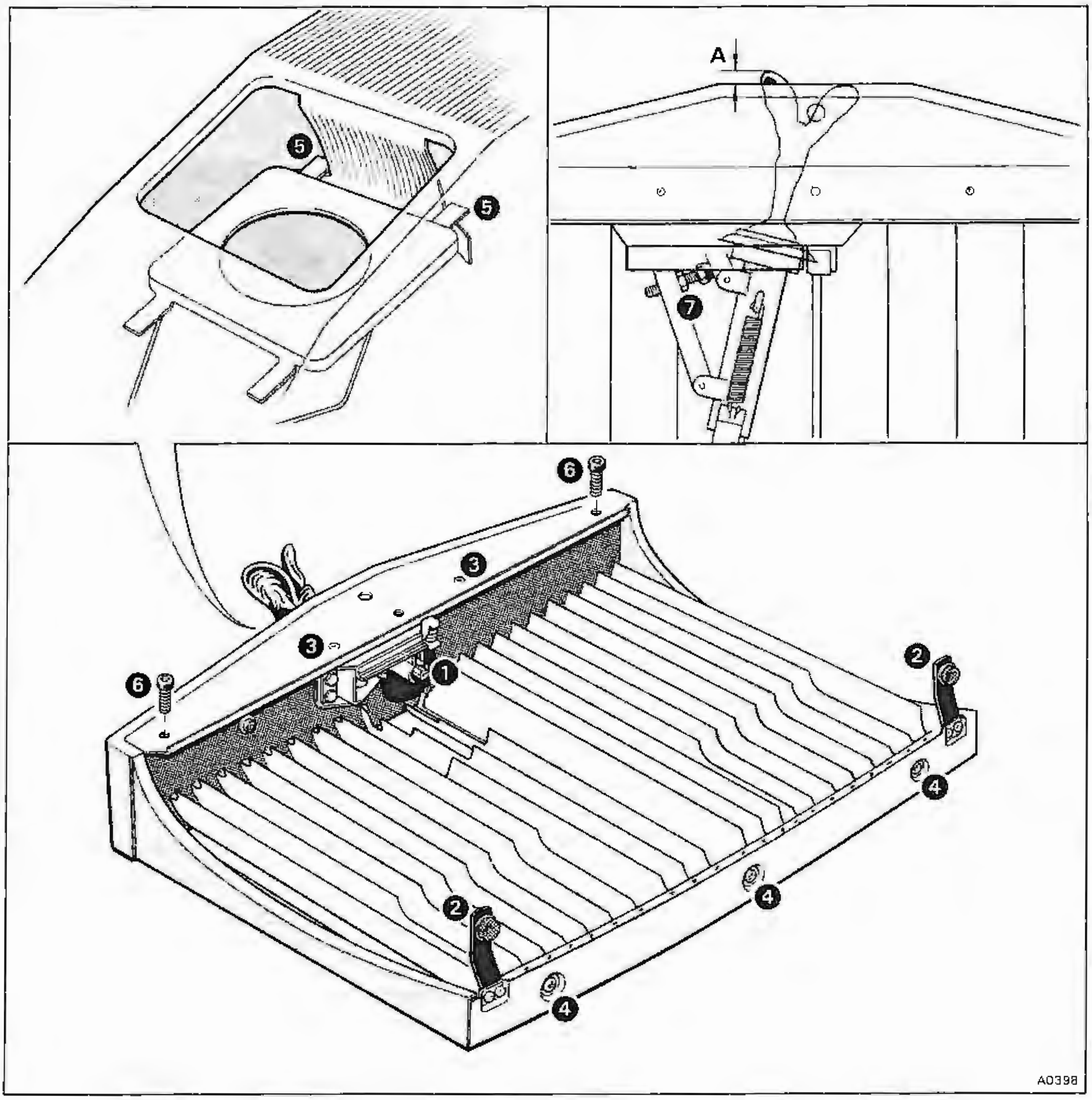


Fig. S12-3 Radiator shell (retractable mascot)

8. To remove the detent spring (item 8) proceed as follows.

Remove the roll pin (item 9) securing the detent lever (item 10) to the retract mechanism mounting bracket.

Remove the lever and spring.

9. To remove the mascot container spring (item 11) proceed as follows noting that the spring is in a compressed state and could suddenly eject when the roll pins (item 12) are removed.

Remove the roll pins (item 12) securing the tab-washer (item 13) and spring. Remove the spring.

10. To remove the mascot finisher spring (item 14) carefully unwind the spring over the finisher ring (item 15). Care must be taken not to distort the spring or damage the surface of the ring.

11. To assemble the retract mechanism reverse Operations 1 to 10 inclusive, noting the following.

To ensure the correct operation of the retract mechanism, new roll pins should be fitted on assembly.

When securing the damper to the radiator vane

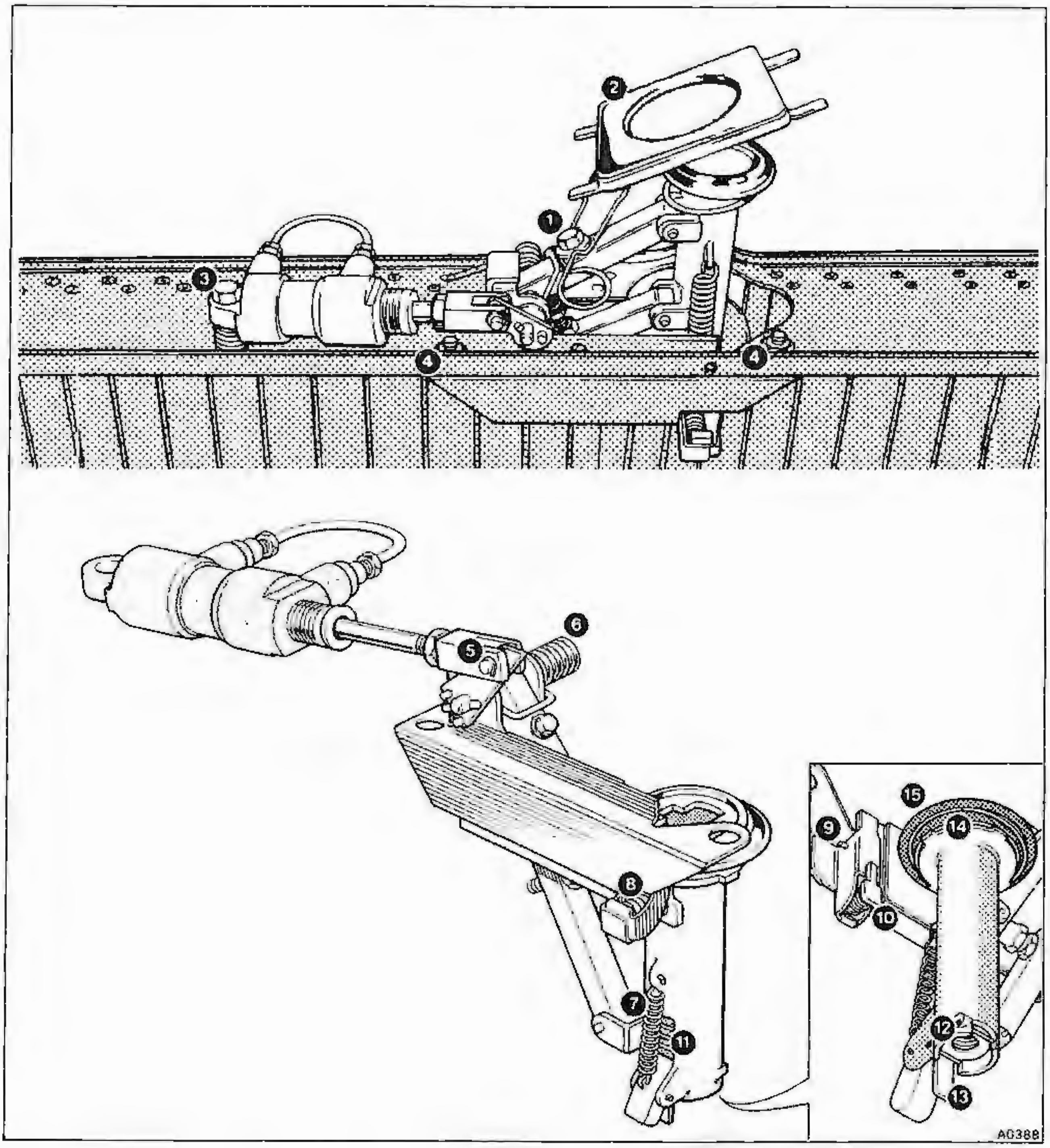


Fig. S12-4 Mascot retract mechanism (hydraulic damper)

bearing plate, tighten the bolt until the body of the damper is parallel to the bearing plate.

All springs and pivot points should be lubricated with Shell Retinax 'A' grease, or its equivalent.

Mascot retract mechanism – (Gas spring damper) – To dismantle and assemble (see fig. S12-5)

1. Dismantle the radiator shell.
2. Slacken the setscrew (item 1), then remove the mascot plinth and spring assembly (item 2).
3. Unclip the damper unit from the ball pin situated on the upper mounting plate (item 3).
4. Remove the setscrews (item 4), clamping plate, and washer securing the retract mechanism to the radiator vane assembly. Withdraw the mechanism.
5. To remove the damper proceed as follows.

With the mechanism in the retracted position, release the spring pin (item 5). Note the position and quantity of any spacing washers situated between the operating lever and the clevis jaw of the damper.

Remove the damper.

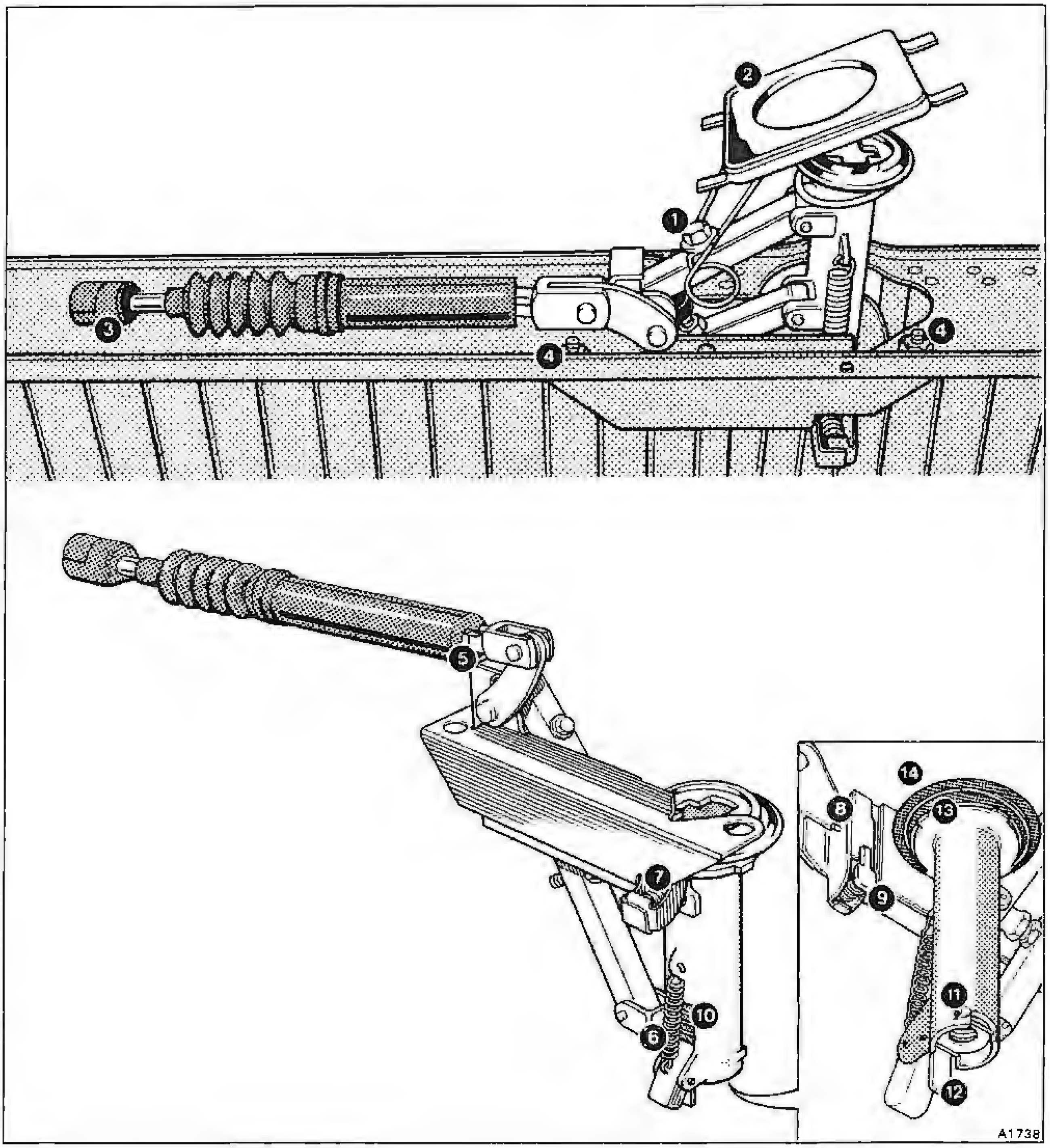


Fig. S12-5 Mascot retract mechanism (gas spring damper)

Warning The gas spring damper is a pressurized unit and no attempt should be made to dismantle it.

6. Unhook and remove the pawl spring (item 6).
7. To remove the detent spring (item 7) proceed as follows.

Remove the roll pin (item 8) securing the detent lever (item 9) to the retract mechanism mounting bracket.

Remove the lever and spring.

8. To remove the mascot container spring (item 10) proceed as follows noting that the spring is in a compressed state and could suddenly eject when the roll pins (item 11) are removed.

Remove the roll pins (item 11) securing the tab-washer (item 12) and spring. Remove the spring.

9. To remove the mascot finisher spring (item 13) carefully unwind the spring over the finisher ring (item 14). Care must be taken not to distort the spring or damage the surface of the ring.
10. To assemble the retract mechanism reverse Operations 1 to 9 inclusive, noting the following.

To ensure the correct operation of the retract mechanism, new roll pins should be fitted on assembly.

All springs and pivot points should be lubricated with Shell Retinax 'A' grease, or its equivalent.

Bentley Eight radiator shell – To dismantle and assemble (see fig. S12-6)

1. Remove the radiator shell.
2. Protect the polished surface of the radiator shell with masking tape. Then, place it face downwards onto a suitably covered bench.
3. Unscrew and remove the radiator shell lower mounting brackets (item 1).
4. To remove the radiator shell grille proceed as follows.

Remove the retaining nuts (item 2) securing the grille to the radiator shell.

Remove the clamping plates, then withdraw the grille from the radiator shell.

5. Release the nuts and spring washers (item 3), then remove the Bentley motif and nose trim.
6. To assemble the radiator shell reverse Operations 1 to 5 inclusive noting the following.

To prevent corrosion, coat the assembled grille retaining nuts (item 2) and clamping plates with Tectyl, or its equivalent.

Bentley Mulsanne, Mulsanne S, and Turbo R radiator shell – To dismantle and assemble (see fig. S12-7)

1. Remove the radiator shell.
2. Protect the polished/painted surface of the radiator shell with masking tape. Then, place it face downwards onto a suitably covered bench.
3. Unscrew and remove the radiator shell lower mounting brackets (item 1).
4. Remove the setscrews and washers (item 2) securing each vane assembly to the radiator shell. Carefully withdraw both vane assemblies.
5. Release the nuts and spring washers (item 3),

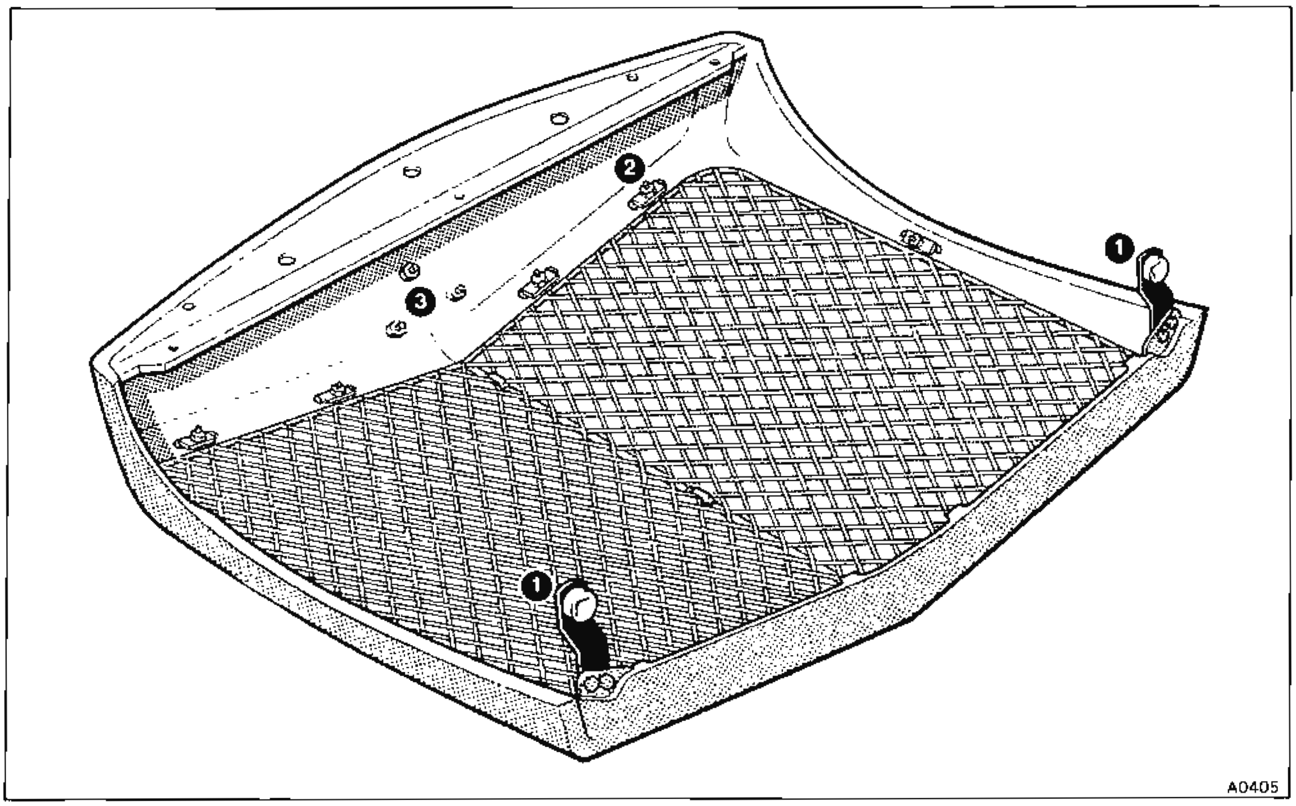


Fig. S12-6 Radiator shell – Bentley Eight

then remove the Bentley motif and nose trim.
6. To assemble the radiator shell reverse Operations 1 to 5 inclusive.

Headlamp surround – To remove and fit
(see fig. S12-8, inset A)
Cars other than those fitted with twin round headlamps.
1. Remove the screw (item 1) securing the outboard end of the lower trim strip. Carefully detach the strip from the clips (item 2) situated below the headlamp unit(s).
2. Carefully remove the headlamp surround (item 3) by detaching it from the six retaining clips situated around the headlamp aperture, taking care not to damage the paintwork.
3. If it is necessary to renew the headlamp surround retaining clips proceed as follows.
Disconnect the battery.
Remove the headlamp and side lamp units, refer to TSD 4701 Electrical Manual. Note that on cars fitted with twin rectangular headlamps, sufficient access can be gained, without the removal of the headlamp units, by unscrewing and removing the black plastic headlamp finisher.
Using a suitable tool, remove and discard the surround retaining clips taking care not to damage the paintwork.
Fit the clips and fasteners in position and secure by tapping the retaining pegs (item 4) into position.
4. Check the condition of the self-adhesive headlamp aperture seals (item 5) and renew if necessary.
5. To fit the headlamp surround reverse the removal procedure.

Headlamp surround and side/position lamp assembly – To remove and fit (see fig. S12-8, inset B)
Cars fitted with twin round headlamps.
1. Disconnect the battery.
2. Raise the bonnet.
3. Support the headlamp surround and side lamp assembly. Then, turn the two reach bolts (item 1) anti-clockwise until the surround assembly is released. Withdraw the surround and release the side lamp connectors (item 2). Note the position of the leads to ensure correct assembly.
4. Check the condition of the self-adhesive headlamp aperture seals and renew if necessary.
5. To fit the headlamp surround and side lamp assembly reverse the removal procedure.

Air dam – To remove and fit (see fig. S12-9)
1. Raise the front of the car (see Chapter R).
2. Remove the five nuts and washers (item 1) securing each snow shield.
3. Manoeuvre the snow shields clear of the retaining studs and remove, disconnecting the air horns (if fitted) situated inside the left-hand snow shield.
4. If bumper mounted fog lamps are fitted, disconnect the battery and release the connectors (item 2). Release the bolts, nuts, and washers (item 3) and remove the fog lamps.

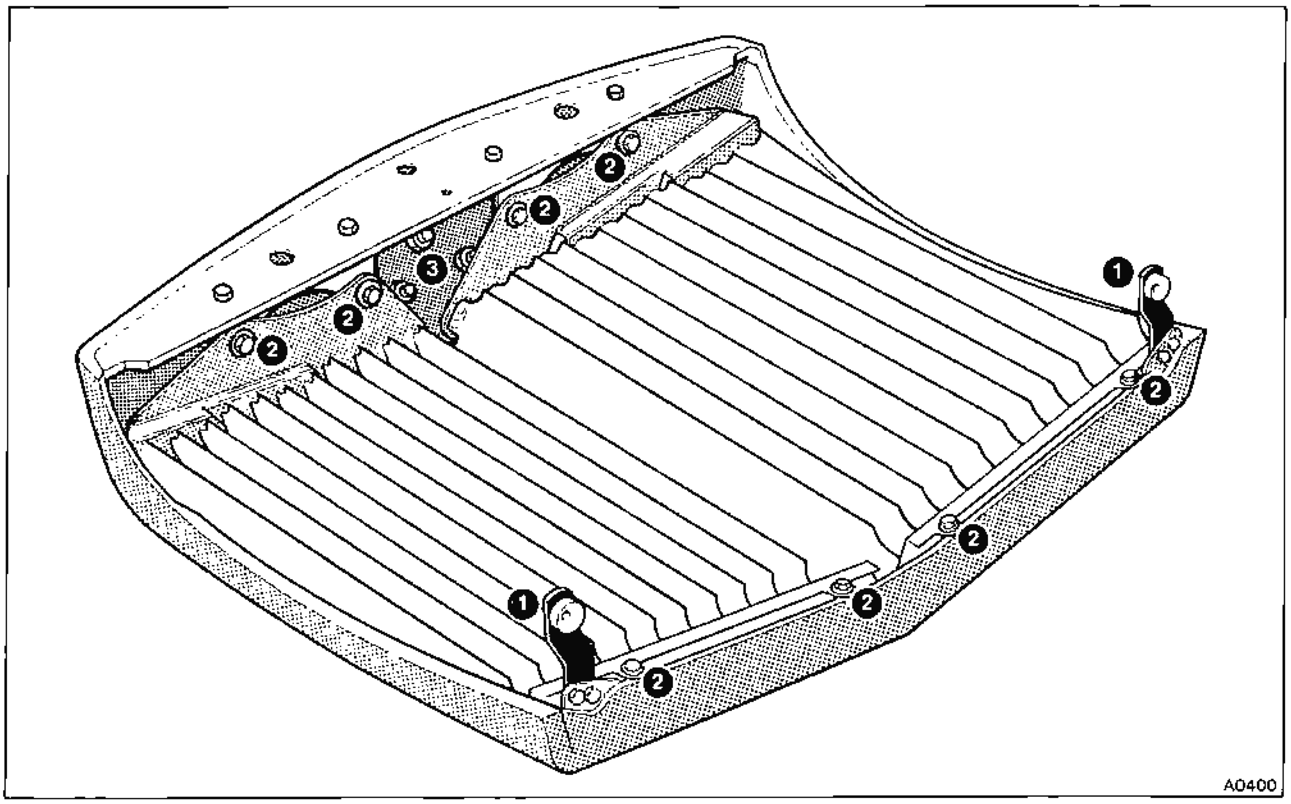


Fig. S12-7 Radiator shell – Bentley Mulsanne, Mulsanne S, and Turbo R

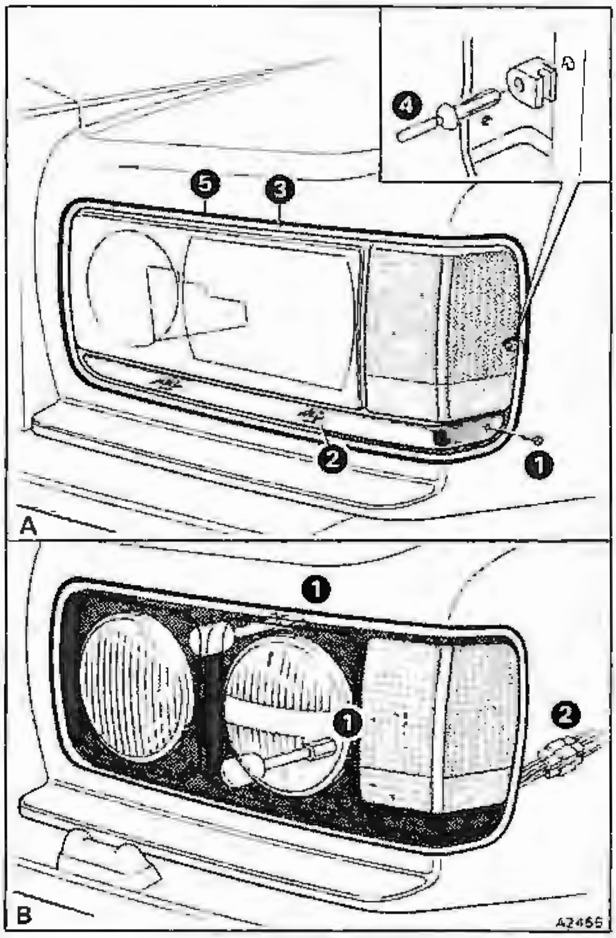


Fig. S12-8 Headlamp surrounds
A Cars other than those fitted with twin round headlamps
B Cars fitted with twin round headlamps

5. From underneath the centre of the air dam, lift the rubber sealing flap to disengage it from the brackets situated on the radiator assembly (item 4).
6. Remove the nuts, washers, and clamping plates (item 5) securing the air dam to the front wing panels.
7. Support the air dam. Then, remove the four bolts, nuts, and washers (item 6). Remove the air dam.
8. To fit the air dam reverse the removal procedure noting the following.

Prior to fitting the air dam, apply a bead of Sikaflex sealant between the air dam to wing panel joints.

Ensure that the rubber sealing flap is held in position by the brackets situated on the radiator assembly.

Front wing undersheets – To remove (see fig. S12-10)
1. Raise the bonnet.
2. To protect the paintwork, fit front wing covers RH2684.
3. Raise the front of the car and remove the road wheels (see Chapter R).
4. From inside the engine compartment, remove the plastic thread protectors (item 1) from the undersheet screws.
5. Remove the self-tapping screws (item 2) securing the rear section of the undersheet to the valance panel.
6. Carefully break the seal between the undersheet and the valance panel, then remove the rear section of the undersheet.
7. Remove the self-tapping screws (item 3) securing the front section of the undersheet to the valance panel.
8. Release the three nuts and washers (item 4) securing the front of the undersheet to the snow shield.
9. Carefully break the seal between the undersheet

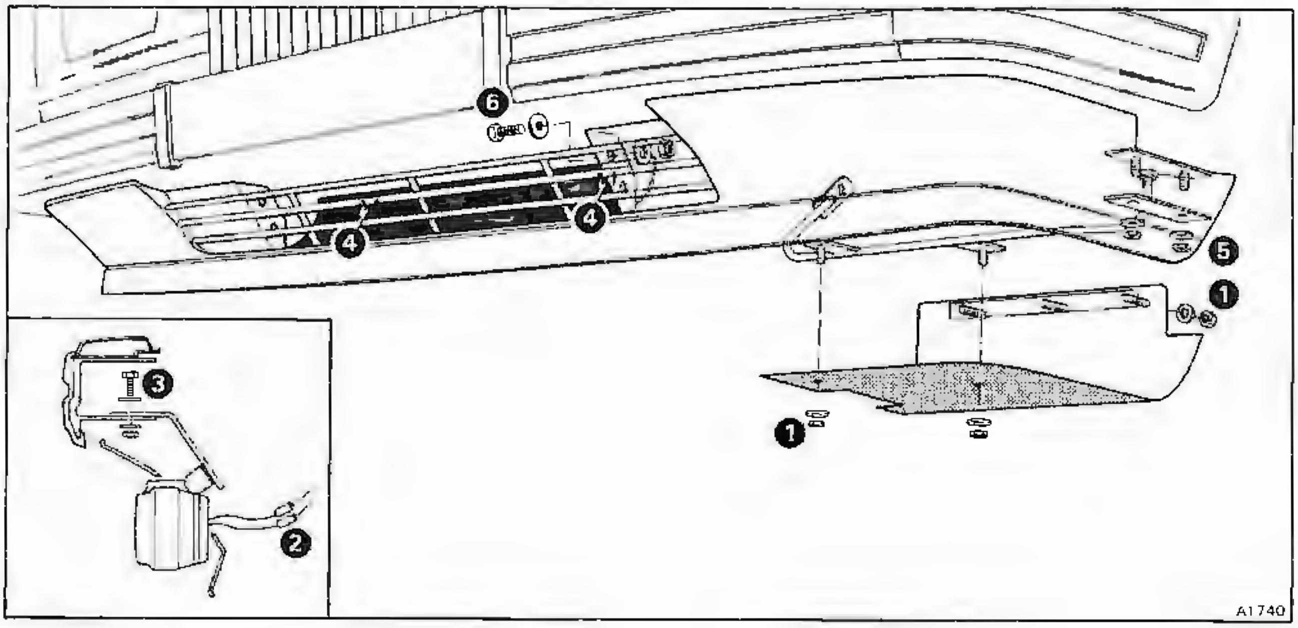


Fig. S12-9 Air dam mounting arrangement

and the valance panel, then remove the front section of the undersheet.

Front wing undersheets – To fit (see fig. S12-10)
Reverse the procedure given for removal noting the following.
1. To prevent possible water ingress, ensure that the wheel-arch sealing strip (item 5) is in good condition and forms a waterproof seal when the undersheets are fitted. Renew if necessary.
2. Apply a bead of Bostik Seelastik, or its equivalent, to the joint between the front and rear sections of the undersheet and between the undersheet and valance panel.

Bonnet moulding – To remove and fit (see fig. S12-11)
1. Raise the bonnet.
2. Remove the domed nuts and large washers (item 1).
3. Release the self-tapping screws (item 2) and remove the bonnet pads. It may be necessary to loosen the bonnet lamp mounting bracket to facilitate removal of the rear bonnet pad.
4. Remove the nut and washer (item 3) securing the front of the moulding.
5. Remove the screw and washer (item 4) securing the rear of the moulding.
6. Remove the five retaining nuts (item 5), plain washers, and rubber sealing washers.
7. Remove the bonnet moulding complete with retaining studs, taking care not to damage the paintwork.
8. To fit the moulding reverse the removal procedure noting the following.

To prevent water ingress it is important that the sealing washers are positioned between the plain washers and the bonnet panel.

Take care not to overtighten the bonnet moulding securing nuts.

Air intake grilles and scuttle panel – To remove (see fig. S12-12)
1. Disconnect the battery.
2. Raise the bonnet.
3. To protect the paintwork, fit front wing covers RH2684.
4. To remove the windscreen wiper arm assemblies proceed as follows.

Unclip the plastic covers and remove the wiper arm securing nuts (item 1).

Loosen the Allen headed setscrew (item 2). Then, using extractor tool RH9623 carefully remove each wiper arm assembly.
5. Unscrew and remove the air intake grilles (item 3) and foam filters (if fitted).
6. Remove the four setscrews (item 4).
7. Loosen the setscrews (item 5). Then, lift the front of the scuttle panel slightly and pull it forward to disengage the rear retaining clips.

Disconnect the windscreen washer hoses and remove the panel.

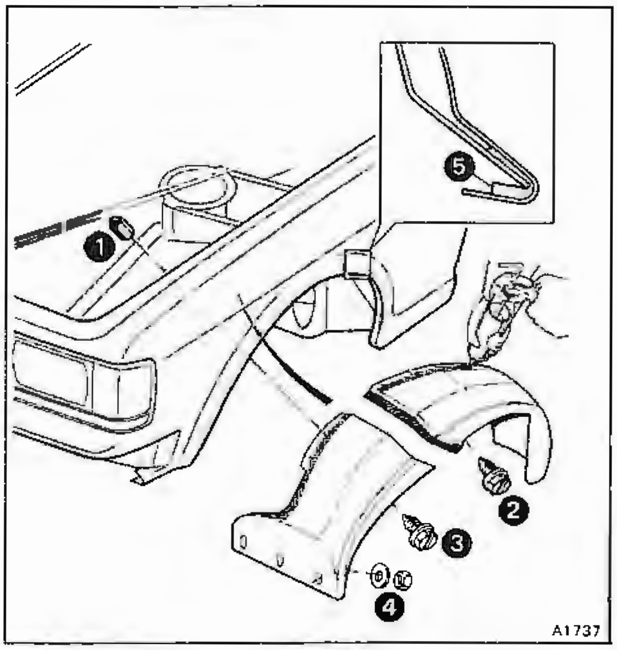


Fig. S12-10 Front wing undersheets

Air intake grilles and scuttle panel – To fit (see fig. S12-12)
Reverse the procedure given for removal noting the following.
1. Ensure that the scuttle panel is secured by the rear retaining clips.
2. Check that the scuttle panel fits flush with the top of the front wings.
3. If foam air intake grilles are fitted, check that they are not damaged or excessively dirty.
4. Check that the windscreen wipers and washers operate correctly and that the wipers park correctly.

Door aperture finishers (if fitted) – To remove and fit
The stainless steel door aperture finishers are simply secured to the underside of the front and rear door apertures using self-tapping screws. A small cover conceals the joint between the front and rear finisher. To gain access to the joint cover securing screws it will be necessary to unscrew and remove the stainless steel 'BC' post finisher.

When fitting the door aperture finishers ensure that the finisher to body seal is in position.

Sill mouldings (if fitted) – To remove and fit (see fig. S12-13)
1. Unscrew and remove the access plate (item 1) situated on the front wing undersheet.
2. Remove the exposed nut, plain washer, and sealing washer (item 2) securing the front of the moulding to the wing panel.
3. Lift the front of the moulding away from the wing panel and progressively disengage the plastic retaining clips (item 3).
4. Remove the moulding by pulling it forward to disengage the spring clip (item 4).

5. To ensure the correct retention of the moulding check that the clip retainers (item 5) situated in the sill panel are not damaged or excessively worn. Renew if necessary.
6. To fit the mouldings reverse the removal procedure noting the following.

To prevent water ingress it is important that the sealing washer is positioned between the plain washer and the wing panel.

Sill treadrubbers – To renew (see fig. S12-13)
1. Unscrew and remove the stainless steel trim covers (item 6).
2. Unscrew and remove the treadrubber retainers (item 7).
3. Using a scraper, remove the treadrubbers taking care not to damage the paintwork.
4. Using abrasive paper roughen the bonding surface of the new treadrubber.
5. Thoroughly clean the bonding surfaces of the treadrubber and sill panel using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
6. Apply Bostik Primer 9252 to the bonding surface of the sill panel. Allow at least one hour to dry.
7. Apply Boscoprene Adhesive 2402 (parts 1 and 2) to the bonding surfaces of the treadrubber and sill. Allow between 10 and 15 minutes for the adhesive to 'flash' dry, then press the treadrubber into position using maximum hand pressure.
8. Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

Rear wheel-arch stoneguards (if fitted) – To renew (see fig. S12-13)
1. Using a suitable scraper, remove the stoneguard (item 8) taking care not to damage the paintwork.
2. Remove all traces of adhesive from the wheel-arch using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
3. Apply Bostik Primer 9252 to the bonding surface of the wheel-arch. Allow at least one hour to dry.
4. Using abrasive paper roughen the bonding surface of the new stoneguard.
5. Thoroughly clean the bonding surface of the stoneguard using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
6. Apply Boscoprene Adhesive 2402 (parts 1 and 2) to the bonding surfaces of the stoneguard and wheel-arch. Allow between 10 and 15 minutes for the adhesive to 'flash' dry, then press the stoneguard into

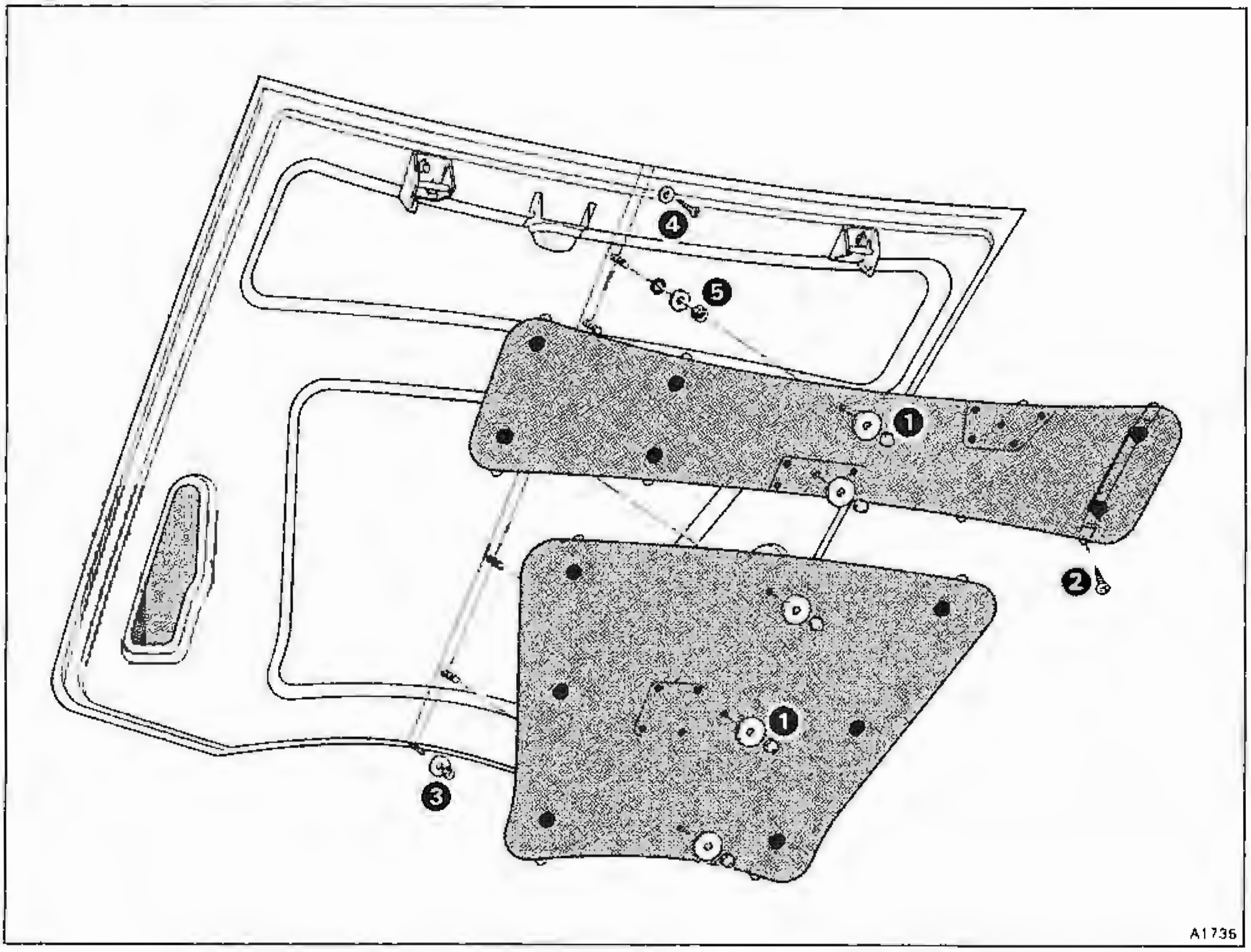


Fig. S12-11 Bonnet moulding

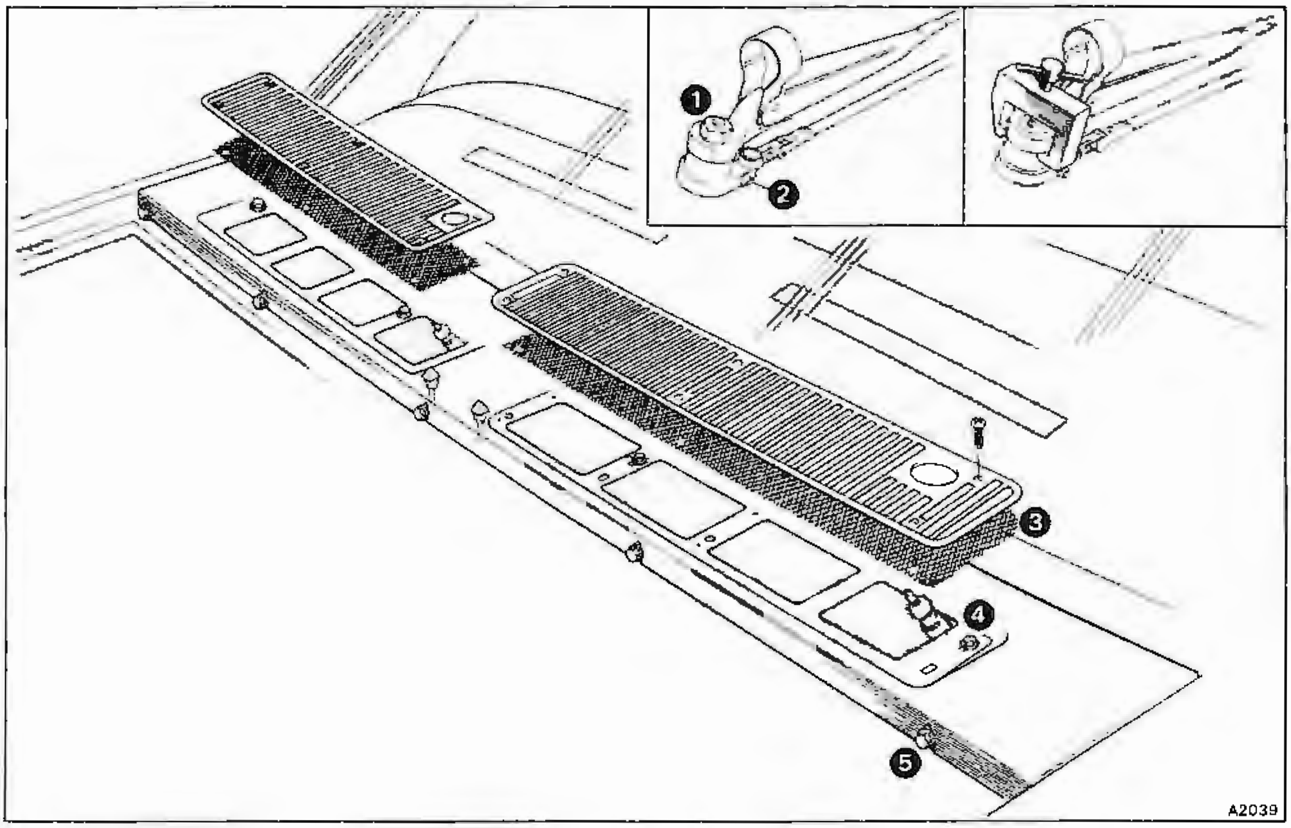


Fig. S12-12 Air intake grilles and scuttle panel

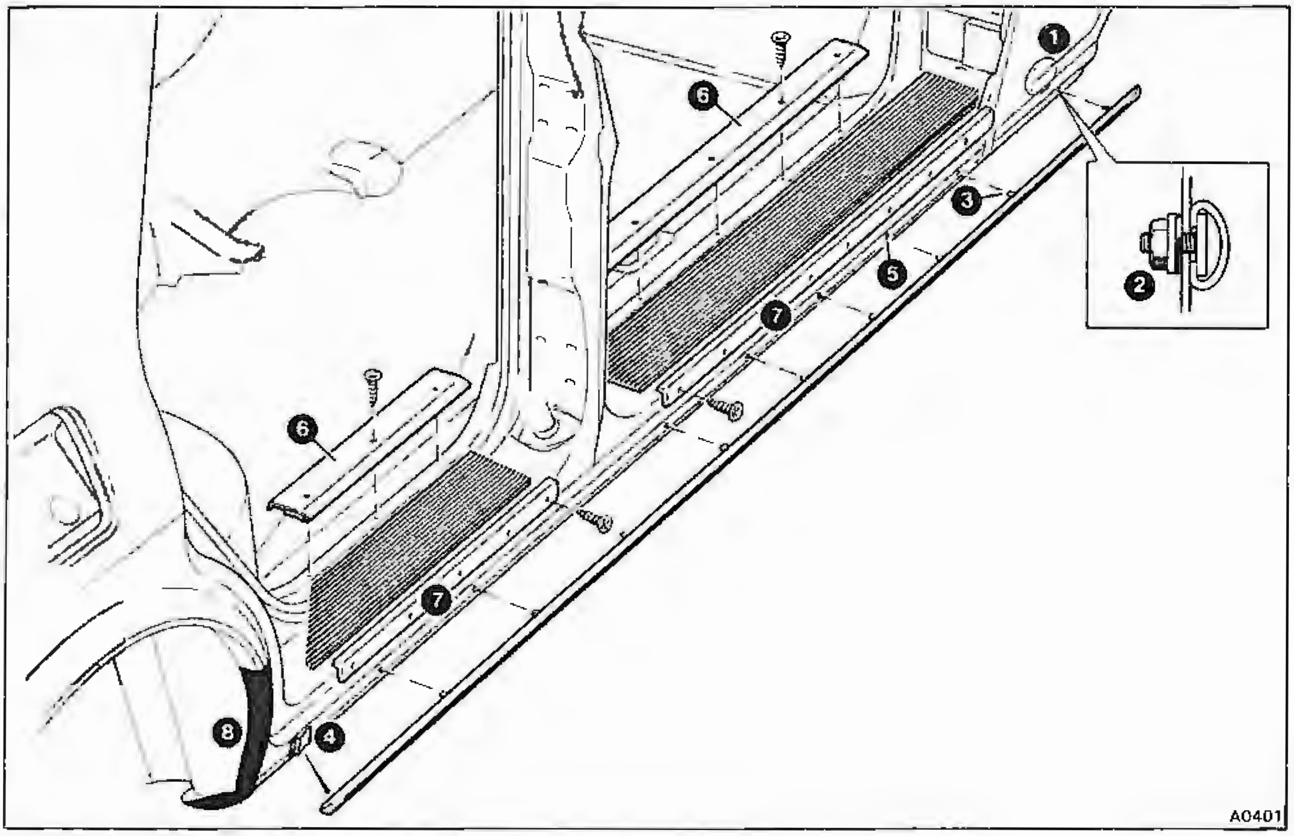


Fig. S12-13 Sill mouldings, treadrubbers, and rear wheel-arch stoneguards

position using maximum hand pressure.
7. Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

Fuel filler door and hinge – To remove (see fig. S12-14)
1. Open the fuel filler door. This can be achieved manually from the ring pull in the luggage compartment or electrically by depressing the button situated on the instrument facia.
2. Release the nuts and washers (item 1) securing the door to the hinge. Remove the door and spacing plate.
3. To remove the hinge assembly proceed as follows.
Using a pencil, mark the position of the hinge onto the body.
Release the three Allen headed setscrews and washers (item 2).
4. To separate the door spring (item 3) from the hinge proceed as follows.
Remove the spring clip (item 4) and washer from the hinge pin.
Unhook the warning plate spring (if fitted).
Withdraw the hinge pin and remove the door spring, noting the position and quantity of any spacing washers.

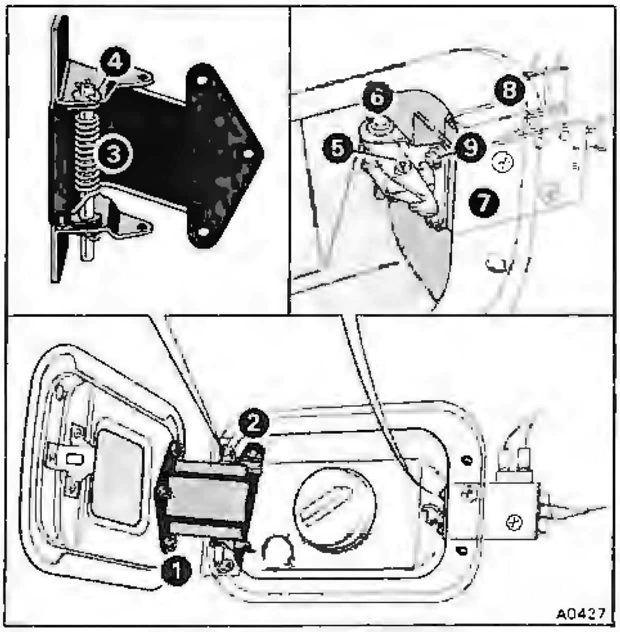


Fig. S12-14 Fuel filler door and release mechanism

Fuel filler door and hinge – To fit (see fig. S12-14)
Reverse the procedure given for removal noting the following.
1. Prior to tightening the setscrews securing the hinge, align the marks made during removal.
2. Ensure that the fuel filler door blends perfectly with the rear wing panel and that an even clearance exists around the door.

Fuel filler door release mechanism – To remove and fit (see fig. S12-14)
1. Remove the split pin (item 5) and washers securing

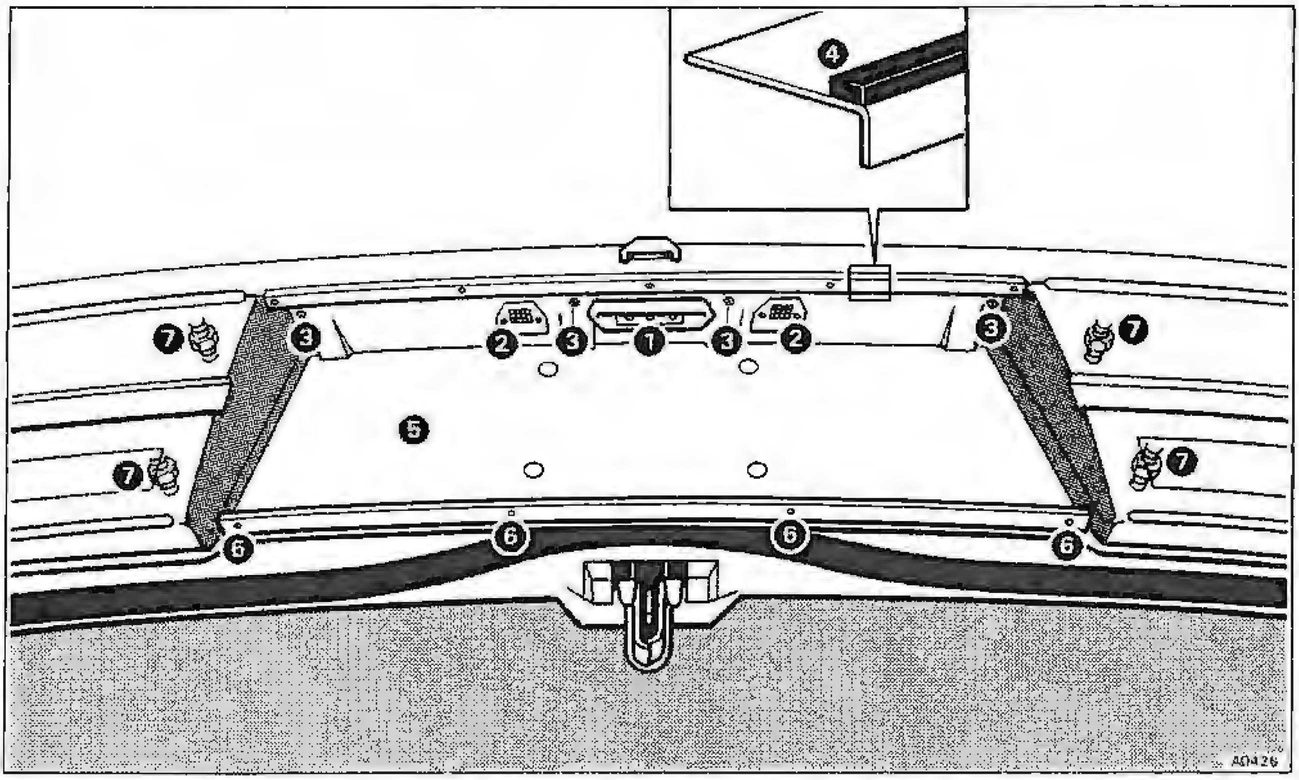


Fig. S12-15 Luggage compartment lid exterior fittings

the release trigger to the solenoid plunger.

2. Release the nut and washer then withdraw the pivot bolt (item 6). Remove the release trigger and spacing tube, noting the position and quantity of any spacing washers situated between the release trigger and mounting bracket.

3. To remove the fuel filler door release solenoid (item 7) proceed as follows.

Disconnect the battery.

To gain access to the release solenoid, it will be necessary to remove the left-hand side trim panel from within the luggage compartment (see Section S16).

Release the Lucar connectors (item 8).

Support the solenoid assembly, then remove the retaining nuts and washers (item 9). Withdraw the solenoid assembly.

4. To fit the fuel filler door release mechanism reverse the removal procedure.

Number plate lamp mounting bracket – To remove and fit (see fig. S12-15)

1. Disconnect the battery.
2. Drill out the pop rivets (item 1) securing the luggage compartment lid release handle. Remove the retaining plate, handle, and seal.
3. Remove the screws (item 2) securing each number plate lamp. Withdraw the lamps and foam gaskets. Release the Lucar connectors and remove the lamps.
4. Release the screws and washers (item 3) securing the mounting bracket. Remove the mounting bracket/finger grip assembly together with the foam seal (item 4). If the seal is found to be damaged or ineffective it must be renewed.
5. To fit the mounting bracket reverse the removal procedure.

Number plate trim panel – To remove and fit (see fig. S12-15, item 5)

Long wheelbase cars only

1. Unscrew and remove the number plate.
2. Release the screws (item 6), then remove the lower finger grip.
3. To release the number plate trim panel from underneath the lamp units proceed as follows.

Remove both luggage compartment lid outer trim panels.

Slacken the exposed lamp unit securing nuts (item 7) sufficiently to allow the trim panel to be removed.

4. To fit the trim panel reverse the removal procedure.

Exterior badges – To remove and fit (see fig. S12-16)

1. To remove the badges fitted to the luggage compartment lid and/or the rear lower areas of the front wing panels proceed as follows.

To gain access to the badge securing nuts it will be necessary to remove either the appropriate luggage compartment lid outer trim panel or a cover plate screwed to the front wing undersheets.

Release the retaining nuts (item 1), plain washers, and sealing washers. Remove the badge taking care not to damage the paintwork.

Note To remove the badges mounted on the rear quarter panels reference should be made to Section S11.

2. Prior to fitting a badge, apply a small amount of Bostik Seelastik, or its equivalent, around the base of the badge securing studs.
3. To prevent water ingress it is important that the sealing washers are positioned between the plain washers and the luggage compartment lid/front wing panel.

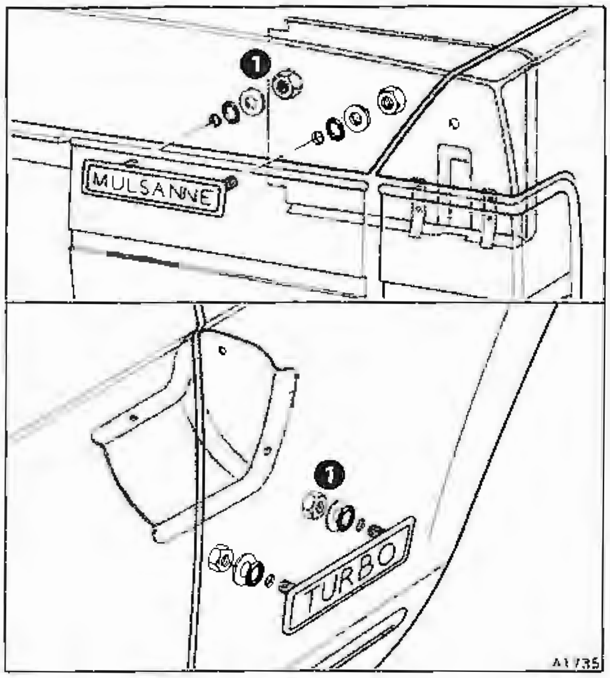


Fig. S12-16 Exterior badges

Spare wheel carrier – To remove (see fig. S12-17)

1. Remove the rubber access plug situated underneath the luggage compartment floor carpet (item 1).
2. To release the spare wheel retainer (if fitted) proceed as follows.

On cars fitted with pressed steel wheels, turn the retainer locking arm to its horizontal position (see inset A). Then, press the retainer arm to its fully down position.

On cars fitted with aluminium alloy wheels, pull the retainer locking arm fully rearward (see inset B).

3. Using the wheel nut spanner and bar provided in the tool kit, turn the carrier lowering bolt (item 2) anti-clockwise until further rotation is prevented.
4. If fitted, raise the hinged spare wheel access panel.
5. If a spare wheel carrier lifting tube (item 3) is fitted proceed as follows.

Remove the protective cover from the lifting tube and insert the wheel nut spanner bar.

Lift the rear of the carrier sufficiently to either clear the support hook (item 4) or to allow the lowering tube to be disengaged from the slotted carrier support bracket (item 5).

Pivot the lowering tube assembly clear, then lower the rear of the carrier to the ground. Remove the bar and slide the spare wheel from the carrier.

6. On carriers not fitted with a lifting tube proceed as follows referring to inset C.

Slide the spare wheel from the carrier.

To facilitate assembly, scribe the position of the large washer (item 6) onto the lowering tube assembly.

Support the rear of the carrier. Then, remove the nut and washer (item 7). Pivot the lowering tube assembly clear and lower the rear of the carrier to the ground.

7. Remove the nuts and washers (item 8) from the carrier pivot bolts.

8. Support the carrier, then withdraw the pivot bolts and washers. Lower the carrier to the ground.

Spare wheel carrier – To fit (see fig. S12-17)

Reverse the procedure given for removal noting the following.

1. Lubricate the lowering bolt and the two carrier pivot bolts with Rocol MTS 1000 grease, or its equivalent.
2. Check the condition of the rubber bushes (item 9). Renew if necessary.
3. Prior to fitting the carrier, ensure that the distance tubes (item 10) are in position.
4. When the carrier is fully raised, check that the spare wheel is securely clamped against the underside of the luggage compartment floor. If the wheel is not securely held, adjust the carrier as follows.

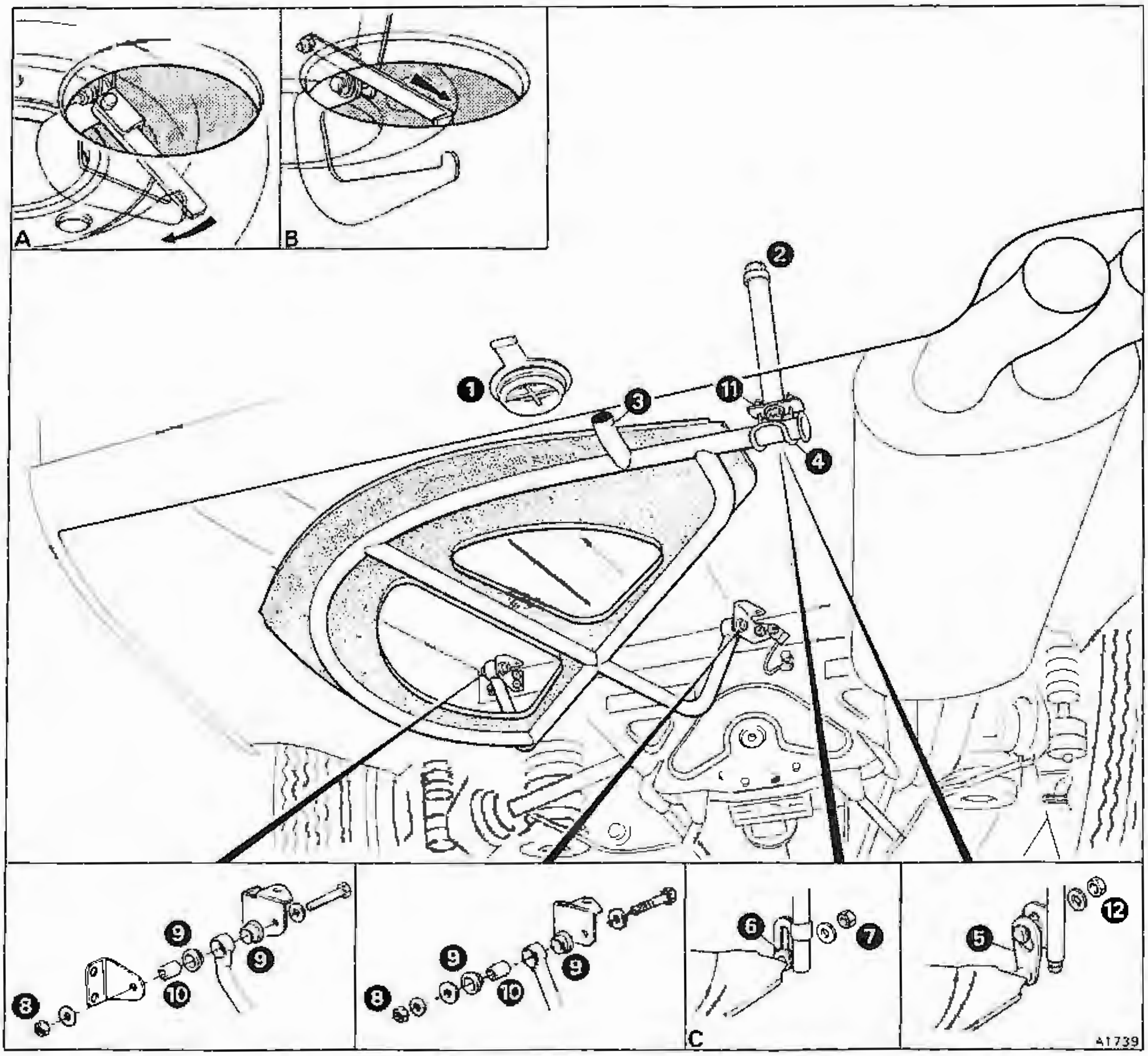


Fig. S12-17 Spare wheel carrier

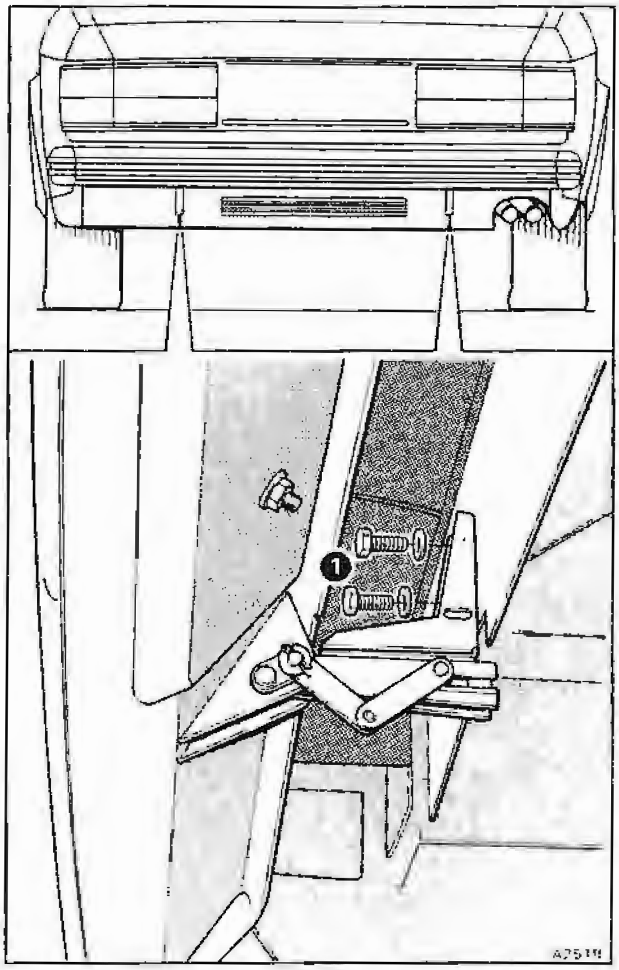


Fig. S12-18 Spare wheel access panel

Carriers fitted with a lifting tube.

Lower the carrier slightly by loosening the operating bolt two or three complete turns.

On carriers fitted with a support hook (item 4) proceed as follows.

Support the carrier. Then, raise the support hook by turning each adjusting nut (item 11) clockwise one or two complete turns.

Raise the carrier and check that the spare wheel is securely held. If necessary repeat the adjustment operation.

On carriers fitted with a slotted support bracket (item 5) proceed as follows.

Support the carrier. Then, loosen the support bolt securing nut (item 12). Move the carrier support bolt to a higher position within the adjustment slot. Tighten the securing nut.

Raise the carrier and check that the spare wheel is securely held. If necessary repeat the adjustment operation.

Carriers not fitted with a lifting tube.

Lower the carrier slightly by loosening the operating bolt two or three complete turns.

Support the carrier. Then, loosen the securing nut (item 7). Move the carrier securing bolt to a higher position within the adjustment slot. Tighten the securing nut.

Raise the carrier and check that the spare wheel is securely held. If necessary repeat the adjustment operation.

5. Check that the spare wheel is positioned with the tyre valve aligned with the access hole in the luggage compartment floor.
6. Ensure that the spare wheel retainer (if fitted) passes through the centre of the wheel and is locked into position.

Spare wheel access panel – To remove and fit
(see fig. S12-18)
1989 model year Bentley Turbo R cars

1. Raise the hinged access panel.
2. Support the panel, then remove the setscrews and washers (item 1) securing the hinge mechanisms to the body. Remove the panel and hinge assembly.
3. To fit the panel reverse the removal procedure noting the following.

Lower the access panel and check that it aligns with the rear wing panels. If necessary, adjust the position of the rubber stop situated on the left-hand inner wing panel.

Lubricate the moving parts of the hinge mechanisms with a light oil or grease.

Front and rear seats

Contents

3/88
Printed in England

Front and rear seats

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

Front seat cushion and valance assembly – To remove and fit (see fig. S13-1)
1. Remove the two screws and cup washers (item 1) securing the squab back panel. Lift the back panel slightly to disengage the upper retaining brackets then remove.
2. Remove the two screws and cup washers (item 2) securing the cushion valance to the seat base.
3. From underneath the rear of the seat, unhook the cushion retaining strap (item 3). Lift the front of the cushion to disengage the retaining pegs, then unhook the front of the retaining strap and remove the cushion.
4. To fit the cushion reverse the removal procedure

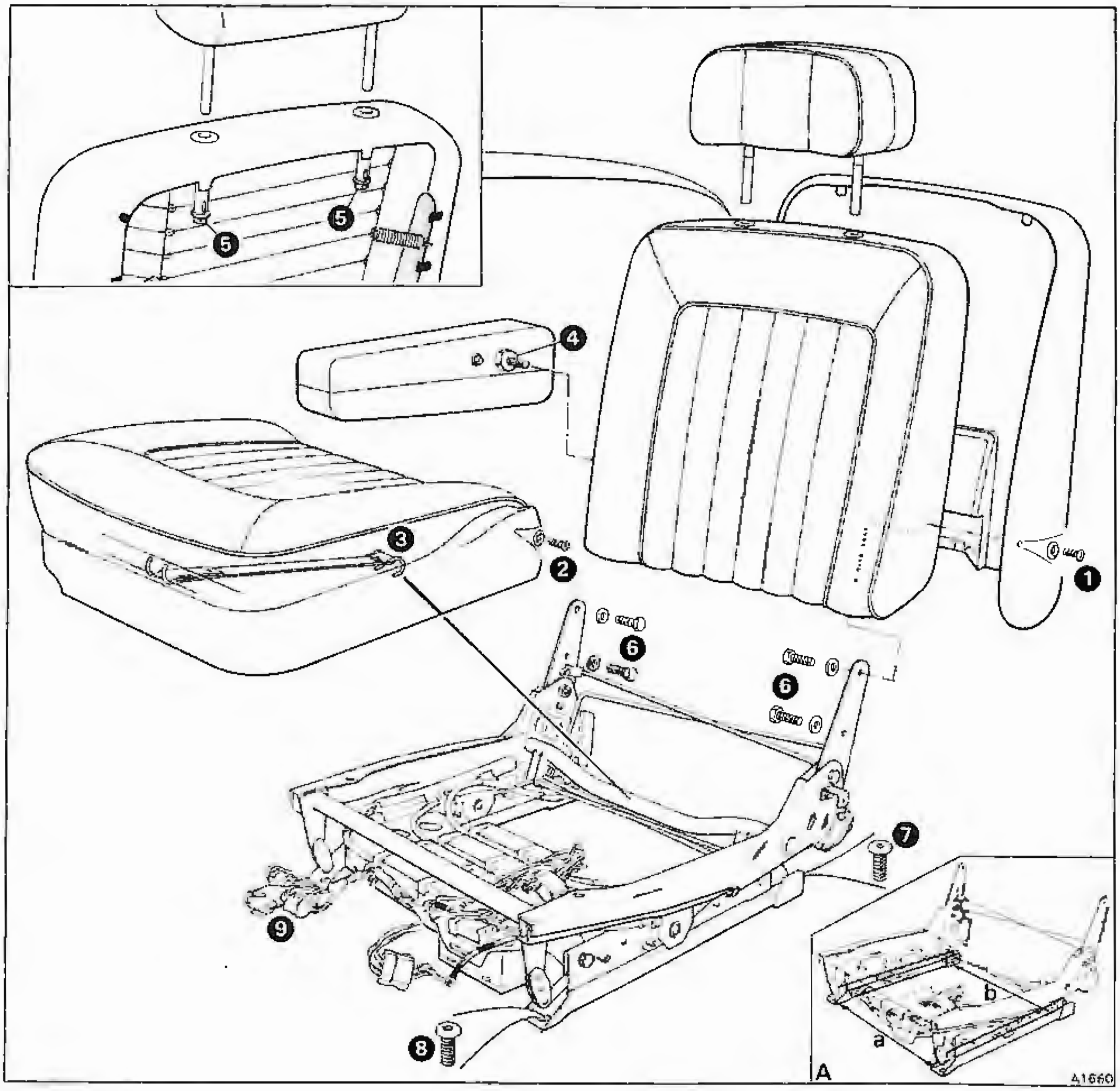


Fig. S13-1 Front seat trim and mounting arrangement
a 370,5 mm (14.600 in)
b 365,0 mm (14.370 in)

ensuring that the retaining pegs locate in the holes situated at the front of the seat base.

Front seat arm rest – To remove and fit
(see fig. S13-1)
1. Remove the two screws and cup washers (item 1) securing the squab back panel. Lift the back panel slightly to disengage the upper retaining brackets then remove.
2. Carefully insert a slim 15/16 A-F spanner between the seat squab and the arm rest, then release the shouldered bolt (item 4). Remove the arm rest.
3. Each arm rest is made up of an upper and lower trimmed section which are clipped together. To open the arm rest, carefully insert a small steel rule, or a similar tool, at the rear of the arm rest between the upper section and the beading attached to the lower section. Carefully prise the two sections apart.
4. To assemble the arm rest, engage the clips at the front of each section, then bring the rear of both sections together. Insert a small steel rule and press the retaining clip downwards until the two sections engage.
5. To fit the arm rest reverse the removal procedure.

Front seat head restraint – To remove and fit
(see fig. S13-1)
1. Remove the two screws and cup washers (item 1) securing the squab back panel. Lift the back panel slightly to disengage the upper retaining brackets then remove.
2. Lift the head restraint to the full extent of its adjustment.
3. Locate the head restraint retaining clips situated at the base of each support tube (item 5). Push both clips clear of the support legs then lift the head restraint out of the seat squab.
4. To fit the head restraint, simply locate the support legs into the top of the seat squab and push down until the retaining clips engage. The head restraint can then be adjusted vertically to a desirable position.

Front seat squab – To remove and fit (see fig. S13-1)
1. Remove the two screws and cup washers (item 1) securing the squab back panel. Lift the back panel slightly to disengage the upper retaining brackets then remove.
2. Remove the four M8 setscrews and washers (item6) securing the squab frame to the seat base assembly. Carefully withdraw the seat squab assembly.
3. To fit the seat squab reverse the removal procedure.

Front seat complete assembly – To remove
(see fig. S13-1)
1. Remove the two screws and cup washers (item 1) securing the squab back panel. Lift the back panel slightly to disengage the upper retaining brackets then remove.
2. Remove the two screws and cup washers (item 2) securing the cushion valance to the seat base.
3. From underneath the rear of the seat, unhook the cushion retaining strap (item 3). Lift the front of the cushion to disengage the retaining pegs, then unhook the front of the retaining strap and remove the cushion.
4. Turn the ignition key to the ACC or RUN position. Then, using the seat adjustment controls, move the seat forward to the full extent of its travel.

Warning Ensure that your hands are kept clear of the seat mechanism during this operation.

5. Using a 'Torx' head socket driver, remove the two exposed socket screws (item 7) securing the rear of the seat.

Similarly, move the seat fully rearwards and remove the socket screws (item 8) securing the front of the seat. Note the position and quantity of any spacing washers situated between the seat base and the floor.

6. Switch off the ignition and disconnect the battery.
7. Disconnect the electrical plugs and sockets (item 9).
8. With the help of an assistant, carefully remove the seat assembly from the car.

Front seat complete assembly – To fit
(see fig. S13-1)
Reverse the procedure given for removal noting the following.
1. It is important to ensure that any spacing washers situated between the seat base and the floor are replaced in their original positions.
2. Prior to tightening the seat base securing socket screws, ensure that the distance between the left-hand and right-hand seat slide is correct (see fig. S13-1, inset A).
3. Torque tighten the socket screws (items 7 and 8) to between 48 Nm and 54 Nm (4,9 kgf m and 5,5 kgf m; 36 lbf ft and 40 lbf ft). The socket screws should be tightened in the following sequence. Rear inboard, rear outboard, front inboard, and front outboard.
4. When fitting the seat cushion, ensure that the retaining pegs locate in the holes situated at the front of the seat base.
5. If the seat has been electrically disconnected for more than 4 weeks the seat adjustment memory function (if fitted) will be lost. If this has occurred, it will be necessary to reactivate the memory as follows.

Warning When the seat memory is reactivated, the seat will move immediately and automatically to a set adjustment position. Take care therefore to avoid contact with the seat when carrying out the following procedure.

Ensure that the gear range selector lever is in the park position, then turn the ignition key to either the ACC or RUN position.

Depress the memory (MEM) and the numbered store/recall buttons corresponding to the seat to be activated in the following sequence. MEM five times, 4 once, 3 twice, 4 once. To ensure activation of the memory this operation should be completed within approximately five seconds.

Front seat mechanism assembly – Repair procedure
The operation of each front seat is controlled by four identical electric motors. Each motor is connected, via drive cables, to two gearboxes mounted on opposite

sides of the seat mechanism base. The gearboxes operate in pairs providing four adjustment positions, seat squab rake, front tilt, rear tilt, and forward/rearward movement. In the event of a fault developing in the operation of a seat mechanism reference should be made to the following fault diagnosis chart.

Fault diagnosis

Fault	Possible cause	Remedy
1. Seat 'twisting' during travel (indicating loss of drive to one gearbox)	a. Broken drive cable. b. Gearbox failure.	a. Renew the drive cables in pairs, i.e. motor set (see Drive cables – To renew). **Note** On a number of early cars, black coloured inner cables were fitted. It is advisable to replace these with gold coloured inner cables as a complete seat set. b. Renew the gearbox. (see Gearbox – To renew).
2. Loss of movement in any one of the four adjustment positions, e.g. front tilt, rear tilt, etc.	a. Motor failure. **Note** Each motor is protected by an internal thermal cut-out. Therefore, ensure that the motor has not overheated.	a. Test the motor (refer to TSD 4701 Electrical Manual).
3. Unacceptable gearbox noise	a. Gearbox failure. Check if the gearbox centre shaft is revolving.	a. If the gearbox centre shaft is revolving, renew the gearbox (see Gearbox – To renew). **Note** On the front tilt, rear tilt, and forward/rearward gearboxes it may be possible to reduce the noise level by adjusting the centre shaft nut (see fig. S13-2, item 1). Take care not to overtighten the nut during this operation. If the noise level does not improve, renew the gearbox.
4. Unacceptable motor noise.	a. Motor failure	a. Renew the motor (see Motor – To renew)
5. General noisy operation of the seat mechanism.	a. Loose motor. b. Loose seat memory electronic control unit (if fitted). c. Incorrectly positioned or unclipped drive cables.	a. Secure correctly. b. Secure correctly. c. Reposition and/or reclip.
6. Excessive free movement of the seat squab.	—	Refer to the information under the heading Seat squab rake adjustment.

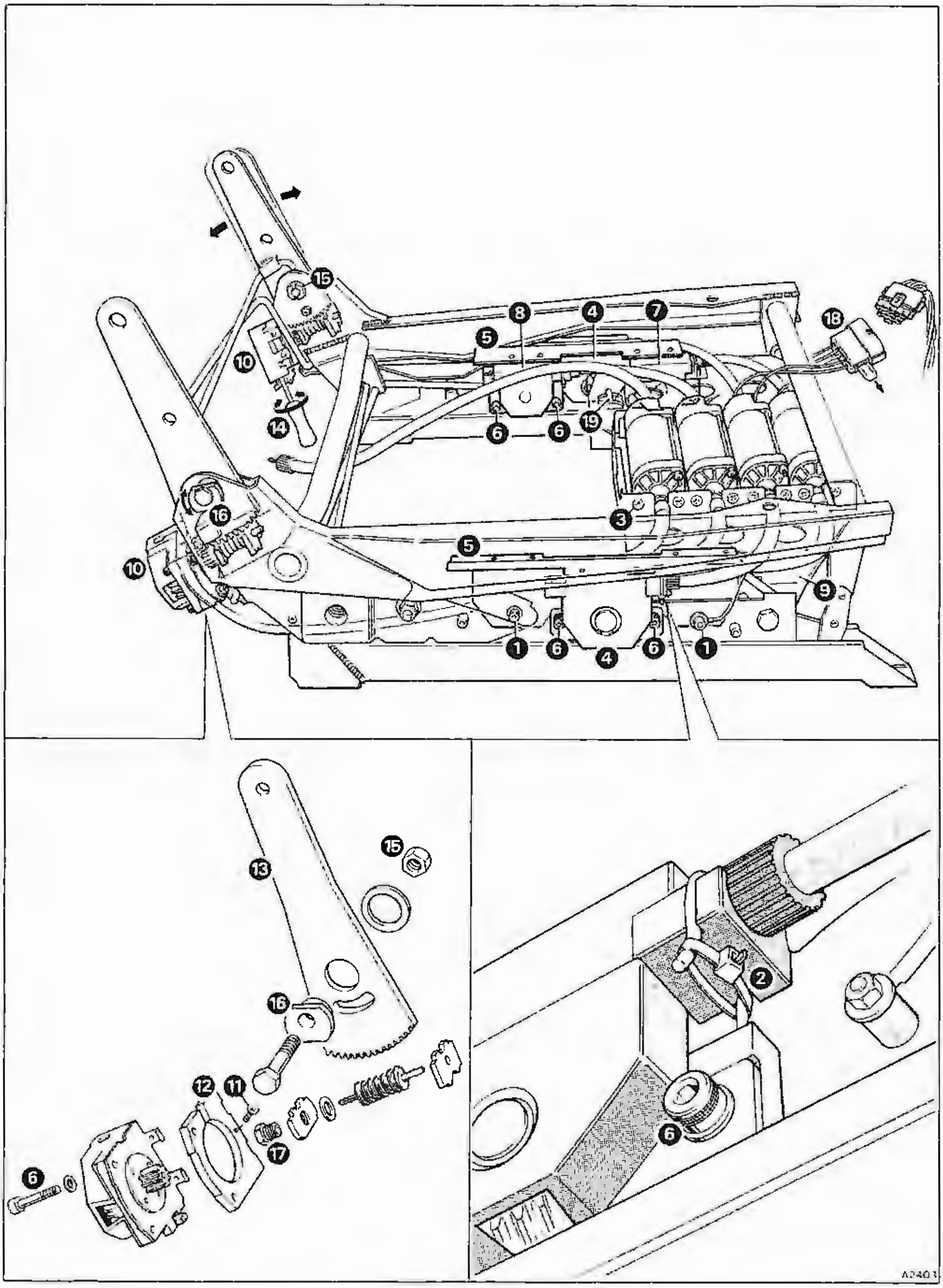


Fig. S13-2 Front seat mechanism

Drive cables – To renew (see fig. S13-2)
The following procedure can be adopted for any one of the eight drive cables fitted to a seat mechanism.
1. Remove the seat cushion assembly as described under the heading Front seat cushion and valance assembly – To remove and fit.
2. Using the seat adjustment controls, operate the seat mechanism to gain access to the drive cable to gearbox connections.
3. Disconnect the battery.
4. Cut and discard the plastic cable ties (item 2) and remove the drive cable securing clips. Note that new cable ties must be fitted on assembly.
5. Withdraw each drive cable from the gearbox.
6. Cut and discard any cable ties situated along the length of the drive cables, noting that on assembly new ties must be fitted in similar positions.
7. Remove the four screws (item 3) securing the appropriate motor.

Lift the motor clear of its mounting bracket and withdraw both drive cable assemblies.
8. To fit new drive cables reverse the removal procedure noting the following.

Failure of a drive cable will almost certainly introduce 'twist' into the seat mechanism as a result of continued operation of the opposite cable/gearbox. **This must be corrected.** Refer to the information under the heading Seat mechanism twist – To correct.

Forward and rearward movement gearbox – To renew (see fig. S13-2, item 4)
1. Remove the seat cushion assembly as described under the heading Front seat cushion and valance assembly – To remove and fit.
2. Using the seat adjustment controls, operate the seat mechanism to gain access to the gearbox.
3. Disconnect the battery.
4. Unscrew and remove the plastic gearbox cover (item 5).
5. Cut and discard the plastic cable tie (item 2) and remove the drive cable securing clip.

Note that a new cable tie must be fitted on assembly.
6. Withdraw the drive cable from the gearbox.
7. Remove the gearbox centre shaft nut, washer, and spacer (item 1) and release the sensor earth lead (if fitted).
8. Release the Lucar connector securing the signal lead (if fitted) to the gearbox.
9. Remove the gearbox securing bolts, nuts, and washers (item 6).
10. Carefully withdraw the gearbox, noting that a thin thrust washer may be fitted to the centre shaft. The washer, if fitted, must be positioned on the centre shaft of the new gearbox prior to fitting.
11. To fit the new gearbox reverse the removal procedure noting the following.

Failure of a gearbox will almost certainly introduce 'twist' into the seat mechanism as a result of continued operation of the opposite gearbox. **This must be corrected.** Refer to the information under the heading Seat mechanism twist – To correct.

Front tilt gearbox/rear tilt gearbox – To renew (see fig. S13-2, items 7 and 8)
1. Remove the seat cushion assembly as described under the heading Front seat cushion and valance assembly – To remove and fit.
2. Using the seat adjustment controls, operate the seat mechanism to gain access to the appropriate gearbox.
3. Disconnect the battery.
4. Unscrew and remove the plastic gearbox cover (item 5).
5. If the front tilt gearbox (item 7) is to be renewed, release the motor mounting bracket (item 9) from the seat mechanism slide.
6. Cut and discard the plastic cable tie (item 2) and remove the drive cable securing clip. Note that a new cable tie must be fitted on assembly.
7. Withdraw the drive cable from the gearbox.
8. Remove the gearbox centre shaft nut, washer, and spacer (item 1) and release the sensor earth lead (if fitted).
9. Release the Lucar connector securing the signal lead (if fitted) to the gearbox.
10. Remove the gearbox securing bolts, nuts, and washers (item 6).
11. Carefully withdraw the gearbox, noting that a thin thrust washer may be fitted to the centre shaft. The washer, if fitted, must be positioned on the centre shaft of the new gearbox prior to fitting.
12. To fit the new gearbox reverse the removal procedure noting the following.

Failure of a gearbox will almost certainly introduce 'twist' into the seat mechanism as a result of continued operation of the opposite gearbox. **This must be corrected.** Refer to the information under the heading Seat mechanism twist – To correct.

Seat rake gearbox – To renew (see fig. S13-2, item 10)
1. Remove the seat cushion assembly as described under the heading Front seat cushion and valance assembly – To remove and fit.
2. Using the seat adjustment controls, operate the seat rake to the fully forward position and the rear tilt to the fully raised position.
3. Disconnect the battery.
4. If fitted, disconnect the sensor earth lead and signal lead from the gearbox.
5. Cut and discard the plastic cable tie (item 2) and remove the drive cable securing clip. Note that a new cable tie must be fitted on assembly.
6. Withdraw the drive cable from the gearbox.
7. Remove the gearbox securing bolts, nuts, washers, and self-tapping screw (items 6 and 11).
8. Carefully withdraw the gearbox and spacer assembly. Unscrew and remove the spacer (item 12) and discard the gearbox.
9. To fit the new gearbox reverse the removal procedure noting the following.

Ensure that the cut-out in the gearbox spacer aligns with the seat rake arm (item 13).

Failure of a gearbox will almost certainly introduce 'twist' into the seat mechanism as a result of continued operation of the opposite gearbox. **This must be corrected.** Refer to the information under the heading Seat mechanism twist – To correct.

Seat mechanism twist – To correct (see fig. S13-2)

1. Disconnect the battery.
2. If necessary, remove the complete seat assembly from the car and rest the mechanism onto a perfectly flat surface.
3. Using a small screwdriver, or a similar tool, (item 14) turn the affected gearbox drive until the twist has been removed.
4. To confirm that the twist has been corrected proceed as follows.

Fit the drive cables. Then, using the seat adjustment controls, operate the appropriate gearboxes to the full extent of their travel, ensuring that both gearboxes cease operation simultaneously.

If necessary, repeat the above procedure until the twist has been completely removed.

Seat squab rake adjustment (see fig. S13-2)
It should be noted that to ensure the correct operation of the squab rake a small amount of free movement must be present in the seat squab. However, if the movement at the top of the seat squab exceeds 6 mm (0.240 in) then the following adjustment procedure should be carried out.

1. Remove the squab back panel (see Front seat cushion and valance assembly – To remove and fit).
2. Disconnect the battery.
3. Slacken the squab pivot bolt nuts (item 15).
4. Using a suitable tool, turn each eccentric cam (item 16) until the free movement at the top of the squab is reduced to 6 mm (0.240 in). Note that it may be

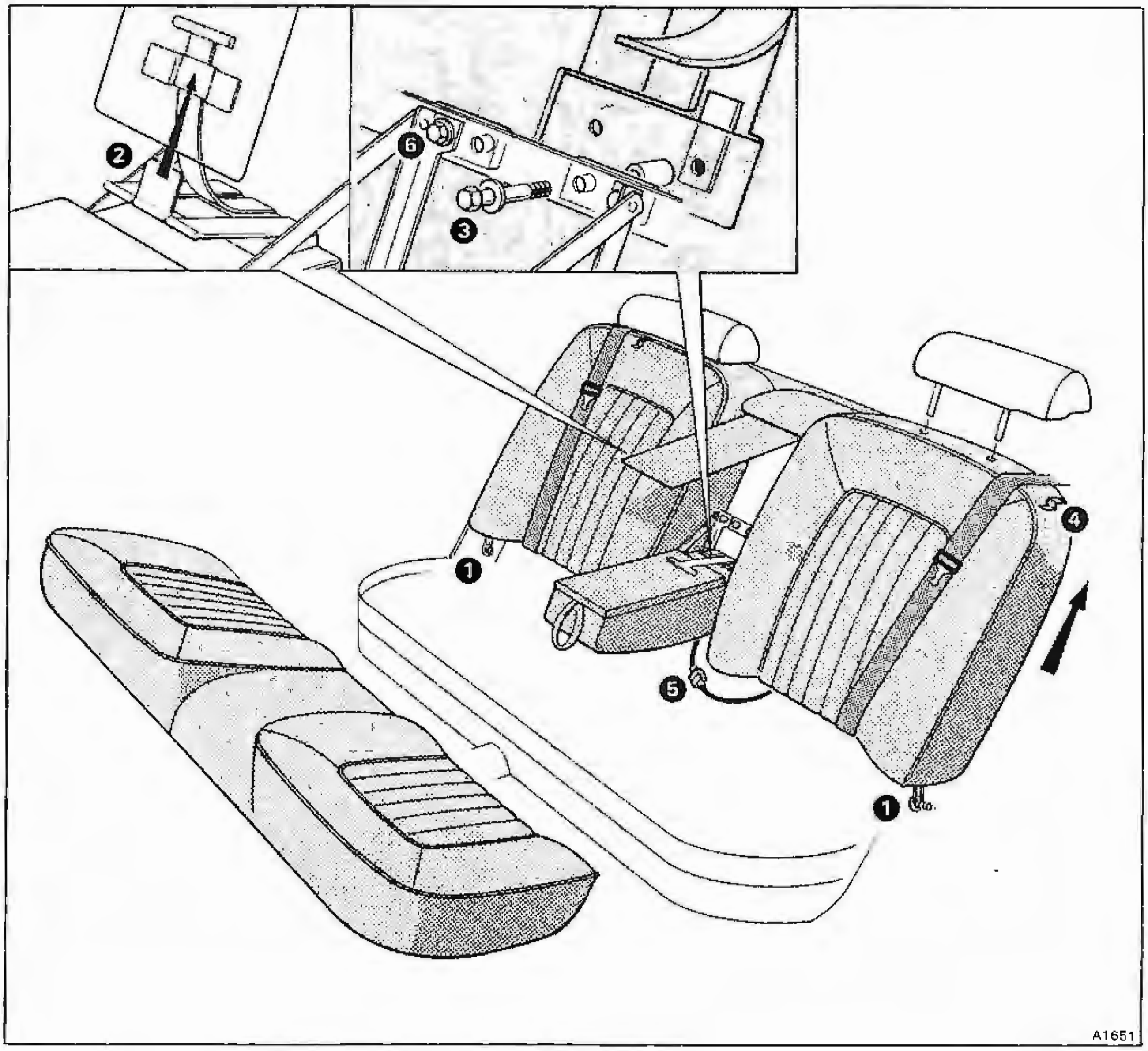


Fig. S13-3 Rear seat trim – Other than Bentley Turbo R necessary to remove the seat squab to gain access to the cams.

5. If the acceptable limit cannot be achieved by turning the cams, then the seat rake spacer bushes (item 17) should be adjusted as follows.

To gain access to the spacer bushes, remove the seat rake gearboxes (see Seat rake gearbox – To renew).

Using a socket spanner, turn each spacer bush clockwise until all free movement is removed from the seat squab. Then, turn the bush a quarter of a turn anti-clockwise to provide slight squab movement.

Note Ensure that steel spacer bushes are fitted. On a number of early cars nylon bushes were fitted, these should be discarded and replaced by the steel type.

6. Repeat Operation 4 to reset the eccentric cams.
7. Torque tighten the pivot bolt nuts (item 15) to 35 Nm (3,5 kgf m; 26 lbf ft).

Motor – To renew (see fig. S13-2)

The following procedure can be adopted for any one of the four motors fitted to a seat mechanism.

1. Disconnect the battery.
2. Disconnect the motor loom plug and socket (item 18). Withdraw the bright coloured keeper bar from the socket. Then, using a suitable thin rod disengage the spring clips securing the appropriate motor leads. Note the position of the leads to ensure correct assembly.
3. Remove the four screws (item 3) securing the appropriate motor. Lift the motor clear of its mounting bracket and withdraw both drive cable assemblies.
4. To fit a motor reverse the removal procedure.

Seat memory electronic control unit (if fitted) – To renew (see fig. S13-2)

1. Remove the seat cushion assembly as described

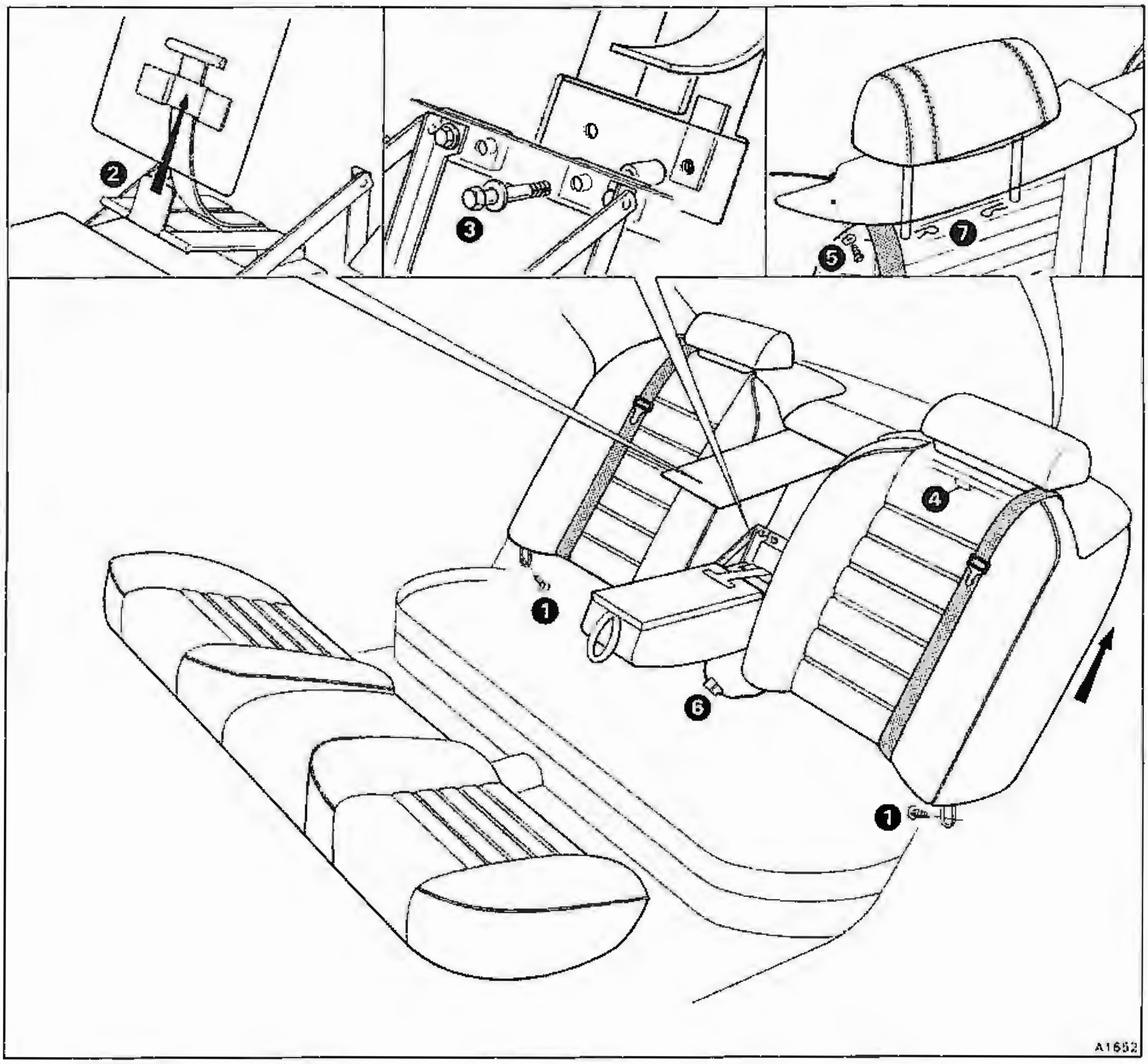


Fig. S13-4 Rear seat trim – Bentley Turbo R under the heading Front seat cushion and valance assembly – To remove and fit.

2. Using the seat adjustment controls, operate the front and rear tilt to the fully raised position.

3. Disconnect the battery.

4. Trace the looms from the electronic control unit to the plug and socket connectors. Disconnect the plugs and sockets.

5. Cut and discard any cable ties situated along the length of the looms, noting that on assembly new ties must be fitted in similar positions. Manoeuvre the looms clear of the seat mechanism.

6. Turn the electronic control unit (ECU) securing clip (item 19) through 90°. Lower the ECU, then slide it clear of the front mounting bracket and remove.

7. To fit a new seat memory ECU reverse the removal procedure noting the following.

To activate the new seat memory ECU refer to the information under the heading Front seat complete assembly – To fit.

Rear seat cushion – To remove and fit
(see fig. S13-3)

1. The rear seat cushion is simply wedged into position in the seat pan and can be removed by raising the front edge and pulling clear of the seat squab. To fit the cushion reverse the removal operation.

Rear seat squab – To remove and fit
Other than Bentley Turbo R (see fig. S13-3)

1. Remove the rear seat cushion.
2. Lift and remove the head rests.
3. Unclip and remove the seat belt reel covers situated on the parcel shelf.
4. Remove the self-tapping screws securing the lower corners of the squab (item 1).
5. Lower the centre arm rest and manoeuvre the trimmed flap clear of the retaining plate (item 2).
6. Remove the two exposed bolts, spacing washers, and tapping plates (item 3).
7. Lift the bottom of the squab slightly sliding the top towards the rear window to disengage the retaining brackets (item 4). Slide the seat belt webbing off the sides of the squab. On cars fitted with a cellular telephone, disconnect the battery then release the plug and socket (item 5). Carefully remove the squab from the car.
8. To fit the squab reverse the removal procedure.

Rear seat squab – To remove and fit
Bentley Turbo R (see fig. S13-4)

1. Remove the rear seat cushion.
2. Remove the self-tapping screws securing the lower corners of the squab (item 1).
3. Lower the centre arm rest and manoeuvre the trimmed flap clear of the retaining plate (item 2).
4. Remove the two exposed bolts, spacing washers, and tapping plates (item 3).
5. Lift the bottom of the squab slightly sliding the top towards the rear window to disengage the retaining brackets (item 4). Ease the squab forward to gain access to the finishing trim outer securing setscrews (item 5). Remove the setscrews to allow the seat belt webbing to be slid off the sides of the squab. On cars fitted with a cellular telephone, disconnect the battery then release the plug and socket (item 6). Carefully remove the squab assembly from the car.
6. To fit the squab reverse the removal procedure.

Centre arm rest – To remove and fit (see fig. S13-3)

1. Remove the four bolts and washers (item 6) securing the arm rest to the squab panel. On cars fitted with a cellular telephone, disconnect the battery then release the plug and socket (item 5). Remove the arm rest.
2. To fit the arm rest reverse the removal operation.

Rear seat head rest – To remove and fit
Bentley Turbo R (see fig. S13-4)

1. Release the rear seat squab.
2. Ease the squab forward and locate the spring clips retaining the head rest support legs (item 7). Withdraw the clips, then lift and remove the head rest.
3. To fit the head rest reverse the removal procedure.

Seat belts

Contents

Printed in England

Seat belts

Introduction
Lap and diagonal retractable seat belts are fitted in the front compartment of the car. The rear compartment has lap and diagonal retractable seat belts fitted to the two outer positions. An additional static lap belt may be fitted to the rear central position.

If a seat belt requires cleaning, sponge the webbing with warm soapy water. Do not use bleaches or dyes as they may impair the efficiency and safety of the seat belts.

Warning In the event of a vehicle being involved in an accident of sufficient severity to cause damage to the front longerons, all the seat belts worn by occupants at the time of the impact **must be** replaced.

If an impact results in local damage to any of the seat belt anchorage points, then that particular seat belt **must be** replaced irrespective of whether the belt was worn or not at the time of the impact.

In the event of a rear impact, the severity of the damage must be judged and if in any doubt the occupied seat belts **must be** replaced.

Front seat belt – To remove (see fig. S14-1)
1. Using the seat adjustment controls, move the front seat forward to the full extent of its travel.
2. Remove the two screws securing the small trim panel (item 1). Lift the trim slightly to disengage the retaining clips and remove.
3. To remove the 'BC' post trim panel proceed as follows.

Unclip and remove the rear compartment floor carpet. Then, remove the two screws (item 2) and carpet retainers.

Peel back the soundproofing material, then remove the two exposed setscrews (item 3).

Loosen the stainless steel sill finishers adjacent to the 'BC' post to enable the ends of the trim to be released.

Release the seat belt webbing from the retaining clip on the 'BC' post panel.

Slide the 'BC' post trim panel upwards to disengage the rear retaining brackets and remove.

4. Remove the anchorage bolt, washers, etc., (item 4) from the top of the reel mechanism cover plate.
5. Remove the setscrews securing the cover plate

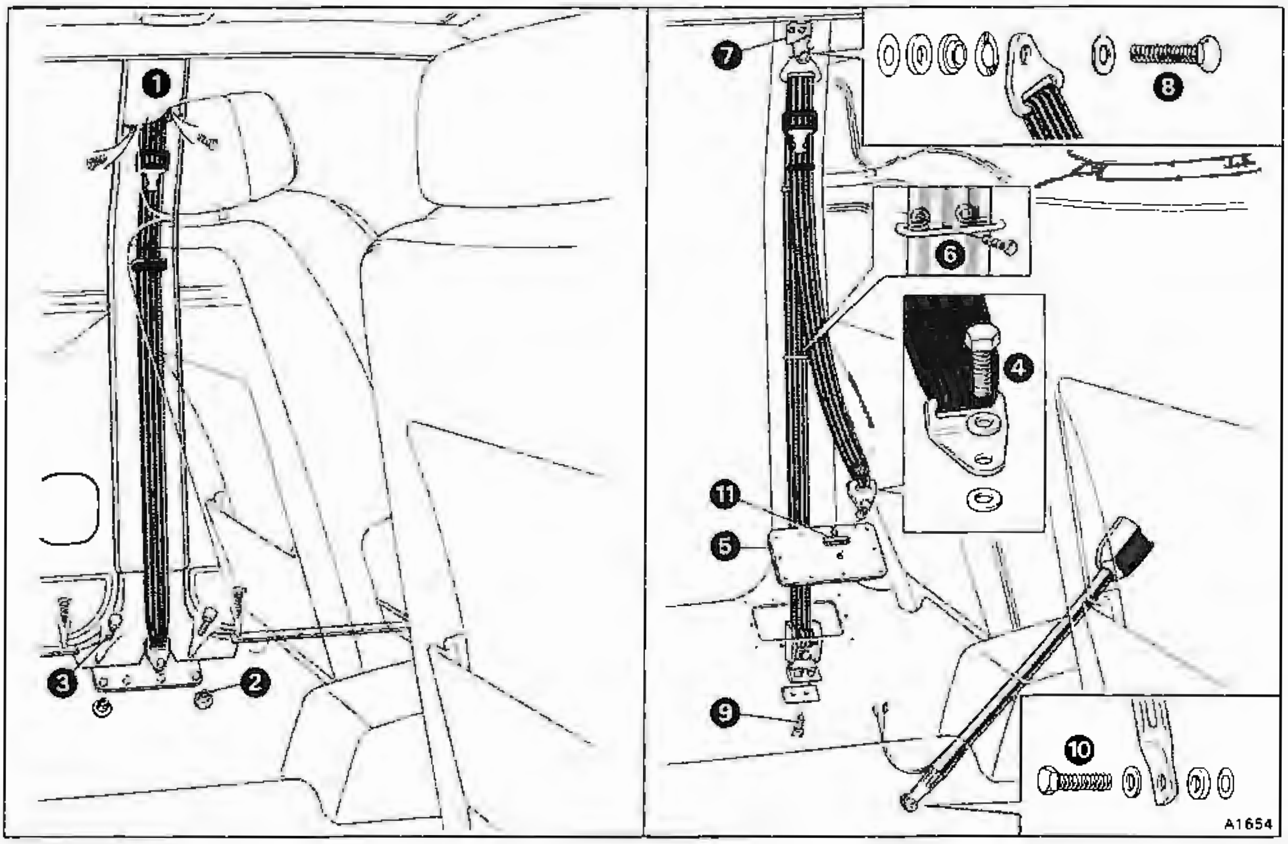


Fig. S14-1 Front seat belt removal

(item 5). Release the seat belt webbing by removing the plastic edge protector and guiding the webbing through the slot provided. Remove the cover plate.

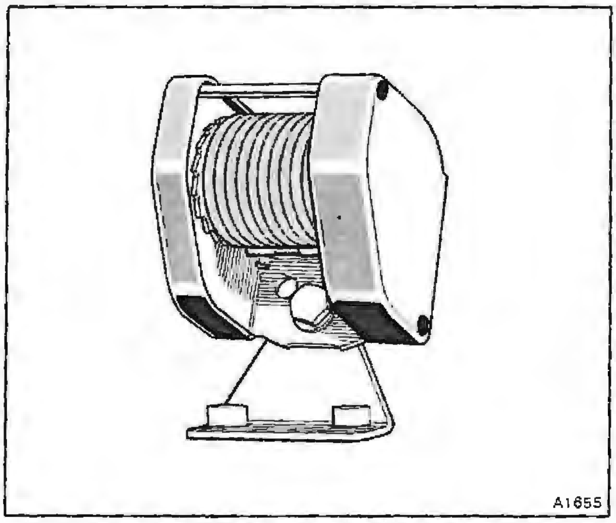


Fig. S14-2 Front seat belt reel to sill mounting arrangement

6. Unscrew and remove the two seat belt guides (item 6).
7. Unscrew and remove the upper trim mounting bracket (item 7).
8. Remove the anchorage bolt, washers, etc., (item 8) securing the seat belt to the top of the 'BC' post. Note that on a number of 1987 model year cars *conforming to an Australian specification*, the upper trim mounting bracket is positioned underneath the anchorage bolt.
9. Remove the two bolts and strengthening plate (item 9) situated underneath the sill panel. Remove the seat belt mechanism assembly.
10. Peel back the transmission tunnel carpet to expose the seat belt stalk anchorage bolt (item 10). Release the bolt, washers, etc., and remove the stalk. *On cars conforming to a North American specification*, disconnect the battery then release the Lucar connectors from the electrical lead protruding from the driver's side seat belt stalk.

Front seat belt – To fit (see fig. S14-1)
Reverse the procedure given for removal noting the following.
1. Prior to fitting the reel mechanism into the sill

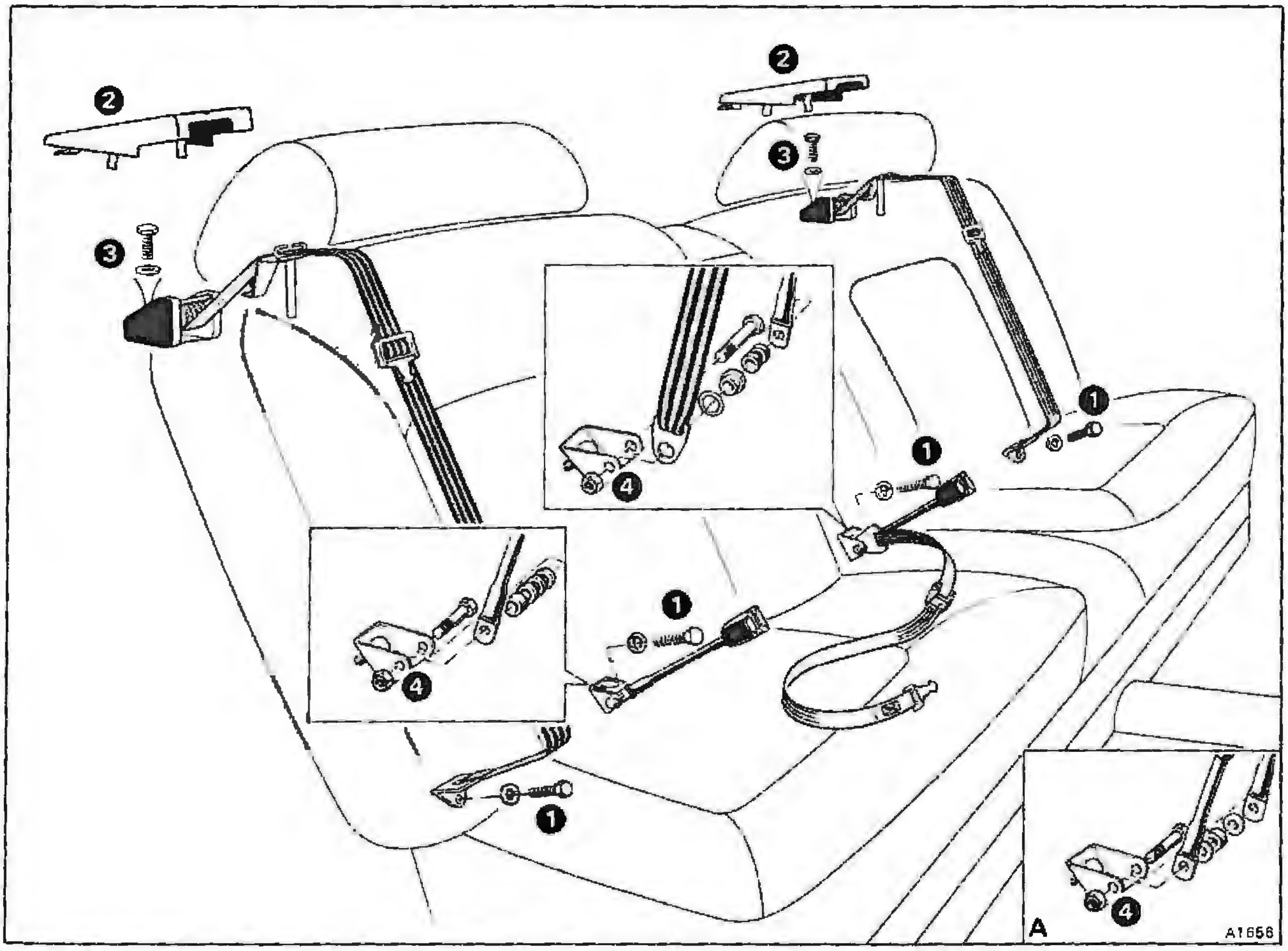


Fig. S14-3 Rear seat belt removal
A Additional stalk for a static lap belt

recess, check that the reel to sill mounting bracket is positioned as shown in figure S14-2. This will ensure that when the reel is mounted in the sill it will be positioned vertically.

2. Torque tighten the seat belt anchorage bolts as follows.

	Nm	kgf m	lbf ft
(items 4, 8, and 10) –	34-41	3,4-4,1	25-30
(item 9) –	22-24	2,2-2,5	16-18

3. Check that the plastic edge protector (item 11) is fitted to the reel mechanism cover plate, preventing possible chafing of the seat belt webbing.

4. Fully extend the seat belt webbing and check that the belt retracts fully when released.

5. *On cars conforming to a North American specification*, a warning buzzer device is fitted to remind occupants to fasten their seat belts. The operation of the warning buzzer is as follows.

If the engine is started without the driver's seat belt fastened, the buzzer will sound and a warning panel on the centre console will illuminate. The buzzer and panel will remain energized for approximately seven seconds. The buzzer will cease immediately the driver's seat belt is fastened.

If the engine is started with the driver's seat belt fastened, the warning panel will illuminate for approximately seven seconds to remind other occupants to fasten their seat belts. The panel will illuminate irrespective of whether the seat belts are fastened or not.

6. To check that the seat belts are operating correctly, select an open stretch of road. Then, when the road is free from any potential danger, accelerate the car to 24 km/h (15 mile/h) and brake sharply. Ensure that the belts lock and subsequently release.

An additional check should be made by fitting the belt and then giving the webbing of the diagonal belt a sharp pull. Ensure that the belt locks, then retracts when the tension is released.

Retractable rear seat belt – To remove (see fig. S14-3)

1. Lift out the rear seat cushion.
2. Remove the rear head rests.
3. To gain access to the seat belt anchorage bolts, it will be necessary to release the bottom of the rear seat squab (see Section S13).
4. Remove the exposed anchorage bolts and washers (item 1) then release the seat belt and stalk.
5. Unclip and remove the seat belt trim covers (item 2).
6. Release the anchorage bolt and washers (item 3) securing the reel mechanism to the parcel shelf. Release the webbing from the seat belt guide noting that *on cars conforming to an Australian specification* a plastic sleeve will first have to be removed from the guide. Remove the reel mechanism assembly.

Retractable rear seat belt – To fit (see fig. S14-3)

Reverse the procedure given for removal noting the following.

1. Torque tighten the seat belt anchorage bolts and nuts (items 1, 3, and 4) to between 34 Nm and 41 Nm (3,4 kgf m and 4,1 kgf m; 25 lbf ft and 30 lbf ft).
2. Fully extend the seat belt webbing and check that the belt retracts fully when released.
3. To check that the seat belts are operating correctly, select an open stretch of road. Then, when the road is free from any potential danger, accelerate the car to 24 km/h (15 mile/h) and brake sharply. Ensure that the belts lock and subsequently release.

An additional check should be made by fitting the belt and then giving the webbing of the diagonal belt a sharp pull. Ensure that the belt locks, then retracts when the tension is released.

Interior trim — passenger compartment

Contents

7/87
Printed in England

Interior trim — passenger compartment

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

Safety procedures
The cleaner and adhesives referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Upper instrument facia panels — To remove and fit (see fig. S15-1)
1. Disconnect the battery.
2. On cars fitted with a switchbox protection pad (item 1) proceed as follows.
Using a suitable tool, carefully prise out the three blanking plugs.
Release the exposed screws and remove the protection pad.
3. Release the screws and remove the trimmed beadings (item 2) situated along the lower edge of the instrument facia panel.
4. Release the grub screws (item 3) and remove both facia vent control knobs.
5. Release the three screws and cup washers (item 4) securing the instrument facia panel. Manoeuvre the panel from underneath the top roll and remove.
6. To remove the instrument facia end panel proceed as follows.
Open the facia stowage compartment.
Lower the fuse compartment door by depressing the release button situated on the top roll side panel.
Remove the end panel lower securing setscrew and washer (item 5).
To gain access to the end panel upper securing nut remove the screws and cup washers (item 6), then fold back the side lining of the stowage compartment.
Remove the nut and washer (item 7), taking care not to damage the soldered connections at the rear of the map lamp/vanity mirror switch.
Withdraw the panel and release the electrical connectors, noting the position of the leads to ensure correct assembly.
7. To fit the instrument facia panels reverse the removal procedure.

Top roll, demister panel, and lower trim panels — To remove and fit (see fig. S15-2)
1. Disconnect the battery.
2. Remove the upper instrument facia panels.
3. Remove the screws and washers (item 1) and lower the parking brake trim panel. Release the Lucar connectors from the footwell lamp (item 2) and remove the panel.
4. Remove the top roll securing screws, nuts,

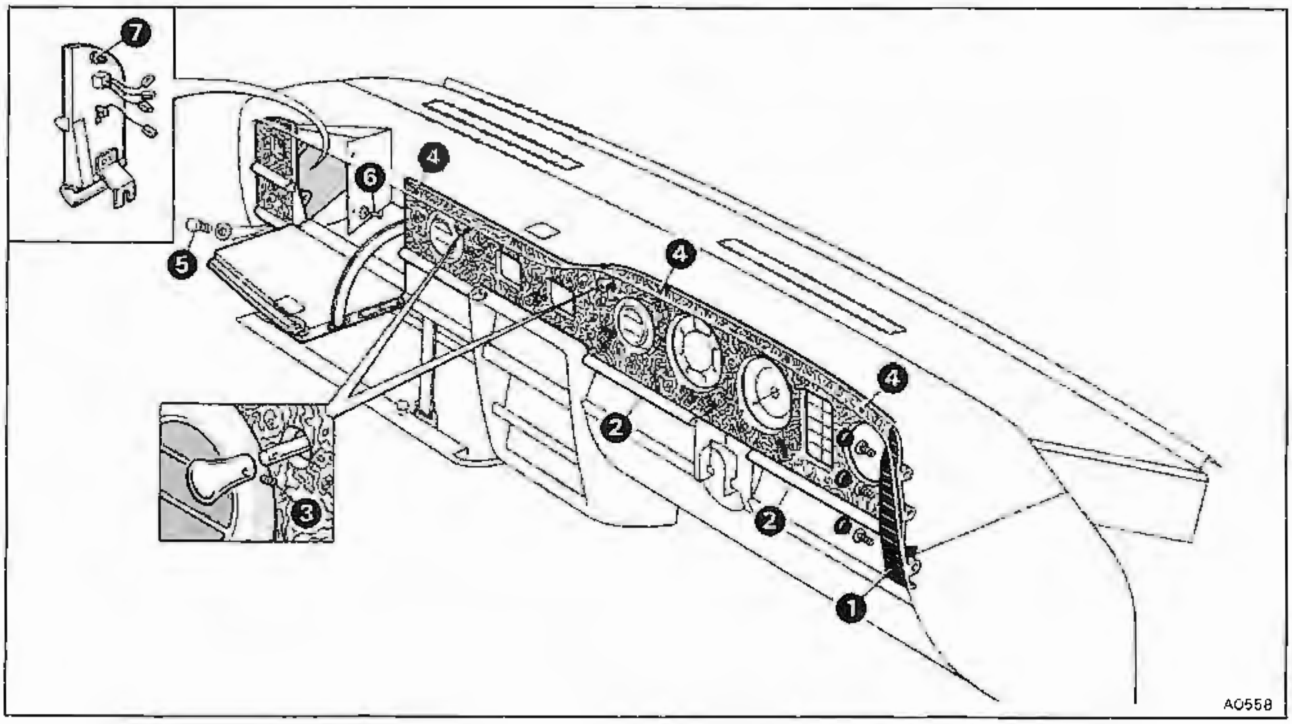


Fig. S15-1 Upper instrument facia panels

bolts, and washers (item 3).

5. Carefully withdraw the top roll assembly horizontally to avoid damaging the solar temperature sensor (item 4).

6. To remove the demister panel proceed as follows.

Remove the bolts, nuts, and washers (item 5).

Raise the front of the panel slightly to clear the windscreen demister ducting. Then, carefully ease the panel from underneath the windscreen finisher trim and remove.

7. Remove the windscreen finisher trim panel (item 6) by pulling it forward to disengage the retaining tabs.

8. To remove the fuse compartment door proceed as follows.

Release the Lucar connectors from the footwell lamp (item 7).

Unhook the support straps then release the nuts and washers (item 8) and remove the fuse compartment door. Note that the fuse compartment lamp switch cancelling bracket is secured underneath the outboard securing nuts.

9. To fit the lower trim panels, demister panel, and top roll reverse the removal procedure.

Facia door and stowage compartment — To remove and fit (see fig. S15-3)

1. Release the screws (item 1) and remove the facia stowage door.

2. To remove the stowage compartment proceed as follows.

Disconnect the battery.

Remove the two screws (item 2). Withdraw the stowage compartment lamp and release the Lucar connectors.

Remove the screws, cup washers, and plastic clips (item 3) securing the stowage compartment to the instrument board.

To gain access to the stowage compartment lamp switch and luggage compartment locking selector switch, fold back the side lining of the stowage compartment (item 4).

Release the Lucar connectors from both switches.

Release the screws and washers (item 5), then remove the switch mounting bracket/door check arm assembly.

Carefully withdraw the stowage compartment.

3. To fit the stowage compartment and facia door reverse the removal procedure.

Centre console — To remove and fit (see fig. S15-4)

Other than Bentley Mulsanne S and Turbo R cars

1. Disconnect the battery.

2. Remove the upper instrument facia panel.

3. Loosen the setscrews and washers (item 1) securing the lower sides of the console.

4. Remove the screws (item 2) securing the top of the console to the instrument board. Carefully

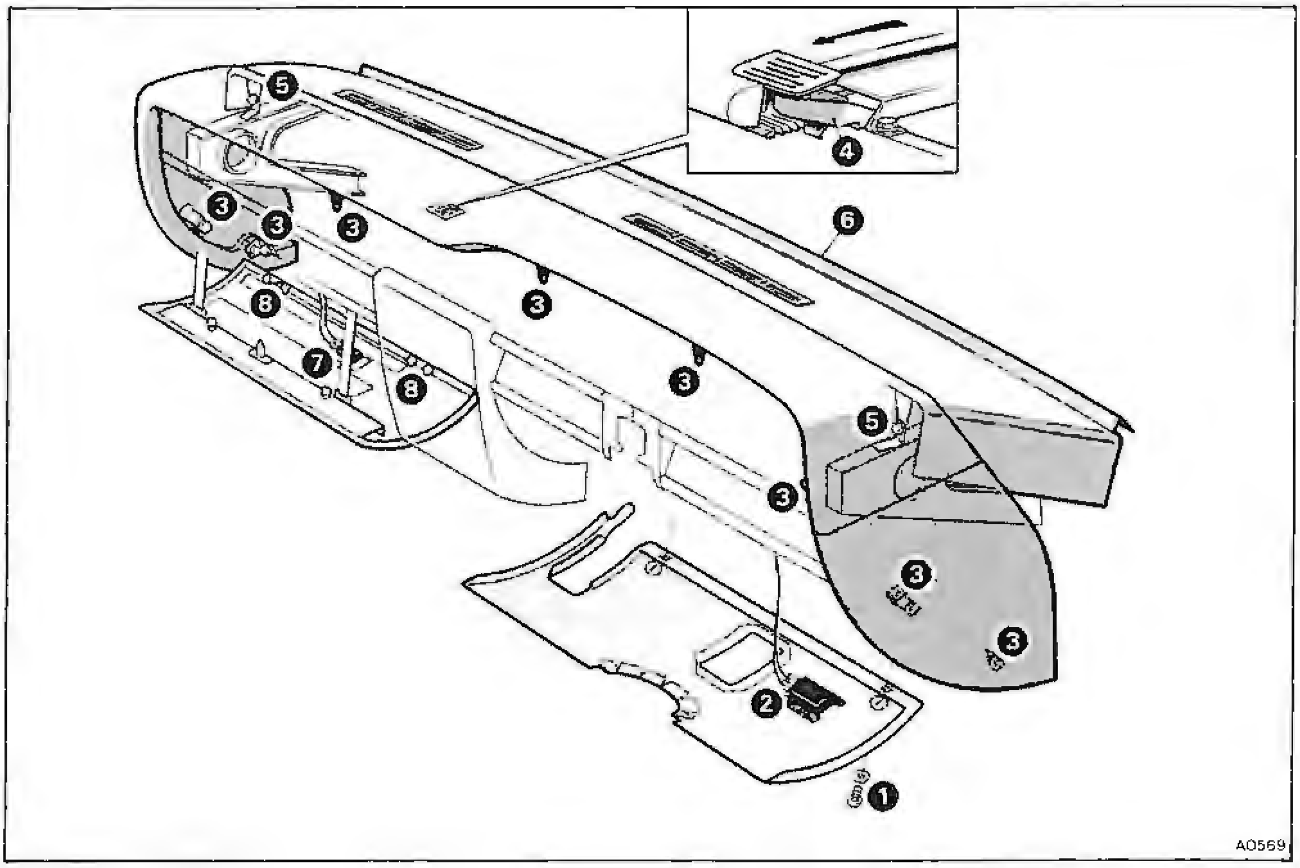


Fig. S15-2 Top roll, demister panel, and lower trim panels

withdraw the console sufficiently to gain access to the electrical connections. Disconnect the various leads, noting their positions to ensure correct assembly.

5. To fit the centre console reverse the removal procedure.

Centre console — To remove and fit (see fig. S15-5)
Bentley Mulsanne S and Turbo R cars

1. Remove the upper instrument facia panel.
2. Remove the screws (item 1) securing the console to the instrument board.
3. Turn the ignition key to the ACC or RUN position. Then, using the seat adjustment controls, move both front seats rearward to the full extent of their travel. Disconnect the battery.
4. To gain access to the console rear securing screws it will be necessary to remove the front seat cushions (see Section S13). Remove the exposed screws (item 2).
5. Lift out the ash tray, then remove the exposed screws (item 3) securing the console to the transmission tunnel.
6. Carefully withdraw the console assembly sufficiently to disconnect the various electrical leads. In view of the large number of connections, it is advisable to label each one as it is disconnected.
7. To fit the console reverse the removal procedure.

Lower instrument facia panels — To remove and fit (see fig. S15-6)

1. Disconnect the battery.
2. Lower the fuse compartment door by depressing the release button situated on the top roll side panel.
3. Release the setscrews and washers (item 1). Then, unclip and remove the facia panel adjacent to the centre console.
4. Remove the parking brake trim panel (see Top roll, demister panel, and lower trim panels — To remove and fit, Operation 3).
5. Release the screws and remove the trimmed beadings (item 2) situated along the lower edge of the instrument facia panel.
6. Release the screws and washers (item 3) securing the air conditioning control panel to the instrument board. Withdraw the panel and release the electrical connections, noting the position of the leads to ensure correct assembly.

   Similarly, remove the control panel containing the windscreen wipers switch, fuel filler door release button, etc.
7. To fit the lower instrument facia panels, reverse the removal procedure.

Instrument board — To remove and fit (see fig. S15-7)

1. Disconnect the battery.
2. Remove the upper and lower instrument facia panels, facia stowage door, top roll, lower trim panels, and centre console.
3. Disconnect the electrical leads from all instruments, lamps, switches, etc. In view of the large number of connections, it is advisable to label each one as it is disconnected to facilitate assembly.
4. Remove the nuts (item 1) securing the air vent control levers to the instrument board.
5. To remove the circular facia air outlets and ducts refer to Chapter C.
6. Remove the bolts, nuts, and washers (item 2) securing the lower centre section of the instrument board.
7. Remove the bolts, nuts, and washers (item 3) securing the upper centre section of the instrument board.

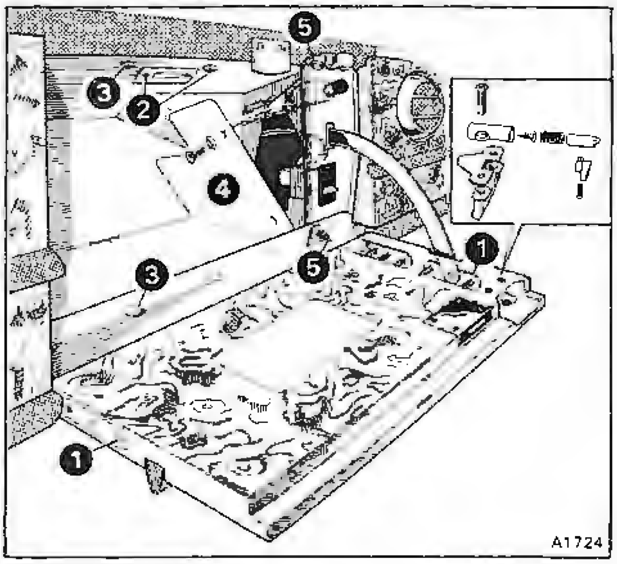


Fig. S15-3 Facia stowage compartment

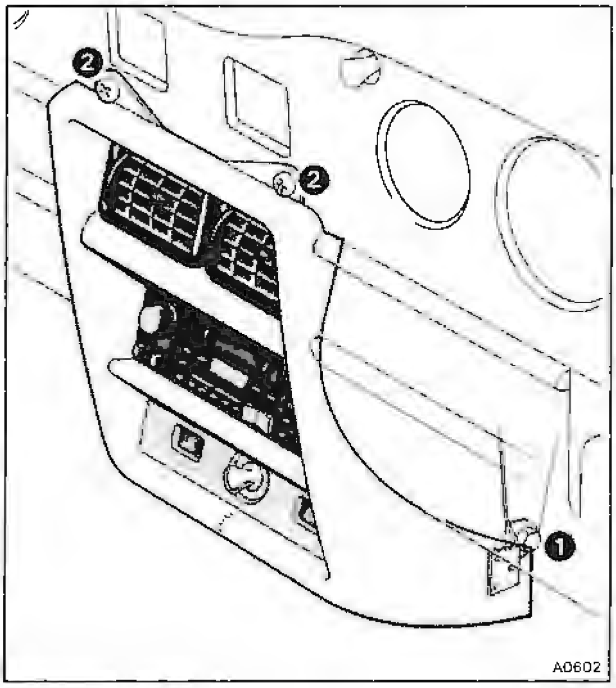


Fig. S15-4 Centre console
Other than Bentley Mulsanne S and Turbo R cars

8. With the help of an assistant, support the instrument board then release the nuts and washers (item 4) securing each end. Remove the instrument board.

9. To fit the instrument board reverse the removal procedure.

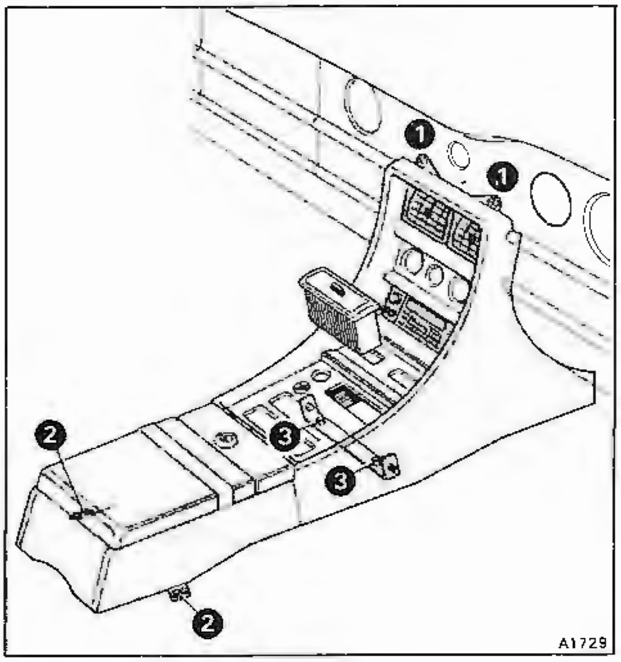


Fig. S15-5 Centre console
Bentley Mulsanne S and Turbo R cars

Front header trim panels — To remove (see fig. S15-8)

1. Disconnect the battery.
2. Unscrew and remove the interior rear view mirror. On cars fitted with a cellular telephone, unclip the microphone mounted on the mirror stem.
3. Pull the sun visors from their inboard retaining clips. Release the screws (item 1) and remove the sun visors.
4. Remove the screws (item 2). Slide back the centre header trim panel and release the Lucar connector (if fitted) from the passenger side visor retaining clip and unplug the cellular telephone microphone (if fitted). Remove the trim panel.
5. Remove the flexible outer covers from the coat hooks situated on the cantrail trim panels. Unscrew the coat hooks and remove the stainless steel trim finishers.
6. Unclip and remove the 'A' post/cantrail trim panels (item 3).
7. Release the screws (item 4) and remove the visor clip retaining brackets and header trim panels.
8. Carefully separate the glued edge of the header trim material and foam (item 5) from the headlining material. Remove the exposed self-tapping screws and washers (item 6), then remove the header trim pieces.

Front header trim panels — To fit (see fig. S15-8)
Reverse the procedure given for removal noting the following.

1. To fit the header trim pieces (item 5) proceed as follows.

Using the self-tapping screws and washers (item

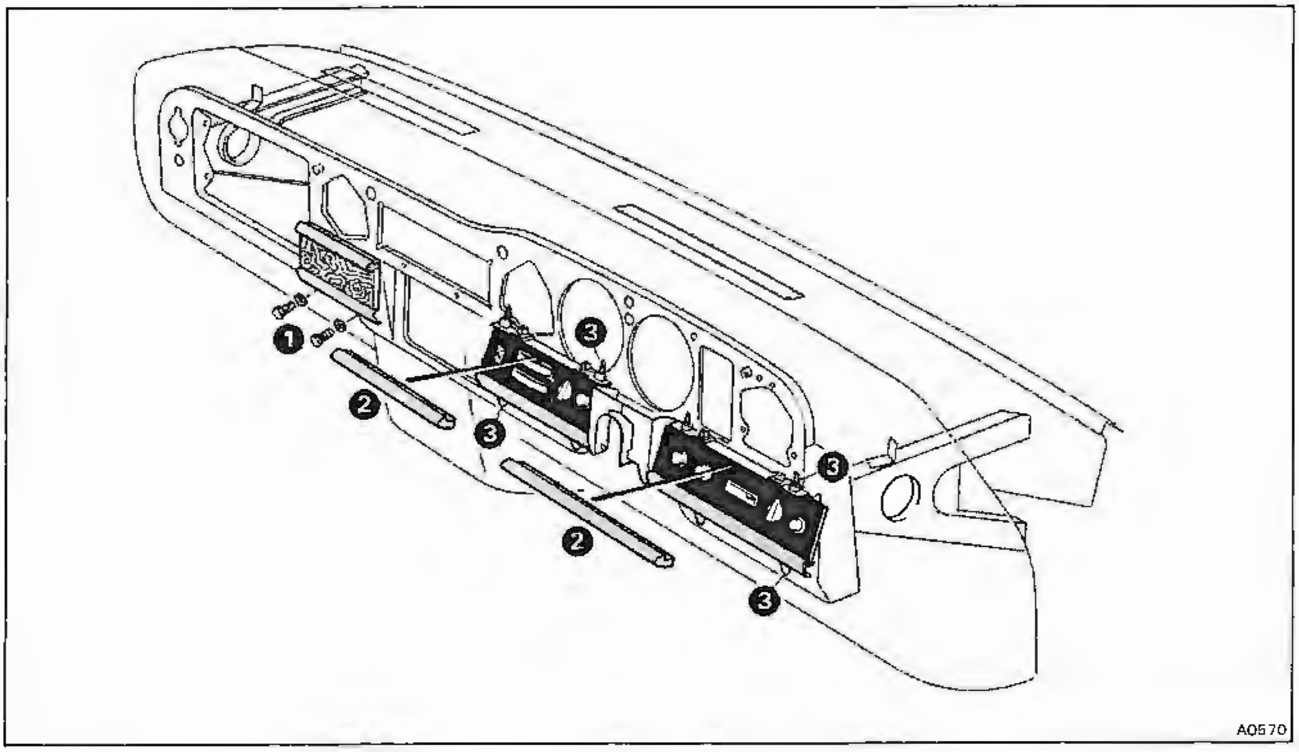


Fig. S15-6 Lower instrument facia panels

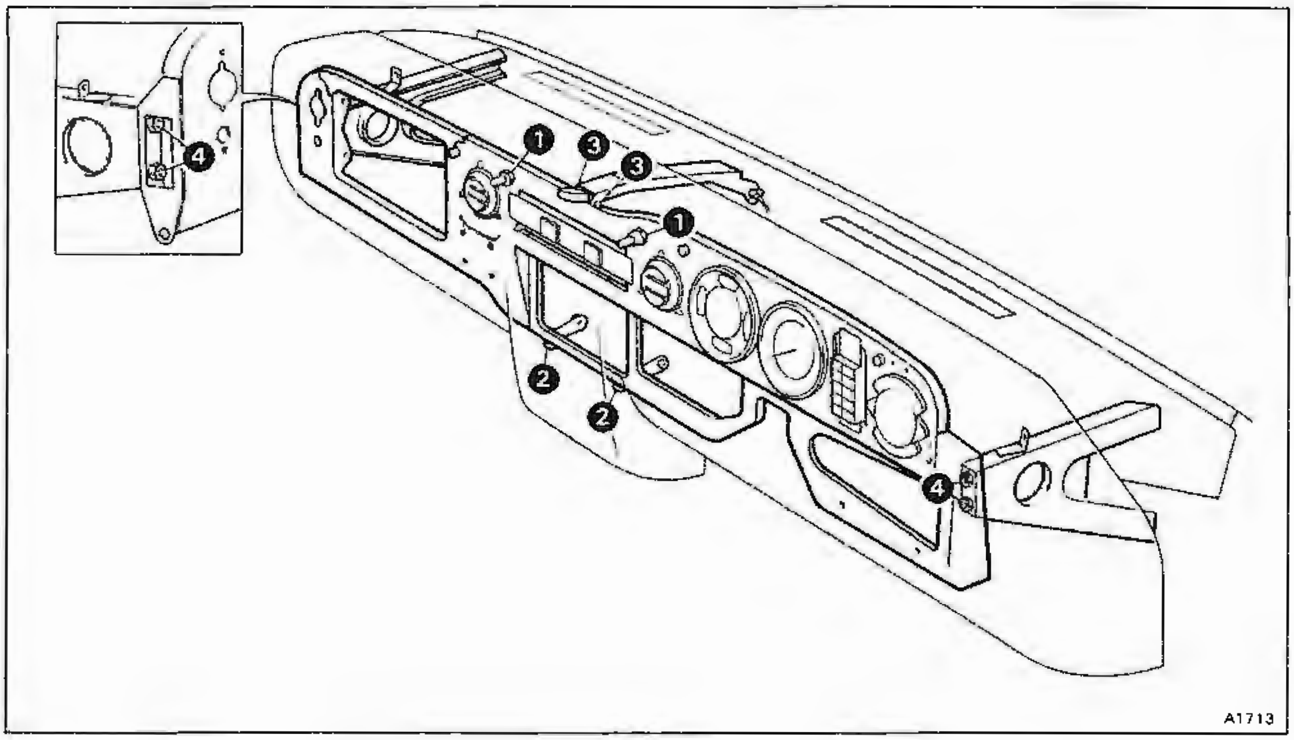


Fig. S15-7 Instrument board

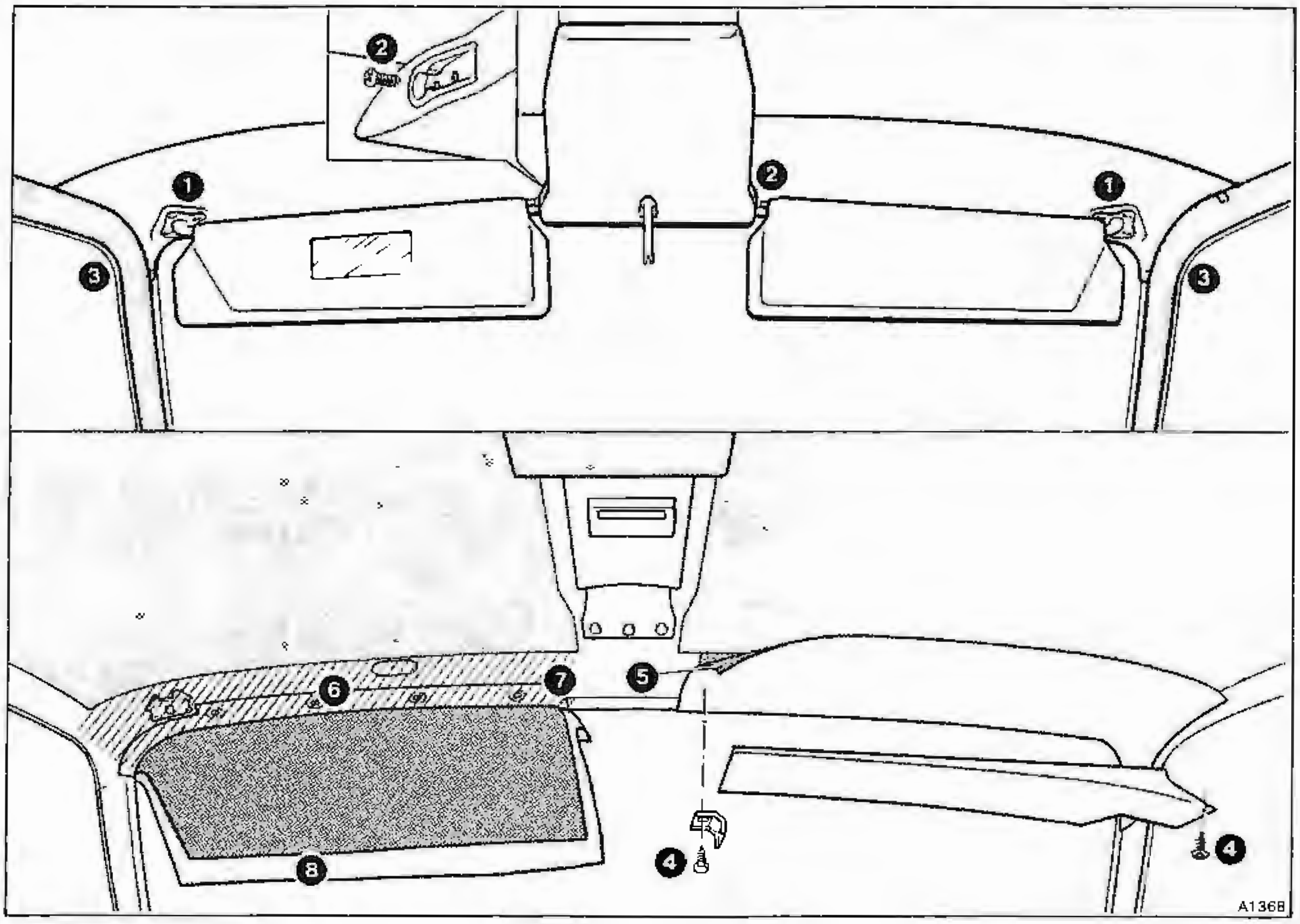


Fig. S15-8 Front header trim panels

6), secure the trim pieces to the header panel.

Apply Apollo Adhesive AX 2344 to the header panel covering an area approximately 75 mm (3.0 in) wide. Refer to cross-hatched area (item 7). Allow five minutes for the adhesive to 'flash' dry, then press the foam panel (item 8) firmly into position.

Apply Apollo Adhesive AX 2344 to the roof headlining material adjacent to the edge of the foam panel. Cover an area approximately 25 mm (1.0 in) wide. Similarly, cover the corresponding area of the header trim piece material. Allow five minutes for the adhesive to 'flash' dry. Then, keeping the trim piece material taut, press firmly into position.

Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

Parcel shelf, cantrail/quarter panel, and rear header trim panel — To remove and fit (see fig. S15-9)

1. Remove the rear seat cushion and squab assembly (see Section S13).
2. Remove the seat belt anchorage bolts situated on the rear squab panel. Release the webbing from the seat belt guides and carefully allow the belts to retract into the reel mechanisms. Note that *on cars conforming to an Australian specification* a plastic sleeve will first have to be removed from each guide.
3. If fitted, release the front of the trimmed stop lamp unit from the retaining clip (item 1). Carefully raise the front of the lamp unit and pull it forward slightly to disengage the rear retaining lugs. Disconnect the battery then unplug the electrical lead to the lamp and remove the stop lamp unit.
4. Ease the front of the parcel shelf (item 2) upwards slightly and carefully remove.
5. To remove the cantrail/quarter panel proceed as follows.

Disconnect the battery.

Using a suitable flat bladed tool, carefully ease the front of the companion frame (if fitted) out of its recess (item 3).

Release the Lucar connectors, noting the position of the leads to ensure correct assembly, then remove the companion frame.

Pull down the spring loaded grab handle (item 4) to expose the retaining screws. Release the screws and remove the handle.

Remove the flexible outer cover from the coat hook situated on the cantrail trim panel (item 5).

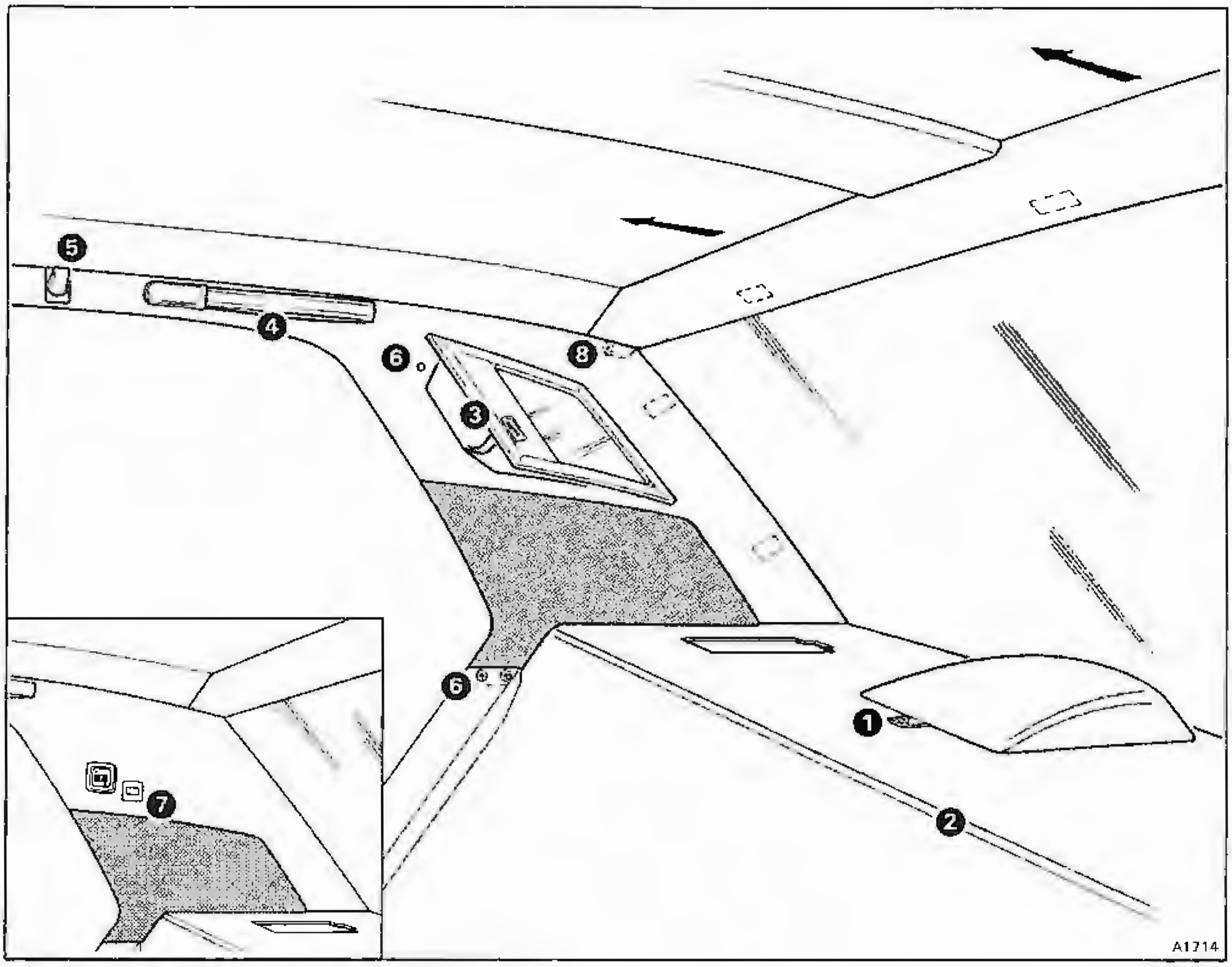


Fig. S15-9 Parcel shelf, cantrail/quarter, and rear header trim panels

Unscrew the coat hook and remove the stainless steel trim finisher.

Remove the self-tapping screws (item 6).

On Bentley Eight cars, carefully ease the escutcheon cover (item 7) from the interior/map lamp switch, release the exposed screws and remove the escutcheon.

Remove the cantrail/quarter panel by pulling it forward to disengage the rear retaining brackets.

6. Release the self-tapping screw (item 8) from each end of the rear header trim panel. Remove the panel by pulling it forward to disengage the rear retaining brackets.

7. To fit the rear header trim panel, cantrail/quarter panel, and parcel shelf reverse the removal procedure.

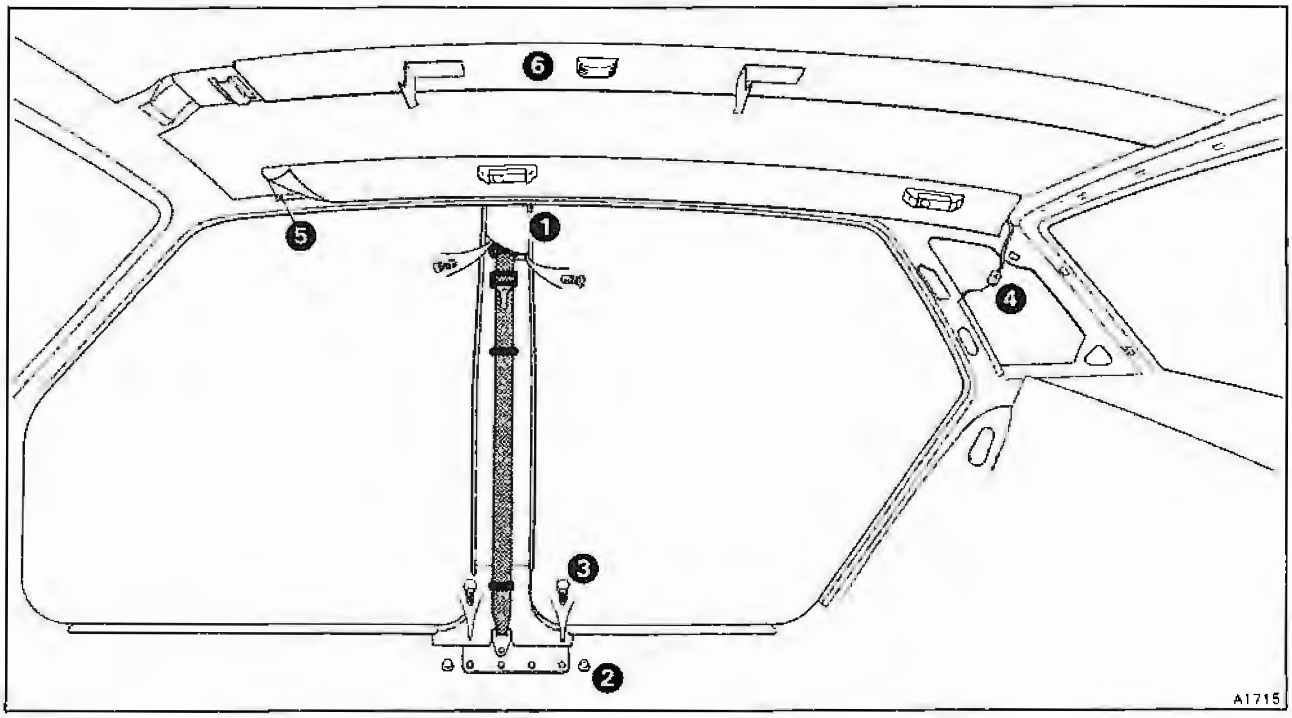


Fig. S15-10 'BC' post, side header, and centre roof trim panels

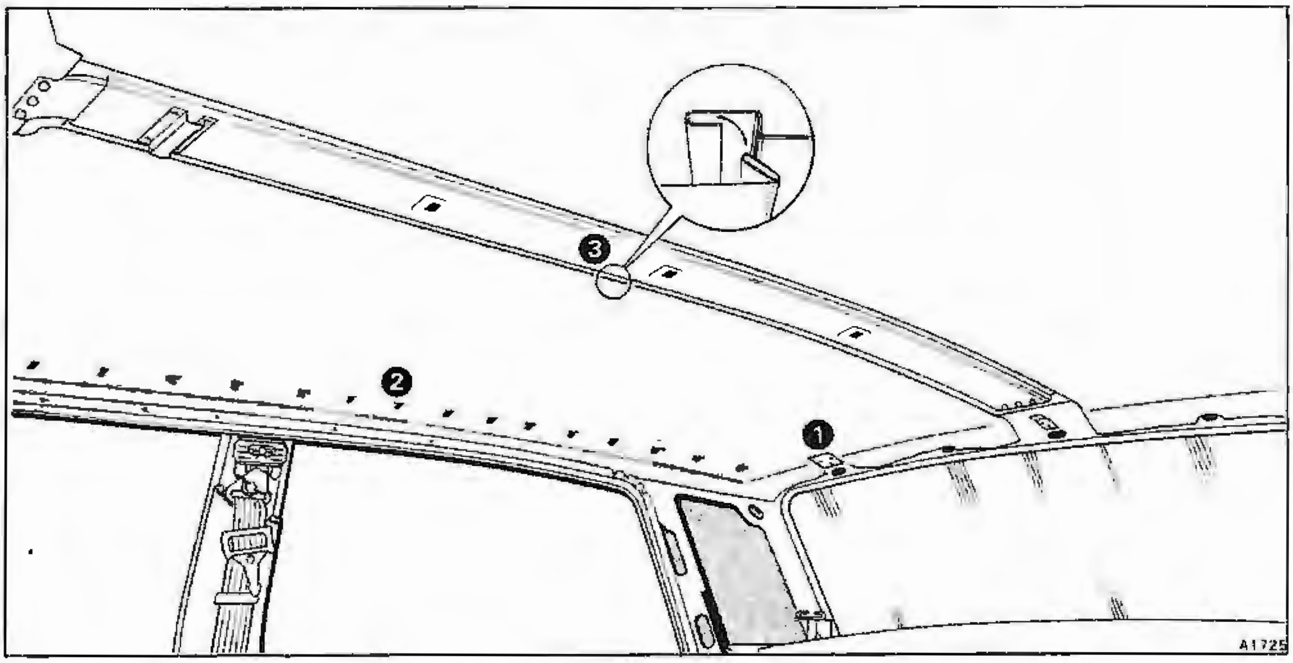


Fig. S15-11 Headlining removal

'BC' post, side header, and centre roof trim panels — To remove and fit (see fig. S15-10)

1. To remove the 'BC' post trim proceed as follows.

Remove the two screws securing the upper trim panel (item 1). Lift the trim slightly to disengage the retaining clips and remove.

Unclip the rear compartment floor carpet and remove the two exposed screws and carpet retainers (item 2).

Peel back the soundproofing material, then remove the two exposed setscrews (item 3).

Loosen the stainless steel sill finishers adjacent to the 'BC' post to enable the ends of the trim to be released.

Release the seat belt webbing from the retaining clip on the 'BC' post trim panel.

Slide the 'BC' post trim panel upwards to disengage the rear retaining brackets and remove.

2. To remove the side header trim panel proceed as follows.

Remove the front header trim, rear header trim, and cantrail trim.

Disconnect the battery. Then, unplug the interior lamp loom connector (item 4).

Separate the glued edge of the side header trim material from the cantrail panel to expose the securing screws (item 5).

Release the screws, then remove the side header panel complete with the interior lamps.

3. To remove the centre roof trim panel (item 6) proceed as follows.

Disconnect the battery.

Remove the front centre header trim panel.

Slide the centre roof trim panel towards the front of the car to disengage the retaining brackets. Release the Lucar connectors at the rear of the panel. Remove the panel complete with the upper air temperature sensor.

4. To fit the centre roof trim panel, side header trim panel, and 'BC' post trim reverse the removal procedure noting the following.

Apply Apollo Adhesive AX 2344 along the edge of the side header trim material and to the corresponding area of the cantrail panel. Allow five minutes for the adhesive to 'flash' dry, then bring both surfaces together using maximum hand pressure.

Headlining material — To remove (see fig. S15-11)

1. Remove the front header trim, rear header trim, cantrail/quarter trim, side header trim, and centre roof trim.
2. From above the rear window, drill out the pop rivets and remove the two outer rear header trim securing brackets (item 1).
3. Remove the headlining clips (item 2).
4. Separate the glued edge of the headlining from the front and rear header and cantrail panels. Release the headlining from the channel formed in the centre roof panel (item 3) and remove.

Headlining material — To fit (see fig. S15-11)

1. Clean the bonding surfaces of the cantrail and header panels using a cloth moistened with Bostik

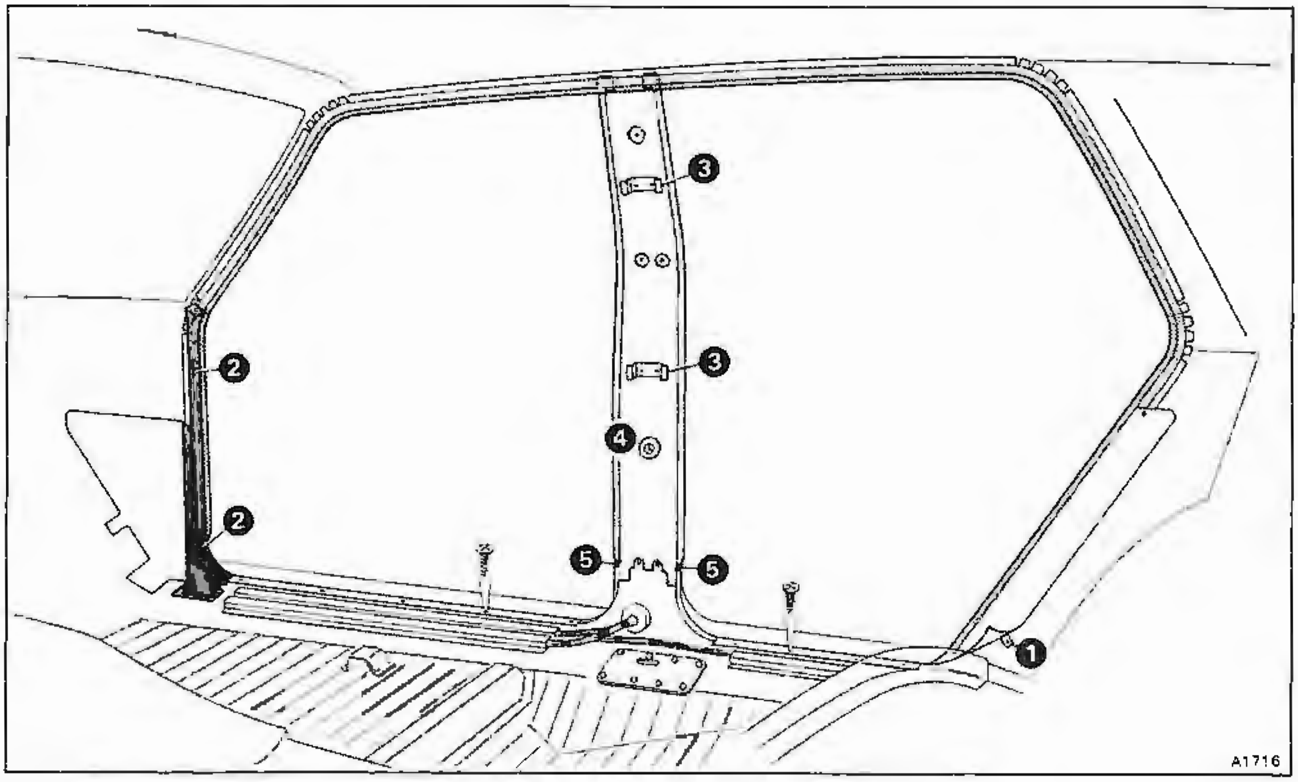


Fig. S15-12 Draught welts

Cleaner 6001. Allow to dry.
2. Lay the headlining panel onto a suitable cloth covered bench. Slide the nylon strip into the sleeve along the inner edge of the headlining.
3. Apply Apollo Adhesive AX 2344 around the outer bonding edges of the headlining to a depth of approximately 75 mm (3.0 in).

Similarly, apply adhesive to the corresponding bonding surfaces of the cantrail and header panels. Allow five minutes for the adhesive to 'flash' dry.
4. Insert the inner edge of the headlining panel containing the nylon strip into the channel formed in the centre roof panel.
5. Keeping the headlining material taut to prevent creasing, press firmly into position along the cantrail and front and rear header panels.
6. Using a trimming knife, remove any excess headlining material.
7. Pierce the headlining material to accept the retaining clips (item 2). Then, press the clips into position along the cantrail panel. Also pierce the headlining material where the cantrail trim securing clips will engage.
8. Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

Draught welts — To remove (see fig. S15-12)
1. Remove the cantrail trim panels and 'BC' post trim.
2. To remove the lower 'D' post trim panel proceed as follows.

Peel back the trim material and remove the exposed screw (item 1).

Loosen the stainless steel sill finisher to enable the end of the trim to be released.
3. To remove the lower 'A' post trim panel proceed as follows.

Remove the two screws and cup washers (item 2).

Loosen the stainless steel sill finisher to enable the end of the trim to be released.
4. Carefully separate the glued draught welt from around the 'A' post, cantrail, and 'D' post and remove.
5. To remove the draught welt from the 'BC' post it will first be necessary to release the upper seat belt anchorage bolt and remove the seat belt guides (see Section S14).
6. Unscrew and remove the 'BC' post trim panel retaining brackets (item 3).
7. Remove the screw and washer (item 4).
8. Release the retaining clips (item 5), then peel back the top of the draught welt and remove.

Draught welts — To fit (see fig. S15-12)
Reverse the procedure given for removal noting the following.
1. Clean the bonding surfaces of the 'A' post, cantrail, and 'D' post using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
2. Fit the 'BC' post draught welt, ensuring that the seat belt guide holes are aligned.

Apply Apollo Adhesive AX 2344 to the top flap of the 'BC' post draught welt and to the corresponding area on the cantrail. Allow five minutes for the adhesive to 'flash' dry, then bring both surfaces firmly together.
3. Lay the draught welt for the 'A' post/cantrail/'D' post onto a suitable cloth covered bench.

Apply Apollo Adhesive AX 2344 along the length of the cloth backing strip.

Similarly, apply adhesive to the corresponding bonding surfaces of the 'A' post, cantrail, and 'D' post. Allow five minutes for the adhesive to 'flash' dry.

Starting at the base of the 'D' post, carefully press the draught welt into position. At each bend, make a series of small cuts in the cloth backing strip to enable the draught welt to easily follow the contour of the door aperture.

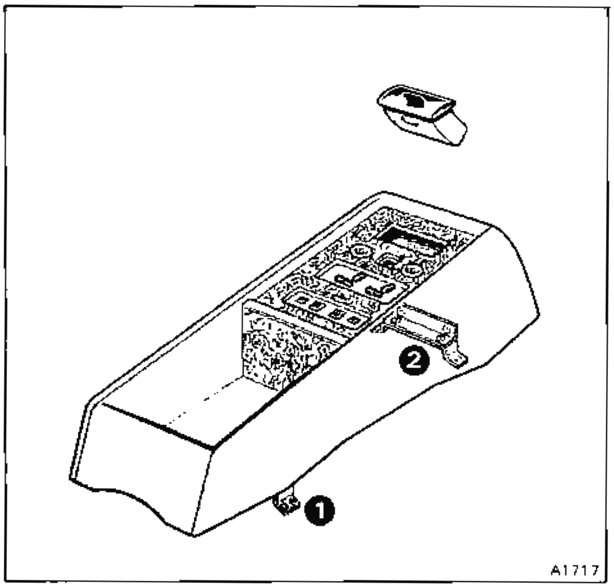


Fig. S15-13 Centre stowage bin

Centre stowage bin — To remove and fit (see fig. S15-13)
1. Disconnect the battery.
2. To gain access to the stowage bin rear securing screws it will be necessary to remove the front seat cushions (see Section S13). Remove the exposed screws (item 1).
3. Lift out the ash tray, then remove the exposed screws (item 2) securing the front of the stowage bin.
4. Carefully raise the stowage bin sufficiently to disconnect the various electrical leads. In view of the large number of connections, it is advisable to label each one as it is disconnected.
5. To fit the stowage bin reverse the removal procedure.

Floor and transmission tunnel carpets — To remove and fit (see fig. S15-14)
1. Release the Velcro strips and stud fasteners securing the floor carpets. Remove the carpets.
2. Remove the centre console/stowage bin.
3. Release the Velcro strips and stud fasteners, then remove the front transmission tunnel carpet.

4. To renew the rear transmission tunnel carpet proceed as follows.

Peel off the transmission tunnel carpet.

Thoroughly clean the bonding surface of the transmission tunnel using a cloth moistened with Bostik Cleaner 6001. Allow to dry.

Apply Apollo Adhesive AX 2344 to the bonding surfaces of the transmission tunnel soundproofing and carpet.

Allow five minutes for the adhesive to 'flash' dry, then bring both surfaces together using maximum hand pressure. Ensure that the carpet is positioned

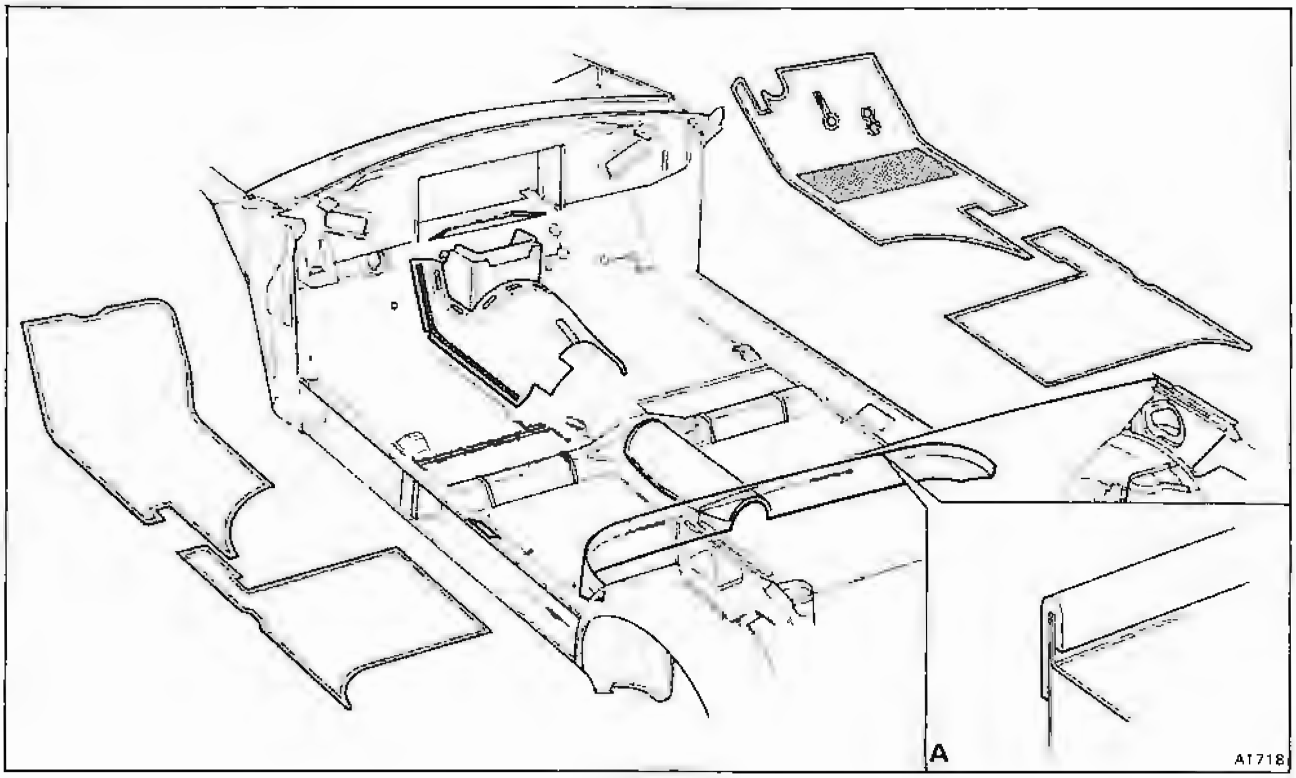


Fig. S15-14 Carpets

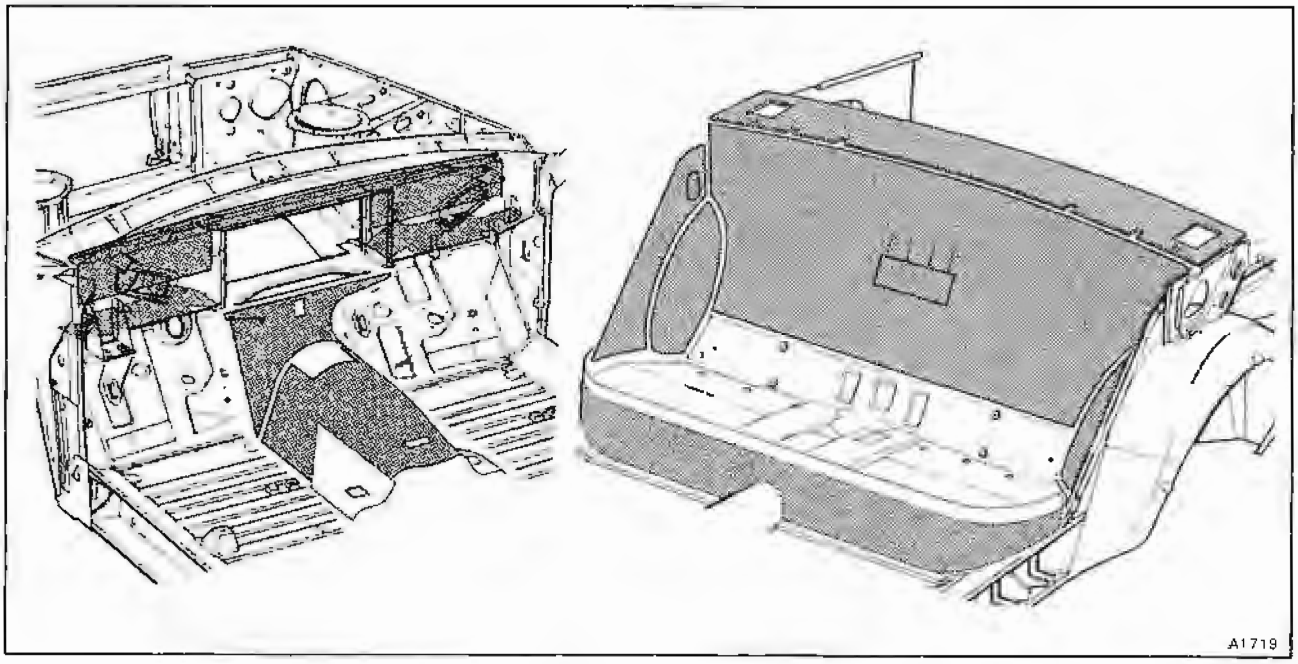


Fig. S15-15 Soundproofing — bulkhead, transmission tunnel, and rear seat area

accurately around the seat belt stalks.

5. If the carpets or rugs require cleaning, refer to Chapter A for full cleaning instructions.

Heelboard carpet trim — To renew (see fig. S15-14)

1. Remove the rear floor carpets.
2. Lift out the rear seat cushion.
3. Peel back the glued rear carpet securing flap from the soundproofing material. Remove the screws and carpet retainers, then fold back the soundproofing material to expose the rear floor area.
4. Disconnect the battery. Then, carefully prise out the heelboard lamps, release the Lucar connectors and remove.
5. Peel back the soundproofing material from the rear seat pan.
6. Carefully peel off the glued heelboard carpet trim. Using a suitable scraper, remove all traces of foam padding from the top section of the heelboard. Then, thoroughly clean the heelboard area using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
7. Apply Apollo Adhesive AX 2344 to the top section of the heelboard and to the foam padding strip. Allow five minutes for the adhesive to 'flash' dry, then press the foam strip into position (see fig. S15-14, inset A).
8. Lay the heelboard carpet trim onto a suitable cloth covered bench.

Apply Apollo Adhesive AX 2344 to the bonding surfaces of the trim and to the heelboard soundproofing and foam padding. Allow five minutes for the adhesive to 'flash' dry.

Starting in the centre and working outwards, firmly press the carpeted area of the trim into position around the transmission tunnel.

Stretch the leather trim over the seat base flange ensuring that no creases occur.

9. Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

Soundproofing — bulkhead, transmission tunnel, and rear seat area — To renew (see fig. S15-15)

A rubberized hessian backed soundproofing material is adhered to the bulkhead, transmission tunnel, and rear seat areas of the car.

1. To renew any of the above soundproofing panels proceed as follows.

Peel off the soundproofing panel.

Thoroughly clean the bonding surface of the body using a cloth moistened with Bostik Cleaner 6001. Allow to dry.

Apply Apollo Adhesive AX 2344 to the bonding surface of the body and to the hessian backing of the soundproofing panel. Allow five minutes for the adhesive to 'flash' dry.

Align the panel, ensuring that any holes or cut-

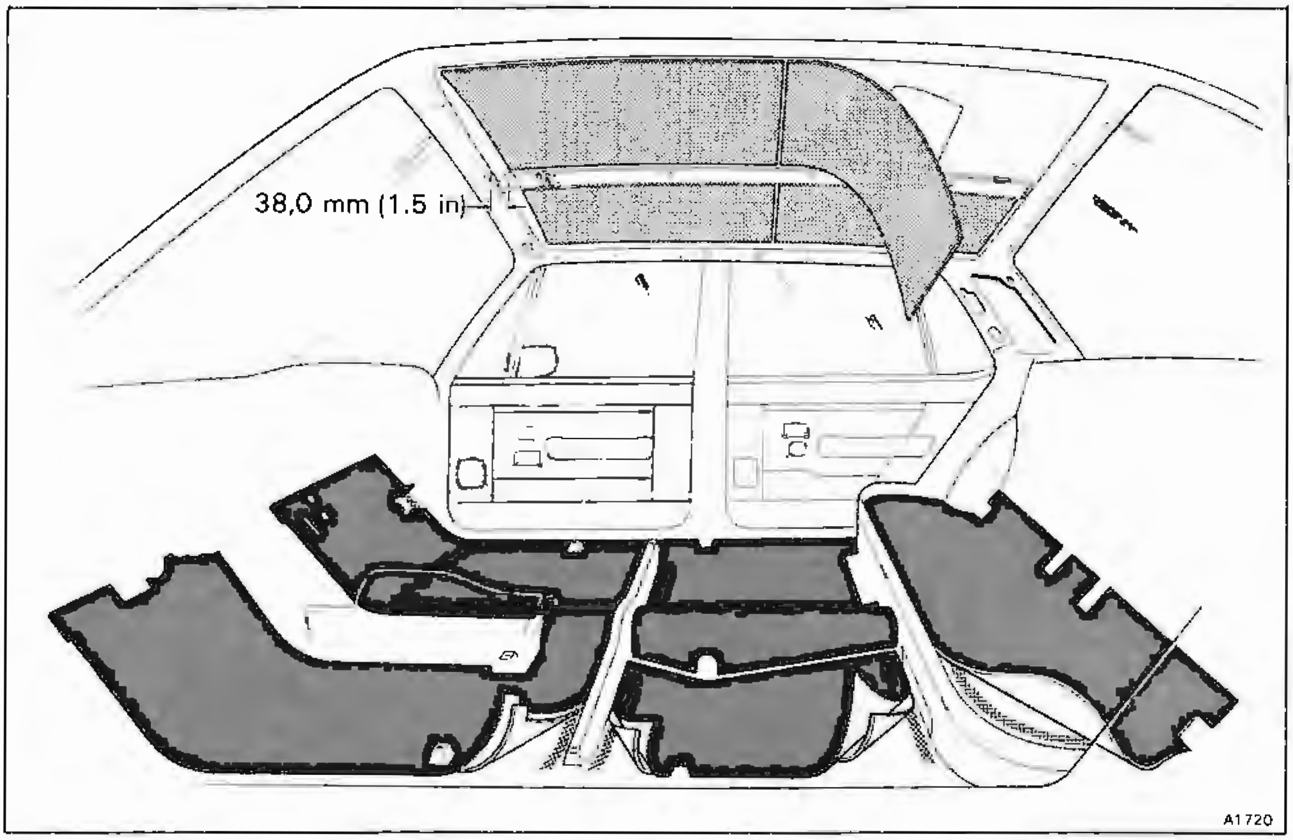


Fig. S15-16 Soundproofing — roof, rear quarter, floor, and rear seat base
On cars conforming to an Australian, Japanese, and North American specification, the dotted line indicates the approximate area covered by insulating material

outs are correctly located, then press firmly into position.

Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

Soundproofing — roof, rear quarter, floor, and rear seat base — To renew (see fig. S15-16)

1. The foam soundproofing panels fitted to the roof panel are self-adhesive and can be easily removed.

Prior to fitting a new soundproofing panel, thoroughly clean the bonding surface of the roof using a cloth moistened with Bostik Cleaner 6001. Allow to dry.

When fitting a panel, remove the backing paper and position as indicated in figure S15-16. Press the soundproofing firmly into position eliminating any air bubbles.

2. The foam soundproofing fitted to each rear quarter is simply wedged behind the inner panel and can be easily renewed if necessary.

3. A PVC coated foam soundproofing material is fitted to the floor and rear seat base areas of the car. Additionally, with the exception of the driver's floor area, a foam underlay is fitted beneath the PVC coated soundproofing.

On cars conforming to an Australian, Japanese, and North American specification, a non inflammable insulating material is fitted beneath the PVC coated soundproofing on the right-hand side of the car. The approximate area covered by this material is indicated in figure S15-16.

To remove a PVC coated foam soundproofing panel, it may first be necessary to unscrew and remove the rear compartment air ducting and the appropriate carpet retainers.

Where soundproofing or foam underlay panels are to be glued to the floor or seat base, the following procedure should be adopted.

Apply Dunlop S1127 Adhesive to the bonding surfaces of the body and the soundproofing. Allow five minutes for the adhesive to 'flash' dry. Align the panel ensuring that any holes or cut-outs are correctly located, then press firmly into position.

Interior trim — luggage compartment

Contents

Contents	Pages Rolls-Royce Silver Spirit	Silver Spur	Bentley Eight	Mulsanne / Mulsanne S	Turbo R
Introduction	S16-3	S16-3	S16-3	S16-3	S16-3
Safety procedures	S16-3	S16-3	S16-3	S16-3	S16-3
Luggage compartment carpets and trim panels — To remove and fit	S16-3	S16-3	S16-3	S16-3	S16-3
Tool stowage tray and rear panel fittings — To remove and fit	S16-4	S16-4	S16-4	S16-4	S16-4
Soundproofing — To remove and fit	S16-5	S16-5	S16-5	S16-5	S16-5

7/87
Printed in England

Interior trim — luggage compartment

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim etc., that are removed.

The trimmed luggage compartment side panels conceal various electrical components. For example, the anti-lock braking system electronic control unit and the automatic radio aerial are housed behind the left-hand side panel. Also, on cars fitted with a cellular telephone, the transceiver unit is mounted on a hinged flap incorporated in the left-hand side panel.

The right-hand side panel conceals the seat/radio memory fuse, and the high mounted stop lamp fuse (if fitted). The earth connection from the battery is also at the rear of this panel.

Incorporated into the right-hand side panel are two containers of hydraulic system mineral oil. Access to the containers can be made by releasing the spring loaded fastener securing the top of the hinged flap.

Safety procedures
The cleaner and adhesive referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Luggage compartment carpets and trim panels — To remove and fit (see fig. S16-1)

1. Release the stud fasteners and remove the luggage compartment floor carpet.
2. To remove the luggage compartment front trim panel proceed as follows.

Remove the battery master switch knob (item 1) by releasing the centre screw, ring nut, and instruction plate.

Remove the screws and cup washers (item 2) situated along the top and bottom of the panel.

Release the two press fasteners (item 3).

Withdraw the trim panel.

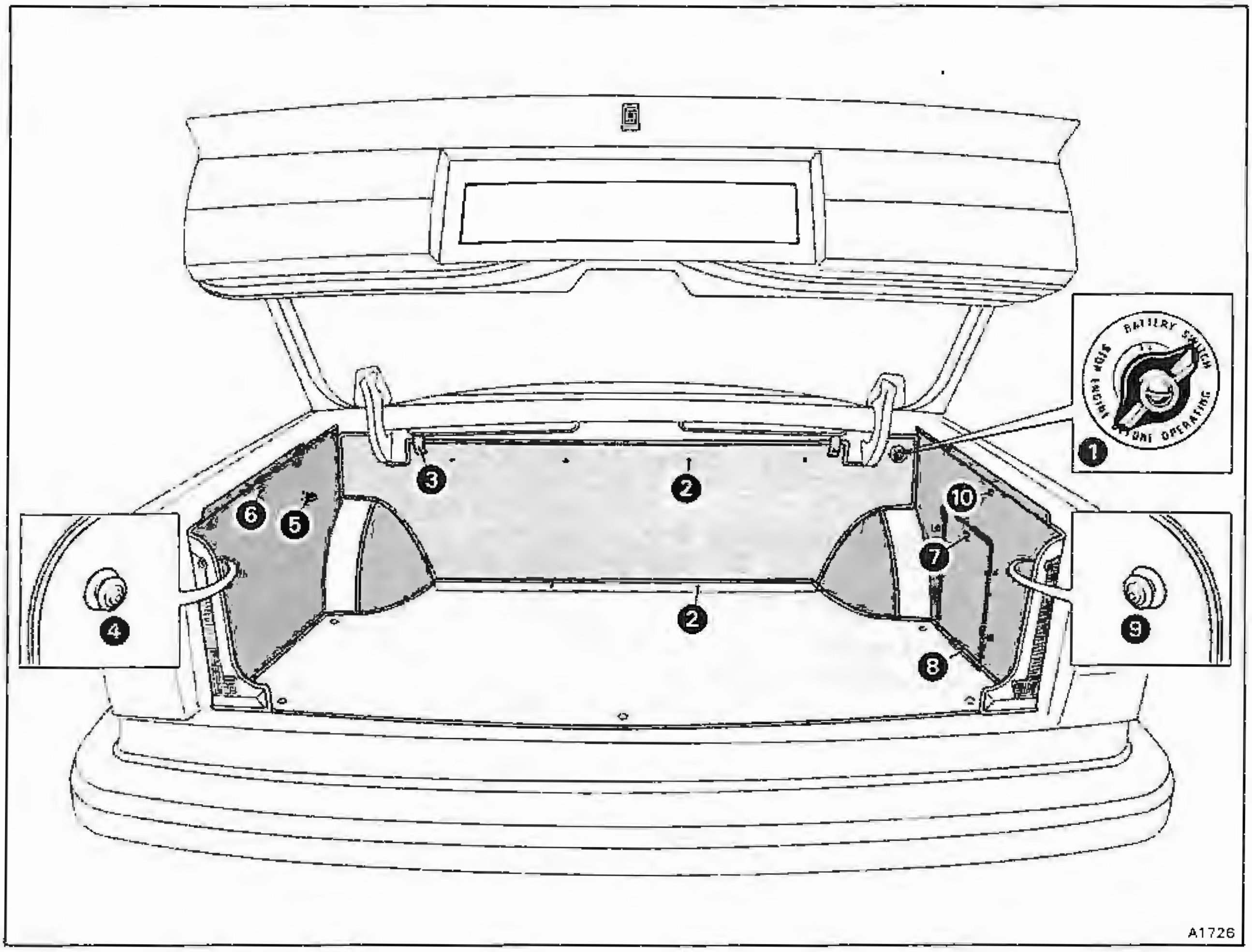


Fig. S16-1 Carpets and trim panels

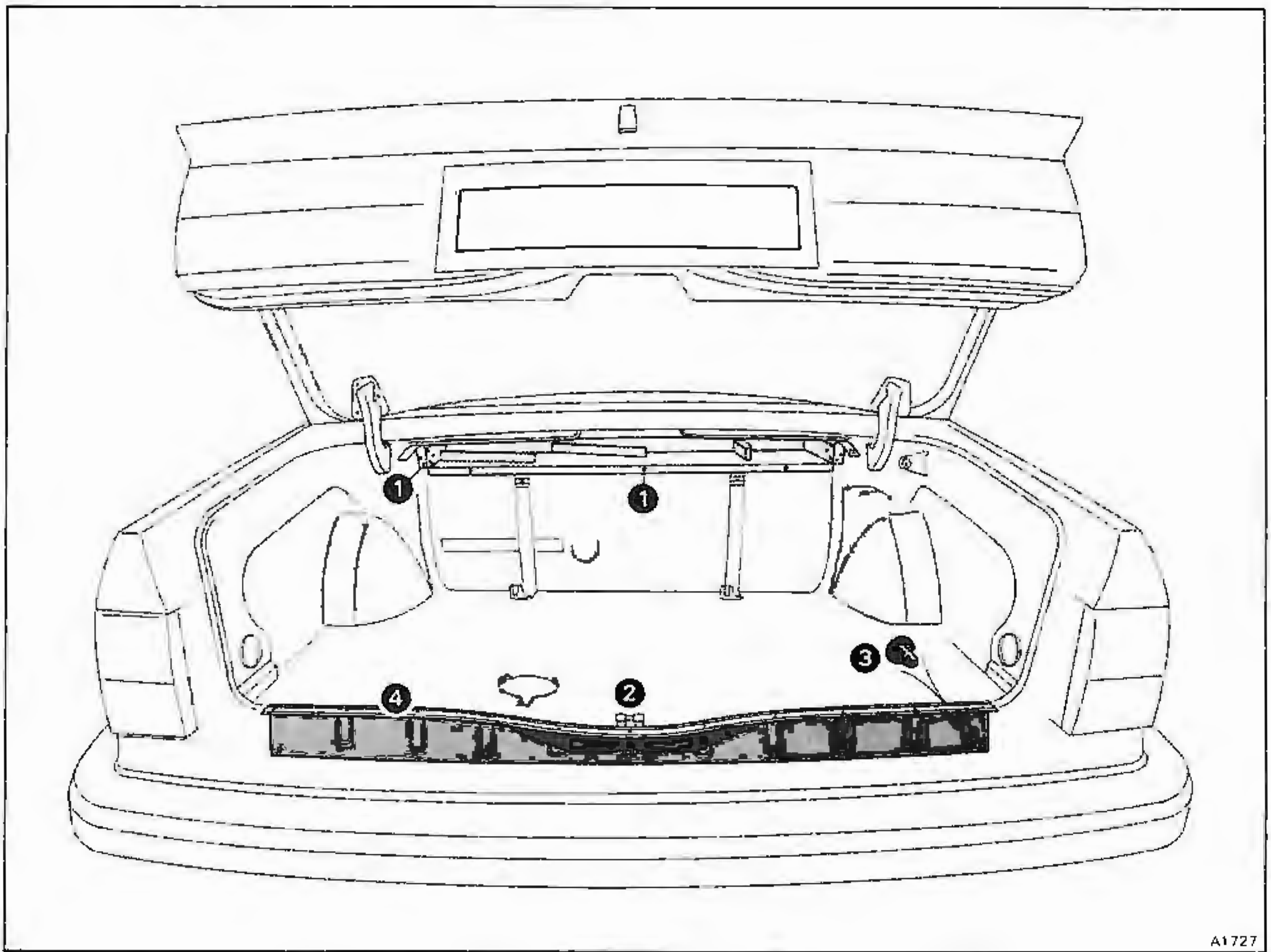


Fig. S16-2 Tool stowage tray and rear panel fittings

3. To remove the left-hand side trim panel proceed as follows.

Pull and release the spring loaded fastener (item 4).

Remove the ring (item 5) from the fuel filler door manual release cable.

On cars fitted with a cellular telephone, release the spring loaded fastener and lower the flap containing the telephone transceiver.

Release the screws and cup washers (item 6) then remove the side panel.

4. To remove the right-hand side trim panel proceed as follows.

Release the spring loaded fastener (item 7), lower the hinged flap and remove the two containers of mineral oil.

Remove the two screws (item 8).

Pull and release the spring loaded fastener (item 9).

Release the screw and cup washer (item 10), then remove the side panel complete with the mineral oil stowage compartment.

5. To renew a wheel-arch carpet proceed as follows.

Peel off the carpet, taking care not to disturb the soundproofing material.

Thoroughly clean the bonding surface of the wheel-arch soundproofing using a cloth moistened with Bostik Cleaner 6001. Allow to dry.

Apply Apollo Adhesive AX 2344 to the bonding surface of the wheel-arch and the carpet. Allow five minutes for the adhesive to 'flash' dry. Ensure that the carpet is correctly aligned then press firmly into position.

6. To fit the carpets and trim panels reverse the removal procedure.

Tool stowage tray and rear panel fittings — To remove and fit (see fig. S16-2)

1. To remove the tool stowage tray proceed as follows.

Remove the front trim panel.

Remove the tools and accessories from the stowage tray.

Release the eight self-tapping screws (item 1).

Carefully remove the tray.

2. To remove the rear panel plastic cover proceed as follows.

Using a pencil, mark the position of the lock catch (item 2). Release the setscrews and washers then remove the catch.

Carefully prise out the four plastic fasteners (item 3) situated along the lower edge of the cover.

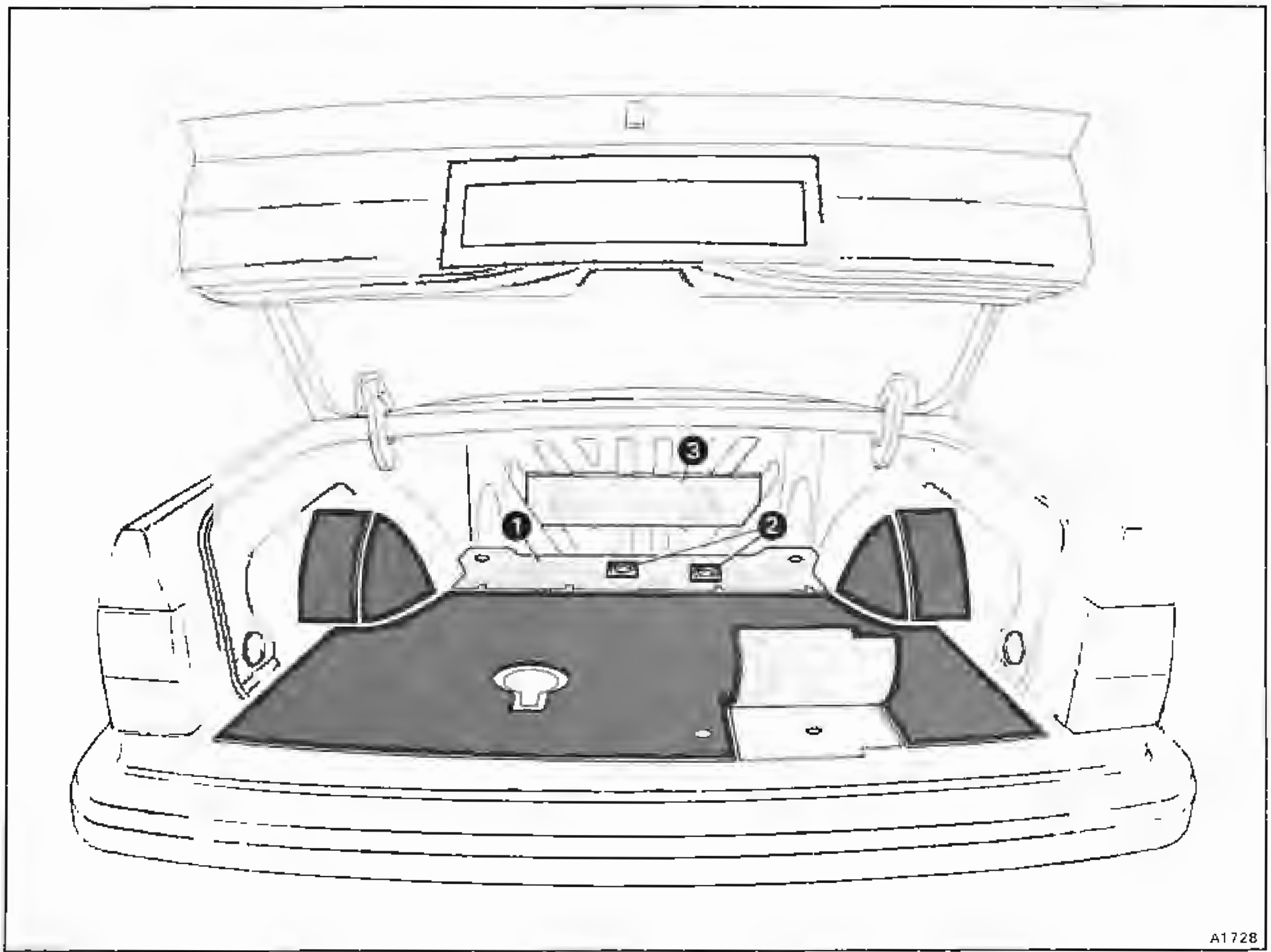


Fig. S16-3 Soundproofing

Unscrew and remove the stainless steel finishing strip (item 4).

Remove the plastic cover.

3. To fit the rear panel cover and tool stowage tray reverse the procedure given for removal noting the following.

Prior to tightening the setscrews securing the lock catch (item 2) align the marks made during removal.

Soundproofing — To remove and fit (see fig. S16-3)

1. To remove the soundproofing panels fitted to each wheel-arch or to the luggage compartment floor area proceed as follows.

Peel off the appropriate soundproofing panel. Note that a number of strips of soundproofing material are glued into the channels formed in the floor panel beneath the main floor soundproofing panel.

Thoroughly clean the bonding surface of the body using a cloth moistened with Bostik Cleaner 6001. Allow to dry.

Apply Apollo Adhesive AX 2344 to the bonding surface of the body and the soundproofing. Allow five minutes for the adhesive to 'flash' dry. Align the panel, ensuring that any holes or cut-outs are correctly located, then press firmly into position.

2. If the fuel tank has been removed, check the condition of the self-adhesive soundproofing panel (item 1), Compriband pads (item 2), and squab panel foam moulding (item 3). Renew if necessary.

Ensure that any blanking grommets removed during this operation are refitted on assembly.

Passive restraint – seat belts

Contents

Pages

Passive restraint – seat belts

Introduction
Passive restraint seat belts are provided for the driver and front seat passenger. Each seat position comprises a diagonal inertia reel belt which travels from its unfastened position on the 'A' post, along a transporter track, to an anchorage point on the 'BC' post. The travel mechanism for the belt is cable driven via an electric motor. The motor being mounted in the sill panel. A manually operated inertia reel lap belt completes the system.

Each seat base incorporates two inertia reel mechanisms. The mechanism for the lap belt is secured to the outboard side of the seat base. The mechanism for the diagonal belt, together with the stalk for the lap belt, is secured to the inboard side of the seat base.

The operation of each diagonal seat belt is independently controlled via an electronic control unit. Each unit is mounted to the underside of a trim panel. The panels being located between the front seats and the centre stowage bin. A check procedure for the system is detailed under the heading Passive restraint system – Operational check procedure.

To reduce the possibility of injury in the event of an accident or if the car is stopped suddenly, it is important that the driver and front seat passenger are restrained by **both** their diagonal belt and manually operated lap belt.

If the travel of a diagonal belt is interrupted the belt will stall and the appropriate seat belt warning panel will illuminate constantly. To reset the system carry out the following procedure.

Ensure that the car is stationary. Then, move the gear range selector lever to the park position and apply the parking brake.

Turn the ignition key to the LOCK position; then back to the RUN position.

The belt should then resume its normal operation.

If after several attempts to reset the system the belt fails to operate then a fault must be suspected.

In the event of a failure, two emergency seat belt tongues are supplied. These provide a **temporary** conventional active restraint system (see Emergency seat belt tongues – Fitting and removal procedure).

If a seat belt requires cleaning, wipe the webbing using warm soapy water and a sponge. Do not use bleaches or dyes, as they may impair the efficiency and safety of the seat belts.

For information on the removal and fitting procedure of the rear seat belts reference should be made to Section S14.

Warning In the event of a vehicle being involved in an accident of sufficient severity to cause damage to the front longerons, all the seat belts worn by occupants at the time of the impact **must be** replaced.

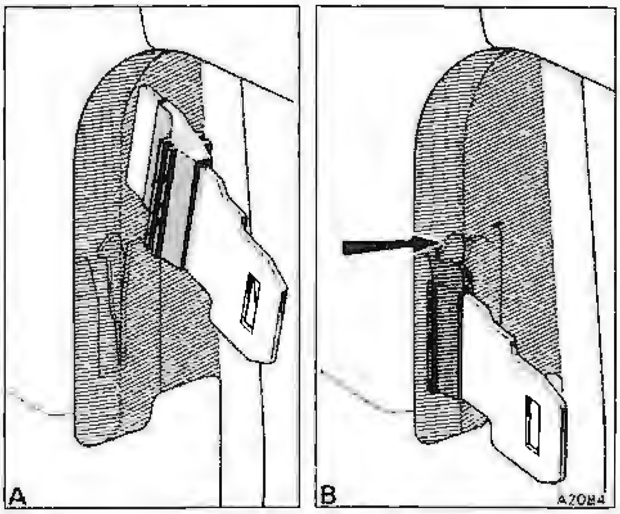


Fig. S17-1 Emergency seat belt tongues

If an impact results in local damage to any of the seat belt anchorage points, then that particular seat belt **must be** replaced irrespective of whether the belt was worn or not at the time of the impact.

In the event of a rear impact, the severity of the damage must be judged and if in any doubt the occupied seat belts **must be** replaced.

Emergency seat belt tongues – Fitting and removal procedure (see fig. S17-1)
Two emergency seat belt tongues are located on the inside of the fuse compartment door. The tongue for the driver's seat belt is marked 'LH top'; the passenger's is marked 'RH top'. In the unlikely event of a failure the appropriate tongue should be inserted into the anchorage point and the diagonal seat belt attached. This will provide a **temporary** conventional active restraint system.

1. To fit an emergency seat belt tongue proceed as follows.

Unclip the appropriate tongue from the fuse compartment door.

Position the tongue as shown in inset A and insert it through the brush seal. Then, slide the tongue downwards into the anchorage point until it 'clicks' into position. When correctly fitted the tongue will be locked into the anchorage point. Remove the plastic protective cover from the emergency tongue.

2. Release the diagonal belt from its travel mechanism by pressing the red button in the retaining clasp. Fasten the belt retaining clasp onto the emergency tongue ensuring that the belt webbing is not twisted.

\ttach the plastic protective cover to the exposed
›nal seat belt tongue. Care must always be taken
ı entering or leaving the car to avoid contact with
›ngue.
'o remove an emergency seat belt tongue
ed as follows.
elease the diagonal belt from the emergency
e.
sing a small screwdriver, or a similar tool, move
curing lever in the direction of the arrow (see
3). Then, lift the tongue clear of the anchorage
and remove.

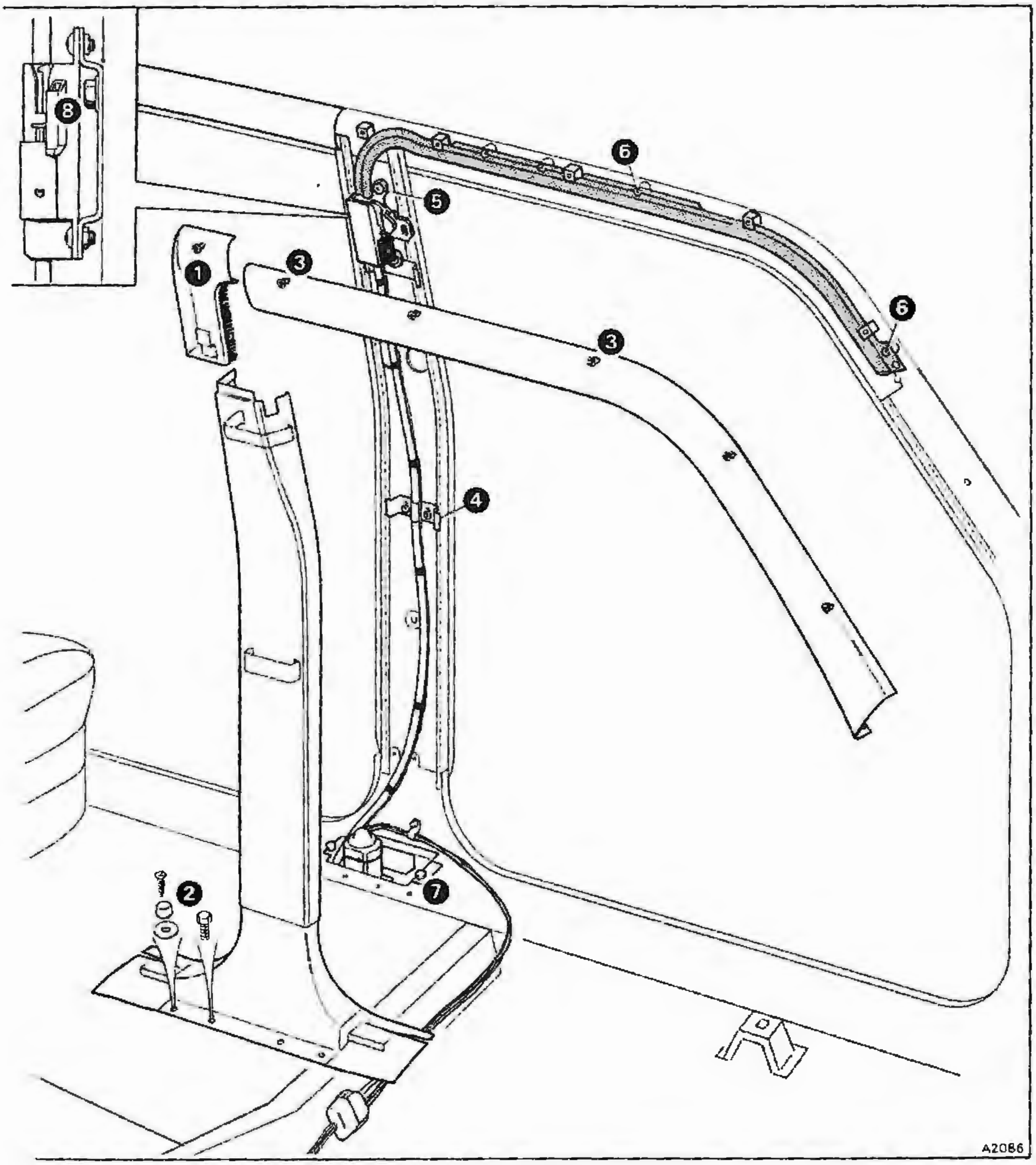
'BC' post and cantrail trim panels – To remove and fit (see fig. S17-2)

1. To remove the 'BC' post trim proceed as follows.

Ensure that the diagonal seat belt is in its unfastened position.

Turn the ignition key to either the ACC or RUN position. Using the seat adjustment controls, move the seat forward to the full extent of its travel. Disconnect the battery.

Unclip the top of the 'BC' post upper trim panel (item 1) from the cantrail. Manoeuvre the panel to release its lower retaining bracket.



Trim panels, transporter track, and drive motor assembly

Unclip the rear compartment floor carpet. Then, remove the exposed setscrews, screws, and carpet retainers (item 2).

Loosen the stainless steel sill finishers adjacent to the 'BC' post.

Slide the 'BC' post trim panel upwards to disengage the panel from the retaining brackets.

2. Carefully remove the cantrail/'A' post trim panel by progressively releasing the five retaining clips (item 3), taking care not to distort the panel.

3. To fit the trim panels reverse the procedure given for removal.

Seat belt transporter track – To remove and fit
(see fig. S17-2)

1. Remove the 'BC' post and cantrail trim (see 'BC'

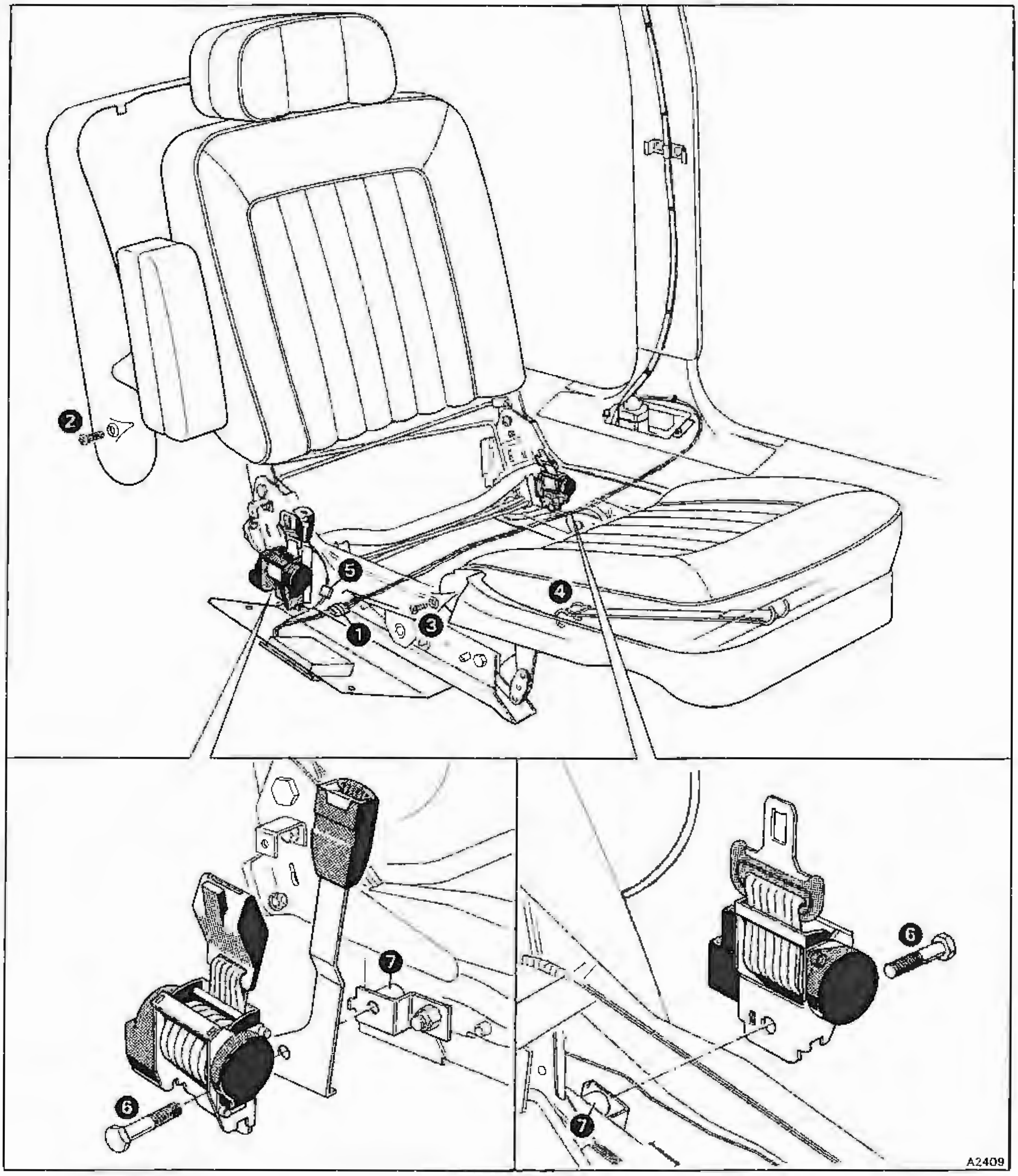


Fig. S17-3 Seat belt reel mechanisms and fittings

post and cantrail trim panels – To remove and fit).
2. Ensure that the diagonal seat belt is in the fastened position. Then, disconnect the battery.
3. Unclip the diagonal belt and allow it to return into the reel mechanism.
4. Unscrew and remove the drive cable retaining bracket (item 4).
5. Support the 'BC' post anchorage point. Then, using a 'Torx' head socket driver remove the securing screws (item 5). Lower the anchorage point clear of the transporter track, taking care not to distort the drive cable.
6. Release the self-tapping screws (item 6) then remove the transporter track and cantrail spacers.
7. To fit the transporter track reverse the procedure given for removal.

'BC' post anchorage point and drive motor assembly – To remove and fit (see fig. S17-2)
1. Remove the 'BC' post and cantrail trim (see 'BC' post and cantrail trim panels – To remove and fit).
2. Ensure that the diagonal seat belt is in the fastened position. Then, disconnect the battery.
3. Unclip the diagonal belt and allow it to return into the reel mechanism.
4. To gain access to the drive motor loom plug and socket proceed as follows.

Remove the front seat cushion and valance assembly (see Seat belt reel mechanisms – To remove and fit, Operation 2).

Unscrew the rear of the air ducting, then lift the soundproofing material to expose the drive motor loom.

Disconnect the plug and socket (see fig. S17-3, item 1). Then, manoeuvre the drive motor loom clear of the seat base area.
5. Unscrew and remove the 'BC' post drive cable retaining bracket (item 4).
6. Support the 'BC' post anchorage point. Then, using a 'Torx' head socket driver remove the securing screws (item 5). Lower the anchorage point clear of the transporter track, taking care not to distort the drive cable.
7. Remove the drive motor securing setscrews (item 7).

Withdraw the drive motor assembly from the sill aperture. Do not lift the motor by means of the drive cable.
8. If it is necessary to remove the anchorage point mounting bracket mark the position of the bracket in relation to the 'BC' post. Release the anchorage bolt (item 8) and remove the bracket.

To fit the bracket align the marks made during removal and torque tighten the anchorage bolt (item 8) to between 34 Nm and 41 Nm (3,4 kgf m and 4,1 kgf m; 25 lbf ft and 30 lbf ft).
9. To fit the 'BC' post anchorage point and drive motor assembly reverse the removal procedure noting the following.

Prior to securing the drive motor assembly ensure that the waterproof cover is trapped between the mounting bracket for the motor and the sill panel.

Torque tighten the seat belt anchorage 'Torx' screws (item 5) to between 27 Nm and 30 Nm (2,8 kgf m and 3,0 kgf m; 20 lbf ft and 22 lbf ft).

Seat belt reel mechanisms – To remove and fit (see fig. S17-3)
1. Unclip the diagonal belt and allow it to return into the reel mechanism.
2. To gain access to the reel mechanisms it will be necessary to remove the seat cushion and valance assembly as follows.

Disconnect the battery.

Remove the two screws and cup washers (item 2) securing the squab back panel. Lift the panel slightly to disengage the upper retaining brackets.

Remove the two exposed screws and cup washers (item 3) securing the cushion valance to the seat base.

Unhook the cushion securing strap (item 4) from underneath the rear of the seat. Lift the front of the cushion to disengage the retaining pegs and unhook the front of the securing strap.

Manoeuvre the cushion and valance assembly clear.
3. Locate the electrical lead at the base of the lap belt stalk. Trace the plug and socket (item 5), disconnect and then release the electrical lead.
4. To gain access to an inboard reel mechanism anchorage bolt it will be necessary to remove the front seat assembly. Refer to Section S13, Front and rear seats.
5. Release the anchorage bolt (item 6) and remove the seat belt reel mechanism, noting the quantity of spacers (item 7) situated between the reel mounting bracket and the seat base.
6. To fit the reel mechanism reverse the removal procedure noting the following.

Ensure that the locating tab on the reel mounting bracket passes through the slot in the reel backplate.

Check that the spacer(s) (item 7) are in position between the reel mounting bracket and the seat base.

Torque tighten the anchorage bolts (item 6) to between 34 Nm and 41 Nm (3,4 kgf m and 4,1 kgf m; 25 lbf ft and 30 lbf ft).
7. To check that a reel mechanism is operating correctly proceed as follows.

Fasten the lap belt and ensure that the diagonal belt is fitted correctly.

Select an open stretch of road. Then, when the road is free from any potential danger, accelerate the car to 24 km/h (15 mile/h) and brake sharply. Ensure that both the diagonal and lap belts lock and subsequently release.

An additional check should be made by sharply pulling the webbing of both belts. Ensure that each belt locks, then retracts when the tension is released.

Passive seat belt system – Operational check procedure
Prior to carrying out the following check procedure, apply the parking brake and remove the engine starter relay situated in the engine compartment.

If during this check procedure a fault is detected reference must first be made to TSD 4701, Workshop Manual – Electrical.

1. Close both front doors. Fasten both lap belts (diagonal belts in the unfastened position). Place the gear range selector lever in the park position.

Operation	Check
a. Turn the ignition key to the RUN or START position.	Ensure that the passenger's diagonal belt immediately travels to its anchorage point. The driver's diagonal belt should travel to its anchorage point immediately a gear range position other than park is selected. Both the driver's and passenger's seat belt warning panels should flash for approximately six seconds. **Note** If a warning panel continues to flash and is accompanied (for six seconds) by a warning chime, reference **must** be made to the heading Diagonal belt proximity switch.
b. Release the driver's lap belt.	A chime should sound for approximately six seconds and the driver's seat belt warning panel should flash for the same duration. Fasten the lap belt. Repeat this check on the passenger's lap belt.
c. Release the driver's diagonal belt from its travel mechanism by pressing the red button in the retaining clasp.	The chime should sound for approximately six seconds and the driver's seat belt warning panel should flash for approximately sixty seconds. Fasten the diagonal belt. Repeat this check on the passenger's diagonal belt.

2. Close both front doors. Fasten both lap belts (diagonal belts in the fastened position). Place the gear range selector lever in a position other than park. Turn the ignition key to the LOCK position.

Operation	Check
a. Open both front doors.	Ensure that the passenger's diagonal belt immediately travels to its unfastened position (irrespective of the gear range selector position). The driver's diagonal belt should travel to its unfastened position immediately the gear range selector lever is moved to the park position.

3. Close both front doors. Fasten both lap belts (diagonal belts in the fastened position). Place the gear range selector lever in the park position. Turn the ignition key to the RUN or START position.

Operation	Check
a. Release the driver's diagonal belt from the travel mechanism tongue by pressing the red button in the retaining clasp. Open the driver's door. As the mechanism travels towards the unfastened position pull on the tongue to prevent movement, causing the mechanism to stall.	Ensure that the driver's seat belt warning panel illuminates constantly. Release the travel mechanism tongue and close the door. To reset the system proceed as follows. Turn the ignition key to the LOCK position; then back to the RUN or START position. The travel mechanism should then resume its normal operation and both warning panels should flash for approximately six seconds, then extinguish. Repeat this check on the passenger's travel mechanism.

4. Close both front doors. Fasten both lap belts (diagonal belts in the fastened position). The following check procedure must be carried out as the car is being driven. This procedure is only applicable to the passenger's diagonal belt, therefore an assistant will be required to occupy the passenger's seat.

Operation	Check
a. Select a safe area to carry out the test. Drive the car forwards at approximately walking speed. Taking care to avoid any obstruction, partly open the passenger's door.	Ensure that the passenger's diagonal belt remains in the fastened position whilst the car is in motion.
b. Stop the car with the passenger's door held in the open position.	Approximately three seconds after the car becomes stationary the diagonal belt should travel to its unfastened position.

Diagonal belt proximity switch (see fig. S17-4)
A proximity switch is incorporated into the casing of the motor limit switch situated adjacent to each 'BC' post anchorage point.

On Bentley Eight cars from vehicle identification number *SCBZE02B7JCX22382* and Bentley Mulsanne S cars from *SCBZS02B5JCX22406* an alteration to the position of the proximity switch has been introduced by the fitting of an additional 2 mm (0.080 in) thick spacer and a modified 6 mm (0.240 in) backing spacer (see inset A).

This alteration can also be incorporated on cars prior to the above vehicle identification numbers. However, the proximity switch must first be tested to ensure that no electrical fault is present. To test the switch proceed as follows.

1. Repeat Operation 1a, as described under the heading Operational check procedure.
2. When the diagonal belt has completed its travel to the anchorage point, **immediately** release the belt clasp and hold the magnet closer to the switch assembly.

If the chime and warning panel cancel, and resume operation only when the magnet is moved away, this indicates that the proximity switch is operating correctly and the alteration can ba incorporated as described in Operations 3 to 10 inclusive.

Note If the chime and warning panel do not cancel when the magnet is held close to the switch then an electrical fault must be suspected and reference should be made to TSD 4701 Electrical Manual.

3. The part numbers of the items required to incorporate the alteration are as follows.
   CD 6541 – 2 mm (0.080 in) spacer, right and left-hand switch.
   CD 6540 – 6 mm (0.240 in) backing spacer, right-hand switch.
   CD 6539 – 6 mm (0.240 in) backing spacer, left-hand switch.
4. Disconnect the battery.
5. Unclip the top of the 'BC' post upper trim panel from the cantrail (see fig. S17-2). Manoeuvre the panel to release its lower retaining bracket.
6. Remove the screw securing the switch assembly to the anchorage point.
7. Remove and discard the existing 6 mm (0.240 in) backing spacer.
8. Position the modified 6 mm (0.240 in) backing spacer together with the additional 2 mm (0.080 in) spacer as shown in inset A.
9. Secure the switch assembly to the anchorage point and fit the 'BC' post trim panel.
10. Connect the battery and check the operation of the switch.

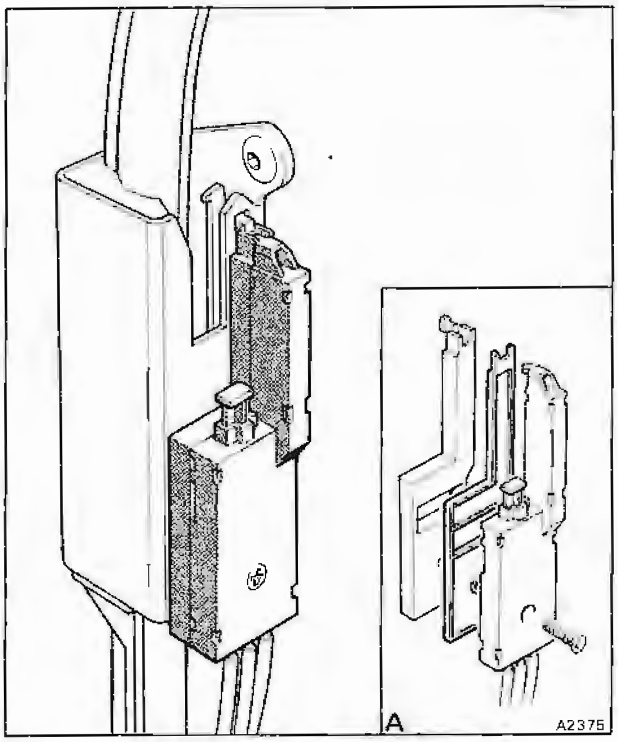


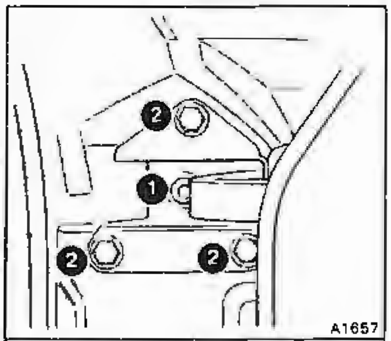
Fig. S17-4 Proximity switch

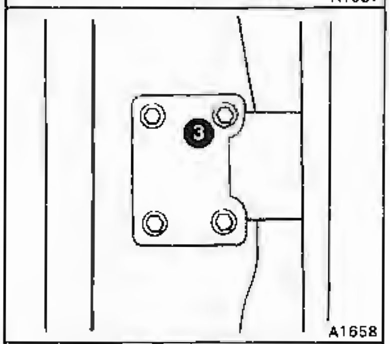
Special torque tightening figures

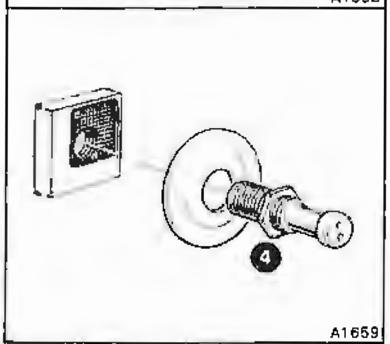
Introduction
This section contains the special torque tightening figures applicable to Sections S4 to S17 inclusive.
For standard torque tightening figures refer to Chapter P.

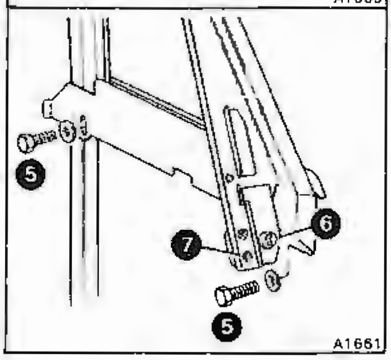
Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

Section S4/S5

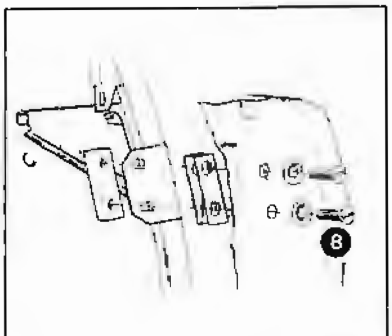
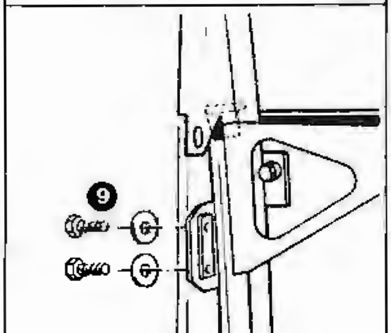
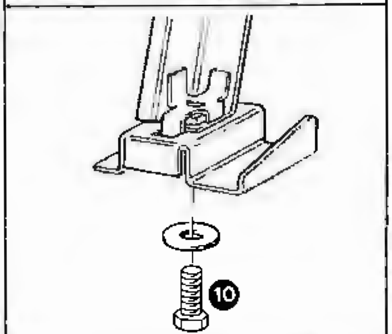
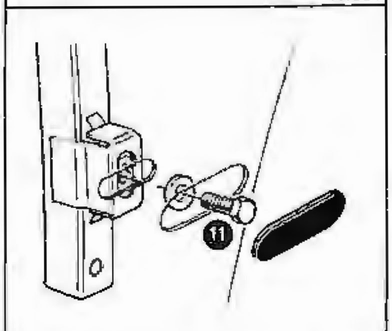
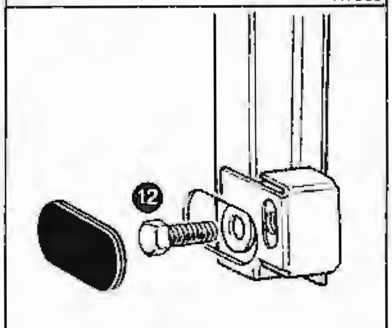




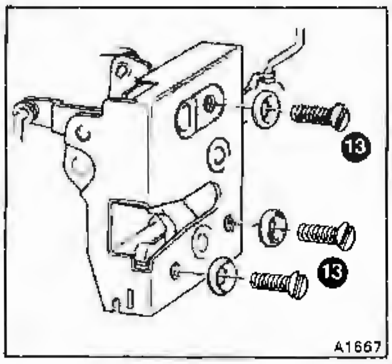




Ref.	Component	Nm	kgf m	lbf ft
1	Front door hinges – Allen headed setscrews	23-34	2,3-3,4	17-25
2	Front door hinges – hexagonal headed setscrews	23-34	2,3-3,4	17-25
3	Rear door hinges – hexagonal headed setscrews	23-34	2,3-3,4	17-25
4	Striker pin lock-nut – 'B' and 'D' posts	27-33	2,8-3,3	20-24
5	Front and rear door frame – waist securing setscrews	11-13	1,1-1,4	8-10
6	Front door frame – ring bolt	22-24	2,2-2,5	16-18
7	Front door frame – countersunk socket screws	6-8	0,6-0,8	4·5-6

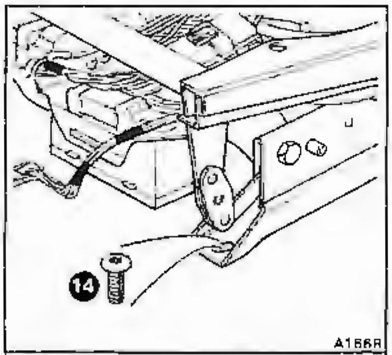
	Ref.	Component	Nm	kgf m	lbf ft
 A1662	8	Front door frames – 'B' post – setscrews	6-8	0,6-0,8	4-5-6
 A1663	9	Rear door frames – 'C' post – setscrews	11-13	1,1-1,4	8-10
 A1664	10	Front door frame – lower securing setscrew	11-13	1,1-1,4	8-10
 A1665	11	Front and rear door frame – lower rear securing setscrew	11-13	1,1-1,4	8-10
 A1666	12	Rear door frame – lower front securing setscrew	11-13	1,1-1,4	8-10

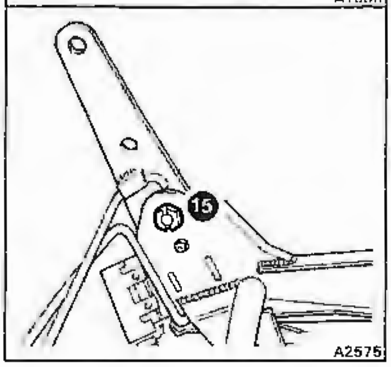
Section S4/S5



Ref.	Component	Nm	kgf m	lbf ft
13	Front and rear door latch – countersunk setscrews	4,1-6,1	0,4-0,6	3-4·5

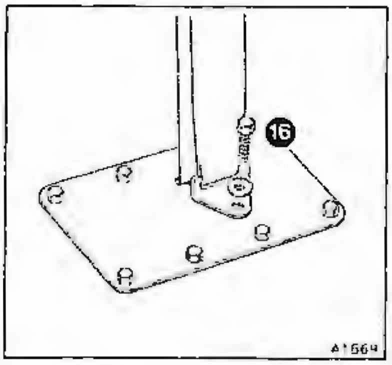
Section S13



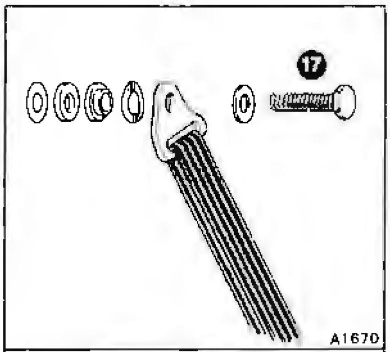


Ref.	Component	Nm	kgf m	lbf ft
14	Front seat mounting – socket screws	48-54	4,9-5,5	36-40
15	Front seat rake pivot bolt – nut	35	3,5	26

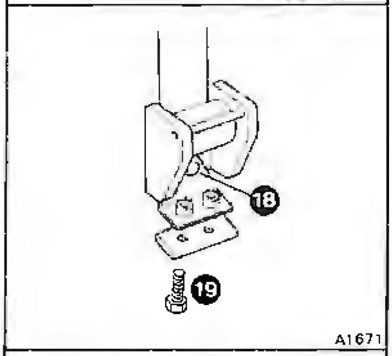
Section S14



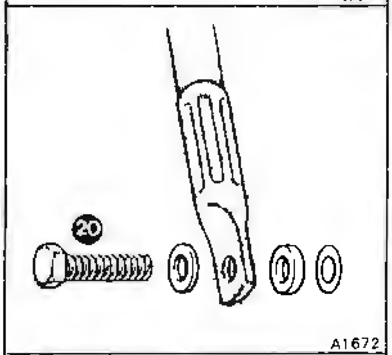
Ref.	Component	Nm	kgf m	lbf ft
16	Front seat belt to sill cover plate – bolt	34-41	3,4-4,1	25-30



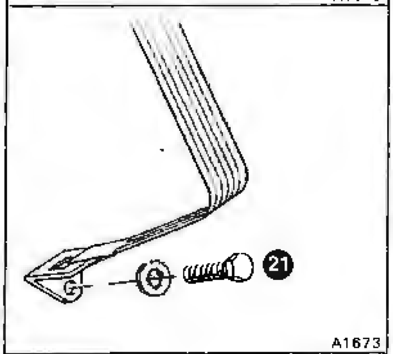
Ref.	Component	Nm	kgf m	lbf ft
17	Front seat belt to 'BC' post – bolt	34-41	3,4-4,1	25-30



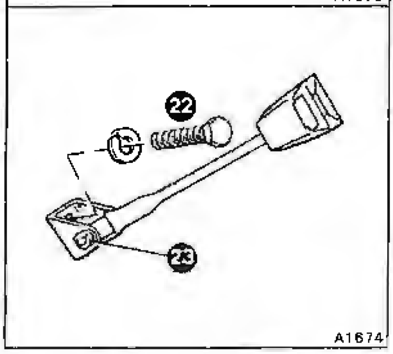
Ref.	Component	Nm	kgf m	lbf ft
18	Front seat belt reel mounting bracket – bolt	34-41	3,4-4,1	25-30
19	Front seat belt reel to sill – bolts	22-24	2,2-2,5	16-18



Ref.	Component	Nm	kgf m	lbf ft
20	Front seat belt stalk to tunnel – bolt	34-41	3,4-4,1	25-30

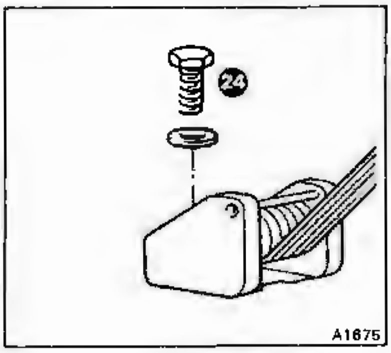


Ref.	Component	Nm	kgf m	lbf ft
21	Rear seat belt to squab panel – bolt	34-41	3,4-4,1	25-30



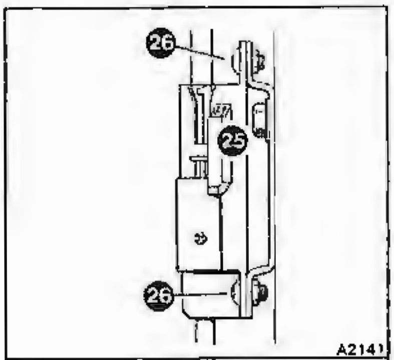
Ref.	Component	Nm	kgf m	lbf ft
22	Rear seat belt stalk to squab panel – bolt	34-41	3,4-4,1	25-30
23	Rear seat belt stalk to mounting bracket – nut	34-41	3,4-4,1	25-30

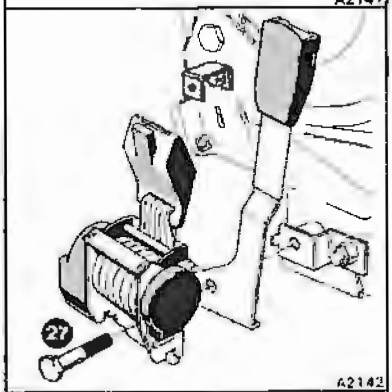
Section S14

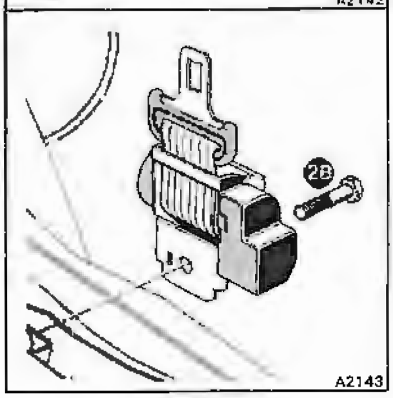


Ref.	Component	Nm	kgf m	lbf ft
24	Rear seat belt reel to parcel shelf – bolt	34-41	3,4-4,1	25-30

Section S17







Ref.	Component	Nm	kgf m	lbf ft
25	Passive restraint anchorage point mounting bracket – bolt	34-41	3,4-4,1	25-30
26	Passive restraint anchorage point – 'Torx' screws	27-30	2,8-3,0	20-22
27	Passive restraint inboard seat belt reel mechanism – bolt	34-41	3,4-4,1	25-30
28	Passive restraint outboard seat belt reel mechanism – bolt	34-41	3,4-4,1	25-30

Workshop tools

This section contains the workshop tools applicable to Sections S4 to S17 inclusive.

RH 9623	Windscreen wiper arm extractor tool
RH 9637	Windscreen removal knife
RH 9778	Door latch striker pin holding tool
RH 9779	Door latch striker pin setting piece

Printed in England

Doors

Contents

Doors

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

On completion of any work carried out on the inside of the door and prior to the fitting of the door trim, ensure that any loose debris, etc., is removed from the bottom of the door.

If special torque tightening figures are not specified, setscrews, bolts, etc., should be tightened to the standard figures quoted in Chapter P.

Safety procedures
The adhesive and cleaner referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Door trim – To remove and fit (see fig. S20-1)
1. Raise the arm rest release catch (item 1), then lift the arm rest clear of its adjustment slide.
2. Unscrew and remove the arm rest adjustment slide.
3. Using a suitable tool, carefully ease the escutcheon covers (item 2) from both door release handles, centralized door locking switch, and window lift switch(es). Then, unscrew and remove the escutcheons.
4. Remove the self-tapping screws (item 3) situated along the carpeted area of the door trim.
5. Carefully manoeuvre the trim panel forward to release the two rear retaining brackets (item 4) and remove.
6. To remove the two smaller door trim panels release the exposed countersunk screws (item 5).
7. If it is necessary to remove the stowage compartment/cocktail box assembly proceed as follows.

   Disconnect the battery.

   Unclip and lower the lamp (item 6). Release the Lucar connectors and remove the lamp.

   Release the self-tapping screws (item 7). Then, withdraw the stowage compartment/cocktail box assembly.
8. To fit the door trim reverse Operations 1 to 7 inclusive.

Waist rail finisher – To remove and fit (see fig. S20-1)
1. Remove the door trim panel.
2. Loosen the exposed waist rail securing screws (item 8).
3. Remove the two screws (item 9) from the top of the waist rail. Then, lift the waist rail finisher assembly clear of the door.
4. To fit the waist rail finisher reverse the removal procedure.

Waist rail finisher seals – To renew (see fig. S20-1)
1. Remove the waist rail finisher.
2. The length of rubber seal (item 10) situated towards the front of the finisher is simply wedged into a retaining channel and can easily be renewed as necessary.
3. To renew the felt strip (item 11) glued along the remaining length of the finisher proceed as follows.

   Using a suitable tool, remove and discard the felt strip taking care not to damage the polished surface of the waist rail finisher.

   Thoroughly clean the bonding surface of the finisher using a cloth moistened with Bostik Cleaner 6001.

   Apply an even coat of Apollo Adhesive AX2344 to the bonding surfaces of the finisher and the felt strip. Allow five minutes for the adhesive to 'flash' dry. Then, bring the bonding surfaces together using maximum hand pressure. Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

Door – To remove and fit (see fig. S20-1)
1. Disconnect the battery.
2. Remove the door trim panel.
3. Peel back the waterproof cover to expose the door to hinge securing setscrews.
4. Unscrew and remove the carpeted scuttle panel. Then, disconnect the door loom plugs and sockets (see inset A).
5. With the help of an assistant, support the door then remove the setscrews and washers (item 12). Note the position and quantity of any spacing shims situated between the door hinges and the door.
6. Carefully remove the door, releasing the loom through the aperture in the 'A' post panel.
7. To fit the door reverse the removal procedure noting the following.

   To ensure that the clearances between the door and the body are correct, reference should be made to Door adjustment.

Door hinges – To remove and fit (see fig. S20-1)
1. Remove the door.
2. To facilitate assembly, mark the position of each door hinge in relation to the 'A' post panel.
3. Remove the setscrews and washers (item 13) securing the hinges to the 'A' post panel. An Allen key and extension bar will be required to remove the setscrews and washers situated inside the 'A' post apertures.
4. Remove the door hinges and stops.
5. To fit the door hinges reverse the removal procedure noting the following.

   Ensure that the hinge stops are in position.

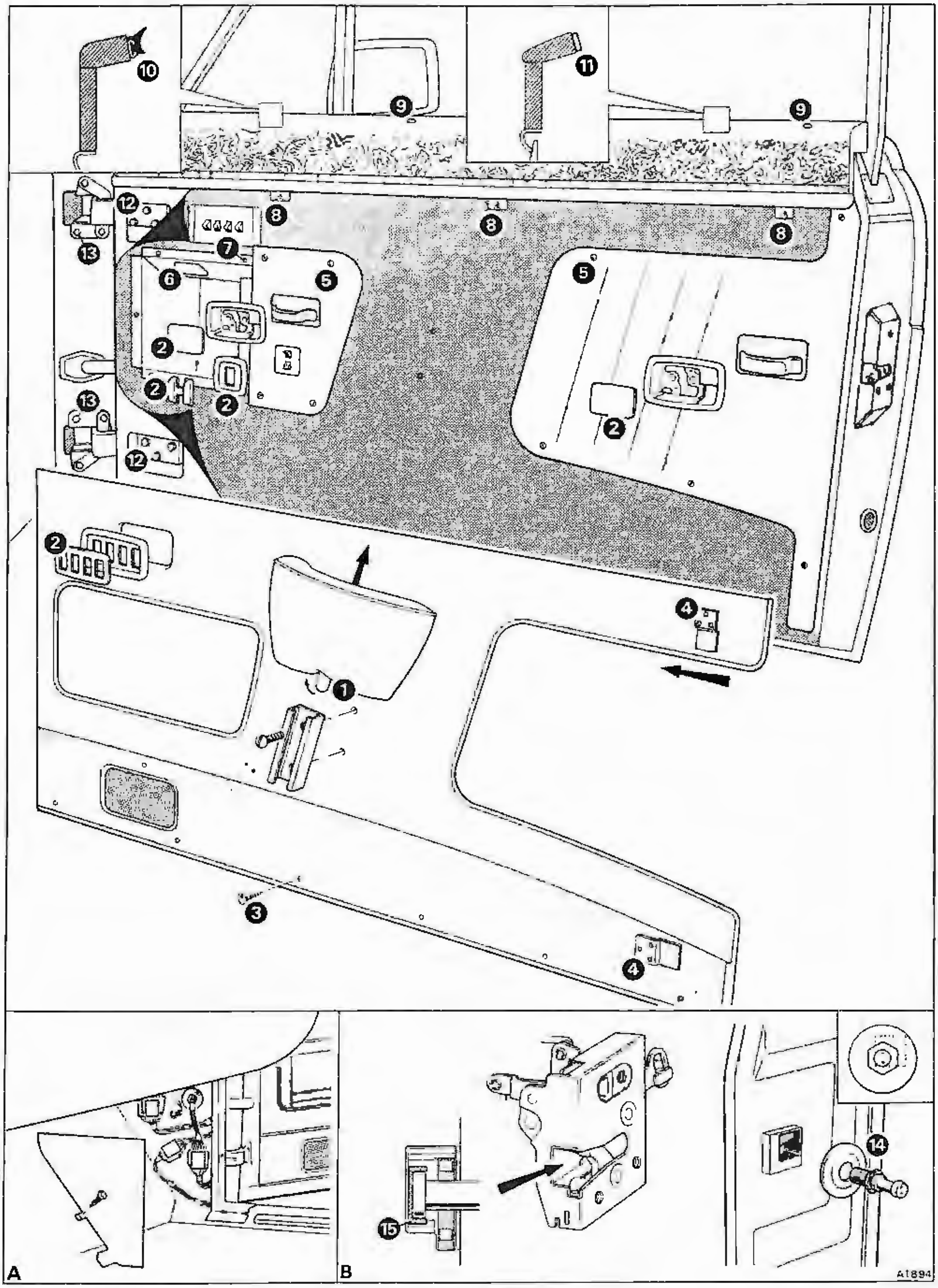


Fig. S20-1 Door trim and door to body mounting arrangement

Torque tighten the hinge securing setscrews as follows.

	Nm	kgf m	lbf ft
Hexagonal headed –	23-34	2,3-3,4	17-25
Allen headed –	23-34	2,3-3,4	17-25

Door adjustment (see fig. S20-1)

1. Disconnect the battery.
2. Remove the door trim panel.
3. Peel back the waterproof cover to expose the door to hinge securing setscrews (item 12).
4. Loosen the setscrews sufficiently to allow the door to be moved on its hinges.
5. Release the striker pin lock-nut (see inset B, item 14). Then, unscrew and remove the striker pin and washer.
6. Adjust the position of the door within the aperture until the clearances are as follows.

    Door/front wing panel – 4 mm (0.157 in)

    Door/sill panel – 4 mm (0.157 in)

    Door/rear wing panel – 3 mm (0.118 in)

7. When the door is correctly positioned, torque tighten the door to hinge setscrews.
8. Fit the striker pin and washer, then attach the setting piece RH 9779 (item 15). The setting piece ensures that a suitable clearance exists between the end of the striker pin and the latch mechanism.
9. Position the striker pin in the lower outboard corner of the adjustment slot (see inset B). Then, finger tighten the lock-nut.
10. Slowly close the door until the latch is almost touching the striker pin. Screw the pin inwards or outwards until the setting piece (item 15) makes contact with the back of the latch mechanism (see inset B).
11. Open the door and remove the striker pin setting piece.
12. Ensure that the door latch claw mechanism is in the **unlocked** position. Then, keeping the exterior handle push button fully depressed, move the door into the closed position i.e. until the door panel is flush with the rear wing panel. This operation will set the striker pin in the correct position in relation to the latch mechanism.
13. Open the door. Using the special tool RH 9778 hold the striker pin in position and torque tighten the lock-nut to between 27 Nm and 33 Nm (2,8 kgf m and 3,3 kgf m; 20 lbf ft and 24 lbf ft).
14. Prior to closing the door check that the head of the striker pin does not foul the back of the latch or the claw mechanism.
15. Close the door, noting the following.

    If the door rises or falls on the striker pin, loosen the lock-nut and adjust the vertical position of the pin.

    If the door does not lie flush with the rear wing panel, loosen the lock-nut and adjust the inboard/outboard position of the pin.

    On completion, torque tighten the striker pin lock-nut to between 27 Nm and 33 Nm (2,8 kgf m and 3,3 kgf m; 20 lbf ft and 24 lbf ft).

Window lift mechanism – To remove and fit (see fig. S20-2)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove and fit).
3. Remove the five countersunk setscrews from the rearward interior door release handle mounting plate (see fig. S20-3, item 1). Lower the mounting plate assembly to disconnect the release handle from the control rod and remove.
4. Peel back and remove the waterproof cover from the inner door panel.
5. Lower the door glass unit until the window lift to door glass mounting bracket (item 1) is visible through the large aperture in the inner door panel.
6. Disconnect the battery.
7. Disconnect the window lift motor plug and socket (item 2).
8. Carefully unhook the tensioning spring (item 3) from the lower door glass guidance slide and allow it to slowly retract. Extreme care must be taken to avoid contact with the very sharp edges of the spring during this operation.
9. Unscrew and remove both door glass guidance slides (item 4).
10. To facilitate assembly, mark the position of the door glass stop (item 5) in relation to the door glass unit. Then, unscrew and remove the stop.
11. Remove the two nuts and washers (item 6) securing the glass unit to the window lift mechanism. Support the glass unit, then withdraw the two setscrews and spacers. Carefully lift the glass unit out of the door.
12. Remove the two setscrews, plain washers, and rubber washers (item 7) securing the top of the window lift mechanism to the inner door panel.
13. Remove the two rubber grommets from the underside of the door. Release the exposed bolts, nuts, and washers (item 8), then manoeuvre the window lift mechanism through the large aperture in the inner door panel.
14. To fit the window lift mechanism, reverse the removal procedure noting the following.

    Prior to securing the base of the window lift mechanism to the door, apply a small amount of Retinax 'A' grease, or its equivalent, to the bolts, nuts, and washers (item 8).

    Apply a small amount of Keenomax C3 grease, or its equivalent, to the door glass guidance slide channel.

Door glass unit – To remove and fit (see fig. S20-2)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove and fit).
3. Unscrew and remove the stainless steel cover plate from the rear face of the door.
4. Remove the five countersunk setscrews from the rearward interior door release handle mounting plate (see fig. S20-3, item 1). Lower the mounting plate

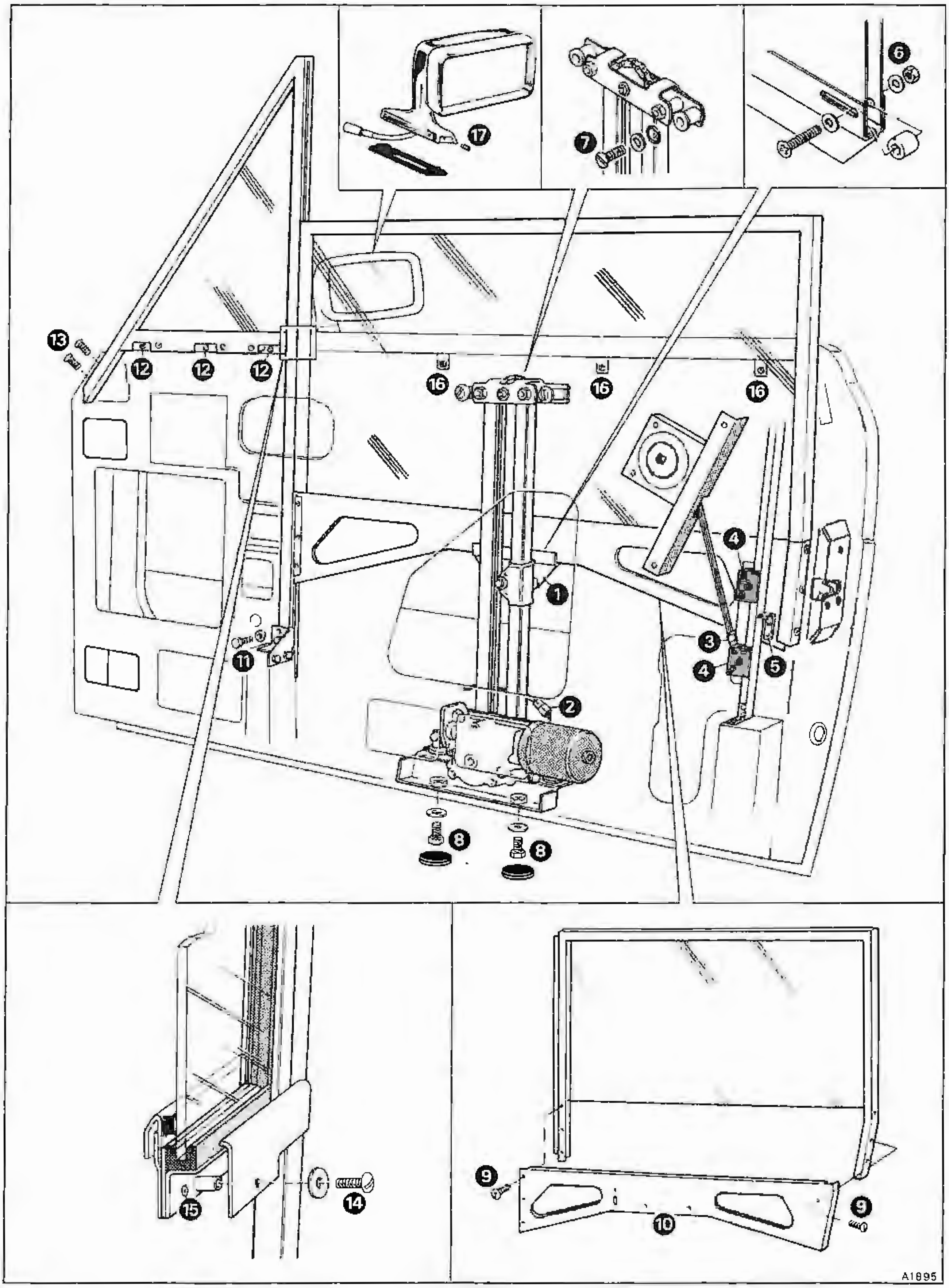


Fig. S20-2 Window lift mechanism, door glass unit and fittings, and front quarter light frame

assembly to disconnect the release handle from the control rod and remove.
5. Peel back and remove the waterproof cover from the inner door panel.
6. Lower the door glass unit until the window lift to door glass mounting bracket (item 1) is visible through the large aperture in the inner door panel.
7. Disconnect the battery.
8. Carefully unhook the tensioning spring (item 3) from the lower door glass guidance slide and allow it to slowly retract. Extreme care must be taken to avoid contact with the very sharp edges of the spring during this operation.
9. Unscrew and remove both door glass guidance slides (item 4).
10. To facilitate assembly, mark the position of the door glass stop (item 5) in relation to the door glass unit. Then, unscrew and remove the stop.
11. Remove the two nuts and washers (item 6) securing the glass unit to the window lift mechanism. Support the glass unit, then withdraw the two setscrews and spacers. Carefully lift the glass unit out of the door.
12. To fit the door glass unit reverse the procedure given for removal.

Door glass – To remove and fit (see fig. S20-2)
1. Remove the door glass unit.
2. Remove the setscrews (item 9). Then, withdraw the glass support mounting bracket (item 10).
3. Carefully slide the door glass out of the frame.
4. Inspect the glass sealing rubbers and renew if necessary.
5. To fit the glass reverse the removal procedure noting the following.

If the original glass is to be fitted ensure that all traces of sealing compound are removed using a cloth moistened with Bostik Cleaner 6001.

Prior to fitting the glass, apply a continuous bead of Seelastik into the frame channels and glass support mounting bracket.

If new glass sealing rubbers have been fitted any excess rubber should be trimmed flush with the frame channels using a sharp knife.

Front quarter frame assembly – To remove and fit (see fig. S20-2)
1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove and fit).
3. Remove the door glass unit (see Door glass unit – To remove and fit).
4. Peel back the waterproof cover to expose the lower frame to door securing setscrews (item 11). Remove the setscrews and washers.
5. Remove the self-tapping screws (item 12) securing the frame to the inner door panel.
6. Remove the countersunk setscrews (item 13) securing the frame to the front face of the door.
7. Carefully withdraw the quarter frame assembly.
8. To fit the quarter frame assembly reverse the procedure given for removal.

Front quarter frame glass – To remove and fit (see fig. S20-2)
1. Remove the front quarter frame assembly (see Front quarter frame assembly – To remove and fit).
2. Release the three setscrews and washers (item 14) then remove the stainless steel trim plate.
3. Drill out the two exposed pop rivets (item 15). Then, remove the angle bracket from underneath the quarter glass.
4. Remove the seal from the lower edge of the glass. Then, carefully slide the glass out of the frame.
5. Inspect the quarter glass seals and renew if necessary.
6. To fit the quarter glass reverse the removal procedure noting the following.

If the original glass is to be fitted ensure that all traces of sealing compound are removed using a cloth moistened with Bostik Cleaner 6001.

Prior to fitting the glass, apply a continuous bead of Seelastik into the quarter glass seals.

Using two 3 mm (0.125 in) diameter pop rivets secure the angle bracket underneath the quarter glass through the existing holes in the quarter frame.

Fence moulding – To remove and fit (see fig. S20-2)
1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove and fit).
3. Remove the door glass unit (see Door glass unit – To remove and fit).
4. Remove the front quarter frame assembly (see Front quarter frame assembly – To remove and fit).
5. Peel back the felt strip to expose the fence moulding to door securing screws (item 16). Release the self-tapping screws and carefully remove the fence moulding taking care not to damage the paintwork.
6. Inspect the felt strip and the fence moulding seals. Renew if necessary.
7. To fit the fence moulding reverse the procedure given for removal.

Door mirror – To remove and fit (see fig. S20-2)
1. Disconnect the battery.
2. Ease the rubber flap from the end of the mirror base to expose the mirror retaining grub screw (item 17).
3. Turn the screw anti-clockwise until the mirror assembly can be slid away from the door panel and clear of its mounting plate.
4. Disconnect the mirror loom plugs and sockets then remove the mirror assembly. Secure the sockets with masking tape to ensure that they do not drop inside the door.
5. To fit the door mirror reverse the removal procedure noting the following.

When fitting the mirror, thread the loom into the door in a forwards direction, i.e. towards the front of

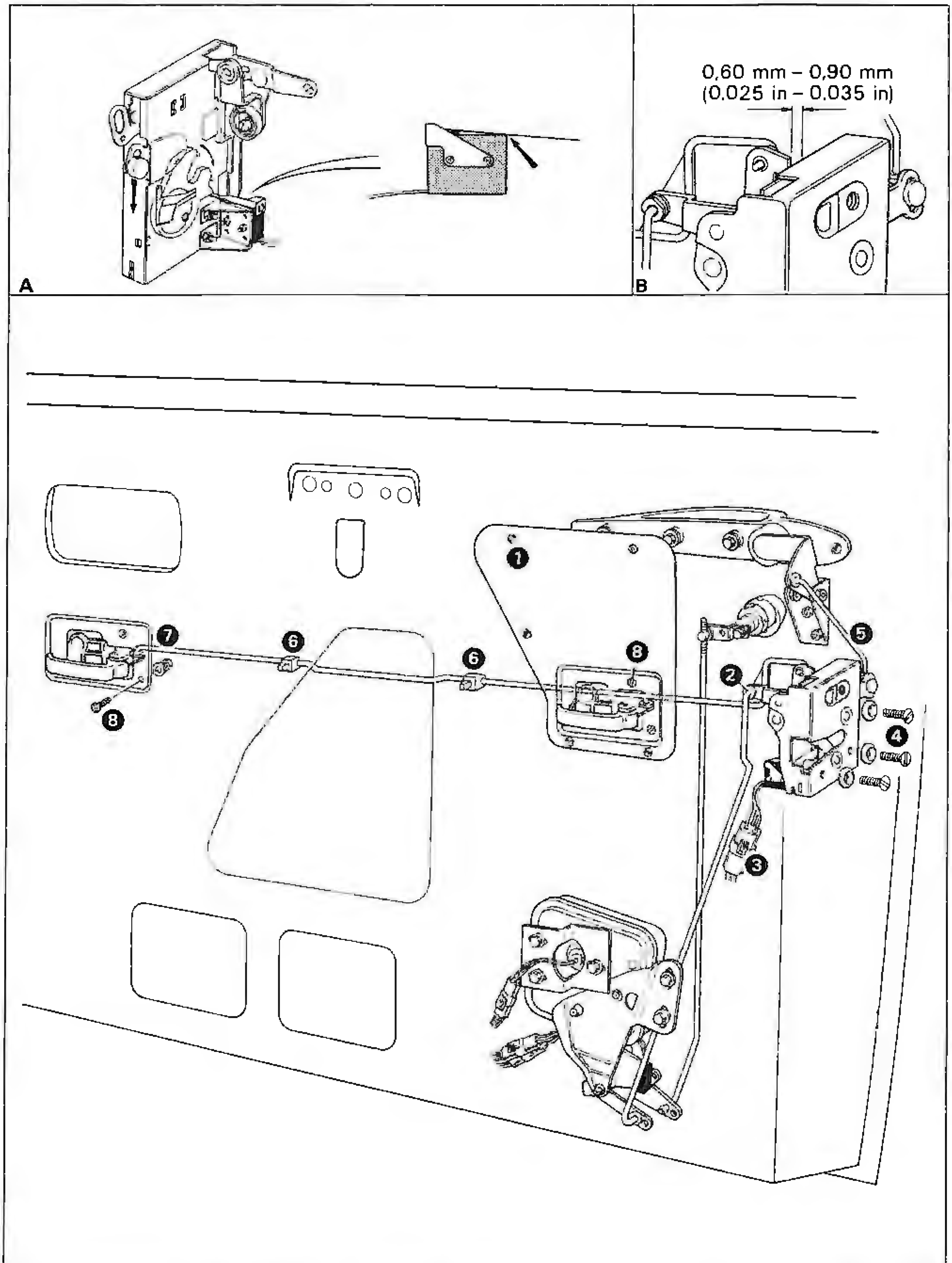


Fig. S20-3 Door latch, interior release handles, and fittings

the car. This avoids the possibility of the plug and socket fouling the window lift mechanism.

Door latch – To remove (see fig. S20-3)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove and fit).
3. Remove the door glass unit (see Door glass unit – To remove and fit).
4. Disconnect the battery.
5. Peel back the waterproof cover from the inner door panel.
6. Disconnect the exposed relay lever link rod (item 2) from the door latch.
7. Disconnect the courtesy lamp micro-switch plug and socket (item 3).
8. Remove the setscrews and washers (item 4) securing the latch to the door panel.
9. Lower the latch and disconnect the exterior handle control rod (item 5) from the plastic connector on the door latch. Note that a number of spacers are fitted to the control rod.
10. Release the interior door handle control rod from the clips (item 6) situated on the inner door panel. Disconnect the control rod from the forward door release handle (item 7). Then, withdraw the latch/control rod assembly from the door.
11. If necessary, unscrew and remove the courtesy lamp micro-switch from the latch.

Door latch – To fit (see fig. S20-3)

Reverse the procedure given for removal noting the following.

1. If the courtesy lamp micro-switch has been removed from the latch proceed as follows.

   Move the claw mechanism of the latch into the 'door closed' position.

   Loosely fit the micro-switch assembly to the latch using the screws, nuts, and shakeproof washers.

   Release the claw mechanism into the 'door open' position. Then, adjust the position of the switch until the actuator lever is lightly touching the corner of the switch (see inset A, arrowed). Tighten the securing screws.
2. Place the latch/control rod assembly into the door and connect the control rod to the forward release handle.

Note Wherever control rods have been disconnected, it is important that new Fastex bushes are fitted on assembly. This will ensure that the control rods are correctly secured.

3. Fit the exterior handle control rod (item 5), complete with the correct number of spacers, into the plastic connector on the latch.
4. Secure the latch to the door panel using three **new** M6 setscrews and washers. Torque tighten the setscrews to between 4,1 Nm and 6,1 Nm (0,4 kgf m and 0,6 kgf m; 3 lbf ft and 4.5 lbf ft). **This torque figure must not be exceeded.**
5. Connect the relay lever link rod (item 2) to the latch.
6. Ensure that the interior door handle control rod is secured by the clips (item 6) situated on the inner door panel.
7. To check the operation of the interior and exterior handles reference should be made to Interior and Exterior handles – To set.

Interior door handles – To remove and fit (see fig. S20-3)

1. Remove the door trim (see Door trim – To remove and fit).
2. To remove the rearward door release handle proceed as follows.

   Remove the five countersunk setscrews (item 1) from the release handle mounting plate.

   Lower the mounting plate assembly to disconnect the release handle from the control rod and remove.
3. To remove the forward door release handle proceed as follows.

   Remove the three screws, nuts, and washers (item 8).

   Release the door handle control rod from the clips situated on the inner door panel. Then, disconnect the handle from the control rod.
4. To fit the door handles reverse the removal procedure noting the following.

   For information on the correct setting of the interior door handles reference should be made to Interior door handles – To set.

Interior door handles – To set (see fig. S20-3)

1. Loosen the screws (item 8) securing both handle bases to the inner door panel.
2. Move the handle bases forward (i.e. away from the latch) until any free play is removed. Check that both release handles return fully against their stops.
3. Move the handle bases further forward, against latch spring pressure, until the correct clearance is achieved between the lever and the latch body (see inset B). Then, tighten the setscrews securing the handle bases.
4. With the door open, move the claw mechanism of the latch into the 'door closed' position and check the operation of both handles.

   Never attempt to close the door with the latch mechanism in the 'door closed' position, or severe damage to the latch may result.

Exterior door handle – To remove and fit (see fig. S20-4)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove and fit).
3. Remove the door glass unit (see Door glass unit – To remove and fit).
4. Remove the screw and spacer (item 1).
5. Support the door handle, then release the three setscrews, washers, and spacers (item 2). Carefully withdraw the handle taking care not to damage the paintwork.
6. To fit the exterior door handle reverse the removal procedure noting the following.

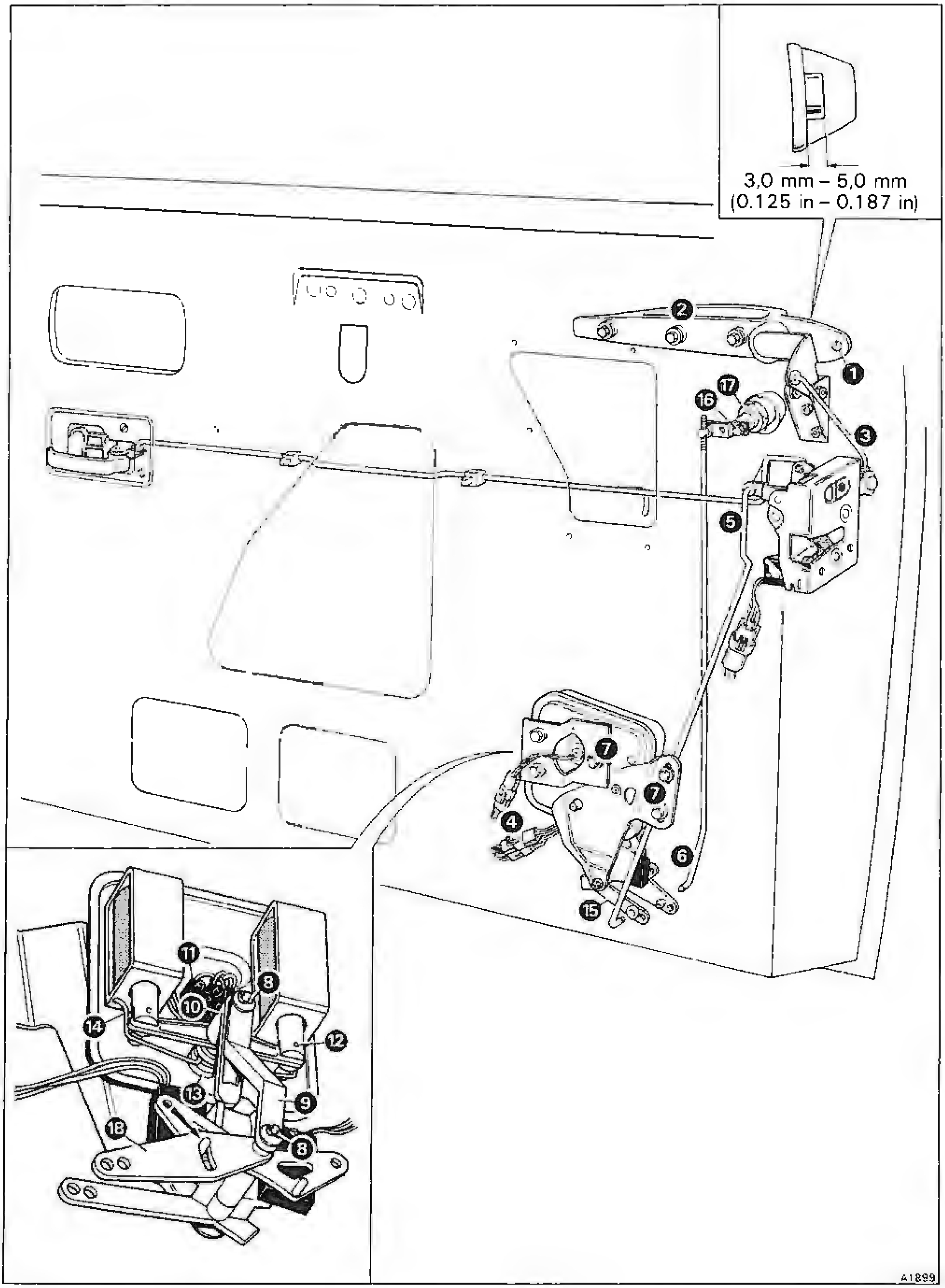


Fig. S20-4 Exterior door handle, solenoid assembly, private lock unit, and fittings

For information on the correct setting of the exterior handle reference should be made to, Exterior door handle push button – To set.

Exterior door handle push button – To set
(see fig. S20-4)

1. With the door open, move the claw mechanism of the latch into the 'door closed' position.

Never attempt to close the door with the mechanism in this position, or severe damage to the latch may result.

2. Depress the push button and check that the latch operates correctly. The latch should operate with between 3 mm and 5 mm (0.125 in and 0.200 in) of push button overtravel.

To adjust the push button overtravel, it will be necessary to lower the door latch and amend the number of spacers on the exterior handle control rod (item 3). Refer to Door latch – To remove.

Solenoid assembly – To remove and dismantle
(see fig. S20-4)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the five countersunk setscrews from the rearward interior door release handle mounting plate (see fig. S20-3, item 1). Lower the mounting plate assembly to disconnect the release handle from the control rod and remove.
3. Peel back the waterproof cover from the inner door panel.
4. Fully raise the door glass, then disconnect the battery.
5. Disconnect the plugs and sockets (item 4) from the solenoids and micro-switches.
6. Disconnect the relay lever link rod (item 5) from the door latch.
7. Disconnect the private lock control rod (item 6) from the solenoid assembly.
8. Remove the three setscrews and washers (item 7) securing the solenoid assembly to the inner door panel. Then, carefully manoeuvre the assembly clear of the door.
9. If it is necessary to replace a solenoid proceed as follows.

Remove the circlips and nylon washers (item 8).

Withdraw the tie piece (item 9) and drive lever (item 10). Then, unclip and remove the plastic solenoid cover.

Disconnect the solenoid leads from the terminal block (item 11).

Unscrew and remove the solenoid/connecting link assembly from the base plate. The solenoids can then be separated from the connecting link by removing the roll pins (item 12).

Solenoid assembly – To assemble and fit
(see fig. S20-4)

1. Prior to fitting the solenoid/connecting link assembly to the base plate ensure that two nylon spacers (item 13) are in position on the mounting shaft.
2. Loosely fit the solenoid/connecting link assembly to the base plate. Align the solenoids to give unrestricted movement of the connecting link, then tighten the solenoid securing screws. Check that the self-centring spring (item 14) is fitted correctly.
3. Connect the solenoid leads to the terminal block, then press the solenoid cover in position.
4. Fit the drive lever and tie piece, then secure using circlips and nylon washers.
5. To fit the solenoid assembly to the door reverse the removal procedure, Operations 1 to 8 inclusive, noting that wherever control/link rods have been disconnected it is important that new Fastex bushes are fitted on assembly.

To set the position of the solenoid assembly in the door, reference should be made to Solenoid assembly – To adjust.

Solenoid assembly – To adjust (see fig. S20-4)

1. Loosen the three setscrews (item 7) securing the solenoid assembly to the inner door panel.
2. Disconnect the relay lever link rod (item 5) from the door latch lever.
3. Press the door latch lever down into the unlocked position.
4. Move the relay lever (item 15) down sufficiently to take up any free play.
5. Adjust the height of the solenoid assembly until the relay lever link rod (item 5) aligns with the hole in the door latch lever. Tighten the solenoid assembly securing setscrews.
6. Connect the relay lever link rod to the door latch, noting that wherever link rods have been disconnected it is important that new Fastex bushes are fitted on assembly.

Private lock – To remove (see fig. S20-4)

1. Remove the door trim (see Door trim – To remove and fit).
2. Remove the waist rail finisher (see Waist rail finisher – To remove and fit).
3. Remove the door glass unit (see Door glass unit – To remove and fit).
4. Remove the balance lever retaining nut (item 16), noting the position and quantity of any spacing washers. Manoeuvre the balance lever and control rod assembly clear of the private lock.
5. Remove the large nut and spacer (item 17) securing the private lock to the door, then withdraw the lock.

Private lock – To fit (see fig. S20-4)

Reverse the procedure given for removal noting the following.

1. Prior to assembly, apply Keenomax C3 waterproof grease, or its equivalent, to the private lock spacer. Fit the spacer with the drain slots facing towards the outer door panel.
2. Ensure that the key slot is vertical, then secure the private lock and spacer to the door using the large nut.
3. Attach the balance lever/control rod assembly and spacing washers.
4. Check that the door locks and unlocks smoothly.

If adjustment is necessary, reference should be made to Private lock control rod – To adjust.

Private lock control rod – To adjust (see fig. S20-4)
1. Set the private lock key slot vertical, then remove the key.
2. Disconnect the private lock control rod (item 6) from the transfer lever.
3. Move the transfer lever (item 18) down until it comes into contact with the peg (arrowed). Ensure that the remaining levers do not move.
4. Turn the private lock control rod, either clockwise or anti-clockwise, until the rod aligns with the hole in the transfer lever. If there are two holes in the transfer lever, align the control rod with the inner hole.
5. Connect the control rod to the transfer lever, noting that wherever rods have been disconnected it is important that new Fastex bushes are fitted on assembly.
6. Check that the door locks and unlocks smoothly when operated by the key. Ensure that the extra force required to activate the micro-switches is equal in both the lock and unlock direction. Operation of the micro-switches can be identified by listening for the 'click' as they activate.

Checking the centralized door locking system

Operation	Check
Door closed. Upper portion of the centralized door locking switch depressed.	Door can be opened using the interior handles and exterior push button.
Door closed. Lower portion of the centralized door locking switch depressed.	Door cannot be opened from the interior handles or the exterior push button until the upper portion of the centralized door locking switch is depressed.
Door open. Lower portion of the centralized door locking switch depressed.	Door lock self-cancels when the door is closed (exterior push button not depressed). Door remains locked when the door is closed (exterior push button depressed).
Door open or closed. Lower portion of the centralized door locking switch depressed.	Both doors and luggage compartment lock.

Operation	Check
Door open or closed. Upper portion of the centralized door locking switch depressed.	Both doors unlock. Luggage compartment will unlock only if the selector switch situated in the facia stowage compartment is in the AUTO position.
Turn key (towards rear of car) to lock position.	Door locks.
Turn key further against spring pressure.	Both doors and luggage compartment lock.
Turn key (towards front of car) to unlock position.	Door unlocks.
Turn key further against spring pressure.	Both doors unlock. Luggage compartment will unlock only if the selector switch situated in the facia stowage compartment is in the AUTO position.

Rear quarter

Contents

2/88
Printed in England

Rear quarter

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

Safety procedures
The adhesives and cleaner referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Waist rail finisher, 'BC' post trim, and side arm rest trim – To remove and fit (see fig. S21-1)
1. Remove the screws and cup washers (item 1). Then, carefully lift off the waist rail finisher and trim roll assembly.
2. To remove the 'BC' post trim panel proceed as follows.

Carefully prise the plastic cover (item 2) from the lower seat belt anchorage bolt. Remove the bolt and allow the belt to carefully retract.

Turn back the floor carpet, then remove the exposed screw and washer (item 3).

Remove the two screws and cup washers (item 4) securing the top of the 'BC' post trim panel.

Carefully remove the trim panel, noting that the rear of the panel is secured by Velcro fasteners (item 5).

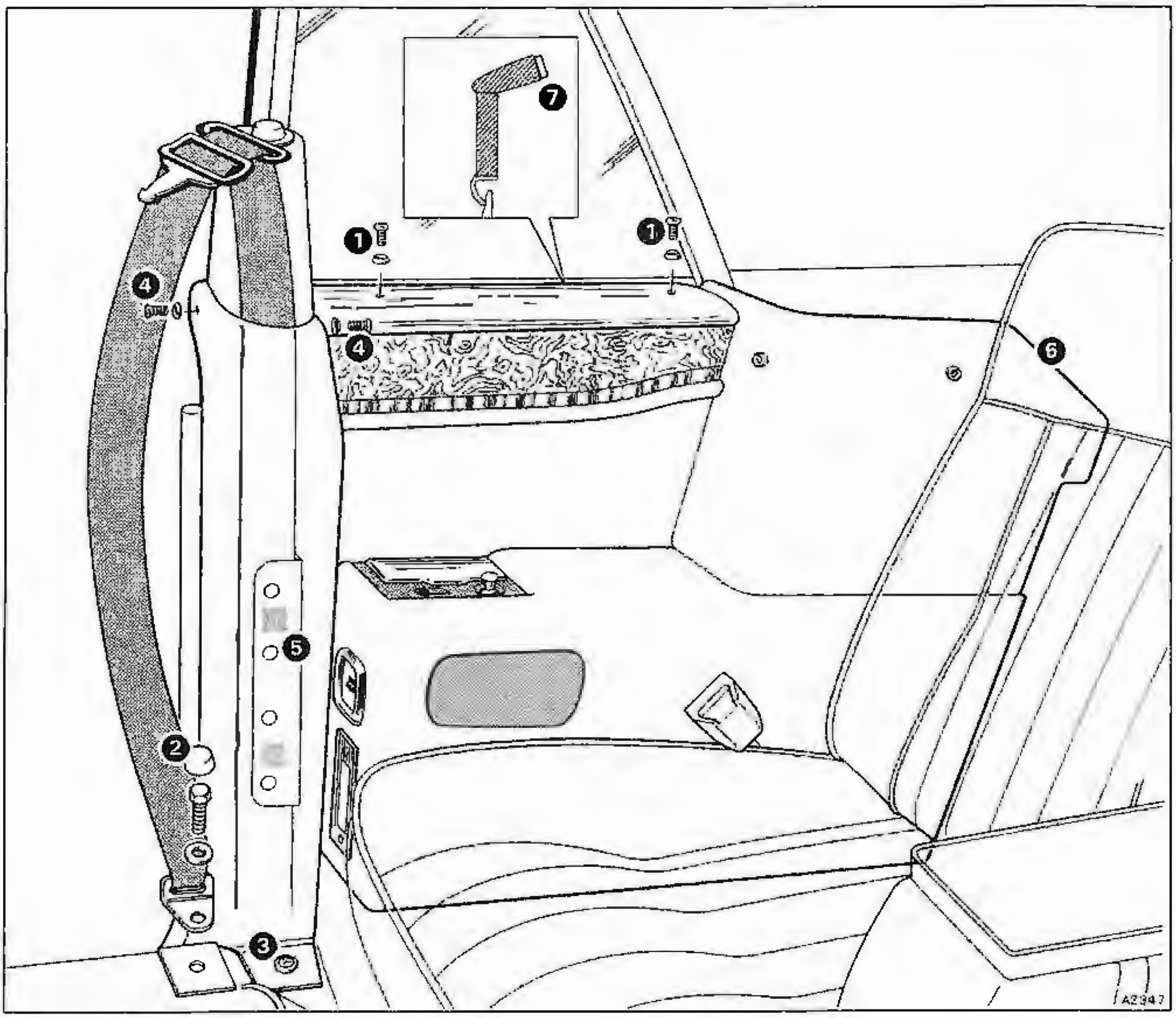


Fig. S21-1 Rear quarter trim

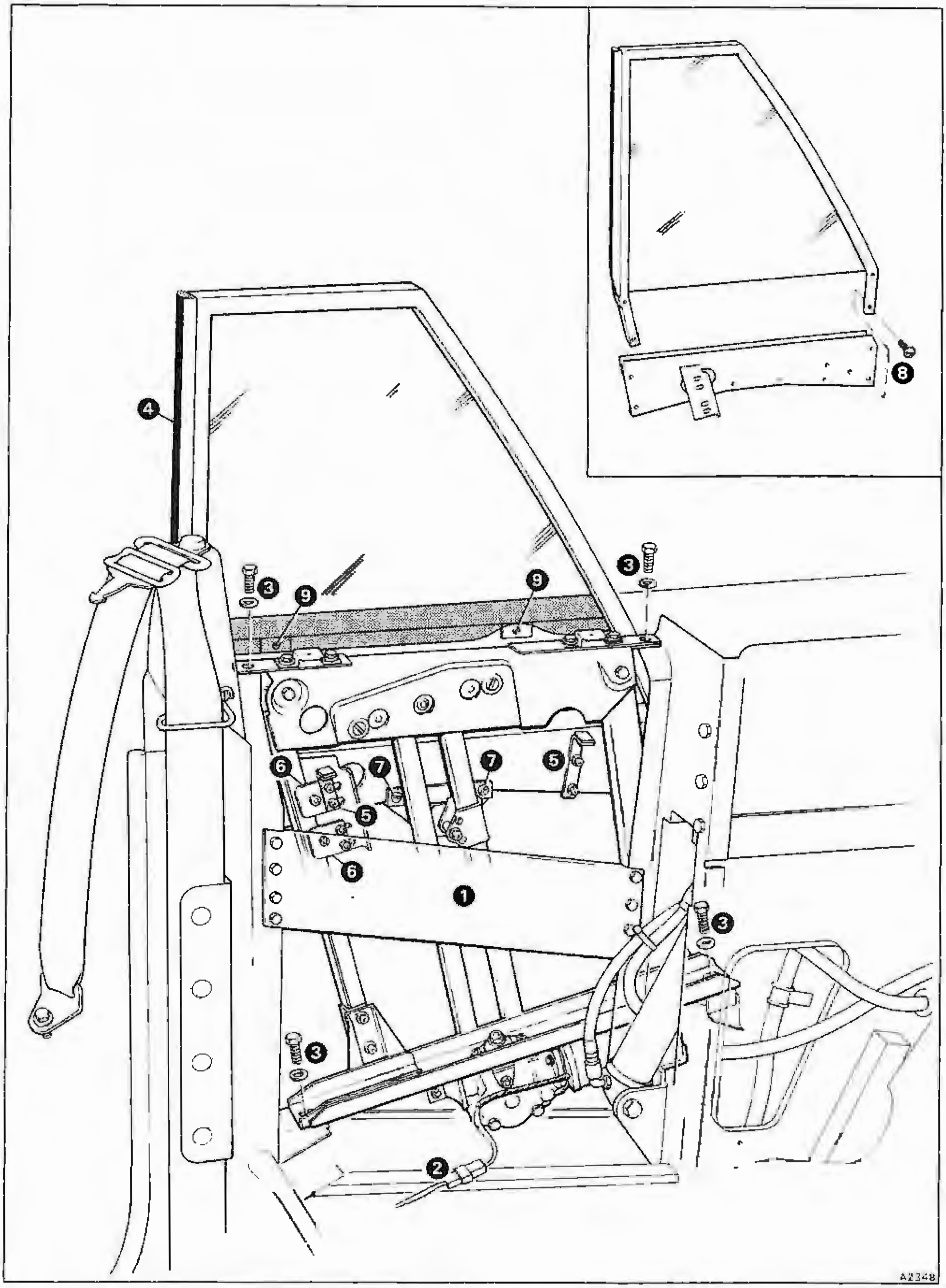


Fig. S21-2 Window lift mechanism and quarter glass assembly

3. To remove the side arm rest trim proceed as follows.

Disconnect the battery.

Remove the rear seat cushion and squab assembly (see Section S27).

Lift the rear of the arm rest trim (item 6) clear of the hoodwell. Ease the trim forward to gain access to the rear of the window lift and interior lamp switches, lamp, and cigar lighter. In view of the numerous connections, it is advisable to label each one as it is disconnected.

Remove the side arm rest trim.

4. To fit the trim panels reverse the removal procedure.

Waist rail finisher seal – To renew (see fig. S21-1)

1. Remove the screws and cup washers (item 1). Then, carefully lift off the waist rail finisher and trim roll assembly.
2. To renew the felt sealing strip (item 7) proceed as follows.

Using a suitable tool, remove and discard the glued felt strip taking care not to damage the polished surface of the waist rail finisher.

Thoroughly clean the bonding surface of the finisher using a cloth moistened with Bostik Cleaner 6001.

Apply an even coat of Apollo Adhesive AX2344 to the bonding surfaces of the finisher and the felt strip. Allow five minutes for the adhesive to 'flash' dry. Then, bring the bonding surfaces together using maximum hand pressure. Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

Rear quarter window lift mechanism and glass frame assembly – To remove and fit (see fig. S21-2)

1. Partly raise the rear quarter window, then disconnect the battery.
2. Remove the rear quarter trim (see Waist rail finisher, 'BC' post trim, and side arm rest – To remove).
3. Peel back and remove the waterproof covering from the window lift mechanism.
4. Unscrew and remove the strengthening plate (item 1).
5. Disconnect the window lift motor plug and socket (item 2).
6. Release the upper and lower fixings (item 3) securing the rear quarter assembly to the body. Then, carefully lift the assembly clear.
7. To fit the window lift mechanism and glass frame assembly reverse the removal procedure.

Rear quarter frame to door frame seal – To renew (see fig. S21-2)

1. Remove the quarter window lift and glass frame assembly (see Rear quarter window lift mechanism and glass frame assembly – To remove and fit).
2. To renew the seal (item 4) proceed as follows.

Using a suitable tool, remove and discard the glued seal taking care not to damage the polished surface of the quarter frame.

Thoroughly clean the bonding surface of the quarter frame using a cloth moistened with Bostik Cleaner 6001.

Apply an even coat of Bostik Adhesive 1261 to the bonding surfaces of the quarter frame and seal. Allow between 10 and 15 minutes for the adhesive to 'flash' dry. Then, bring the bonding surfaces together using maximum hand pressure. Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

Quarter glass unit – To remove and fit
(see fig. S21-2)

1. Remove the quarter window lift and glass frame assembly (see Rear quarter window lift mechanism and glass frame assembly – To remove and fit).
2. To facilitate assembly, mark the position of the quarter glass stops (item 5). Unscrew and remove the stops.
3. Unscrew and remove the glass guidance slides (item 6).
4. Remove the two nuts and washers securing the glass unit to the window lift mechanism (item 7). Withdraw the setscrews and spacers, then lift the glass unit clear of the mechanism.
5. To fit the glass unit reverse the removal procedure.

Quarter glass – To remove and fit (see fig. S21-2)

1. Remove the quarter glass unit from the window lift mechanism (see Quarter glass unit – To remove and fit).
2. Remove the setscrews (item 8). Then, withdraw the glass support mounting bracket.
3. Carefully slide the glass out of the frame.
4. Inspect the glass sealing rubbers and renew if necessary.
5. To fit the glass reverse the removal procedure noting the following.

If the original glass is to be fitted ensure that all traces of sealing compound are removed using a cloth moistened with Bostik Cleaner 6001.

Prior to fitting the glass, apply a continuous bead of Seelastik into the frame channels and glass support mounting bracket.

If new glass sealing rubbers have been fittad any excess rubber should be trimmed flush with the frame channels using a sharp knife.

Fence moulding – To remove and fit (see fig. S21-2)

1. Remova the rear quarter trim (see Waist rail finisher, 'BC' post trim, and side arm rest trim – To remove).
2. Remove the quarter window lift and glass frame assembly (see Rear quarter window lift mechanism and glass frame assembly – To remove).
3. Peel back the felt strip to expose the fence moulding to body securing screws (item 9). Release the self-tapping screws and carefully remove the fence moulding taking care not to damage the paintwork.
4. Inspect the felt strip and the fence moulding seal. Renew if necessary.
5. To fit the fence moulding reverse the procedure given for removal.

Bonnet

Contents

Printed in England

Bonnet

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

If special torque tightening figures are not specified, setscrews, bolts, etc., should be tightened to the standard figures quoted in Chapter P.

Bonnet – To remove (see fig. S22-1)
1. Disconnect the battery.
2. Raise the bonnet.
3. Disconnect the bonnet lamp loom plug and socket (item 1).
4. Cut and discard the plastic cable ties (item 2) securing the bonnet lamp loom to the left-hand hinge.
5. Unscrew and release the earth bonding strap (item 3).
6. To facilitate assembly, mark the position of each hinge in relation to the bonnet.
7. With the help of an assistant, support the bonnet and remove the setscrews and washers (item 4). Remove the bonnet.

Bonnet – To fit (see fig. S22-1)
Reverse the procedure given for removal noting the following.
1. Prior to tightening the bonnet securing setscrews, align the marks made during removal.
2. Check that the bonnet to body clearances are equal and that the bonnet opens and closes without difficulty. If necessary, adjust the position of the catch plates situated on the bonnet.
3. Ensure that the bonnet locating pegs align with their respective rubber bushes situated on the bulkhead (see fig. S22-2, item 1).
4. *On cars conforming to a North American specification,* check that the protrusions on the bonnet retention brackets align with their respective holes in the brackets situated on the bulkhead.

Bonnet hinges – To remove and fit (see fig. S22-1)
1. Remove the bonnet (see Bonnet – To remove).
2. Release the clip (item 5) securing the coolant hose to the left-hand hinge.
3. To facilitate assembly, mark the position of each hinge in relation to the body.
4. Release the two setscrews and washers securing each hinge (item 6). Remove the hinges.
5. To fit the hinges reverse the procedure given for removal.

Bonnet catch mechanism – To remove and fit (see fig. S22-2)
1. Raise the bonnet.
2. Carefully move the countershaft (item 2) into the 'bonnet closed' position, and remove the springs (item 3).
3. Unclip and straighten the looped end of the bonnet release cable. Loosen the grub screw (item 4) and release the cable from the retainer.
4. To facilitate assembly, mark the position of each guide plate (item 5) in relation to its mounting bracket.
5. Remove the guide plate securing setscrews and washers. Note the position of any suppressors that may be secured under the setscrews.
6. Carefully remove the countershaft and guide plates assembly.
7. To fit the catch mechanism, reverse the removal procedure noting the following.

Prior to tightening the countershaft securing setscrews align the guide plates with the marks made during removal. Check that the countershaft is located in the support bracket (item 6).

Do not attempt to close the bonnet until the release cable has been fitted and set (see Bonnet release cable – To renew).

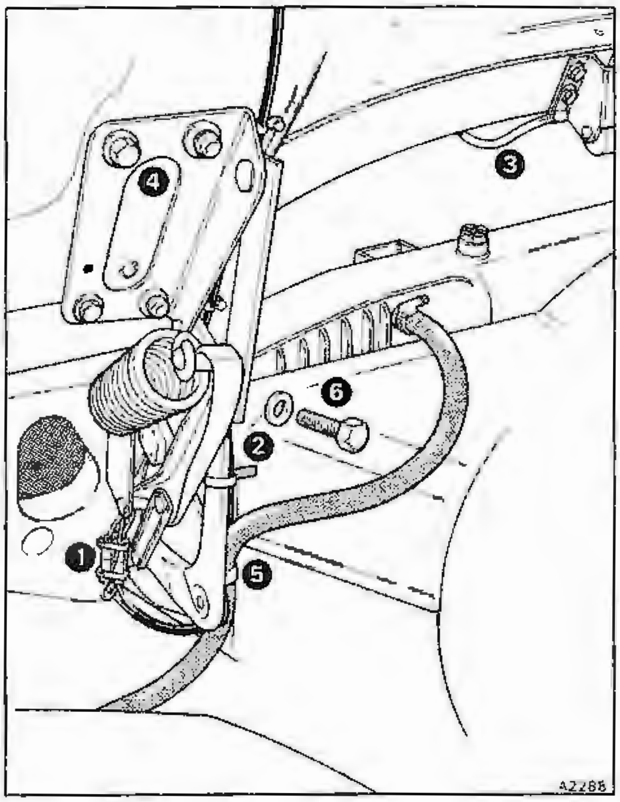


Fig. S22-1 Bonnet and hinge mounting arrangement

Bonnet release cable – To renew (see fig. S22-2)
1. Raise the bonnet.
2. Unclip and straighten the looped end of the bonnet

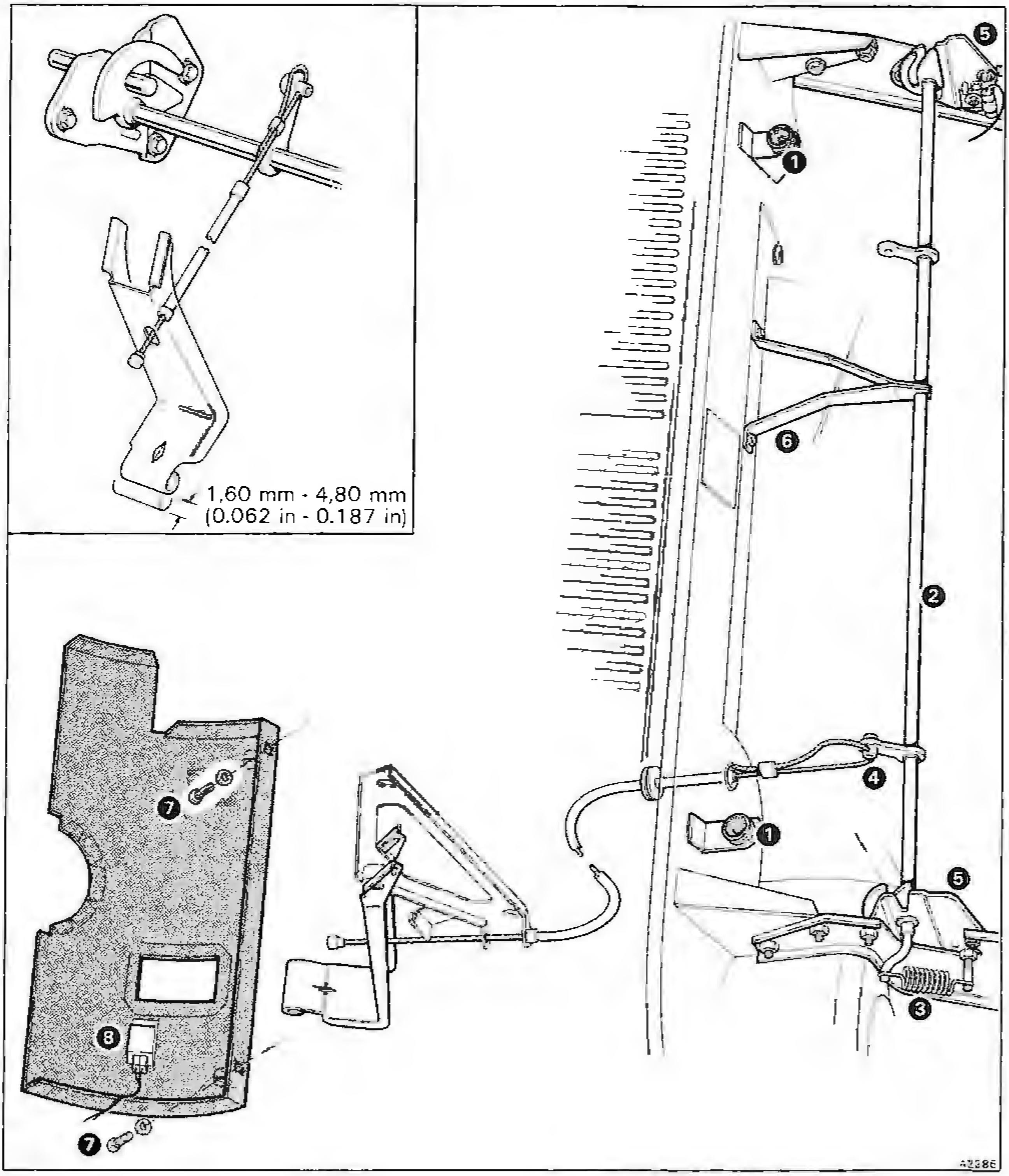


Fig. S22-2 Bonnet release mechanism

release cable. Loosen the grub screw (item 4) and release the cable from the retainer.

3. Remove the screws and washers (item 7) and lower the parking brake trim panel. Release the Lucar connectors from the footwell lamp (item 8) and remove the panel.

4. Completely withdraw the bonnet release cable, pulling it through the pivot on the release handle.

5. Lightly smear the new cable with Rocol MTS 1000 grease, or its equivalent. Carefully feed the cable into position through the release handle pivot and outer sheath.

6. Place a length of 6,35 mm (0.250 in) diameter bar in the guide plate. Then, carefully move the countershaft

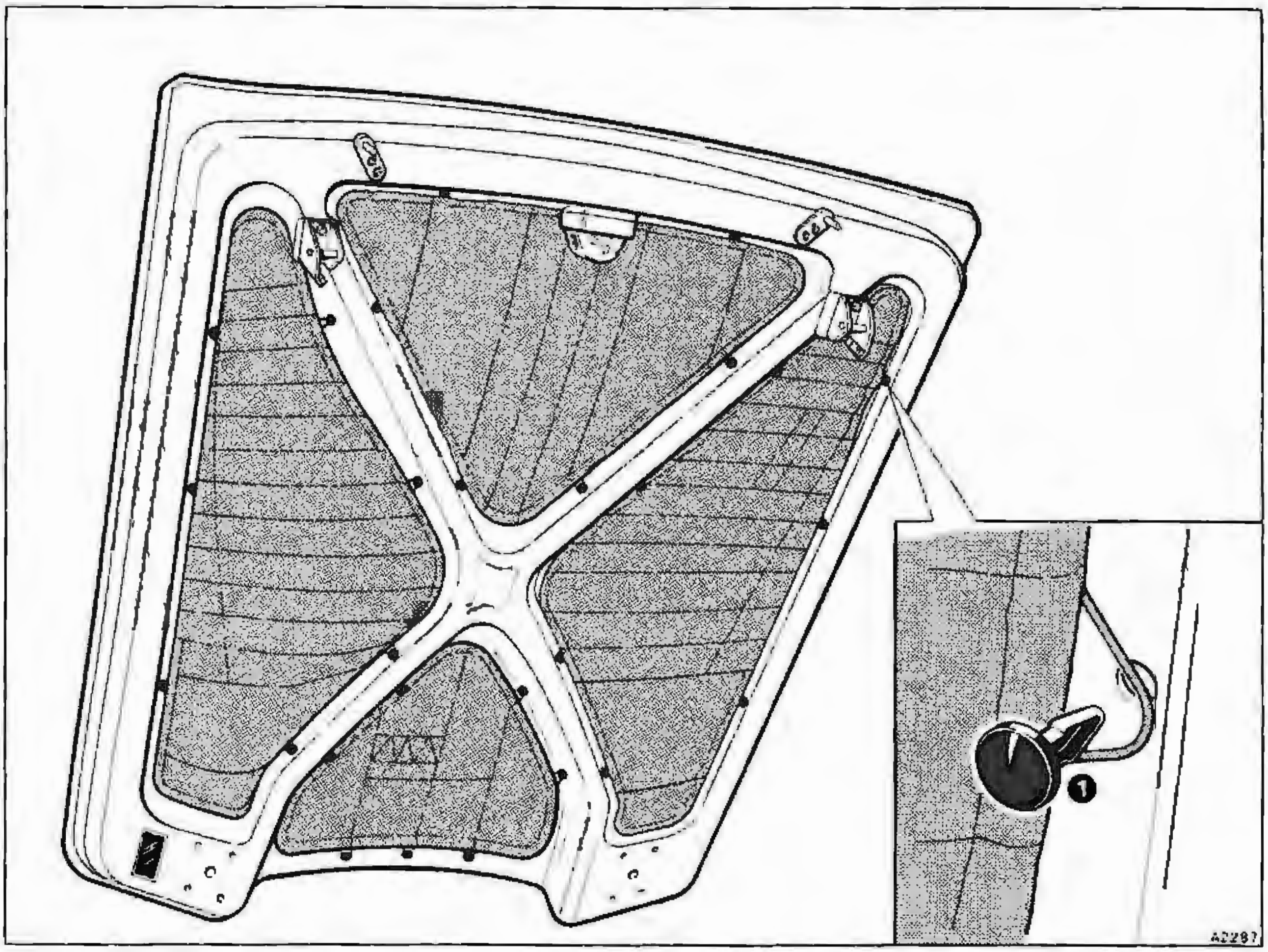


Fig. S22-3 Bonnet pads

into the 'bonnet closed' position (see inset).
7. Thread the release cable through the retainer in the countershaft until the nipple end of the cable fits into the pivot on the release handle. Then, tighten the grub screw.
8. Check that there is between 1,6 mm and 4,8 mm (0.062 in and 0.187 in) of free movement in the release handle (see inset). This movement is measured from the handle resting on its rubber stop to the point when it begins to operate the countershaft. If necessary, loosen the grub screw and adjust the cable.
9. Loop the excess cable and clip into position approximately 38 mm (1.50 in) from the retainer.
10. Remove the length of bar from the guide plate and operate the bonnet release lever. Check that the countershaft moves into the 'bonnet open' position, and that the release handle returns to its stop when released.
11. Check that the bonnet opens and closes without difficulty.

Bonnet pads – To remove and fit (see fig. S22-3)
1. Each bonnet pad is held in position by a number of plastic drive fasteners (item 1). To remove a bonnet pad, simply prise out the drive fasteners taking care not to damage the paintwork.
2. To ensure the correct retention of the bonnet pads it is recommended to fit new drive fasteners on assembly.

Bonnet seals – To renew
1. The bonnet seals are simply a push-on fit over the scuttle panel and front wing flanges and can easily be renewed as necessary, taking care not to damage the paintwork.

Luggage compartment lid

Contents

10/87
Printed in England

Luggage compartment lid

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

If special torque tightening figures are not specified, setscrews, bolts, etc., should be tightened to the standard figures quoted in Chapter P.

Luggage compartment lid – To remove
(see fig. S23-1)

1. Disconnect the battery.
2. Unscrew and remove the hinge cover trim (item 1).
3. To gain access to the luggage compartment lid loom connector it will be necessary to remove the front trim panel as follows.

Unclip and remove the luggage compartment floor carpet.

Remove the battery master switch knob (item 2) by releasing the centre screw, ring nut, and instruction plate.

Unscrew and remove the side trim panel (item 3).

Remove the screws (item 4) from the hinged tool cover. Release the fastener and carefully remove the tool cover. Withdraw the containers of mineral oil.

Remove the front trim panel securing screws and cup washers (item 5).

Ease the trim panel forward to gain access to the rear of the interior lamp and centralized door locking switch (item 6). Release the exposed Lucar connectors, noting the colour and position of the leads to ensure correct assembly. Then, remove the front trim panel.

4. Cut and discard the cable ties (item 7) securing the electrical loom to the right-hand luggage compartment lid hinge.
5. Disconnect the loom plug and socket (item 8). Then, manoeuvre the loom clear of the hinge mounting area.

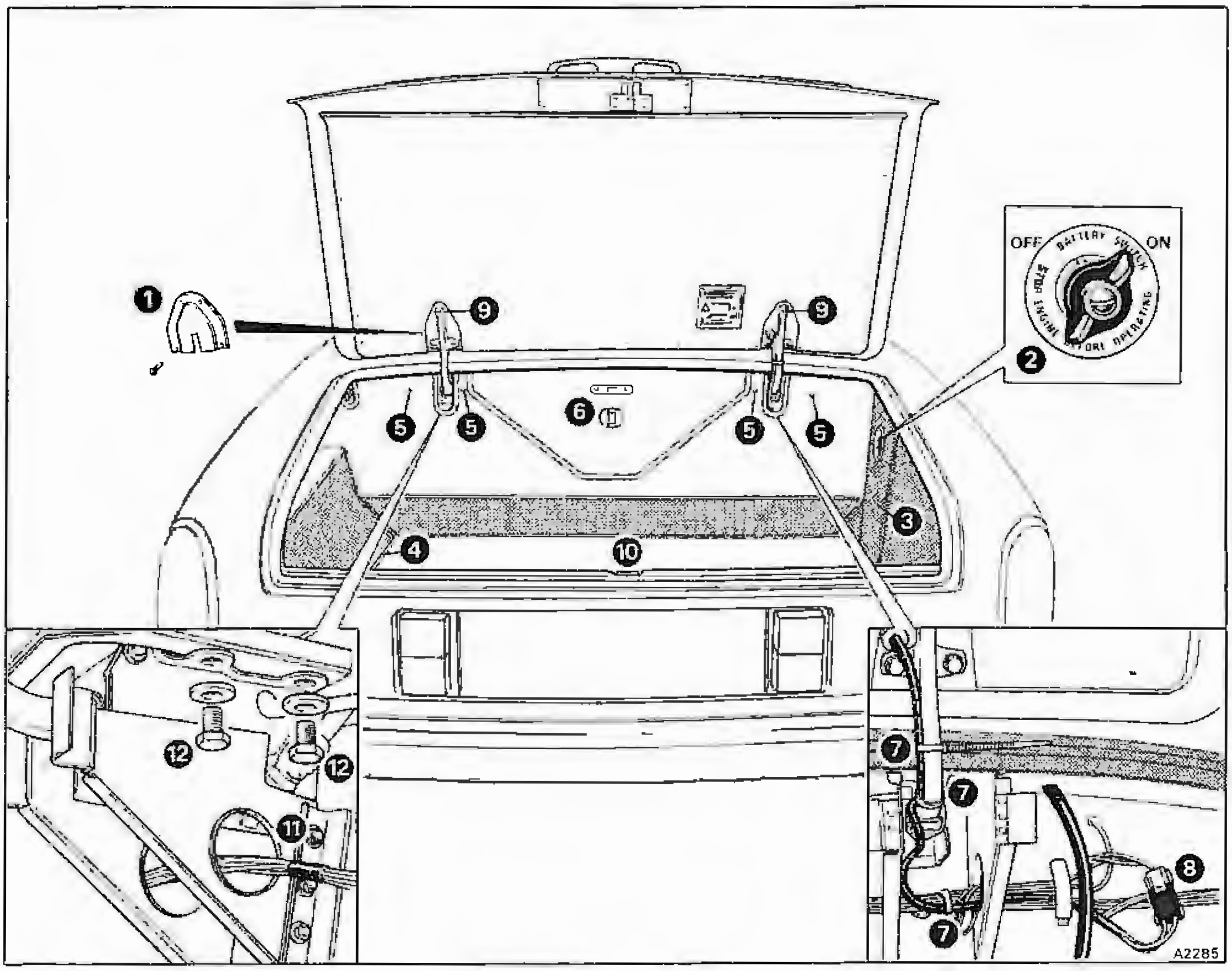


Fig. S23-1 Luggage compartment lid trim and hinge mounting arrangement

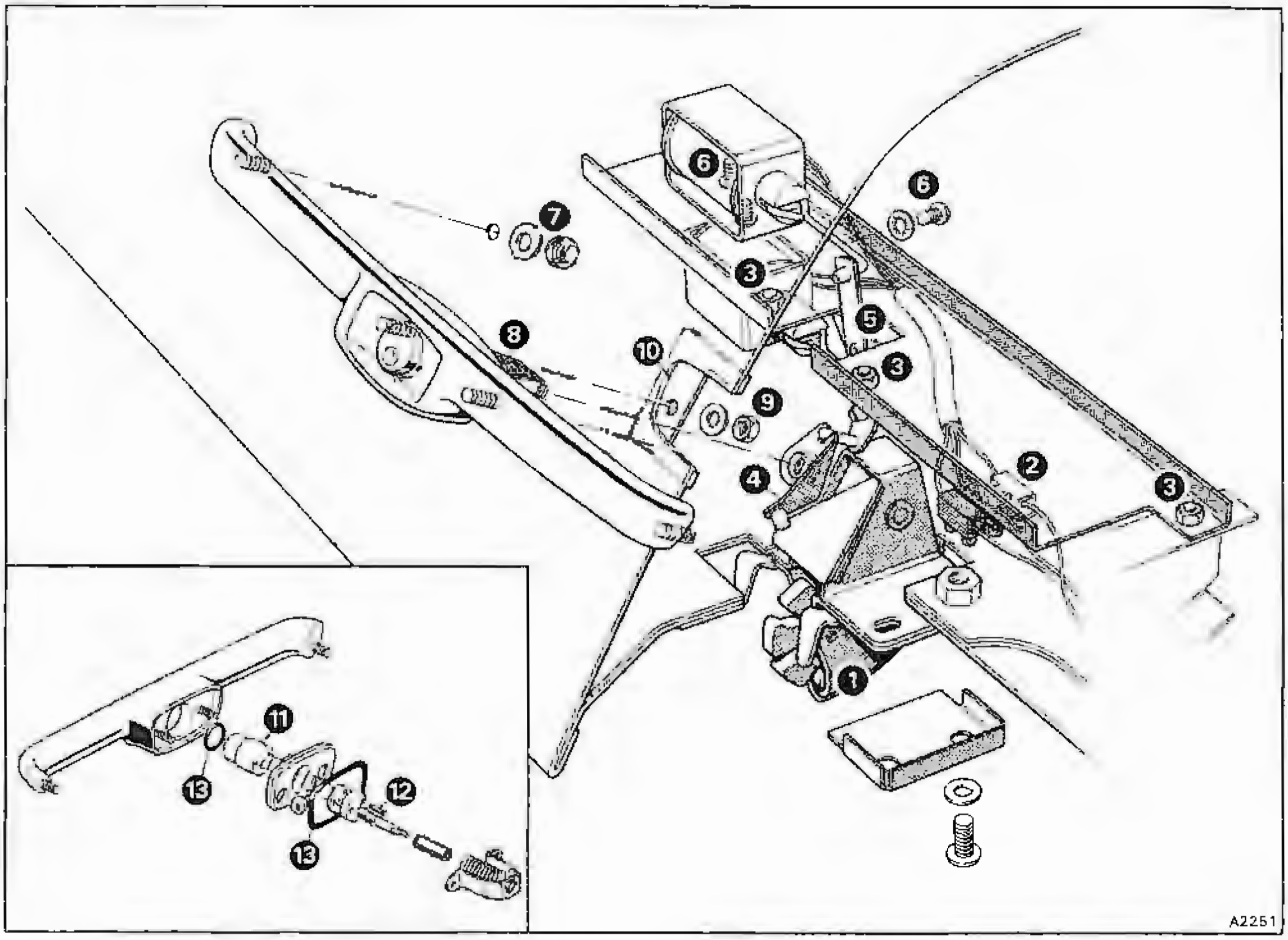


Fig. S23-2 Luggage compartment lock mechanism

6. To facilitate assembly, mark the position of each hinge in relation to the luggage compartmant lid.
7. With the help of an assistant, support the luggage compartment lid and remove the setscrews and washers (item 9). Note the position and quantity of any shims situated between the hinges and the luggage compartment lid. Remove the lid.

Luggage compartment lid – To fit (see fig. S23-1)
Reverse the procedure given for removal noting the following.
1. Prior to tightening the luggage compartment lid securing setscrews align the marks made during removal.
2. Using a pencil, mark the position of the latch striker (item 10). Release the securing setscrews and washers, then remove the latch striker.
3. Carefully close the luggage compartment lid and check that the clearances between the lid and the body are equal. If necessary, adjust the position of the lid then tighten the securing setscrews.
4. Fit the latch striker, aligning the marks made during removal. Check that the lid can be opened and closed without difficulty. Ensure that the lid lies flush with the rear wing panels when closed. If necessary, adjust the vertical position of the striker.
5. Check that the luggage compartment lock and unlock solenoids, centralized door locking switch, high mounted stop lamp (if fitted), and the interior lamp are all operating correctly.

Hinges – To remove and fit (see fig. S23-1)
1. Remove the luggage compartment lid (see Luggage compartment lid – To remove).
2. Release the Lucar connectors from the luggage compartment interior lamp switch situated on the right-hand hinge.
3. Remove the hinge support bracket securing bolts, nuts, and washers (item 11).
4. Release the setscrews and washers (item 12). Remove the hinges, noting the position and quantity of any shims situated between the hinges and the body.
5. To fit the hinges reverse the removal procedure.

Latch mechanism – To remove and fit
(see fig. S23-2)
1. Using a pencil, mark the position of the latch mechanism (item 1) in relation to the stainless steel access plate.
2. Support the latch mechanism, then remove the four securing screws and washers. Withdraw the latch mechanism and finishers. Note the position and quantity

of any shims situated between the latch and the access plate.
3. To fit the latch mechanism reverse the removal procedure.

Lock mechanism – To remove and dismantle
(see fig. S23-2)
1. Disconnect the battery.
2. Unscrew and remove the hinge cover trim and the luggage compartment lid inner trim panel.
3. Remove the latch mechanism and stainless steel access plate (see Latch mechanism – To remove and fit).
4. Disconnect the electrical leads from the lock and unlock solenoids at the terminal block (item 2). Note the position of the leads to ensure correct assembly.
5. Remove the four setscrews and washers (item 3). Carefully manoeuvre the lock mechanism clear of the private lock contactor plate (item 4) and withdraw it from the luggage compartment lid.
6. To remove the solenoids from the mounting bracket proceed as follows.
Disengage the solenoid operating rods from the plastic bushes in the pivot lever (item 5).
Remove the screws and spring washers (item 6) then withdraw the solenoid assemblies. The solenoid plungers can be separated from the operating rods by removing the roll pins.

Lock mechanism – To assemble and fit
(see fig. S23-2)
Reverse the procedure given for removal noting the following.
1. Loosely fasten the lock and unlock solenoids to the mounting bracket and align to give unrestricted movement of the pivot lever. Tighten the securing screws.
2. Manoeuvre the lock mechanism into position ensuring that the pin on the pivot lever engages with the slot in the contactor plate (item 4).
3. Apply a small amount of Keenomax C3 waterproof grease, or its equivalent, to the pivot points on the lock mechanism.
4. Check that the lock and unlock solenoids are operating correctly.

Handle and private lock push button assembly – To remove and dismantle (see fig. S23-2)
1. Disconnect the battery.
2. Remove the latch mechanism and stainless steel access plate (see Latch mechanism – To remove and fit).
3. Release the nut and washer securing the contactor plate (item 4) to the private lock unit. Manoeuvre the contactor plate clear of the lock mechanism pivot lever (item 5) and remove.
4. Remove the nuts and washers (item 7) securing each end of the handle.
5. Support the private lock guide bracket (item 8). Then, remove the nuts and washers (item 9) also the clamping plate (item 10). Whilst holding the guide bracket in position on the private lock unit, carefully withdraw the handle/private lock assembly.
6. If necessary, the private lock barrel (item 11) can be separated from the push button unit by removing the retaining screws (item 12).

Handle and private lock push button assembly – To assemble and fit (see fig. S23-2)
Reverse the procedure given for removal noting the following.
1. To prevent possible water ingress, it is advisable to renew the rubber sealing rings (item 13) prior to fitting the handle.
2. Fit the handle assembly, ensuring that the slot in the contactor plate (item 4) engages with the pin on the lock mechanism pivot lever.
3. Apply a small amount of Keenomax C3 waterproof grease, or its equivalent, to the private lock guide bracket spring.
4. Prior to closing the luggage compartment lid, depress the private lock push button checking that it operates smoothly in both the lock and unlock positions.

Windscreen

Contents

12/87
Printed in England

Windscreen

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

Safety procedures
The cleaners referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section S3.

Windscreen – To remove
1. To lower the power operated hood proceed as follows.

Apply the parking brake and ensure that the gear range selector lever is in the park position.

Switch on the ignition.

Fully release the two hood securing catches situated underneath the sun visors.

Depress the hood operating switch, situated on the centre console, holding it down until the hood has fully lowered.

2. Switch off the ignition and disconnect the battery.
3. Raise the bonnet.
4. Protect any exposed paintwork in the vicinity of the windscreen with clean felt or a similar material.
5. To remove the windscreen wiper arm assemblies

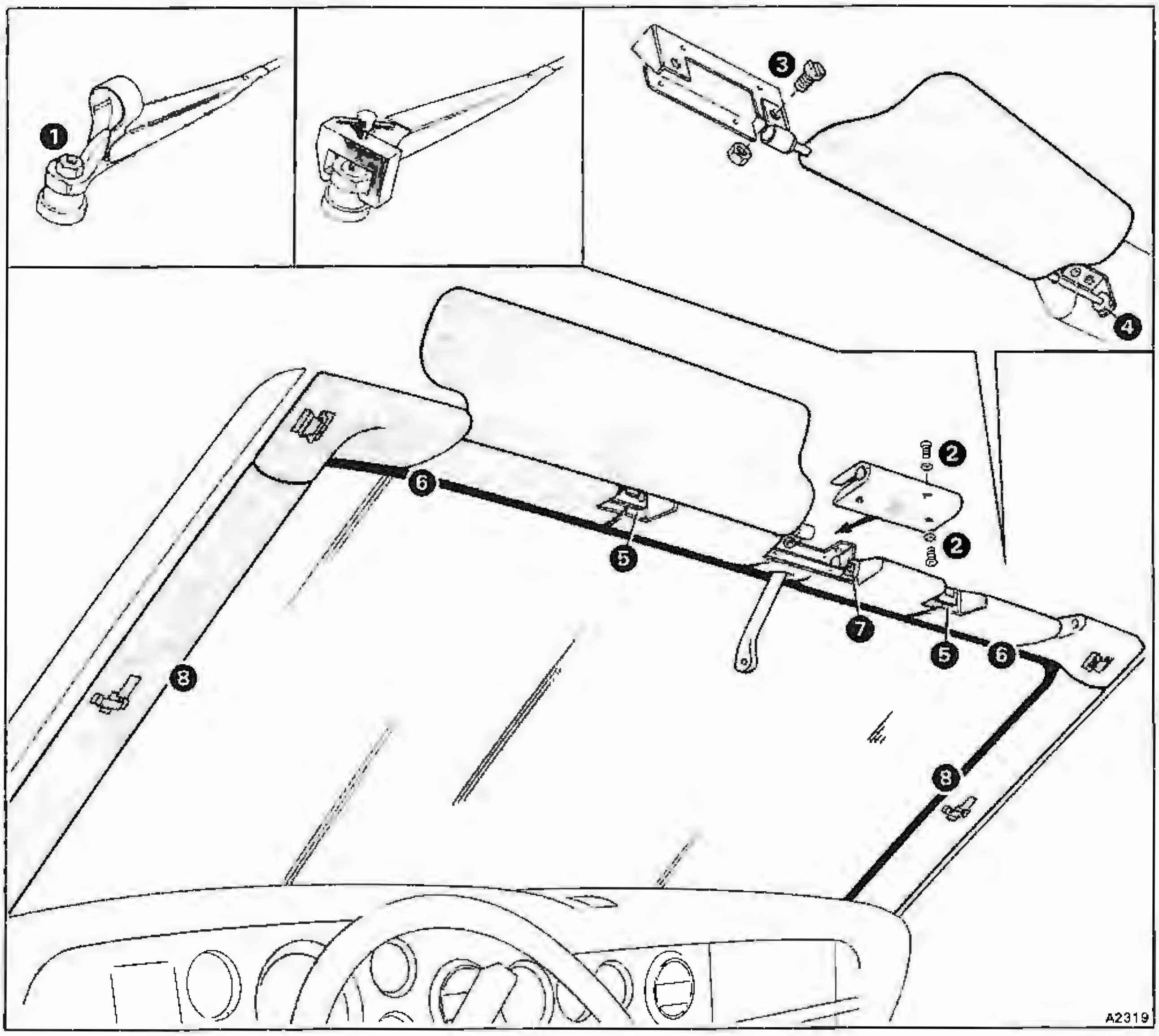


Fig. S24-1 Windscreen interior trim

proceed as follows referring to figure S24-1.

Unclip the plastic covers and remove the wiper arm securing nuts (item 1).

Using extractor tool RH 9623 carefully remove each wiper arm assembly.

6. To remove the sun visors proceed as follows referring to figure S24-1.

Remove the four screws and cup washers (item 2), and withdraw the sun visor centre trim panel. Note that on cars fitted with a cellular telephone a microphone is mounted behind the panel.

Release the inboard end of each sun visor spindle by removing the exposed nuts and bolts (item 3).

Remove each sun visor in turn by pulling the outboard end of the spindle clear of the nylon bush (item 4) mounted behind the side header trim.

7. Unscrew and remove the hood securing catches and polished finishers (item 5).

8. Unclip and remove the side header trim panels (item 6).

9. Unscrew and remove the interior rear view mirror.

10. Remove the self-tapping screws (item 7) and lower the centre header trim panel.

11. Lift the 'A' post trim panels (item 8) to disengage the rear retaining clips and remove. Remove the top roll and demister panel (see Section S29).

12. *On cars conforming to a North American specification,* remove the self-tapping screws, setscrews, and washers securing the windscreen finisher retention plates to the body (see fig. S24-2, item 1).

13. From outside the car, carefully unclip the trim pieces (item 2) covering the windscreen finisher joints.

14. Using a flat bladed tool, carefully ease each half of the windscreen finisher from the moulded seal.

15. From inside the car, ease the lip of the seal over the body aperture flange (see fig. S24-2, inset A). A small steel rule or a similar tool will assist during this operation. Start in the top corners and work towards the centre, simultaneously applying pressure to the glass. An assistant will be required to support the glass/seal assembly as it is pushed out of the aperture. Avoid sharp blows as this may damage the glass or paintwork. A steady pressure is all that is required.

16. Rest the removed glass/seal assembly, external surface uppermost, onto a suitably prepared work surface. Remove the seal from the glass.

Windscreen – To fit

1. Using a plastic or wooden scraper, remove all traces of sealing compound from the windscreen aperture flange. Thoroughly clean the flange area using a cloth moistened with Genklene. **Extreme care must be taken to prevent Genklene coming into contact with finished paintwork.**

2. If the original windscreen and/or seal is to be fitted ensure that all traces of sealing compound are removed using a cloth moistened with Bostik Cleaner 6001. The seal should be examined closely for any sign of damage. If in doubt always fit a new seal.

On cars conforming to a North American

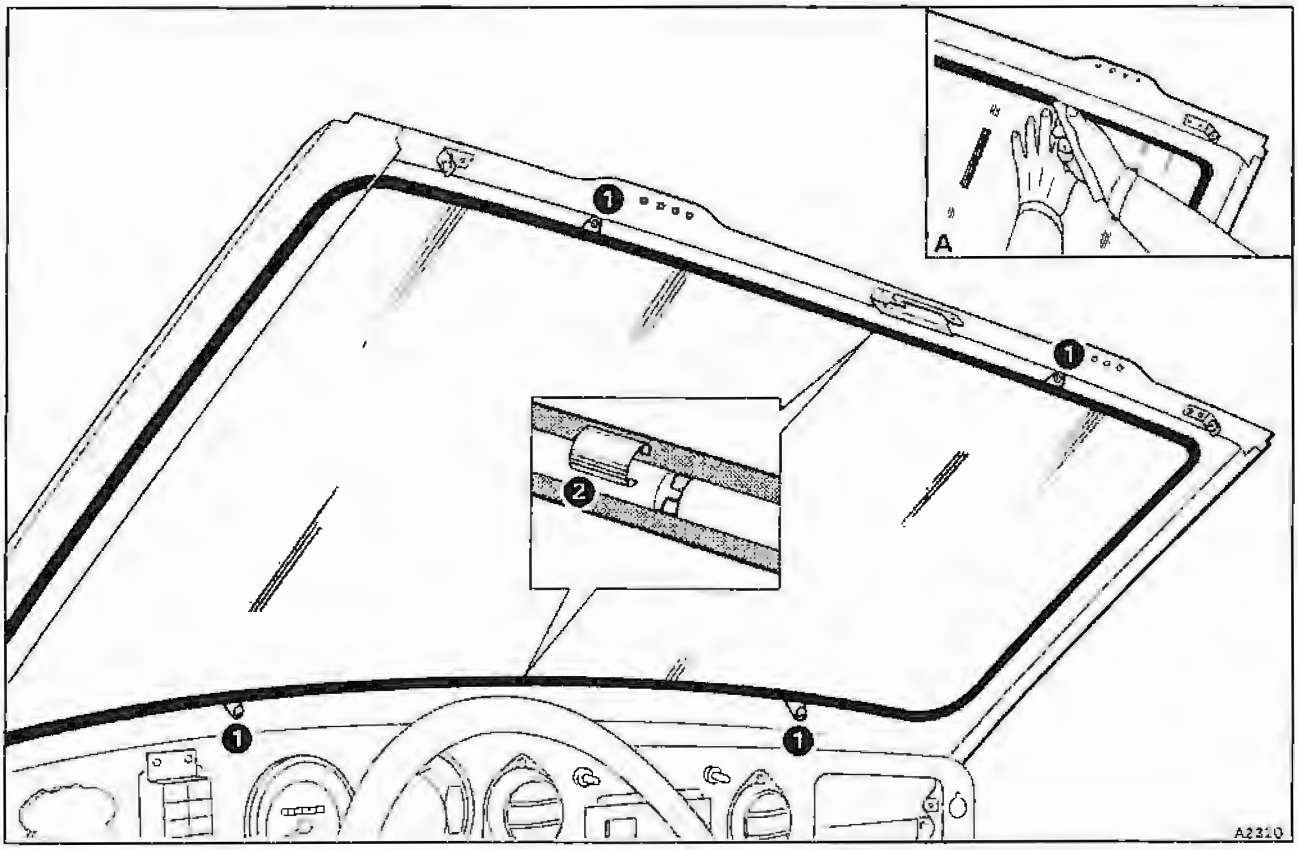


Fig. S24-2 Windscreen removal

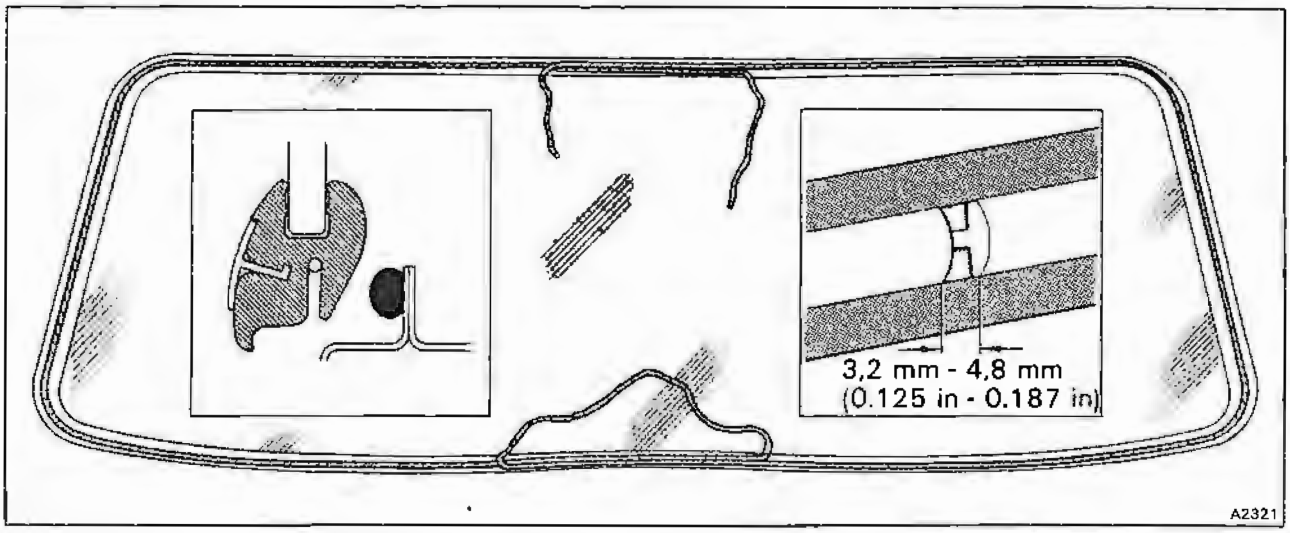


Fig. S24-3 Position of cord and sealing arrangement

specification, it will be necessary to make four cuts in the new seal to accept the windscreen finisher retention plates.

3. Apply a small amount of Palm Grease, or its equivalent, to the base of the windscreen finisher i.e. the section of the finisher that fits into the moulded seal. Press each half of the finisher into the seal. Check that a gap of between 3,2 mm and 4,8 mm (0.125 in and 0.187 in) exists between each half of the finisher (see fig. S24-3).

4. Clip the trim pieces into position, covering the windscreen finisher joints.

5. Turn the windscreen over so that the internal surface is uppermost. Thread a length of cord around the inside lip of the seal (see fig. S24-3). Leave a loop in the cord at the bottom of the windscreen and overlap the two ends of the cord at the top. Secure the loose ends of the cord to the glass with masking tape.

6. Using a sealant cartridge gun, run a continuous 6 mm (0.250 in) diameter bead of Arbomast Autograde Sealant or Seelastik around the windscreen aperture flange. *On cars conforming to a North American specification,* apply an additional bead of sealant over each retention plate slot in the top and bottom of the aperture flange.

7. With the help of an assistant, position the glass/seal/finisher assembly with the lower edge seated in the aperture. *On cars conforming to a North American specification,* align the windscreen finisher retention plates with their respective slots in the aperture flange. Then, using a rubber mallet, apply several sharp blows around the seal/finisher area starting in the centre of the upper edge. The windscreen should then be seated inside the aperture.

8. From inside the car, remove the masking tape securing the cord.

9. With an assistant applying steady pressure to the exterior of the glass, carefully pull the looped cord at the bottom of the windscreen so that the seal is drawn over the aperture flange. Pull the cord alternately to the right and left, along the bottom of the windscreen and half-way up each side. Similarly, pull each end of the cord along the top of the windscreen until the cord is completely removed. Ensure that the seal is fitted over the flange at all points around the aperture.

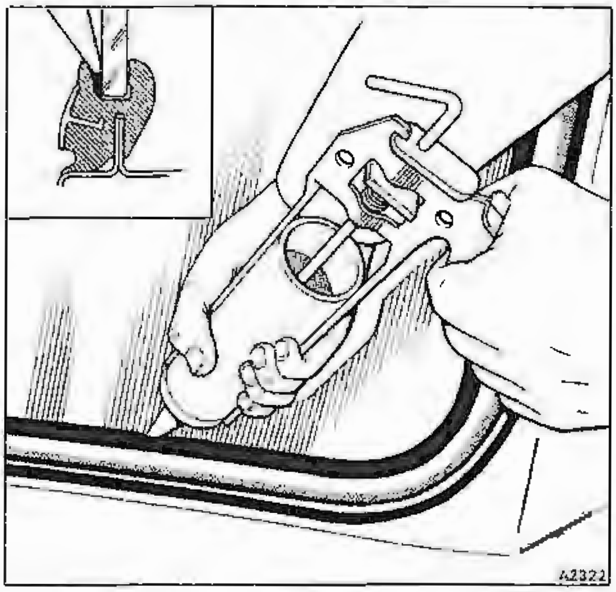


Fig. S24-4 Applying sealant between the seal and the glass

10. From outside the car, check that the seal/finisher is seated flush against the body. If necessary, apply further pressure with a rubber mallet.

11. *On cars conforming to a North American specification,* align the holes in the windscreen finisher retention plates with the holes in the body and secure using the self-tapping screws, setscrews, and washers.

12. From outside the car, carefully ease back the seal and insert the nozzle of a sealant cartridge gun between the seal and the glass. Then, apply a

continuous bead of Arbomast Autograde Sealant or Seelastik into the glass channel (see fig. S24-4).

13. Remove any excess sealant from the interior and exterior of the windscreen using a cloth moistened with Bostik Cleaner 6001.

14. Test the windscreen for leaks by applying water under pressure. If the sealing is satisfactory, fit the top roll and windscreen trim by reversing the removal procedure.

Bumpers

Contents

12/88
Printed in England

Bumpers

Introduction
Each bumper assembly is constructed around an aluminium beam. A polished stainless steel finisher covers the upper surface of the beam. Moulded rubber sections secured to the front face of the beam abut with side mouldings to complete the assembly.

Each bumper assembly is secured to the body by two mounting units. The outer end of each unit houses an adapter which is bolted, via a metalastik bush, to the aluminium beam. The inner ends of the units are bolted through the longerons at the front and rear of the car. *On cars conforming to a North American*

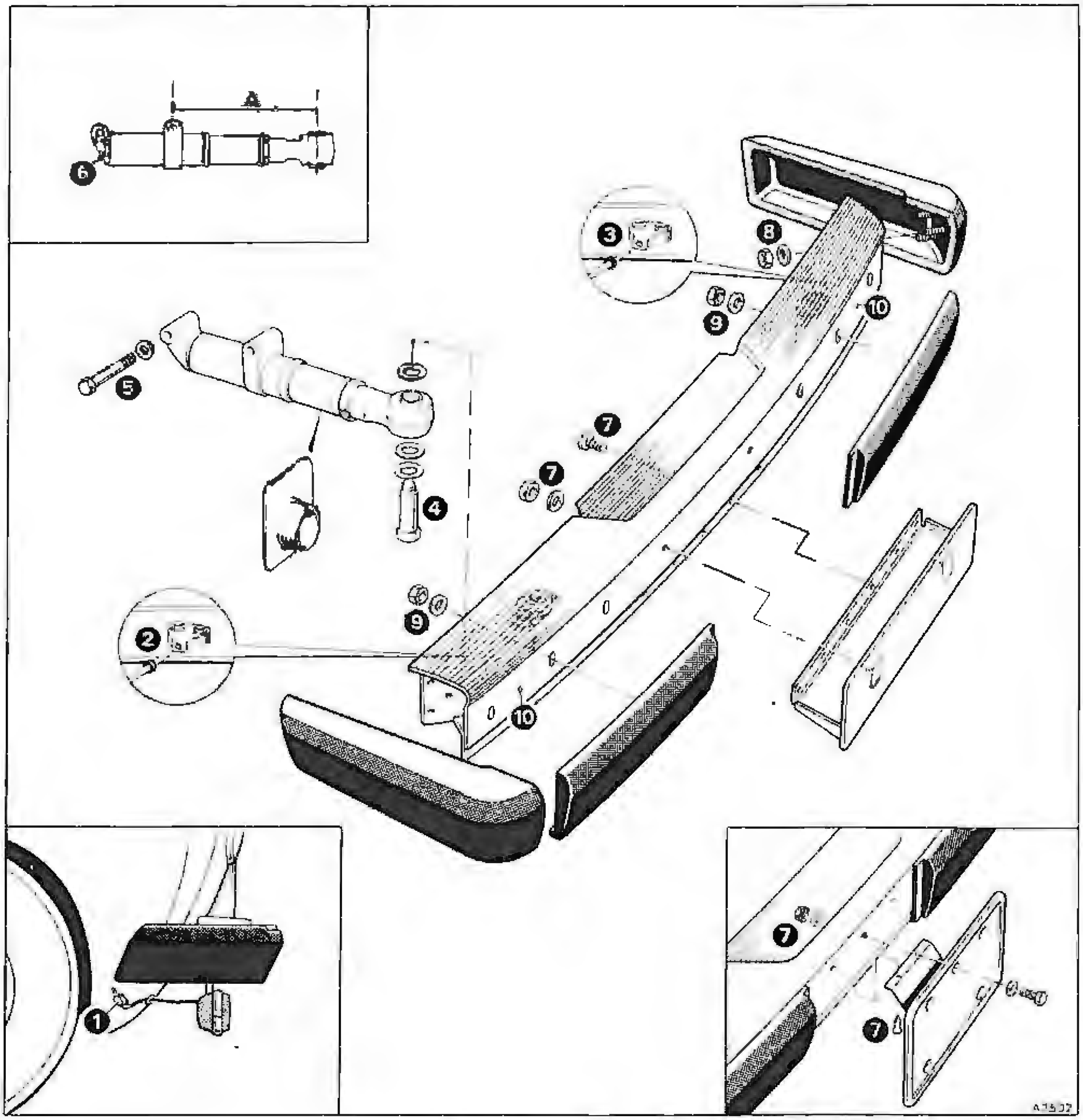


Fig. S25-1 Front bumper assembly
A 178 mm – 179 mm (7.0 in – 7.050 in)

specification; also cars conforming to a 1989 model year Middle East specification, the mounting units are energy absorbing.

Prior to commencing work, a suitably prepared area should be made available where work can be carried out on a removed bumper assembly. Care must be taken to avoid damaging the painted surface of the rubber mouldings and the polished surface of the bumper finisher during the removal and dismantling operations.

Front bumper assembly – To remove and fit
(see fig. S25-1)

1. If bumper mounted fog lamps are fitted proceed as follows.
Disconnect the battery.
Locate and release the electrical connectors (item 1). Then, manoeuvre the fog lamp looms clear of the lower body panel.
2. Withdraw the air conditioning ambient sensor (item 2) and the ice warning sensor, if fitted, (item 3) from their mounting blocks situated on the bumper beam. Secure the sensor leads safely until the bumper is refitted.
3. With the help of an assistant, support the bumper and remove the bolts and washers (item 4). Carefully withdraw the bumper assembly, noting the position and quantity of the spacing washers situated between the mounting unit adapters and the bumper beam.
4. If it is necessary to remove the bumper mounting units from the longerons proceed as follows.
Remove the front wing undersheets (see Section S26).
To gain access to the bolts securing the right-hand mounting unit it will be necessary to remove the oil cooler matrix (refer to Chapter E).
Remove the bolts and washers (item 5), noting that the horns mounting bracket is positioned underneath one of the bolts securing the left-hand mounting unit.
Withdraw the mounting units and aperture seals.
5. To set the length of the energy absorbing mounting units *on cars conforming to a North American specification; also cars conforming to a 1989 model year Middle East specification,* proceed as follows.
The length of the unit is measured from the centre of the adapter to the centre of the outer securing bolt hole (see dimension A).
To adjust the length of the unit, turn the piston rod adjusting nut (item 6) clockwise or anti-clockwise. When the length of the unit has been set, apply a small amount of Casco MLF 13 thread locking compound to the adjusting nut.
Apply silicone grease to the exposed threaded section of the piston rod, and protect the outer surface of the absorption unit with a light oil or grease.
6. To fit the bumper assembly reverse the removal procedure noting the following.
Pack the ambient sensor and ice warning sensor mounting blocks with silicone grease, then slide the sensors into position.

Front bumper assembly – To dismantle
(see fig. S25-1)

1. Remove the bumper assembly (see Front bumper assembly – To remove and fit).
2. Remove the screws, nuts, and washers (item 7) securing the number plate mounting bracket.
3. Release the nuts and washers (item 8) and remove the side mouldings.
4. Release the nuts and washers (item 9) and remove the front mouldings.
5. To remove the polished bumper finisher, it will be necessary to drill out the exposed pop rivets (item 10).

Front bumper assembly – To assemble
(see fig. S25-1)
Reverse the dismantling procedure noting the following.

1. Prior to fitting the bumper finisher, apply Keenomax C3 grease, or its equivalent, to the securing rivets (item 10). Also, apply Tectyl 175 corrosion prevention material, or its equivalent, to the areas of the aluminium beam that will come into contact with the stainless steel finisher. This will prevent corrosion caused by the contact of dissimilar metals.
2. Similarly, apply Keenomax C3 grease, or its equivalent, between the securing screws and washers (items 7, 8 and 9) and the aluminium beam.

Rear bumper assembly – To remove and fit
(see fig. S25-2)

1. With the help of an assistant, support the bumper and remove the bolts, nuts, and washers (item 1) securing the mounting units to the longerons. Note than an exhaust mounting bracket is positioned underneath the bolts securing the right-hand side mounting unit.
2. Withdraw the bumper slightly to disengage the side moulding retaining brackets, if fitted, (item 2). Then, remove the bumper assembly and aperture seals.
3. To fit the bumper assembly reverse the removal procedure noting the following.
If retaining brackets (item 2) are fitted, ensure that the side mouldings are correctly secured.
Ensure that the exhaust mounting bracket is replaced underneath the bolts securing the right-hand side mounting unit.

Rear bumper assembly – To dismantle
(see fig. S25-2)

1. Remove the bumper assembly (see Rear bumper assembly – To remove and fit).
2. Release the bolts and washers (item 3). Then, remove the mounting units noting the position and quantity of the spacing washers situated between the adapters and the beam.
3. Release the nuts and washers (item 4) and remove the side mouldings.
4. Release the nuts and washers (item 5) and remove the front moulding.
5. To remove the polished bumper finisher, it will be necessary to drill out the exposed pop rivets (item 6).

Rear bumper assembly – To assemble (see fig. S25-2)
Reverse the dismantling procedure noting the following.

1. Prior to fitting the bumper finisher, apply Keenomax C3 grease, or its equivalent, to the securing rivets (item 6). Also, apply Tectyl 175 corrosion prevention material, or its equivalent, to the areas of the aluminium beam that will come into contact with the stainless steel finisher. This will prevent corrosion caused by the contact of dissimilar metals.
2. Similarly, apply Keenomax C3 grease, or its equivalent, between the mild steel retaining washers (items 4 and 5) and the aluminium beam.
3. To set the length of the energy absorbing mounting units *on cars conforming to a North American specification; also cars conforming to a 1989 model year Middle East specification,* proceed as follows.

The length of the unit is measured from the centre of the adapter to the centre of the outer securing bolt hole (see dimension A).

To adjust the length of the unit, turn the piston rod adjusting nut (item 7) clockwise or anti-clockwise. When the length of the unit has been set, apply a small amount of Casco MLF 13 thread locking compound to the adjusting nut.

Apply silicone grease to the exposed threaded section of the piston rod, and protect the outer surface of the absorption unit with a light oil or grease.

Bumper height – To check (see fig. S25-3)

1. Position the car on a level surface.
2. Ensure that the tyres are inflated to the correct pressures (refer to Chapter R).
3. Prior to measuring the bumper height, prepare the car by adopting either of the following procedures.

a. Fill the fuel tank.

b. Place the gear range selector lever in the park position and switch on the ignition. If the low fuel warning panel illuminates, add 77 kg (170 lb) of ballast to the luggage compartment. The ballast should be positioned as close as possible to the fuel tank trim panel.

If the low fuel warning panel fails to illuminate,

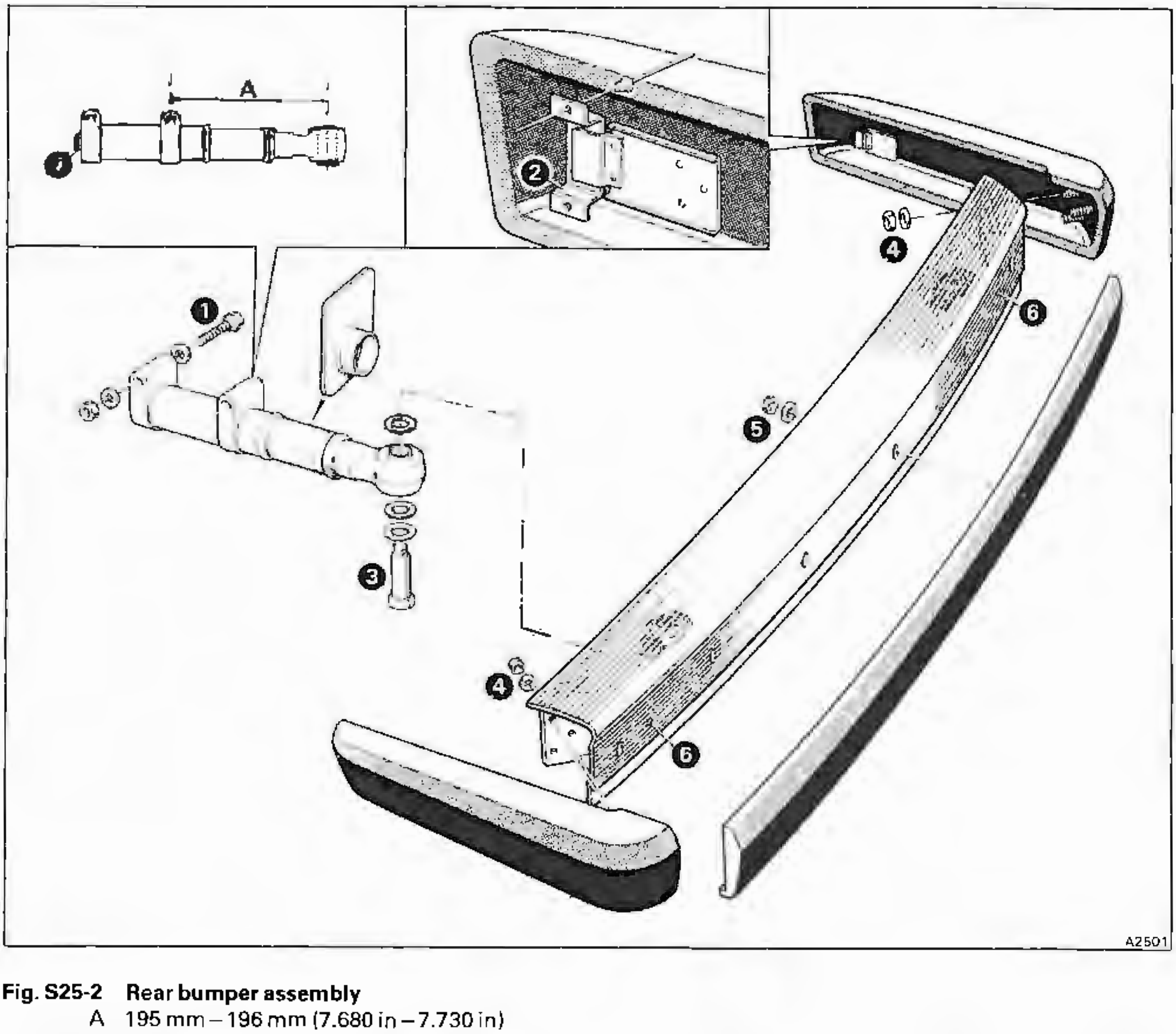


Fig. S25-2 Rear bumper assembly
A 195 mm – 196 mm (7.680 in – 7.730 in)

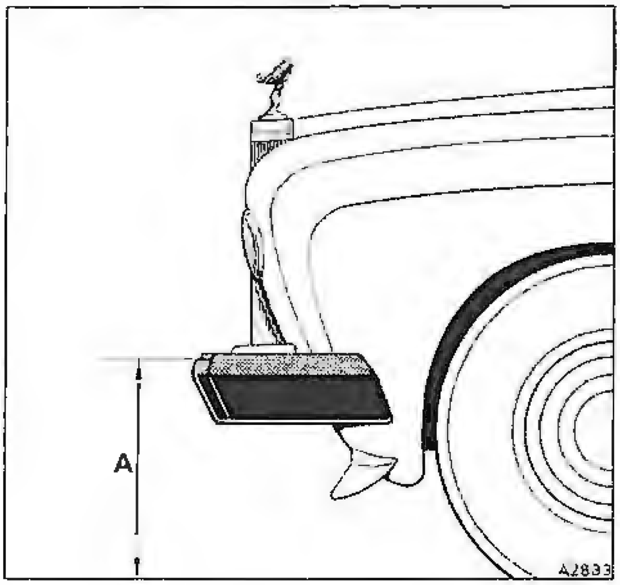


Fig. S25-3 Bumper height
A 474 mm (18.66 in) minimum

syphon fuel from the tank until the panel does illuminate. Then, add the specified ballast to the luggage compartment.

Switch off the ignition.

4. Measure the front and rear bumper height to the position indicated in figure S25-3.

5. If the bumper height is less than the specified minimum limit proceed as follows.

To eliminate suspension stiffness as a possible cause of incorrect bumper height, drive the car both forwards and in reverse two or three times then bring the car gently to rest. Check the bumper height.

If the bumper is within 1,5 mm (0.062 in) of the minimum height, the adapter to bumper beam mounting bolts should be removed and the spacing washer combination altered to produce an acceptable position.

If the bumper height remains below the minimum limit, check the standing height of the car and adjust if necessary (refer to Chapter H).

Exterior fittings

Contents

12/88
Printed in England

Exterior fittings

Introduction
Prior to commencing work, ensure that a suitably prepared area is available to store any items of trim, etc., that are removed.

Safety procedures
The cleaner and adhesives referred to in this section are classified as highly flammable. For guidance on their use reference **must be** made to Section **S3**.

Radiator shell – To remove and fit (see fig. S26-1)
1. Raise the bonnet.
2. Remove the two setscrews and washers (item 1) securing the radiator shell to the lower mounting brackets.
3. Support the radiator shell, then remove the setscrews and washers (item 2).
4. Remove the radiator shell assembly taking care not to damage the paintwork.
5. To fit the radiator shell assembly reverse the removal procedure noting the following.
Prior to fully tightening the shell securing setscrews, carefully close the bonnet and check the shell to bonnet alignment. Adjust if necessary.

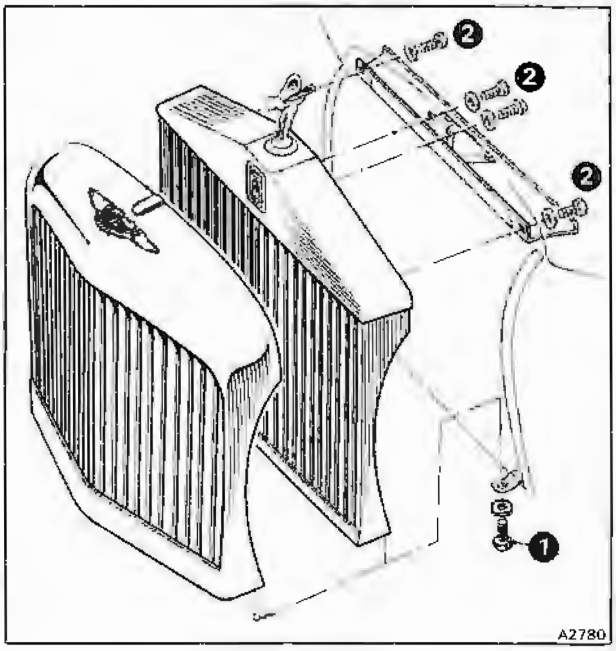


Fig. S26-1 Radiator shell mounting arrangement

Rolls-Royce radiator shell – To dismantle and assemble (see fig. S26-2)
1. Remove the radiator shell assembly.
2. Protect the polished surface of the radiator shell with masking tape. Then, place it face downwards onto a suitably covered bench.
3. Slacken the Allen headed setscrew (item 1) until the mascot assembly can be withdrawn from the shell.

Warning If a chrome finisher button (item 2) is fitted, care must be taken when unscrewing the setscrew (item 1). A spring is situated underneath the button and could suddenly eject as the setscrew is released.

4. Remove the nuts, bolts, and washers (item 3) securing the vane assembly to the radiator shell. Then, carefully withdraw the vane assembly.
5. To assemble the radiator shell reverse the dismantling procedure noting the following.
Prior to securing the vane assembly, ensure that it is positioned centrally within the radiator shell.

Bentley radiator shell – To dismantle and assemble (see fig. S26-3)
1. Remove the radiator shell assembly.
2. Protect the polished surface of the radiator shell with masking tape. Then, place it face downwards onto a suitably covered bench.
3. Remove the setscrews and washers (item 1) securing each vane assembly to the radiator shell. Then, carefully withdraw both vane assemblies.
4. Release the nuts and spring washers (item 2). Then, remove the Bentley motif and nose trim.
5. To assemble the radiator shell reverse operations 1 to 4 inclusive.

Headlamp surround – To remove and fit (see fig. S26-4)
1. To remove a headlamp surround proceed as follows.
Remove the securing screw (item 1) from the headlamp surround.
Lift the surround and unhook it from the two upper retainers.
2. To fit the surround reverse the removal procedure.

Air dam – To remove and fit (see fig. S26-4)
1. To remove the air dam/seal assembly, release the setscrews and washers (item 2) securing it to the lower body panel.
2. If it is necessary to renew the air dam seal proceed as follows.
Using a suitable scraper, remove and discard the glued seal taking care not to damage the paintwork.
Thoroughly clean the bonding surfaces of the new seal and the air dam using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
Apply Apollo Adhesive AX 2344 to the bonding surfaces of the seal and air dam. Allow five minutes for the adhesive to 'flash' dry, then press the seal into position using maximum hand pressure.
Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

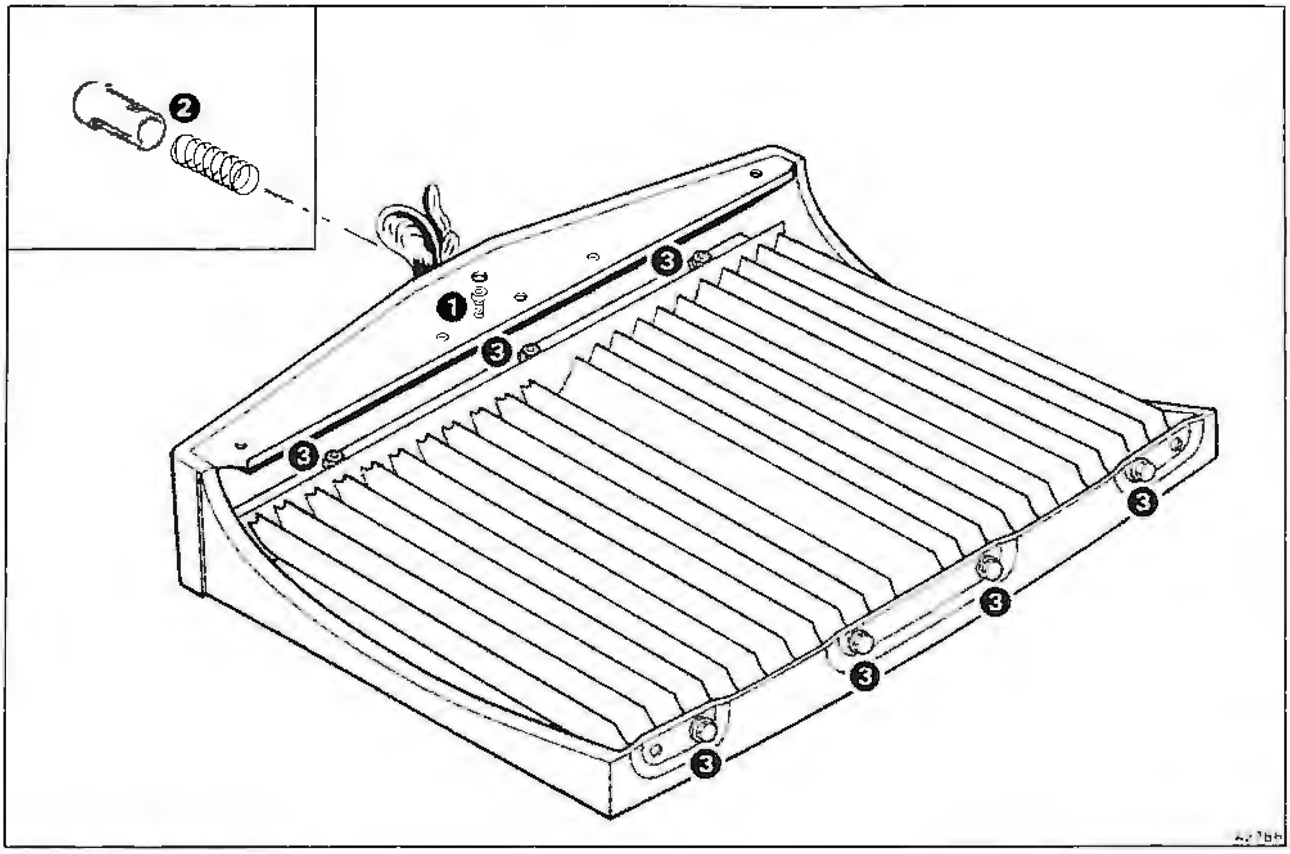


Fig. S26-2 Rolls-Royce radiator shell

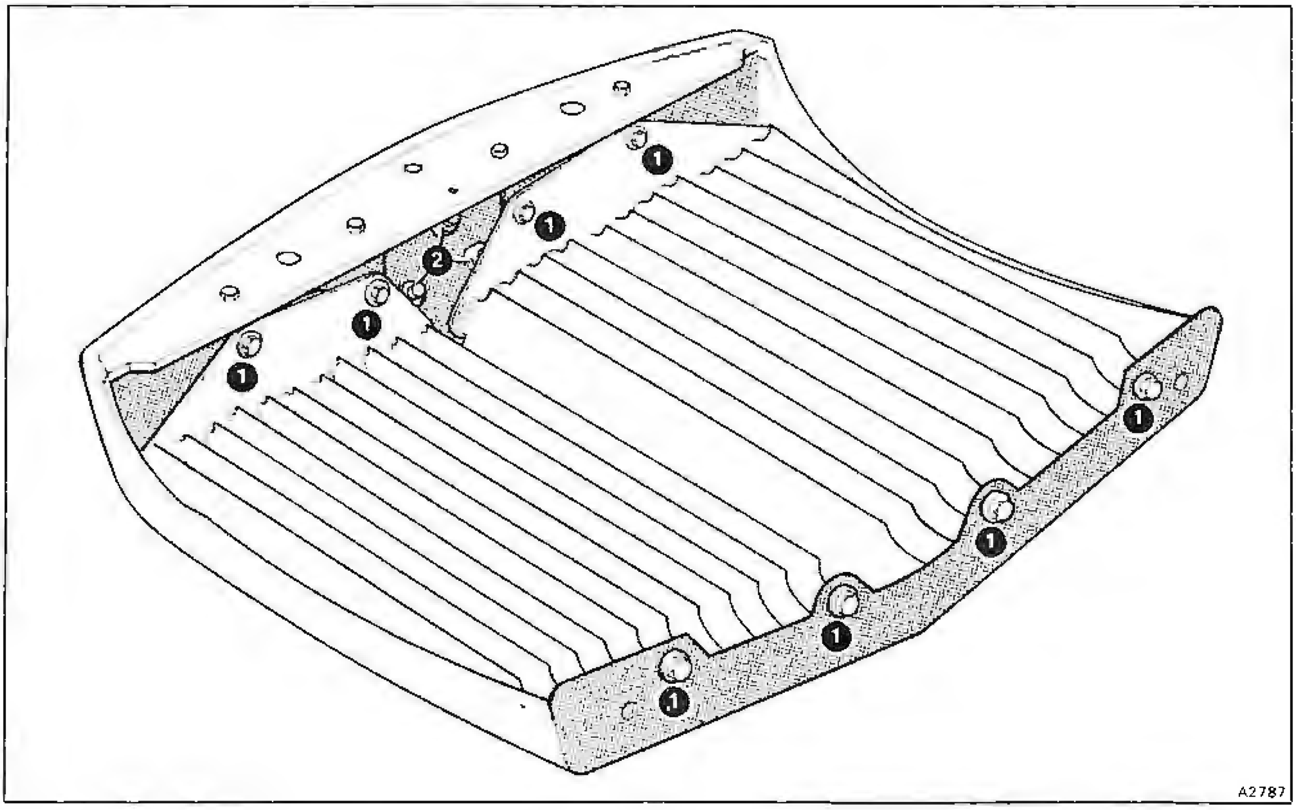


Fig. S26-3 Bentley radiator shell

3. To fit the airdam/seal assembly reverse the removal procedure.

Front bumper fairings – To remove and fit
(see fig. S26-4)

1. To gain access to the fairing securing setscrews (item 3) it may be necessary to remove the bumper assembly (see Section S25).
2. Release the setscrews and washers, then remove the fairing/seal assembly.
3. If it is necessary to renew a fairing seal proceed as follows.

Using a suitable scraper, remove and discard the glued seal taking care not to damage the paintwork.

Thoroughly clean the bonding surfaces of the new seal and the fairing using a cloth moistened with Bostik Cleaner 6001. Allow to dry.

Apply Apollo Adhesive AX 2344 to the bonding surfaces of the seal and fairing. Allow five minutes for the adhesive to 'flash' dry, then press the seal into position using maximum hand pressure.

Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

4. To fit the fairing/seal assembly reverse the removal procedure.

Front wing undersheets – To remove and fit
(see fig. S26-4)

1. Raise the front of the car and remove the road wheels (see Chapter R).
2. Remove the self-tapping screws (item 4) securing the rear section of the undersheet to the valance panel. Carefully break the seal between the undersheet and the valance panel, then remove the rear section of the undersheet. Repeat this operation to remove the front section of the undersheet.
3. To fit the undersheets reverse the removal procedure noting the following.

To prevent possible water ingress, ensure that the sealing strips (item 5) are in good condition and that they form a waterproof seal when the undersheets are fitted. Renew if necessary.

Wheel-arch finishers – To remove and fit
(see fig. S26-4)

1. Each wheel-arch finisher is secured to the body

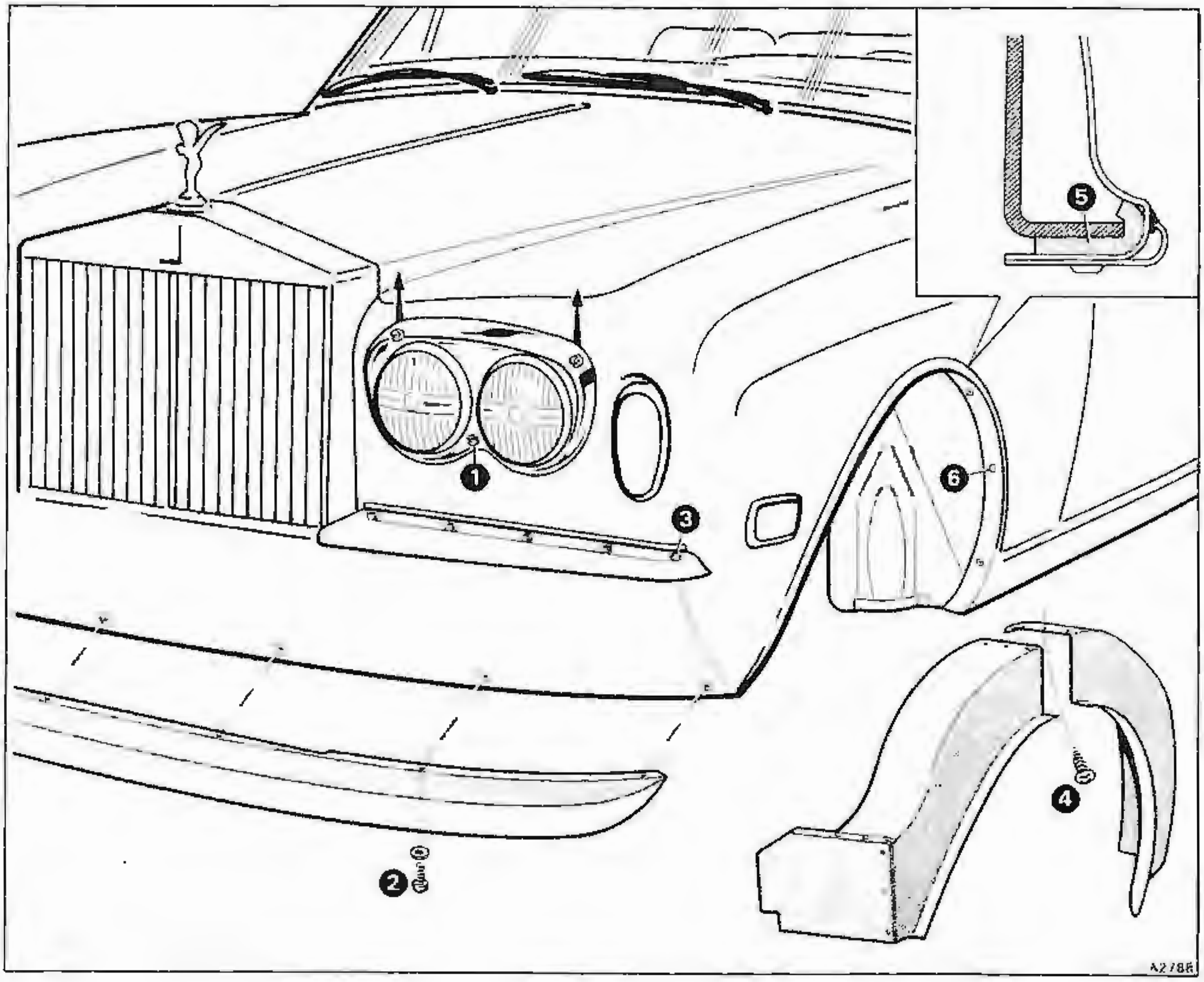


Fig. S26-4 Exterior fittings – Front

using nine 0.125 in (3 mm) diameter stainless steel pop rivets (item 6). To remove a finisher, simply drill out the rivets taking care not to damage the polished surface of the finisher.

2. To fit a finisher reverse the removal procedure noting the following.

Check that the sealing rubber is correctly fitted between the finisher and the body.

Ensure that stainless steel pop rivets are used to secure the finisher.

Bonnet moulding – To remove and fit (see fig. S26-5)

1. Raise the bonnet.
2. Remove the nut and plain washer (item 1) securing the front of the moulding.
3. To gain access to the rear securing nut, it will be necessary to unclip and remove the rear bonnet pad. Remove the exposed nut and plain washer (item 2).
4. Lift the front of the moulding away from the bonnet panel and progressively disengage the plastic retaining clips (item 3). Remove the moulding.
5. To fit the moulding reverse the removal procedure noting the following.

To ensure the correct retention of the moulding check that the clip retainers (item 4) situated in the bonnet panel are not damaged or excessively worn. Renew if necessary.

Prior to fitting the moulding, apply a small amount of Bostik Seelastik, or its equivalent, around the base of the two moulding securing studs.

Air intake grille panel – To remove and fit
(see fig. S26-5)

1. Raise the bonnet.
2. Remove the five setscrews and washers (item 5) securing the front of the grille panel.
3. Pull the grille panel forward slightly to disengage the retaining clips (item 6) situated at the rear of the grille aperture.
4. Withdraw the panel to gain access to the windscreen washer hose. Disconnect the hose from the washer jet and remove the grille panel.
5. To fit the grille panel reverse the removal procedure noting the following.

Inspect the foam air intake filter (item 7). If it is found to be damaged or excessively dirty it must be renewed.

Ensure that the grille panel is secured by the rear retaining clips (item 6).

Sill mouldings – To remove and fit (see fig. S26-6)

1. Remove the nut and plain washer (item 1) securing the rear of the sill moulding.
2. To gain access to the front securing nut (item 2) it will be necessary to remove the rear section of the front wing undersheet (see Front wing undersheets – To remove and fit). Remove the exposed nut and plain washer.
3. Lift the front of the moulding/seal assembly away from the wing panel and progressively disengage the plastic retaining clips (item 3). Remove the moulding.

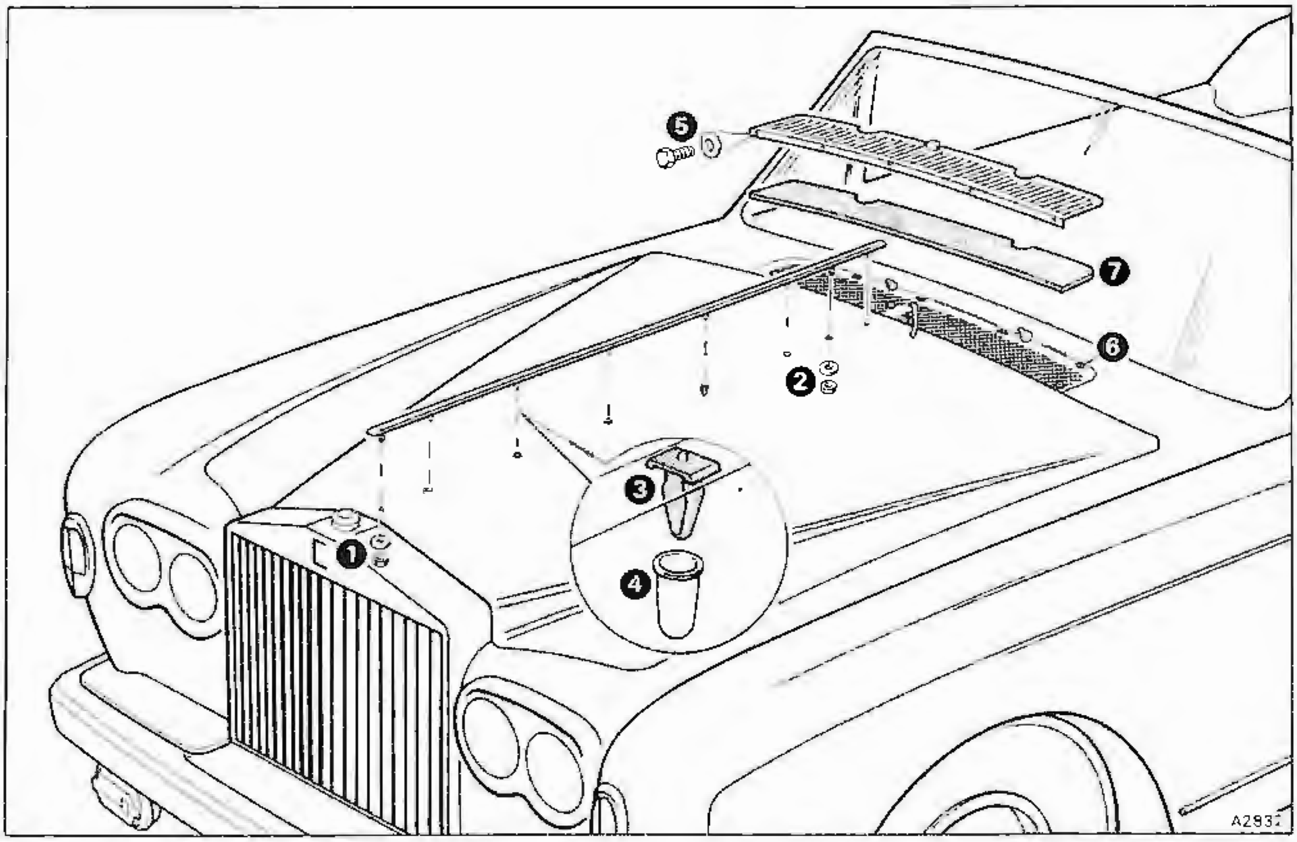


Fig. S26-5 Bonnet moulding and air intake grille

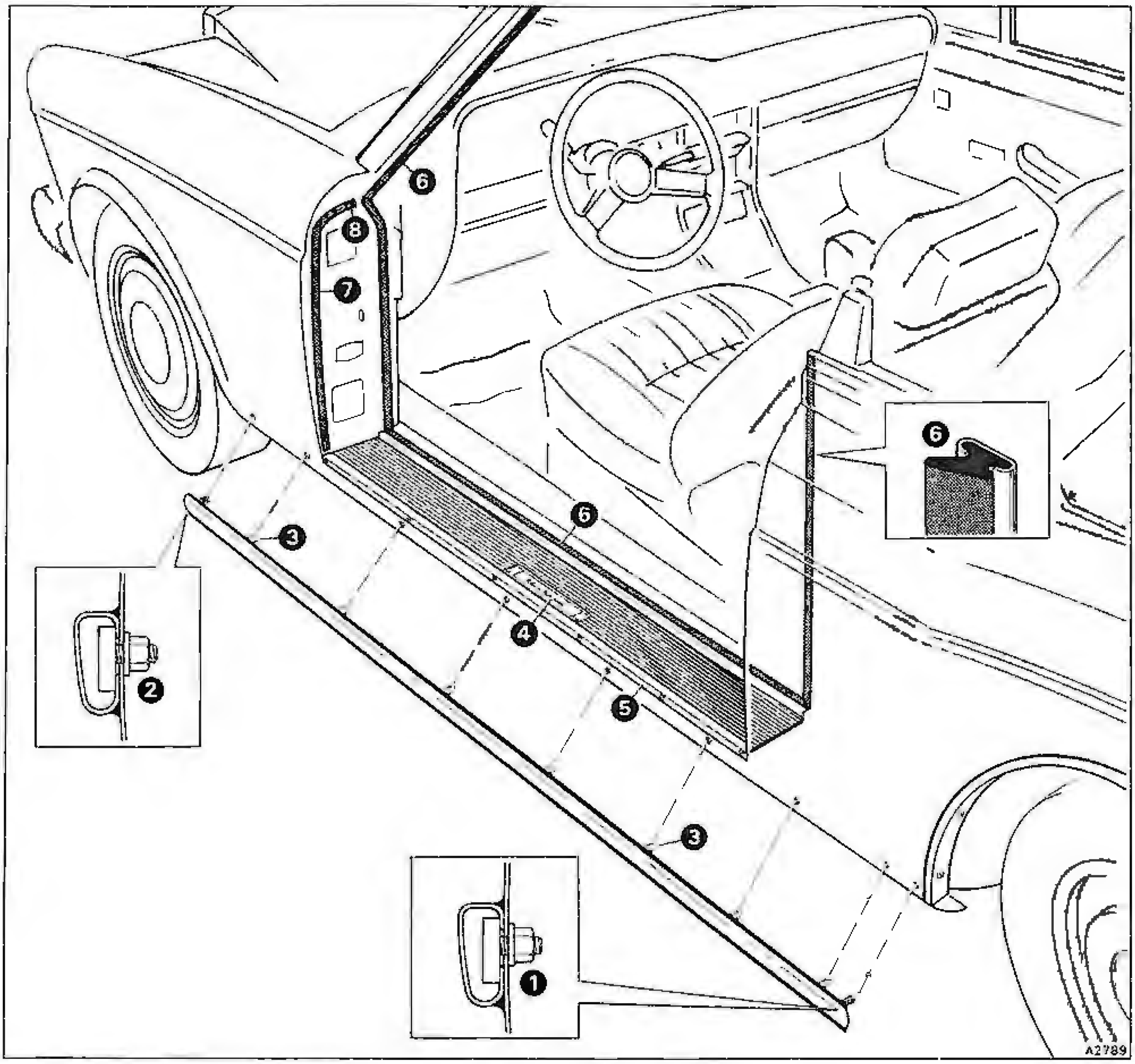


Fig. S26-6 Sill fittings and door to body seals

4. If it is necessary to renew the sill moulding seal proceed as follows.

Using a suitable scraper, remove and discard the glued seal taking care not to damage the paintwork.

Thoroughly clean the bonding surfaces of the new seal and the moulding using a cloth moistened with Bostik Cleaner 6001. Allow to dry.

Apply Apollo Adhesive AX 2344 to the bonding surfaces of the seal and moulding. Allow five minutes for the adhesive to 'flash' dry, then press the seal into position using maximum hand pressure.

Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

5. To fit the sill moulding/seal assembly reverse the removal procedure noting the following.

To ensure the correct retention of the moulding, new retaining clips (item 3) should be fitted on assembly.

Prior to fitting the moulding, apply a small amount of Bostik Seelastik, or its equivalent, around the base of the two moulding securing studs.

Sill treadrubbers – To renew (see fig. S26-6)

1. To facilitate assembly, mark the position of the coachbuilder's nameplate (item 4) in relation to the sill panel. Then, unscrew and remove the nameplate.
2. Unscrew and remove the treadrubber retainer (item 5).
3. Using a suitable scraper, remove and discard the glued treadrubber taking care not to damage the paintwork.
4. Thoroughly clean the bonding surfaces of the new treadrubber and sill panel using a cloth moistened with Bostik Cleaner 6001. Allow to dry.
5. Apply Apollo Adhesive AX 2344 to the bonding surfaces of the treadrubber and sill. Allow five minutes

for the adhesive to 'flash' dry, then press the treadrubber into position using maximum hand pressure.
6. Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

Door to body seals – To renew (see fig. S26-6)
1. The door aperture seal (item 6) comprises of three sections glued together in a mitred joint at each lower corner. To renew a section of the seal proceed as follows.

Carefully pull a portion of the seal out of its retaining channel and progressively remove. Note that to remove the rear section of the seal it may be necessary to release the 'BC' post trim panel (see Section S21).

Using a sharp knife, cut through the glued mitred joint, then remove and discard the section of seal.

When fitting a new section of seal, apply Loctite 495 adhesive to the mitred joint.
2. To renew the 'A' post seal (item 7) proceed as follows.

Remove the self-tapping screw (item 8).

Using a suitable scraper, remove and discard the glued seal taking care not to damage the paintwork.

Thoroughly clean the bonding surfaces of the new seal and the body panel flange using a cloth moistened with Bostik Cleaner 6001. Allow to dry.

Apply Apollo Adhesive AX 2344 to the bonding surfaces of the seal and body panel flange. Allow five minutes for the adhesive to 'flash' dry, then press the seal into position using maximum hand pressure.

Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

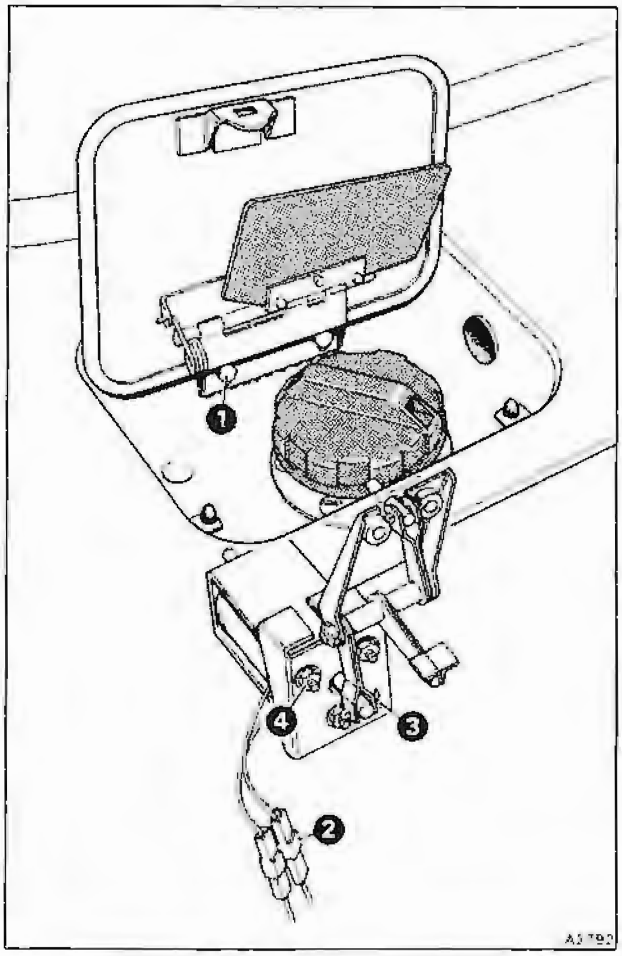


Fig. S26-7 Fuel filler door and release mechanism

Fuel filler door and hinge – To remove and fit (see fig. S26-7)
1. Open the fuel filler door. This can be achieved manually from the lever within the luggage compartment or electrically by depressing the button situated on the instrument facia.
2. Using a pencil, mark the position of the fuel filler door hinge in relation to the body.
3. Release the setscrews and washers (item 1), then remove the fuel filler door and hinge assembly.
4. To fit the assembly, reverse the removal procedure noting the following.

Prior to tightening the setscrews securing the hinge, align the marks made during removal.

Ensure that the fuel filler door blends perfectly with the body and that an equal clearance exists around the door.

Fuel filler door release solenoid – To remove and fit (see fig. S26-7)
1. To gain access to the release solenoid it will be necessary to remove the front trim panel from within the luggage compartment (see Section S23).
2. Disconnect the battery.
3. Release the Lucar connectors (item 2).
4. Remove the split pin (item 3) and washers securing the trigger mechanism to the solenoid plunger.
5. Support the solenoid assembly, then remove the three retaining nuts and washers (item 4). Withdraw the solenoid assembly.
6. To fit the assembly reverse the removal procedure.

Luggage compartment lid badges – To remove and fit (see fig. S26-8)
1. To gain access to the badge securing nuts it will be necessary to unscrew and remove the luggage compartment lid hinge covers and inner trim panel (item 1).
2. Release the securing nuts and plain washers (item 2) from the appropriate badge. Then, carefully withdraw the badge taking care not to damage the paintwork.
3. Prior to fitting a badge, apply a small amount of Bostik Seelastik, or its equivalent, around the base of the badge securing studs.

Luggage compartment seal – To remove and fit (see fig. S26-8)
The luggage compartment seal is a push-on fit over the body panel flanges and can easily be removed and refitted. To release the rear section of the seal first

unscrew and remove the stainless steel finisher (item 3).

When removing the seal care must be taken not to damage the paintwork.

Rear bumper fairing – To remove and fit (see fig. S26-8)

1. On cars fitted with the number plate lamps mounted on the bumper fairing proceed as follows.

Unscrew and remove the lamp cover (item 4). Carefully prise the chromed shield from each lamp holder and remove the glass lens.

Manoeuvre the rubber lamp holders down through the holes in the bumper fairing.

2. Release the fairing securing setscrews and washers (item 5). Then, remove the fairing/seal assembly.

3. If it is necessary to renew a fairing seal proceed as follows.

Using a suitable scraper, remove and discard the glued seal taking care not to damage the paintwork.

Thoroughly clean the bonding surfaces of the new seal and the fairing using a cloth moistened with Bostik Cleaner 6001. Allow to dry.

Apply Apollo Adhesive AX 2344 to the bonding surfaces of the seal and fairing. Allow five minutes for the adhesive to 'flash' dry, then press the seal into position using maximum hand pressure.

Remove any excess adhesive using a cloth moistened with Bostik Cleaner 6001.

4. To fit the fairing/seal assembly reverse the removal procedure.

Spare wheel carrier – To remove (see fig. S26-9)

1. Remove the rubber access plug situated underneath the luggage compartment floor carpet (item 1).

2. To release the spare wheel retainer (if fitted) proceed as follows.

On cars fitted with pressed steel wheels, turn the retainer locking arm to its horizontal position (see inset A). Then, press the retainer arm to its fully down position.

On cars fitted with aluminium alloy wheels, pull the retainer locking arm fully rearward (see inset B).

3. Using the wheel nut spanner and bar provided in the tool kit, turn the carrier lowering bolt (item 2) anti-clockwise until further rotation is prevented.

4. If a spare wheel carrier lifting tube (item 3) is fitted proceed as follows.

Remove the protective cover from the lifting tube and insert the wheel nut spanner bar.

Lift the rear of the carrier sufficiently to either clear the support hook (item 4) or to allow the lowering tube to be disengaged from the slotted carrier support bracket (item 5).

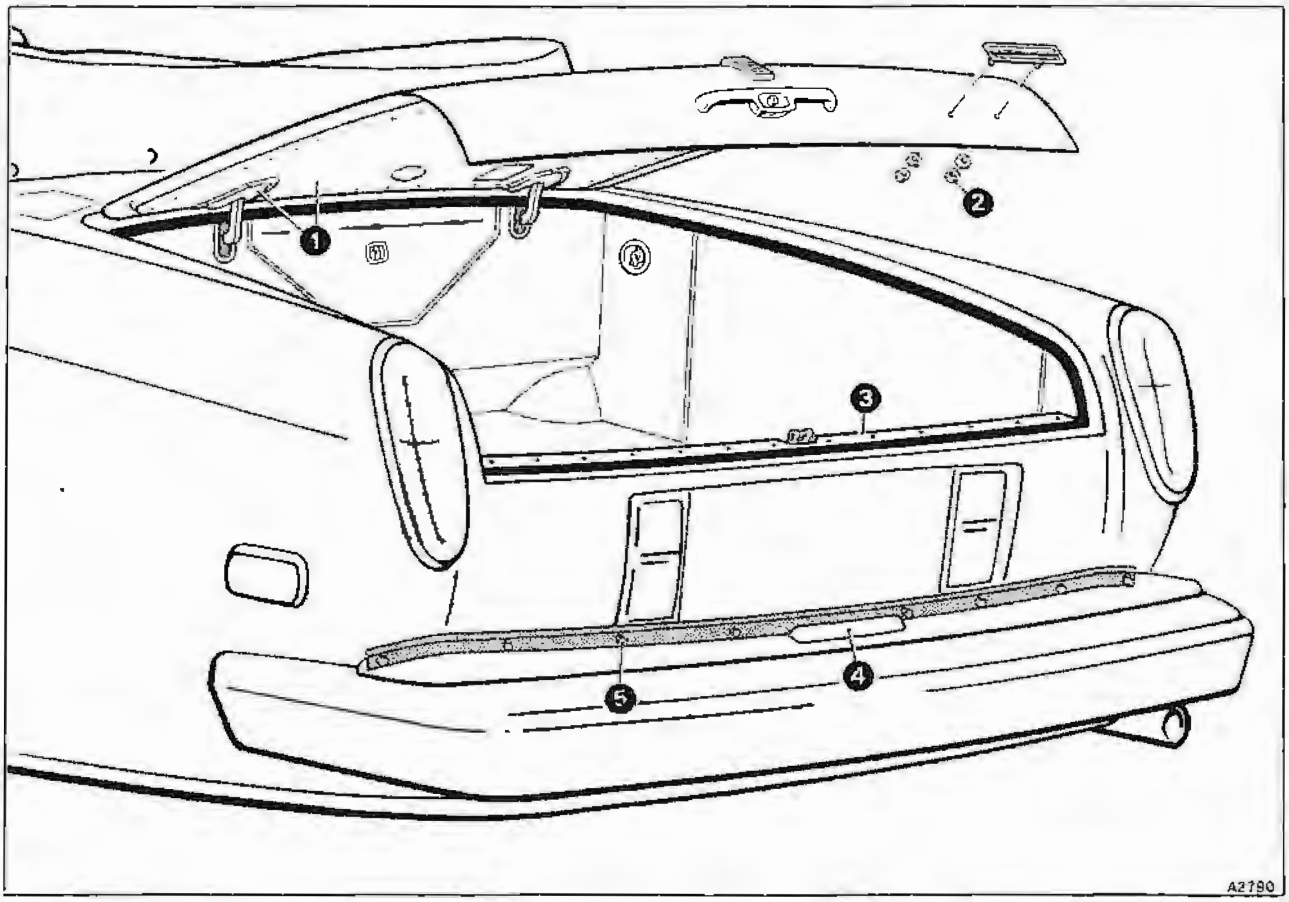


Fig. S26-8 Exterior fittings – Rear

Pivot the lowering tube assembly clear, then lower the rear of the carrier to the ground. Remove the bar and slide the spare wheel from the carrier.

5. On carriers not fitted with a lifting tube proceed as follows referring to inset C.

Slide the spare wheel from the carrier.

To facilitate assembly, scribe the position of the large washer (item 6) onto the lowering tube assembly.

Support the rear of the carrier. Then, remove the nut and washer (item 7). Pivot the lowering tube assembly clear and lower the rear of the carrier to the ground.

6. Remove the nuts and washers (item 8) from the carrier pivot bolts.

7. Support the carrier, then withdraw the pivot bolts and washers. Lower the carrier to the ground.

Spare wheel carrier – To fit (see fig. S26-9)
Reverse the procedure given for removal noting the following.

1. Lubricate the lowering bolt and the two carrier pivot bolts with Rocol MTS 1000 grease, or its equivalent.

2. Check the condition of the rubber bushes (item 9). Renew if necessary.

3. Prior to fitting the carrier, ensure that the distance tubes (item 10) are in position.

4. When the carrier is fully raised, check that the spare wheel is securely clamped against the underside of the luggage compartment floor. If the wheel is not securely held, adjust the position of the carrier as follows.

Carriers fitted with a lifting tube.

Lower the carrier slightly by loosening the

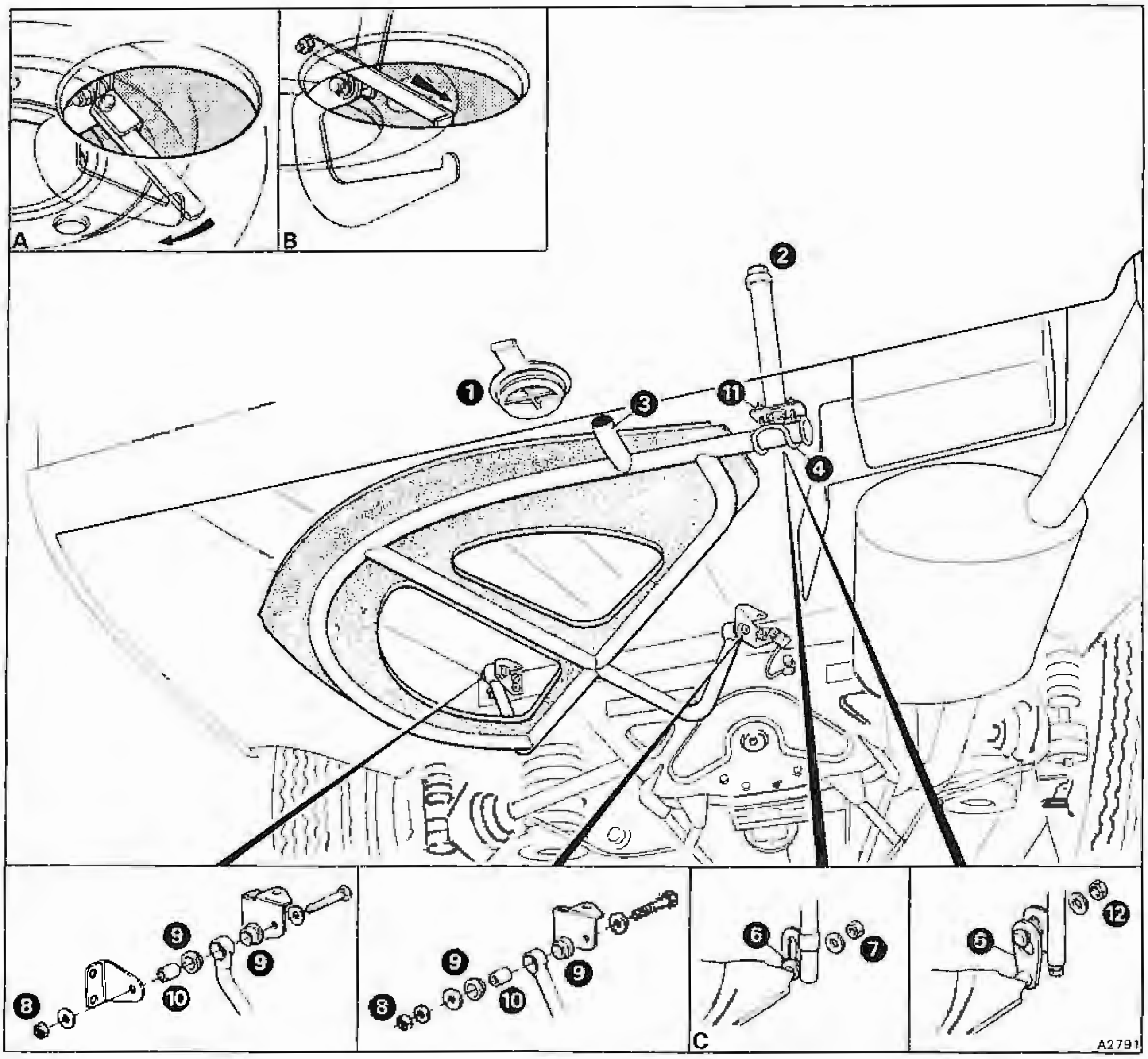


Fig. S26-9 Spare wheel carrier

operating bolt two or three complete turns.

On carriers fitted with a support hook (item 4) proceed as follows.

Support the carrier. Then, raise the support hook by turning each adjusting nut (item 11) clockwise one or two complete turns.

Raise the carrier and check that the spare wheel is securely held. If necessary repeat the adjustment operation.

On carriers fitted with a slotted support bracket (item 5) proceed as follows.

Support the carrier. Then, loosen the support bolt securing nut (item 12). Move the carrier support bolt to a higher position within the adjustment slot. Then, tighten the securing nut.

Raise the carrier and check that the spare wheel is securely held. If necessary repeat the adjustment operation.

Carriers not fitted with a lifting tube.

Lower the carrier slightly by loosening the operating bolt two or three complete turns.

Support the carrier. Then, loosen the securing nut (item 7). Move the carrier securing bolt to a higher position within the adjustment slot. Then, tighten the securing nut.

Raise the carrier and check that the spare wheel is securely held. If necessary repeat the adjustment operation.

5. Check that the spare wheel is positioned with the tyre valve aligned with the access hole in the luggage compartment floor.

6. Ensure that the spare wheel retainer (if fitted) passes through the centre of the wheel and is locked into position.

Seat belts

Contents

2/89
Printed in England

Seat belts

Introduction
Lap and diagonal retractable seat belts are provided for the driver and front seat passenger. Lap belts are provided in the rear compartment for two rear seat passengers. The lap belts are retractable *on cars conforming to a North American specification*, and static for all other markets.

If a seat belt requires cleaning, sponge the webbing with warm soapy water. Do not use bleaches or dyes as they may impair the efficiency and safety of the seat belts.

Warning In the event of a vehicle being involved in an accident of sufficient severity to cause damage to the front longerons, all the seat belts worn by occupants at the time of the impact **must be** replaced.

If an impact results in local damage to any of the seat belt anchorage points, then that particular seat belt **must be** replaced irrespective of whether the belt was worn or not at the time of the impact.

In the event of a rear impact, the severity of the damage must be judged and if any doubt the occupied seat belts **must be** replaced.

Front seat belt – To remove (see fig. S28-1)

1. Using the seat adjustment controls, move the front seat forward to the full extent of its travel.
2. *On cars other than those conforming to a North American specification*, remove the bolts and washers (item 1) securing the slider bar. Release the belt webbing from the slider and allow the seat belt to carefully retract.
3. *On cars conforming to a North American specification*, carefully prise the plastic cover from the lower anchorage bolt (item 2). Remove the bolt and washer and allow the seat belt to carefully retract.
4. To remove the 'BC' post trim panel proceed as follows.

   Remove the two screws and cup washers (item 3). Then, carefully lift off the waist rail finisher and trim roll assembly.

   Remove the two screws and cup washers (item 4) securing the top of the 'BC' post trim panel.

   Turn back the floor carpet, then remove the exposed screw and washer (item 5).

   Carefully remove the trim panel, noting that the rear of the panel is secured by Velcro fasteners (item 6).
5. Unscrew and remove the seat belt guide (item 7).
6. Carefully prise the plastic cover from the upper anchorage bolt (item 8). Remove the bolt and washer and release the belt.
7. Peel back the floor soundproofing material to expose the reel mechanism cover plate (item 9). Then, remove the setscrews securing the cover plate.
8. Remove the plastic edge protector (item 10) and guide the webbing through the slot provided. Remove the cover plate.
9. Remove the two bolts and strengthening plate (item 11) situated underneath the sill panel. Then, withdraw the seat belt reel assembly.
10. To remove the seat belt stalks from the transmission tunnel proceed as follows.

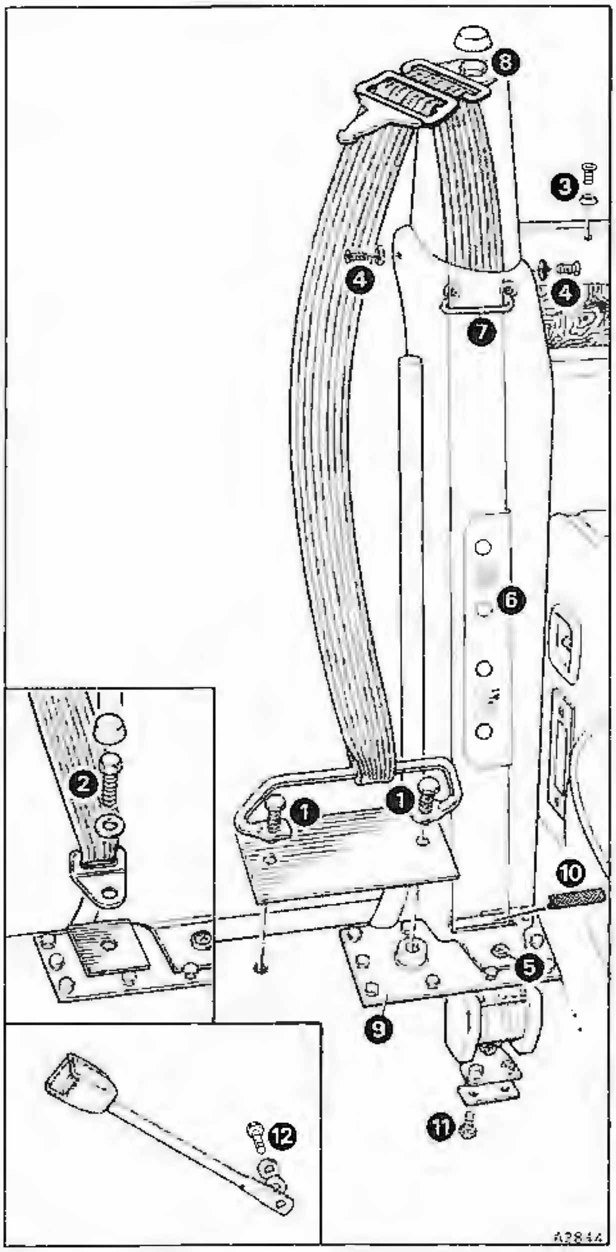


Fig. S28-1 Front seat belt removal

Peel back the transmission tunnel carpet to expose the stalk anchorage bolts (item 12). Remove the bolts and washers and withdraw the stalk. *On cars conforming to a North American specification,* disconnect the battery then release the Lucar connectors from the electrical lead protruding from the driver's side seat belt stalk.

Front seat belt – To fit (see fig. S28-1)
Reverse the procedure given for removal noting the following.

1. Ensure that the seat belt reel assemblies are mounted vertically in the sill recess.
2. Torque tighten the seat belt anchorage bolts (items 1, 2, 8, and 12) to between 34 Nm and 41 Nm (3,4 kgf m and 4,1 kgf m; 25 lbf ft and 30 lbf ft).
3. Check that the plastic edge protector (item 10) is fitted to the reel mechanism cover plate, preventing possible chafing of the seat belt webbing.
4. Fully extend the seat belt webbing and check that the belt retracts fully when released.
5. To check that the seat belts are operating correctly proceed as follows.

Select an open stretch of road.

Then, when the road is free from any potential danger, accelerate the car to 24 km/h (15 mile/h) and brake sharply. Ensure that the belts lock and subsequently release.

An additional check should be made by fitting the belt and then giving the webbing of the diagonal belt a sharp pull. Ensure that the belt locks, then retracts when the tension is released.

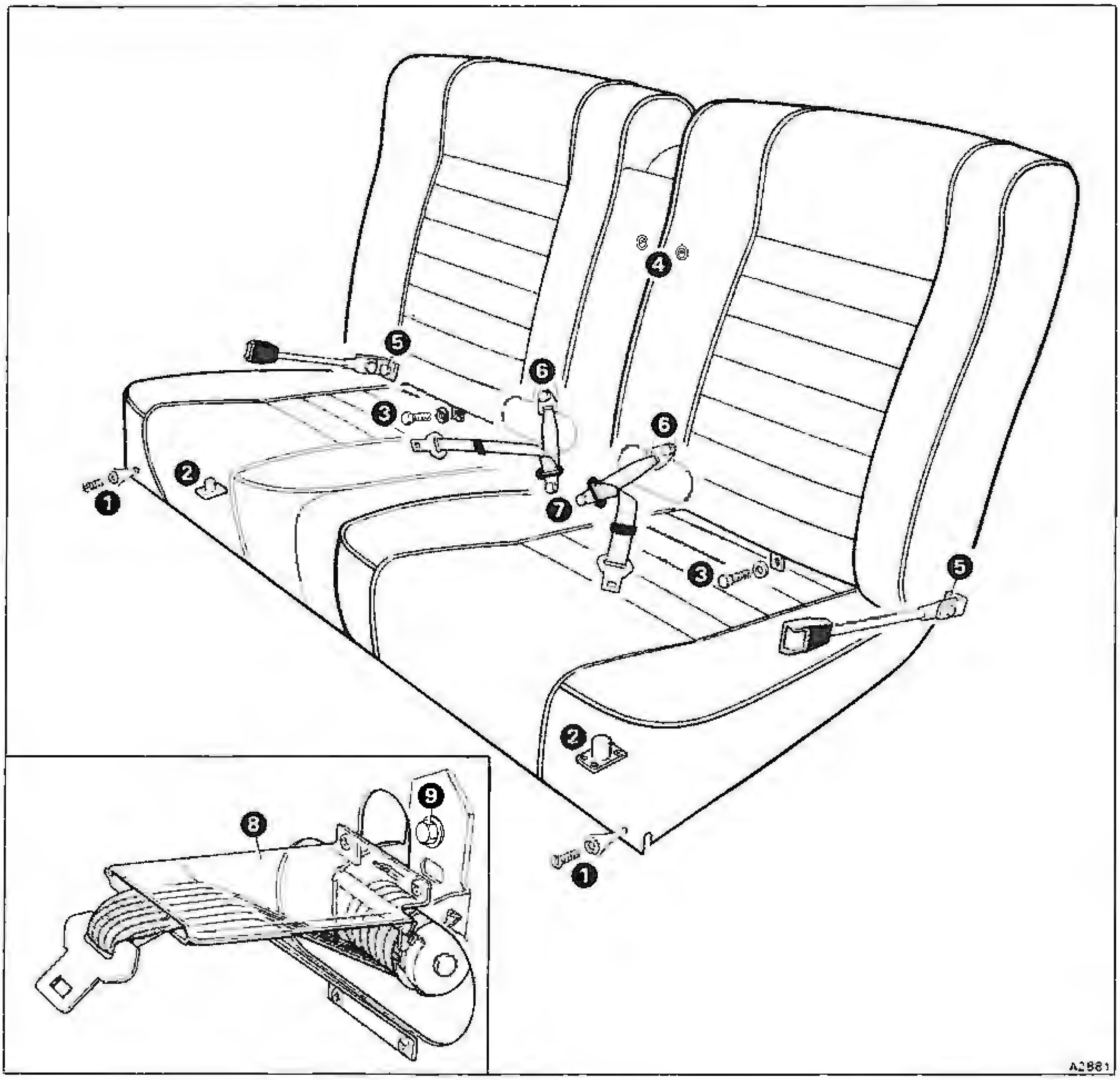


Fig. S28-2 Rear seat belt removal

Rear seat belt – To remove (see fig. S28-2)

1. To gain access to the rear seat belt anchorage bolts it will be necessary to remove the seat cushion and squab assembly as follows.

   Remove the two screws and cup washers (item 1) securing the lower corners of the seat cushion.

   Lift the front of the cushion to disengage the retaining pegs (item 2). Then, pull the cushion clear of the squab and remove.

   Remove the two exposed setscrews and washers (item 3) securing the base of the squab assembly.

   Lower the centre arm rest, then carefully pull down the elasticated backing panel to expose the squab fixings (item 4). Remove the two screws and washers, then carefully allow the elasticated backing panel to retract and raise the arm rest.

   Lift the squab slightly to disengage it from the hoodwell flange. Then, manoeuvre the squab clear of the rear quarter trim. When removing the squab from the car, care must be taken to avoid damage to surrounding trim by the protruding brackets fitted to the base of the assembly.
2. Remove the exposed anchorage bolts (item 5) and withdraw the seat belt stalks.
3. *On cars other than those conforming to a North American specification*, remove the seat belt anchorage bolts and washers (item 6). Then, thread the belt webbing through the running loop (item 7) and remove.
4. *On cars conforming to a North American specification*, unscrew and remove the seat belt webbing guide (item 8). Then, remove the exposed anchorage bolt (item 9) and withdraw the reel mechanism.

Rear seat belt – To fit (see fig. S28-2)

Reverse the procedure given for removal noting the following.

1. Torque tighten the seat belt anchorage bolts (items 5, 6 and 9) to between 34 Nm and 41 Nm (3,4 kgf m and 4,1 kgf m; 25 lbf ft and 30 lbf ft).
2. Ensure that the reel mechanisms (if fitted) are mounted vertically.
3. To check the operation of the retractable seat belts proceed as follows.

   An assistant will be required to occupy a rear seat position during the test.

   Select an open stretch of road.

   Then, when the road is free from any potential danger, accelerate the car to 24 km/h (15 mile/h) and brake sharply. Ensure that the belts lock and subsequently release.

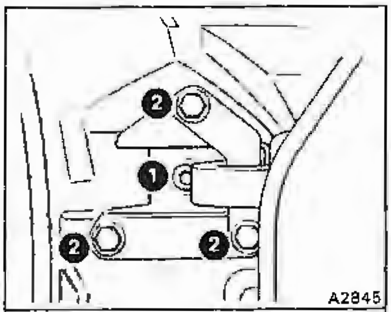
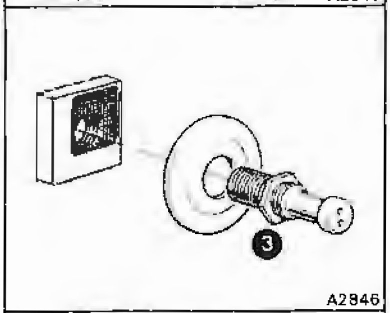
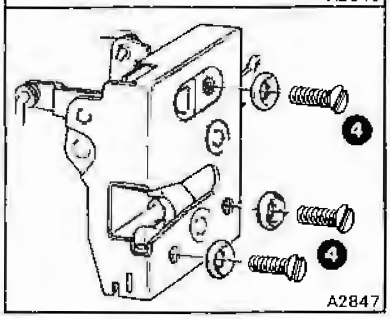
Special torque tightening figures

Introduction
This section contains the special torque tightening figures applicable to Sections S20 to S31 inclusive.

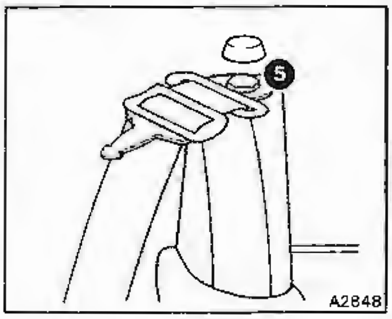
For standard torque tightening figures refer to Chapter P.

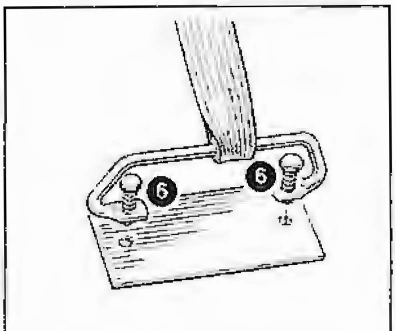
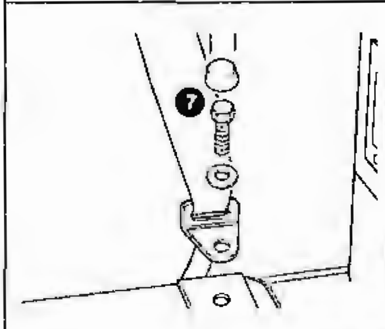
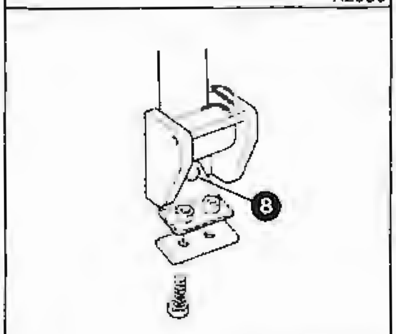
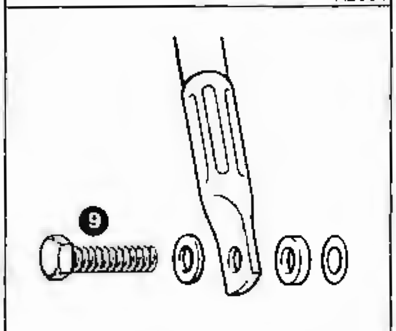
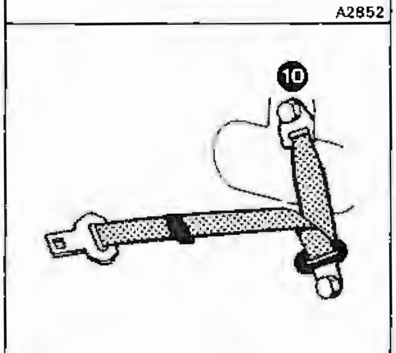
Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

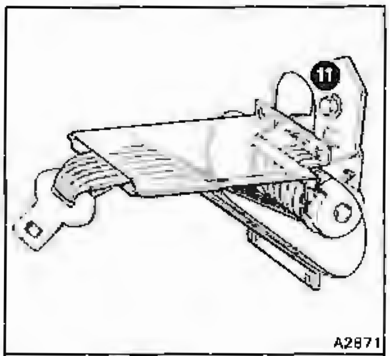
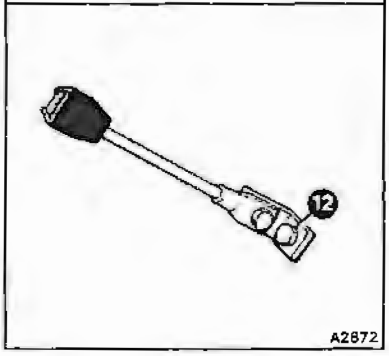
Section S20

	Ref.	Component	Nm	kgf m	lbf ft
	1	Door hinge – Allen headed setscrews	23–34	2,3–3,4	17–25
	2	Door hinge – hexagonal headed setscrews	23–34	2,3–3,4	17–25
	3	Striker pin lock-nut – 'B' post	27–33	2,8–3,3	20–24
	4	Door latch – countersunk setscrews	4,1–6,1	0,4–0,6	3–4.5

Section S28

	Ref.	Component	Nm	kgf m	lbf ft
	5	Front seat belt to 'B' post – bolt	34–41	3,4–4,1	25–30

	Ref.	Component	Nm	kgf m	lbf ft
 A2849	6	Front seat belt slider bar – bolts	34–41	3,4–4,1	25–30
 A2850	7	Front seat belt to sill – bolt	34–41	3,4–4,1	25–30
 A2851	8	Front seat belt reel mounting bracket – bolt	34–41	3,4–4,1	25–30
 A2852	9	Front seat belt stalk to tunnel – bolt	34–41	3,4–4,1	25–30
 A2870	10	Rear seat belt to squab panel – bolt	34–41	3,4–4,1	25–30

Section S28	Ref.	Component	Nm	kgf m	lbf ft
	11	Rear seat belt reel to squab – bolt	34-41	3,4-4,1	25-30
	12	Rear seat belt stalk to squab panel – bolt	34-41	3,4-4,1	25-30

Workshop tools

This section contains the workshop tools applicable to Sections S20 to S31 inclusive.

RH 9623	Windscreen wiper arm extractor tool
RH 9778	Door latch striker pin holding tool
RH 9779	Door latch striker pin setting piece

2/89
Printed in England

Transmission

Contents

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections / Page No.	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
1	7/87	11/88	11/88	7/87	7/87	4/90	11/88	11/88	11/88	7/87
2		11/88	11/88	7/87	7/87	7/87	11/88	11/88	7/87	7/87
3	4/90		11/88		7/87	7/87	11/88			7/87
4			11/88			7/87				
5	4/90					4/90				
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Sections / Page No.	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20
1	11/88	8/87	11/88	8/87	4/90	8/87	4/90	8/87	8/87	8/87
2			11/88	8/87	4/90		4/90	8/87	8/87	8/87
3			8/87				4/90	8/87	8/87	8/87
4			8/87				4/90		8/87	8/87
5									8/87	8/87
6									8/87	8/87
7									8/87	8/87
8										8/87
9										8/87
10										4/90
11										4/90
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Printed in England

Issue record sheet

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections Page No.	T21	T22	T23	T24						
1	9/87	9/87	9/87	4/90						
2	9/87	9/87	9/87							
3	9/87	9/87	9/87							
4	9/87	9/87	9/87							
5		9/87								
6		9/87								
7		9/87								
8		9/87								
9		9/87								
10		9/87								
11		9/87								
12		9/87								
13		9/87								
14		9/87								
15		11/88								
16		11/88								
17		11/88								
18										
19										
20										
21										
22										
23										
24										

Sections Page No.										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Introduction

The torque converter transmission is a fully automatic unit, consisting primarily of a three-element hydraulic torque converter and a compound planetary gear train. Three multiple-disc clutches, one roller clutch, one sprag clutch, and two friction bands, provide the elements which are required to obtain the desired functions of the gear train.

A name plate is fitted to the right-hand side of the transmission, toward the centre of the case. The serial number is prefixed by either the letters RHA, RJA, RNA, or RNAB, and the year in numerals.

On 1989 model year transmissions, the serial number is prefixed by either the letters RDA, RKA, RLA, RMA, or RMAB, and the year in numerals.

The torque converter, clutches, and rollers connect the engine to the planetary gears with the aid of pressurized transmission fluid. Three forward gears and reverse are provided. When necessary, the torque converter will supplement the gears by multiplying engine torque.

The torque converter is of welded steel construction and cannot be dismantled. The unit is made up of two vaned sections which face each other across a fluid filled housing. The pump half of the converter is connected to the engine and the turbine half is connected to the transmission.

When the engine is running the converter pump rotates and throws fluid against the turbine, causing the turbine to rotate. The fluid then returns to the pump in a circular flow and continues this cycle as long as the engine is running.

The converter also has a smaller vaned section, called a stator, which directs the fluid back to the pump through smaller openings at greater speed. The speeded-up fluid imparts additional force to the engine driven converter pump, thus multiplying engine torque.

A hydraulic system pressurized by an internal/external gear type of pump provides the working pressure required to operate the friction elements and automatic controls.

External control connections

The external control connections to the transmission are.

1. An electric gearchange actuator, connecting rod, and levers. The actuator responds to an electrical signal from a switch on the steering column, then moves the gear change lever on the transmission to the required position.
2. Engine vacuum which operates a vacuum modulator unit.
3. 12 volt electrical signals to operate an electrical detent solenoid.

Gear and torque ratios

The gear or torque ratios of the transmission are.

First	–	2.5:1
Second	–	1.5:1
Third	–	1.0:1
Reverse	–	2.0:1

Each gear ratio can be multiplied by as much as 2.2, depending upon the slip speed of the converter pump and turbine.

Vacuum modulator

A vacuum modulator is used to automatically sense engine torque input to the transmission. The modulator transmits this signal to the pressure regulator which controls main line pressure. This ensures that all the torque requirements of the transmission are met and that the correct gear change spacing is obtained at all throttle openings.

Detent solenoid

The detent solenoid is activated by the throttle position switch, mounted on the end of the primary throttle spindle. When the pedal is in the kick-down position, the switch is closed; the solenoid in the transmission is then activated and a down-change will occur at speeds below 129 km/h (80 mile/h). At lower speeds a down-change will occur at smaller throttle openings without the aid of the throttle position switch assembly, or the solenoid.

Heat exchanger

The heat exchanger for the transmission fluid is situated in the bottom of the radiator matrix (see fig. T2-1).

Selector positions

The transmission quadrant has six selector positions which enable the driver to control the operation of the transmission under varying driving conditions. The six selector positions appear in the following sequence, from left to right; P – Park, R – Reverse, N – Neutral, D – Drive, I – Intermediate, and L – Low. The engine can only be started in the park and neutral positions.

P – Park position positively locks the output shaft to the transmission case by means of a locking pawl and prevents the car from rolling either backward or forward when parked on a steep incline.

R – Reverse enables the car to operate in a reverse direction.

N – Neutral enables the engine to be started and run without the car moving.

D – Drive is used for all normal driving conditions and maximum economy. Drive range has three gear ratios, from starting to direct drive. Forced down-changes are available for safe and rapid overtaking, by fully depressing the accelerator pedal.

I – Intermediate adds new performance for congested traffic conditions or hilly terrain. This range has the same starting ratio as D, but prevents the transmission from changing above second gear; acceleration is retained when extra performance is required.

The engine can be used to assist braking in this range.

L – Low range permits operation at a lower gear ratio and should be used when maximum torque multiplication is required or, when descending a steep gradient. When the selector lever is moved from drive (D) to low (L) at normal road speeds, the transmission will change to second gear and remain in second gear until the speed of the car is reduced to the normal 2-1 down-change speed. The transmission will then change down to first gear and remain in first gear regardless of car speed or engine revolutions, until the selector lever is moved into either the drive (D) or the intermediate (I) position.

Hydraulic system

Pressure control

The transmission is controlled automatically by a hydraulic system. Hydraulic pressure is supplied by the transmission oil pump, which is engine driven.

Main line oil pressure is controlled by a pressure regulator valve train which is located in the pump and by the vacuum modulator which is connected to engine vacuum.

The pressure regulator controls main line oil pressure automatically, in response to a pressure signal from a modulator valve. This is done in such a manner, that the torque requirements of the transmission clutches are met and correct gearchange spacing is obtained at all throttle openings.

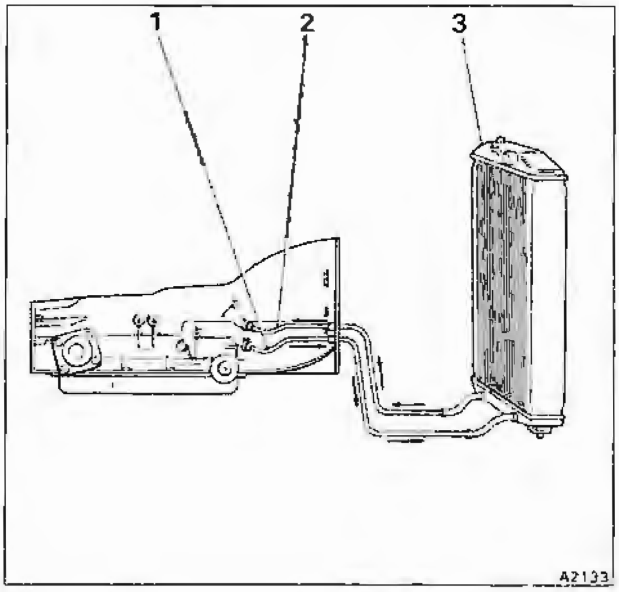


Fig. T2-1 Heat exchanger system
1 Transmission fluid to heat exchanger
2 Transmission fluid from heat exchanger
3 Coolant radiator with heat exchanger in bottom tank

To control line pressure, a modulator pressure is used. This pressure varies in the same manner as torque input to the transmission. Since the torque input to the clutches is the product of engine torque and converter ratio, modulator pressure must compensate for changes in either or both of these.

To meet these requirements, modulator pressure is regulated by engine vacuum, which is an indicator of engine torque and throttle opening. It will decrease as the car speed increases to compensate for the changing converter torque ratio.

Vacuum modulator assembly

The engine vacuum signal is received by the vacuum modulator, which comprises an evacuated metal bellows, a diaphragm, and two springs. The assembly is so arranged that the bellows and external spring apply a force that acts on the modulator valve so that it increases modulator pressure. To control modulator pressure, engine vacuum and an internal spring oppose the bellows and external spring.

To reduce the effect of altitude on change points, the effective area of the diaphragm is different than that of the bellows. Atmospheric pressure acts on the resulting differential area to reduce modulator pressure.

Governor assembly

The speed of the car is signalled to the transmission by a governor which is driven by the transmission output shaft. The governor is comprised basically of a valve body, a regulator valve, and flyweights.

Centrifugal force causes the flyweights to act on the regulator valve. The valve then regulates a pressure signal which increases with road speed.

Governor pressure acts on the modulator valve to cause modulator pressure to decrease as the speed of the car increases.

Servicing

Careful and regular maintenance of the transmission is necessary to ensure maximum reliability.

For details of the servicing and maintenance requirements of the transmission, refer to the Service Schedule Manual – TSD 4702.

It is absolutely essential that attention be paid to cleanliness whenever the interior of the transmission is exposed and when work is being carried out on a particular unit belonging to the transmission. The smallest particle of dirt in the oil may interfere with the correct operation of the valves, particularly in the control valve unit.

A list of approved transmission fluids is given in Chapter D.

Fluid level – To check and top-up

The fluid level in the torque converter transmission can be checked accurately only when the car is standing on a level surface, the engine is running at the idle speed, and the transmission fluid is at normal operating temperature, approximately 77°C (170°F). This is only obtained after 24 kilometres (15 miles) of highway/motorway driving or after 16 kilometres (10 miles) of city driving.

As an initial check, the fluid level may be checked after starting from cold as follows.

1. With the car on a level surface, apply the parking brake and chock the road wheels.
2. On four door cars, remove the protective cover from the windscreen wiper mechanism to gain access to the dipstick. Ensure that the following safety procedure is undertaken to isolate the mechanism prior to removing the cover.

Ensure that the windscreen wiper control switch situated on the facia is in the off position. Remove a windscreen wiper relay, preferably number three (see fig. T3-1). To remove the relay pull it vertically from its mounting.

Always clean the top of the dipstick before removing it from the filler tube.

3. Start and run the engine for three to four minutes with the gear range selector in the park position. Allow the engine to achieve a normal idle speed.
4. Whilst sitting in the driving seat, **firmly apply the footbrake** and move the gear range selector through the full range of gear positions pausing briefly in each range. Return the selector to the park position.
5. Immediately check the fluid level with the engine running at idle speed.

The level should be 25 mm (1 in) below the FULL HOT mark on the dipstick.

Top-up to this level if necessary.

Important When checking the fluid level with the engine running, take care to avoid any moving parts such as drive belts, pulleys, fan blades, etc. Care should also be taken to avoid contact with hot engine components.

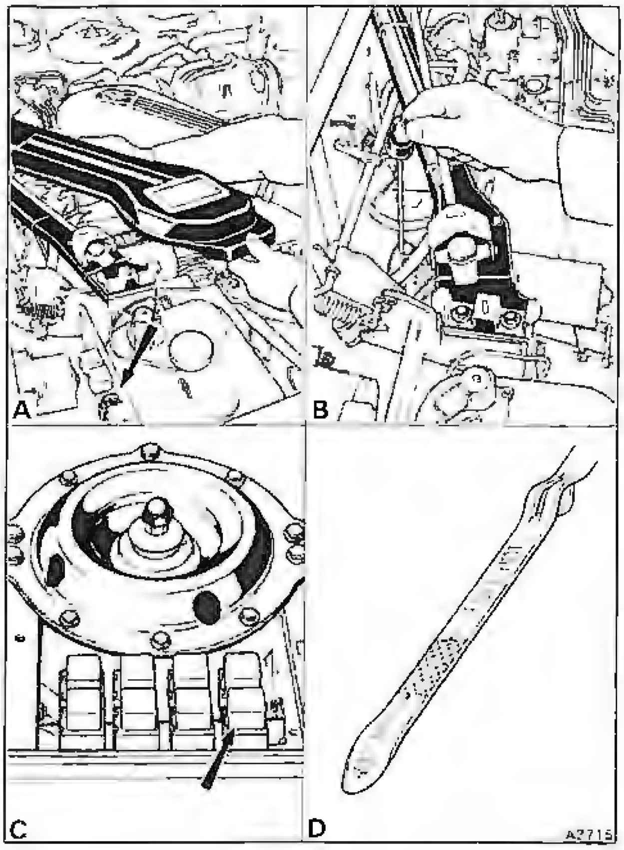


Fig. T3-1 Transmission filler tube and dipstick
A Removing the windscreen wiper mechanism cover. The arrow indicates the wiper motor relay removed
B Withdrawing the dipstick from the filler tube
C Wiper motor relay location (1989 model year four door cars)
D Dipstick markings

After this initial check a further check should be carried out as follows.

6. Drive the car for approximately 24 kilometres (15 miles) of highway/motorway driving or 16 kilometres (10 miles) of city driving. This should ensure the transmission has reached normal operating temperature.

It is essential that this temperature is attained. Do not top-up the fluid level to the FULL HOT mark on the dipstick when the fluid is only warm, as this will result in an overflow situation when the normal operating temperature is attained. Overfilling will result in fluid being discharged from the transmission breather pipe.

7. Position the car on a level surface, firmly apply the parking brake and select park with the gear selector lever.
8. Carry out the procedure described for the initial check (Operations 2 to 5 inclusive).
9. With the transmission fluid at normal operating temperature the level of the fluid should be within the cross hatched area marked on the dipstick (see fig. T3-1).
10. If necessary add fluid by pouring it down the filler tube, with the engine still running, until the fluid is to the FULL HOT mark on the dipstick. **Do not overfill.**
11. When the fluid level is correct, switch off the engine and fit the windscreen wiper mechanism cover and relay.

To drain the sump and renew the intake strainer

1. Position the car on a ramp.
2. Place a clean container having a minimum capacity of 3 litres (5 Imp pt, 6 US pt) beneath the drain plug situated on the corner of the transmission sump (see fig. T3-2).
3. Remove the drain plug and allow the oil to drain from the sump.
4. Remove the setscrews securing the transmission sump and lower the sump. Discard the gasket.
5. Unscrew and remove the stepped bolt securing the intake pipe and strainer assembly to the transmission casing. Remove the strainer assembly.
6. Discard the intake strainer but retain the intake pipe which connects the strainer to the casing.
7. Fit a new rubber 'O' ring onto the intake pipe, lubricate the 'O' ring with clean transmission fluid.
8. Ensure a new rubber seal is fitted to the bore in the new intake strainer. Fit the strainer to the intake pipe and secure the strainer with the stepped bolt.
9. Torque tighten the bolt to 14 Nm (1,4 kgf m, 10 lbf ft).
10. Fit the transmission sump using a new gasket. Torque tighten the setscrews to between 8 Nm and 14 Nm (0,9 kgf m and 1,4 kgf m; 6 lbf ft and 10 lbf ft).
11. Add 4,5 litres (8 Imp pt, 9.6 US pt) of an approved fluid to the sump, pouring the fluid down the filler tube.

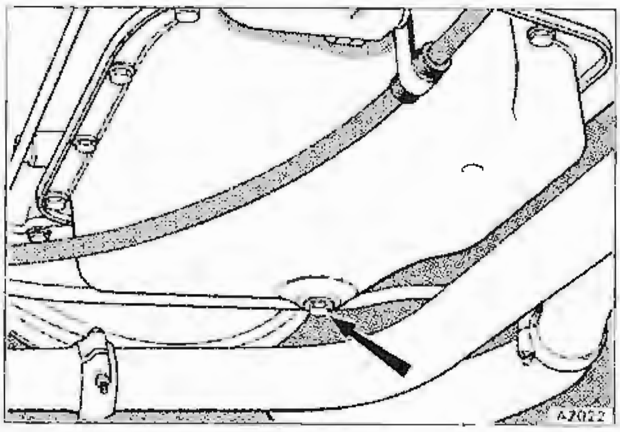


Fig. T3-2 Transmission sump drain plug

Note When draining the sump but not renewing the intake strainer, add only 2,8 litres (5 Imp pt, 6 US pt).

12. Check the fluid level as described under the heading, Fluid level – To check and top-up.

Transmission unit (dry) – To fill

The fluid capacity of the torque converter transmission, including the torque converter, is approximately 10,6 litres (18.75 Imp pt, 22.5 US pt), but the correct level is determined by the marks on the dipstick rather than by the quantity of fluid added.

It is important that the correct level is maintained. When the transmission has been overhauled or a new one fitted and a complete fill is required, including the torque converter, proceed as follows.

1. Pour approximately 6,5 litres (11.5 Imp pt, 14 US pt) down through the filler tube.
2. With the car on a level surface, apply the parking brake and chock the road wheels.
3. Start and run the engine for three to four minutes with the gear range selector in the park position. Allow the engine to achieve a normal idle speed.
4. Whilst sitting in the driving seat, **firmly apply the footbrake** and move the gear range selector through the full range of gear positions pausing briefly in each range. Return the selector to the park position.
5. Immediately check the fluid level with the engine running at idle speed.

The level should be 25 mm (1 in) below the FULL HOT mark on the dipstick.

Top-up to this level if necessary.

6. Drive the car for approximately 24 kilometres (15 miles) of highway/motorway driving or 16 kilometres (10 miles) of city driving. This should ensure the transmission has reached normal operating temperature.

It is essential that this temperature is attained. Do not top-up the fluid level to the FULL HOT mark on the dipstick when the fluid is only warm, as this will result in an overflow situation when the normal operating temperature is attained. Overfilling will result in fluid being discharged from the transmission breather pipe.

Top-up if necessary, as described under the heading, Fluid level – To check and top-up.

The transmission sump should be drained at the intervals specified in the Service Schedule Manual – TSD 4702. New fluid should be added to maintain the correct level on the dipstick.

The fluid intake system incorporates an intake strainer. This strainer should be renewed at the intervals specified in the Service Schedule Manual. In the event of a major failure in the transmission, the strainer must be renewed.

Transmission unit – To check for leaks

Whenever the transmission has been dismantled, completely or partially, the following procedure must be observed to minimise the possibility of fluid leakage.

1. Always fit new gaskets and 'O' ring seals.

2. Use a small amount of petroleum jelly to hold a gasket in position during assembly.
3. Do not use a sealing compound (e.g. Wellseal) with a gasket.
4. Ensure that the cork and paper gaskets are not wrinkled or creased when fitted, or have distorted during storage.
5. Ensure that the square-sectioned 'O' rings are correctly fitted and are not twisted.
6. Ensure that all mating faces are clean and free from burrs and damage.
7. Torque tighten bolts, setscrews, etc., to the torque figures given in Section T23 and Chapter P.
8. When examining the transmission for leaks, determine whether the fluid originates from the transmission or the engine. The original factory fill fluid is red in colour, this assists in locating the source of leakage. If however, the colour cannot be detected in the transmission fluid, add a red aniline dye preparation to the fluid. Red dye appearing in the leaking fluid will positively identify the source of the leak.

If the fluid is known to be leaking from the transmission, examine the following areas.

Front end

It will be necessary to remove the bell housing bottom cover and the lower front cover plate in order to examine the transmission for leakage at the front end.

To correct a leak at the front end, the transmission will have to be removed from the car.

1. If the pump oil seal is suspected of leaking fluid, ensure that the seal has been correctly fitted and is not damaged.

When fitting a new seal (see Section T17) ensure that the seal bore in the case is clean. Examine the finish on the converter neck and the bearing surface in the pump body.

2. Examine the pump square-sectioned 'O' ring and the gasket for damage, renew if necessary.
3. Ensure that the 'O' rings on the pump securing setscrews are not damaged.
4. Examine the torque converter for leakage (see Section T8).

Rear extension

1. Examine the rear extension housing oil seal for damage.
2. Examine the finish on the sliding coupling.
3. Ensure that the gasket fitted between the joint faces has been correctly fitted and is not damaged.
4. Check the securing setscrews for correct torque tightness (see Section T23).
5. Examine the housing for cracks or porosity.

Transmission case

1. Examine the speedometer electronic impulse transmitter drive 'O' ring and lip-type seal. Ensure that the securing setscrew is torque tightened.
2. Examine the governor cover gasket. Ensure that the setscrews are torque tightened (see Section T23).
3. Examine the electrical connector 'O' ring for damage.
4. Examine the parking pawl shaft cup plug for damage.
5. Examine the manual shaft lip seal for damage.
6. Examine the vacuum modulator 'O' ring for damage. Ensure the retaining setscrew is torque tightened (see Section T23).
7. Examine the vacuum modulator for possible damage to the diaphragm.

Note If the transmission is found to be consistently low on fluid, check the modulator to ensure that there is no split in the diaphragm. Apply suction to the vacuum tube and check for leaks. A split diaphragm would allow transmission fluid to be drawn into the engine induction manifold and vacuum line. This condition can usually be detected because the exhaust will be excessively smokey due to the transmission fluid being added to the combustion mixture.

8. Examine the sump gasket. Check the torque tightness of the securing setscrews (see Section T23).
9. Check the torque tightness of the main line pressure tapping plug (see Section T23).
10. Examine the breather pipe for damage.
11. Ensure that the transmission has not been overfilled.
12. Check for coolant in the transmission fluid.
13. Examine the case for cracks or porosity.
14. Ensure that the pump to case gasket is not incorrectly positioned.
15. Ensure that foreign matter is not between the pump and case, or between the pump cover and body.
16. Ensure that the breather hole in the pump cover is not obstructed.
17. Ensure that the 'O' ring on the filter assembly is not cut.

Heat exchanger connections

Ensure that the heat exchanger transmission fluid pipes are correctly fitted and are not damaged. Ensure that the nuts are tight.

Dipstick and filler tube

Examine the rubber grommet for leaks.

Internal leaks

Ensure that the manual linkage is set correctly before removing the sump, as incorrect settings can cause internal leaks at the valves.

If the manual linkage is set correctly, remove the sump.

1. Check the governor pipes for security and damage.
2. Examine the rear servo cover gasket for damage. Ensure that the square-sectioned 'O' ring is fitted correctly and is not damaged. Torque tighten the cover securing setscrews (see Section T23).
3. Examine the control valve unit assembly and oil spacer (guide) plate gaskets.

Check the torque tightness of the unit securing setscrews (see Section T23).

4. Check the torque tightness of the solenoid securing setscrews (see Section T23).
5. Check that the case valve body mounting face is not distorted.

Control joints – To lubricate
During initial assembly, the clevis pins in the control linkage are lubricated with Rocol MTS 1000 grease and should be similarly treated whenever they are removed.

When a car is being serviced, the opportunity should be taken to check the controls for correct operation and to lubricate all the control joints with a few drops of engine oil.

Manual shaft – To lubricate
As part of the linkage maintenance procedure, it is recommended that the manual shaft be lubricated with a few drops of oil at the point where it enters the transmission case.

Testing

Before road testing the car to check the functioning of the transmission, carry out the following.

The car can then be road tested, using all the selector ranges. Note any operating faults.

Check the gearchange pattern as follows.

1. Check the fluid level, top-up if necessary.
2. Ensure that the engine and transmission are at normal operating temperature 77°C (170°F).
3. Ensure that the gearchange actuator is operating satisfactorily.
4. Check the operation of the throttle position switch, adjust if necessary, refer to the Engine Management Systems Manual — TSD 4737.
5. If the oil pressure is to be checked, fit a gauge.
6. Check the manual linkage.

Gearchange pattern check

Drive range

1. Select D range, then accelerate the car from standstill.
2. A 1-2 and a 2-3 up-change should occur at all throttle openings.

Note The change points will vary according to throttle opening.

3. As the speed of the car decreases to a stop, the 3-2 and the 2-1 down-changes should occur.

Intermediate range

1. Select I range.
2. Accelerate the car from standstill.
3. A 1-2 up-change should occur at all throttle openings.
4. A 2-3 up-change cannot be obtained in this range.
5. The 1-2 up-change point will vary according to throttle opening.
6. As the speed of the car decreases to a stop, the 2-1 down-change should occur.

Low range

1. Select L range.
2. No up-change should occur in this range, regardless of throttle opening.

2nd gear – overrun braking

1. Select D range.
2. When a speed of approximately 56 km/h (35 mile/h) has been reached, move the selector lever to the I range position.
3. The transmission should change down to 2nd gear.
4. An increase in the speed of the engine as well as an engine braking effect should be observed.
5. Line pressure should change from between 4,1 bar and 6,2 bar (60 lbf/in² and 90 lbf/in²) to approximately 10,3 bar (150 lbf/in²).

1st gear – downhill or overrun engine braking

1. Select I range.
2. When the speed of the car is approximately 48 km/h (30 mile/h), and at constant throttle, move the selector to L range.

Note Ensure that the speed of the car does not exceed 64 km/h (40 mile/h).

3. An increase in engine rev/min and a braking effect should be noticed as the down-change occurs.

Oil pressure – To check

Before attempting to check the oil pressure or to road test the car, always ensure that the level of fluid in the transmission is correct (see Section T3).

The pressure can be checked by using an oil pressure gauge coupled to the main line tapping in the left-hand side of the transmission case.

1. Clean any dirt from around the line pressure plug; remove the plug.
2. Fit the adapter RH 7914 into the main line tapping; tighten the adapter.
3. Screw a pressure gauge, capable of reading between 0 bar and 20,6 bar (0 lbf/in² and 300 lbf/in²) onto the adapter. Then, position the gauge so that it can be seen from the driver's seat.
4. Connect a tachometer to the engine; this will enable the gear change points to be positively identified.
5. Drive the car until the transmission has reached normal operating temperature 77°C (170°F).
6. Check the fluid level, top-up if necessary.

Road testing the car

The following checks should be carried out during road testing.

Engine idle pressure check

1. Select D range. Drive the car at approximately 48 km/h (30 mile/h) with the throttle eased back. The line pressure should be 4,8 bar (70 lbf/in²).
2. Select I range. Drive the car to obtain a steady road speed of 40 km/h (25 mile/h). Line pressure should be between 10,0 bar and 10,7 bar (145 lbf/in² and 155 lbf/in²).

Full throttle pressure check

1. Jack up the rear of the car and position blocks so that the rear wheels are clear of the ground.
2. Disconnect the vacuum line at the induction manifold.
3. Blank off the orifice in the manifold.
4. Run the engine at fast-idle (between 800 rev/min and 1000 rev/min) in neutral. The oil pressure should be 10,0 bar (145 lbf/in²).
5. Repeat the procedure in reverse. Reverse

pressure should be between 10,0 bar and 10,7 bar (145 lbf/in^2 and 155 lbf/in^2).

6. Connect the vacuum pipe.

Towing

The car must not be towed if any mechanical damage to the transmission components is suspected, or if the torque converter transmission fluid level is low.

Before towing, check the fluid level in the transmission. The level must be **above** the FULL HOT mark on the dipstick when the engine is **not running**.

Should it be necessary to tow the car, even for a short distance, a solid tow bar must be used. This is important, as without the engine running to maintain the pressure in the hydraulic systems, the efficiency of the braking systems is reduced.

If the pressure in the hydraulic systems has been exhausted by operating the footbrake pedal without the engine running, the footbrake would not stop the car. If a solid tow bar is not available, the car must be transported.

Always tow the car with the torque converter transmission in neutral.

To select neutral it is first necessary to turn the ignition key in the switchbox to the RUN position. Providing that the battery is in a charged condition, this action will energize the gearchange actuator mechanism and neutral can then be selected by operating the gear range selector lever. Should the battery be in a discharged condition however, turning the ignition key will not energize the gearchange mechanism and operating the gear range selector lever therefore will not activate the actuator mechanism. In this event, it will not be possible to move the transmission out of the park position and it will be necessary to disconnect the gearchange actuator linkage at the manual shaft lever. Then, before the car can be towed or transported, engage neutral by moving the manual shaft lever two positions rearwards from the fully forward position.

Normally, when the ignition key is removed from the switchbox, park position is automatically engaged and the parking pawl locks the transmission. If it is required to remove the ignition key and still leave the car in neutral for towing, this can be accomplished by first removing the gearchange fuse (fuse A6 on fuse panel F2 on the main fuseboard) and then remove the key from the switchbox.

The car should only be towed for distances of up to 80 kilometres (50 miles) and the maximum towing speed must not exceed 56 km/h (35 mile/h). For greater distances the propeller shaft must be disconnected or the car transported.

Removal of units

Removable units – Transmission in car
The following units can be removed from the transmission without the transmission being removed from the car.

The removal procedure for all units is described in the appropriate section, with the exception of the pressure regulator valve, details of which are included in this section.

Gearchange actuator (Section T6).
Vacuum modulator and valve (Section T9).
Governor assembly (Section T10).
Speedometer drive (Section T11).
Sump, strainer, and intake pipe (Section T12).
Control valve unit (Section T13).
Rear servo (Section T14).
Detent solenoid, control valve spacer, and front servo (Section T15).
Rear extension (Section T16).
Control rods, levers, and parking linkage (Section T18).

Pressure regulator valve – To remove
The pressure regulator valve is a solid type (see fig. T5-1) and must only be used in the pump cover with the squared pressure regulator boss (see fig. T5-2).

1. Run the car onto a ramp. Drain the oil from the sump.
2. Remove the sump as described in Section T12.
3. Withdraw the intake pipe and strainer assembly.
4. Remove and discard the intake pipe 'O' ring.
5. Remove the setscrew which secures the detent roller spring; remove the spring and roller.
6. Slacken the lock-nut which secures the detent lever to the manual shaft.
7. Remove the manual shaft pin from the case.
8. Remove the gearchange lever from the manual shaft.
9. Prise the detent lever from the manual shaft then remove the parking actuator rod and detent lever.
10. Ensure that the manual valve does not slide out of its bore in the control valve unit.
11. Push the manual shaft through the bore in the case to gain access to the pressure regulator valve bore.
12. Using a screwdriver or a steel rod, push the regulator boost valve sleeve against the pressure regulator spring (see fig. T5-3).

Caution The pressure regulator spring is under extreme pressure and will force the valve sleeve out of its bore when the circlip is removed unless the sleeve is firmly held.

13. Continue to exert pressure on the valve sleeve then remove the circlip. Gradually relax the pressure on the valve sleeve until the spring pressure is released.
14. Carefully remove the regulator boost valve sleeve

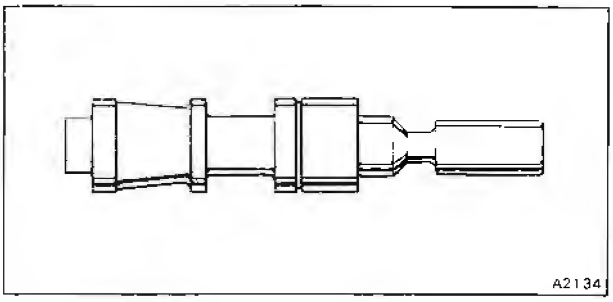


Fig. T5-1 Pressure regulator valve

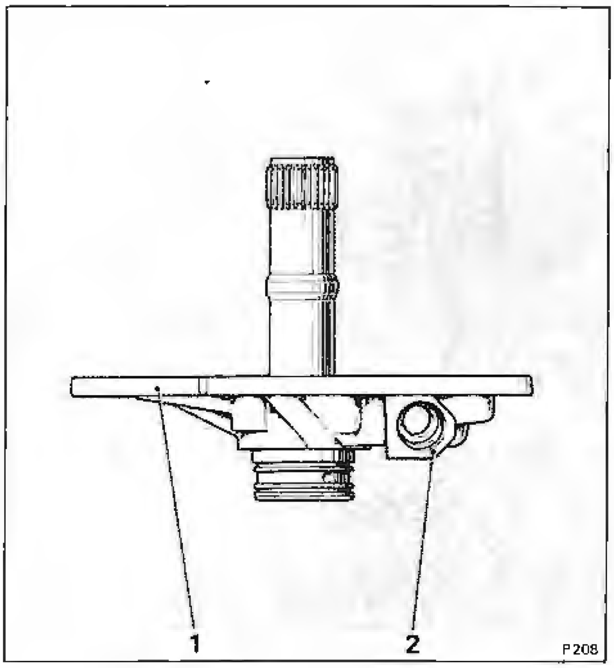


Fig. T5-2 Pump cover assembly
1 Pump cover
2 Pressure regulator boss

and valve, then withdraw the regulator spring. Take care not to drop the valves.

15. Remove the pressure regulator valve and spring retainer. Remove the spacers (if fitted).

Pressure regulator valve – To fit
Before fitting, wash and examine all parts.

1. Fit the spring retainer onto the pressure regulator spring. Fit any spacers which were previously removed.
2. Fit the pressure regulator valve, stem end first, onto the spring.
3. Fit the boost valve into the sleeve with the valve

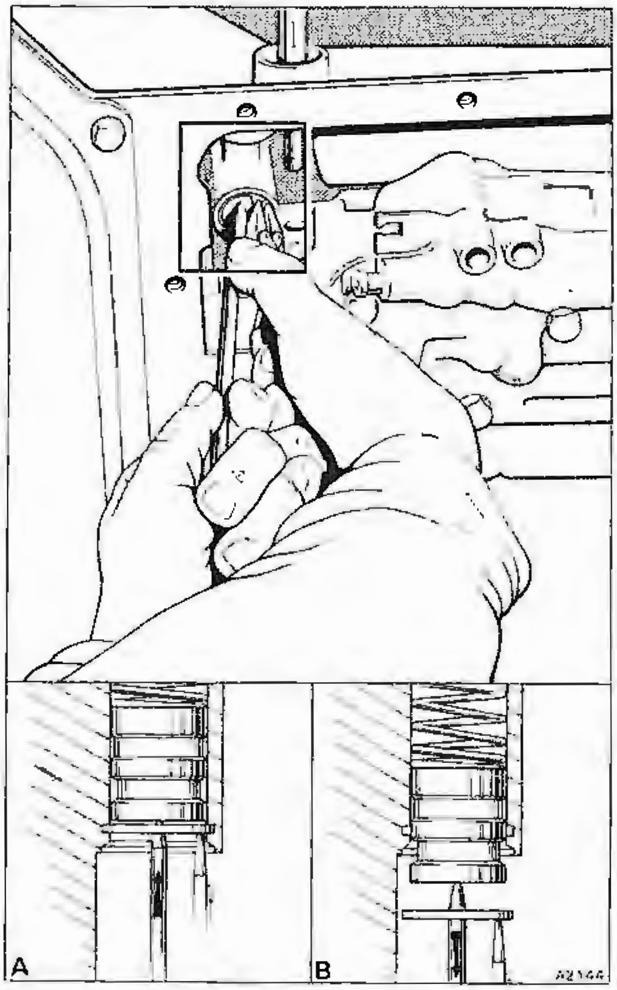


Fig. T5-3 Removing the pressure regulator valve
A Spring compressed
B Circlip removed

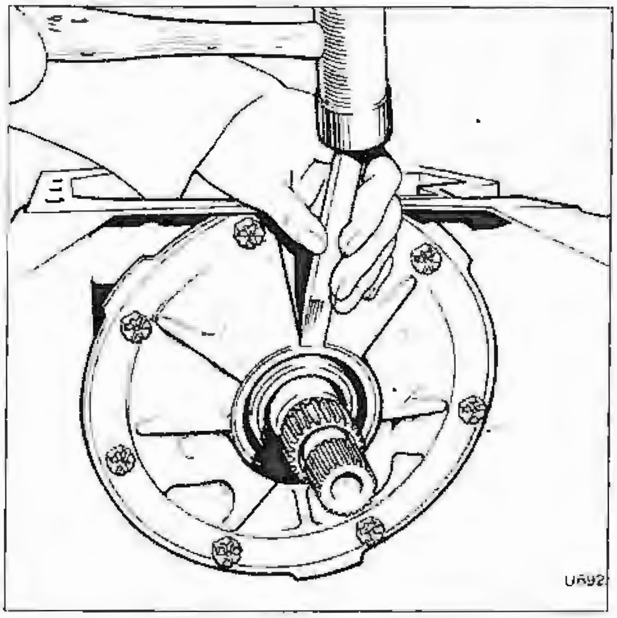


Fig. T5-4 Removing the oil pump seal

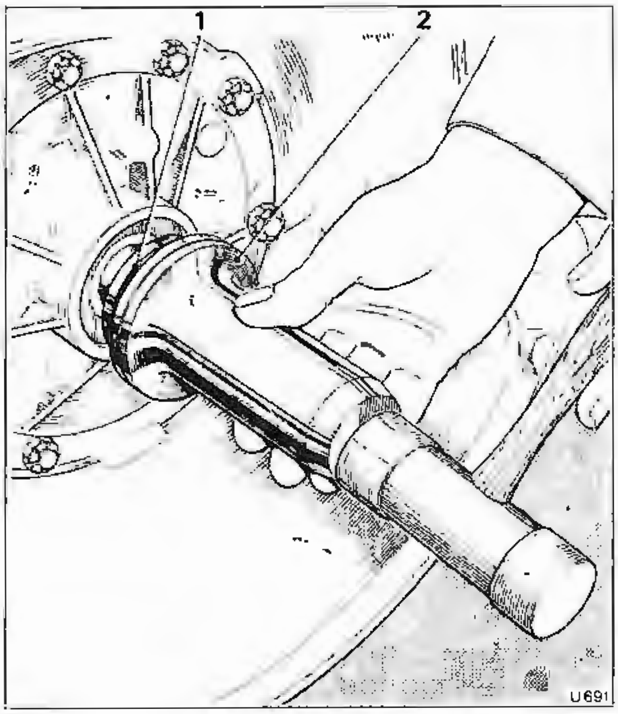


Fig. T5-5 Fitting the oil pump seal
1 Oil seal
2 Seal fitting tool

stem outward. Then, hold together all the parts so that the pressure regulator spring is against the valve sleeve.

4. Fit the complete assembly into the pressure regulator valve bore, taking care that the parts do not fall.
5. Using a screwdriver or a steel rod, push the regulator boost valve sleeve against the spring pressure of the regulator until the end of the sleeve has passed beyond the circlip groove.
6. Fit the circlip then relax the pressure on the sleeve.
7. Fit the parking actuator rod and detent lever, ensuring that the rod plunger is under the parking brake bracket and over the parking pawl.
8. Slide the manual shaft into the case and through the detent lever.
9. Fit the gearchange lever.
10. Fit the lock-nut onto the manual shaft. Torque tighten the nut.
11. Ensure that the manual valve is engaging with the pin on the detent lever.
12. Retain the manual shaft with the pin. Straighten the pin to lock it into position.
13. Fit the detent spring and roller assembly; torque tighten the setscrew.
14. Fit the intake pipe and strainer assembly, also the sump as described in Section T12.
15. Top-up the transmission with an approved fluid (see Chapter D).

Oil pump seal – To renew

1. Remove the transmission from the car (see Section T7).
2. Carefully drive the point of a chisel under the lip of the seal then prise the seal out of the pump body (see fig. T5-4).
3. Before fitting a new seal, ensure that the body bore is clean and free from burrs and that the garter ring is on the seal.
4. Check the finish of the converter neck and the bearing surface in the pump body.
5. Lightly smear the outer edge of the seal case with Wellseal. Then, fit the seal to the pump using tool RH 7953 as shown in figure T5-5.
6. Fit the transmission to the car (see Section T7).

Gearchange actuator

The electric gearchange actuator (see fig. T6-1) is mounted on a bracket secured to the transmission rear extension.

When the ignition is switched on and the selector lever on the steering column is moved to one of the gear range positions, current is allowed to flow to the actuator motor via a relay.

The motor rotates and turns the wormshaft through the flexible coupling. As the worm gear rotates, the slip ring, which is secured to the worm gear also rotates until an insulated slot in the slip ring is aligned with the live contact. When this position is reached, the current is cut off and the motor ceases to rotate.

The electric actuator is wired such that the transmission can be locked by moving the selector lever to the park position, with the ignition switched either on or off. However, to move the transmission out of the park position, the ignition has to be switched on, with the battery in a charged condition.

Note The actuator will also lock the transmission when the ignition key is removed from the switchbox.

Gearchange electric actuator – To remove

It is recommended that the easiest and quickest method of dealing with actuator failure, is by substituting the faulty actuator for a service exchange unit.

If a service exchange unit is not obtainable proceed as follows.

1. Disconnect the battery.
2. Remove the retaining ring and grooved pin from the actuating lever on the electric actuator; disconnect the rod from the lever.
3. Pull the carpet to one side and disconnect the electrical plugs from the left-hand side of the lower facia. Unclip the actuator cables from the loom. Remove the setscrew securing the electrical cable to the transmission tunnel. Also, the three nuts securing the loom/breather connection. Lower the electrical lead, plugs, etc., down through the transmission tunnel opening.
4. Remove the three bolts which secure the actuator to the rear extension bracket, then remove the actuator.

Gearchange electric actuator – To dismantle

1. Disconnect the transmission linkage and the actuator loom plugs. Remove the actuator.
2. Withdraw the side casing by carefuly removing the nuts and washers.
3. Remove the cam securing nut and washer and withdraw the cam.
4. Disconnect all terminals on the contact plate and micro-switches.

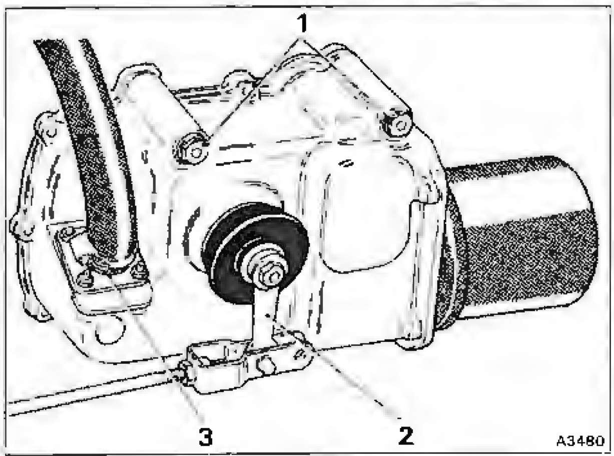


Fig. T6-1 Electric gearchange actuator
1 Actuator securing bolts
2 Actuating lever
3 Cable entry

5. Withdraw the contact plate by removing the nuts and washers. Remove the relay connections.
6. Remove the nuts and bolts which secure the micro-switches, relay mounting bracket, relays, and motor cable connection posts.
7. Remove the securing setscrew and washer and withdraw the output lever.
8. Withdraw the washer and the rubber boot.
9. Remove the circlip and thrust washer.
10. Withdraw the slip ring and gear assembly from the actuator case.
11. Remove the contact segments from the slip ring.
12. Remove the setscrews and washers from the side of the actuator casing and remove the motor assembly and drive coupling. Remove the sealing ring from the actuator case.
13. Remove the internal circlip holding the wormshaft; push the wormshaft and bearings out of the casing.
14. Carefully cut and remove the tie wrap from around the electrical wiring.
15. Remove the securing clips from around both ends of the conduit; withdraw the conduit from the cast elbows.
16. Push out the electrical leads from the loom plugs. Collect the loom plugs, conduit elbow (tunnel connection), securing clips, and conduit.
17. Fasten together the electrical cables with tape and pull them back through the cable exit of the actuator casing.

Gearchange electric actuator – To inspect

1. Examine the aluminium casing for cracks or other damage.

2. Ensure that the joint faces are clean and free from burrs.

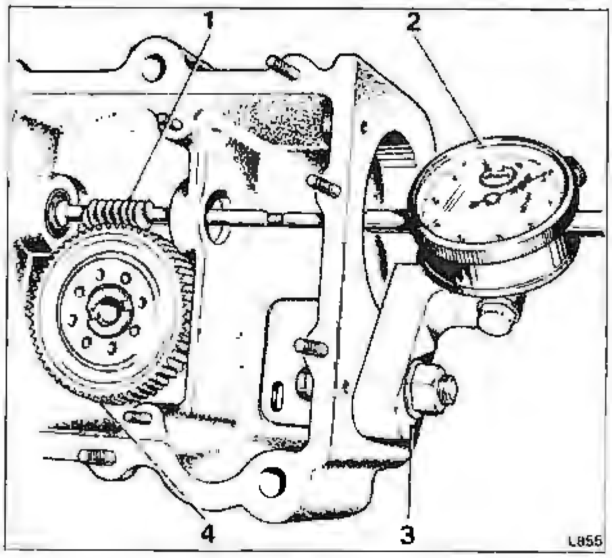


Fig. T6-2 Checking wormshaft end-float
1 Wormshaft
2 Dial indicator gauge
3 Gauge arm
4 Slave gear

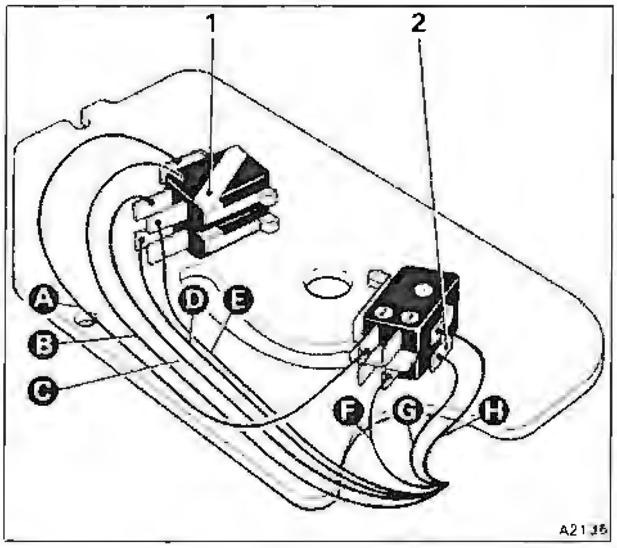


Fig. T6-3 Micro-switch connections
1 Reverse micro-switch
2 Neutral start switch
A Green/yellow cable
B Blue/brown cable
C White/brown cable
D Brown/slate cable
E Green/blue cable
F White/red cable
G White/yellow cable
H Light green/green cable

3. Examine the driving dog slot for excessive wear, also the mating shaft on the drive end of the motor armature shaft. The dog should be an easy sliding fit on the shaft but without excessive side play.
4. Examine the general condition of the plugs.
5. Examine the eight spring contacts for security on the insulated base.

Care must be taken when handling the assembled base plate so that the contacts and the relays are not damaged.

6. Check the height of the contacts from the base plate. The contact point should be approximately 12,32 mm (0.485 in) from the contact (lower) side of the base. If excessive wear has occured on the contact points the base assembly should be renewed.
7. If a Bosch relay assembly is faulty, it is recommended that a new assembly be fitted.
8. Ensure that the terminals and the terminal blocks are secure on the insulated base.
9. Examine the general condition of the wiring.
10. If the components are satisfactory, retain them with adhesive tape until they are required for final assembly.
11. Check the tightness of the setscrews which secure the slip ring assembly to the shaft.
12. Ensure that a 0,64 mm (0.025 in) air gap exists on each side of the silver plated segments which are secured to the slip ring.
13. Ensure that the edges of the slip ring around the air gap are free from burrs.
14. Examine the slip ring face for signs of tracking. This should not normally occur but, if signs of tracking are found, the slip ring assembly must be renewed.
15. Examine the teeth on the worm gear and the worm for damage or uneven wear.
16. Examine the bearing bores in the main casing for signs of fretting. The bearing should be a light push fit in the casing. Reject the casing if the push fit cannot be obtained.
17. Examine the bush which supports the output shaft for wear. The shaft should be a running fit in the bush, without excessive clearance i.e. the shaft should not rock in the bush.

Actuator plugs and cable assembly

1. Inspect the cables where they enter the plugs.
2. Ensure that no corrosion exists and that none of the individual cable strands are broken.

Actuator casing

1. Inspect all the sealing faces, also the actuator casing and the side cover.
2. Remove all traces of sealing joint and sealing compound.

Wormwheel

1. Inspect the wormwheel for abnormal wear of the teeth.

Wormshaft bearing

1. Inspect the bearings for undue wear or signs of roughness when rotated.

Micro-switch contacts – To set

1. Remove the starter relay. Then, switch on the ignition and check that the actuator will select all six gear stations correctly.
2. Move the gear selector lever to D and fit the micro-switch cam to the actuator output shaft. When tightening the nut, the torque reaction should be taken by gripping the output lever such that the tightening force is not absorbed by the nylon teeth of the wormwheel.
3. Move the gear range selector lever to the park position.
4. Locate the two right-hand micro-switches (see fig. T6-3).

   Move the switches towards the peak of the cam until the switch plungers are in the centre of the peak and are depressed to within 0,38 mm (0.015 in) of the switch body as shown in figure T6-5. When both switches are in the correct position, tighten the mounting bolts.
5. Repeat this procedure on the left-hand micro-switches keeping the switch body on the reverse micro-switch parallel to the bottom micro-switch body.
6. Select reverse gear and check that all the other three switches are clear of the cams.
7. Select neutral and ensure that the right-hand pair of switch plungers are correctly depressed and that the reverse micro-switch is clear of the cam.
8. Switch off the ignition and fit the starter relay.
9. Remove the actuator from the car and fit the casing side cover, painting both sides of the new gasket provided with a suitable jointing compound. Fit the actuator to the transmission, connecting the loom plugs and the actuator linkage.

Gearchange electric actuator – To assemble

1. Fit the main output shaft bearing into the actuator casing. The bearing should be fitted such that it is slightly proud on both the inside and outside of the casing.
2. Inspect the inside edge of the cable entry hole and ensure that it is free from burrs and sharp edges.
3. Check the gear form on the wormshaft is free from burrs and that no foreign particles are trapped between the gear teeth.
4. Fit the bearings to the wormshaft ensuring they are lubricated with Retinax A grease. These should be a push fit.
5. Assemble the wormshaft and bearings into the actuator case. The bearings must be a push fit in the casing bores; on no account should they require a hammer load to assemble them.
6. Adjust the end-float of the wormshaft to between 0,005 mm and 0,012 mm (0.002 in and 0.005 in) using a suitable washer. Fit the circlip. Check the end-float on the end of the shaft using a dial indicator gauge (see fig. T6-2).
7. Check the gear form on the nylon gear is good and free from blow holes and burrs. Check that the shaft bearing area is free from burrs.
8. Fit the nylon gear onto the output shaft using four setscrews so that the holes used are at the end of the 'double D' machined flats.
9. Fit the silver plated segments onto the slip ring base. The corners of the segments must be completely free from burrs.

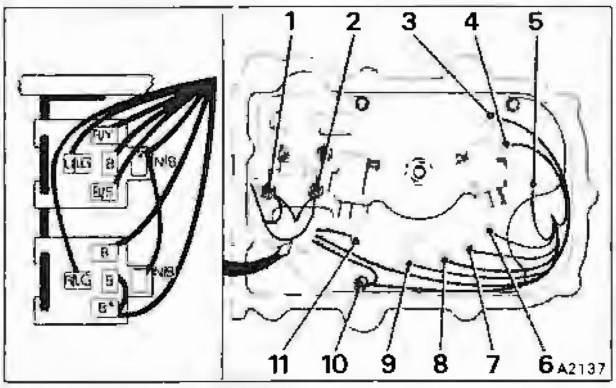


Fig. T6-4 Cable connections
1 Red/light green to motor
2 Blue/light green to motor
3 Red to relay
4 Black/brown to loom
5 Black/red to loom
6 Black/blue to loom
7 Black/green to loom
8 Black/yellow to loom
9 Black/white to loom
10 Black to earth terminal
11 Red/yellow to relay

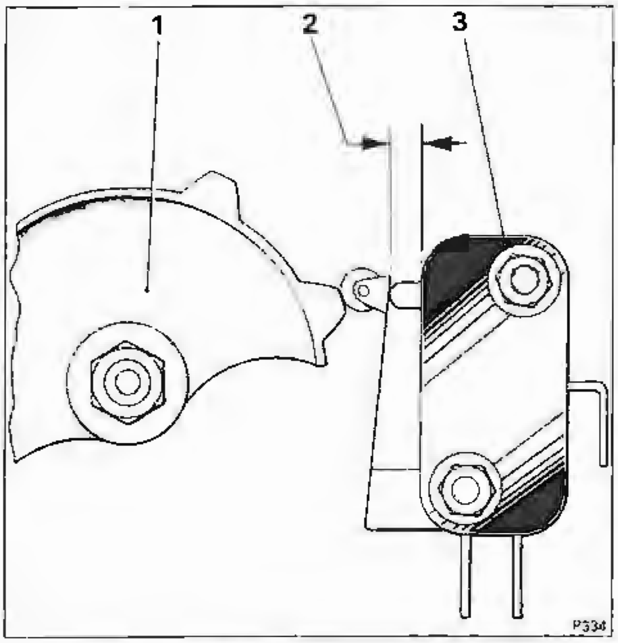


Fig. T6-5 Adjustment of micro-switches
1 Cam
2 Gap 0,38 mm (0.015 in)
3 Micro-switch

10. Fit the slip ring assembly onto the output shaft assembly, using four setscrews and washers. Check the tightness of the setscrews after the initial tightening as the nylon tends to settle slightly after the initial compression.

Note It is essential that the slip ring runs true to the main output shaft.

11. Ensure that both the shaft bearing surface and the inside of the porous bronze bush are clean. **Do not** clean the bronze bush with any degreasing agent.

12. Fit the main output shaft and slip ring assembly into the bush. This should slide in and no attempt should be made to force it into position.

13. Lift out the shaft and check it has received a smear of oil from the porous bronze bush. Lubricate the nylon gear with Retinax A grease and then fit the assembly into the casing.

14. Fit a bronze washer onto the outside of the shaft and then fit the circlip.

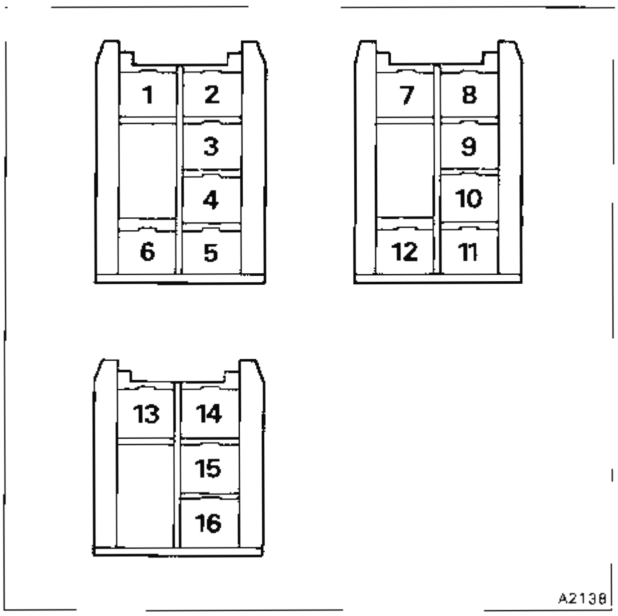


Fig. T6-6 Loom plug connections

1 Black/blue
2 Black/brown
3 Black/white
4 Black/yellow
5 Black/green
6 Black/red
7 Light green/green
8 Green/blue
9 White/brown
10 Brown/black
11 Black/slate
12 Blue/brown
13 Brown/slate
14 Black
15 White/yellow
16 White/red

Note Ensure the wormshaft can turn freely. Rotate the assembly until the slip ring open circuit sections are approximately at 90° to the wormshaft, and the flat side of the 'D' on the shaft is uppermost.

15. Fit the rubber gaiter to the outside of the casing and over the shaft. Then fit a bronze washer, connecting shaft, securing setscrew, and washer.

16. Fit the nylon coupling onto the driving dog of the wormshaft.

17. Seat the 'O' ring in its groove in the actuator casing and pass the motor feed wires through the hole in the casing. Mate the nylon coupling on the wormshaft with the motor shaft and hold the motor in position.

18. Fit the three mounting setscrews and washers and tighten evenly. Check that the wormshaft can be rotated easily.

19. Fit the sealing gasket and outlet elbow to the cable exit of the casing; secure with nuts and spring washers.

20. Feed the loom cables through the actuator casing from the inside. A strip of tape around the cable ends may assist in this operation. Pull the loom through until sufficient length of cable is left inside the casing to connect to the contact plate assembly.

21. Check the inside edges of the conduit elbow (tunnel connection) are free of burrs. Feed the loom through the conduit and elbow; push the conduit over the cable exit connection of the casing and the conduit elbow, secure both ends with clips. Remove the tape from the cable ends; connect the cables into the plugs (see fig. T6-6).

22. At the inside of the actuator casing fit a tie wrap to the loom at the cable exit. This should be passed through the centre of the loom and then wrapped around the loom 1½ times and fixed tightly. The position of the tie wrap must be such that when the actuator is suspended by the loom, the tie wrap takes the load and no electrical connections are under stress.

23. Connect the electrical connections to the relays on the underneath of the contact plate assembly. Fit a tie wrap around the cables and bracket to avoid a foul between the wires and motor shaft.

24. Loosely fit the contact plate assembly into the casing, taking care not to damage the relays. Guide the motor feed wires between the casing and the indentation in the contact plate tufnol base.

25. Fit the four nuts and washers, tightening them evenly.

26. View the layout of the contacts onto the slip ring through the elongated hole in the contact plate, and ensure that there is a minimum of 1,27 mm (0.050 in) between adjacent contacts. Also, ensure that there is approximately 1,58 mm (0.062 in) from either the edge of the segments or the countersinks for the retaining screws.

27. Fit the electrical connections, starting with the longest connections on the contact base, progressing to the shorter wires and then finally the micro-switches, suppressor, and motor terminations (see figs. T6-3 and T6-4).

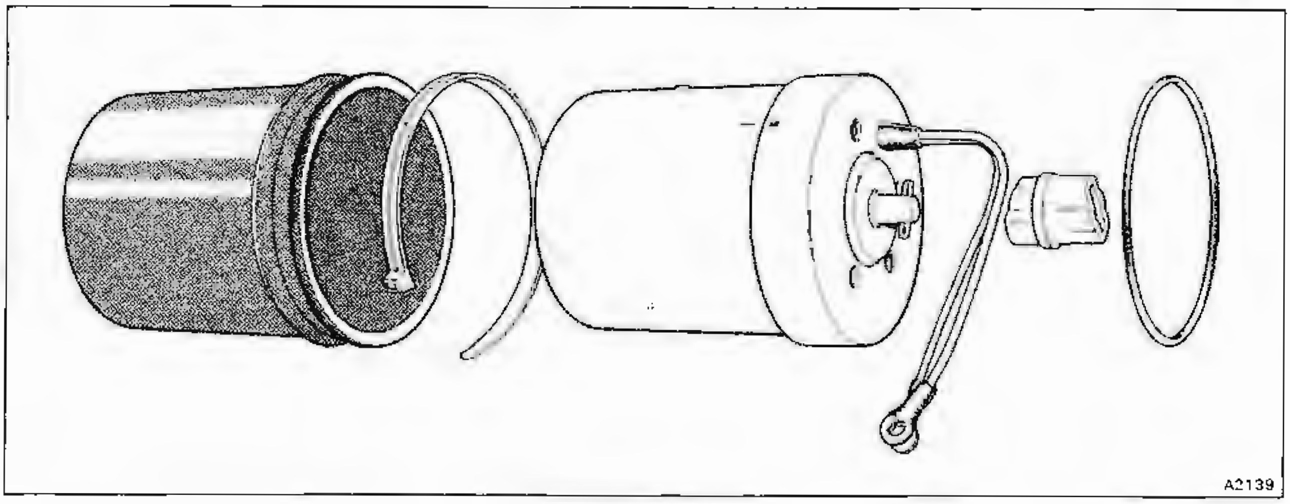


Fig. T6-7 Gearchange actuator motor

28. Fit the casing lid, with its gasket painted with Wellseal on both sides. Tighten down using nuts and spring washers.
29. Fit the rubber boot over the motor. A smear of grease inside the leading edge of the boot assists the fitting. Retain the boot onto the motor using a plastic clip, which, while needing reasonable tightening should not be allowed to cut into the rubber.

Gearchange actuator motor – To dismantle

1. Tap out the driving pin from the driving shaft (see fig. T6-7). Remove the rubber boot.
2. Unscrew and withdraw the two bolts securing the motor housing, remove the housing.
3. Remove the armature from the end plate.

Gearchange actuator motor – To inspect

1. Examine the magnets for any damage, cracks, or fractures.
2. Examine the brushes for wear; fit new brushes if necessary.
3. Examine the armature commutator for wear or damage; if scored polish with fine emery cloth. If the score marks are heavy and cannot be removed with light polishing, fit a new armature.
4. After polishing carefully clean the commutator slots to remove particles of carbon.
5. Examine the bearing bushes for wear, replace if necessary.
6. Examine the armature shaft for wear on the bearing diameter.

Gearchange actuator motor – To assemble

Assemble the actuator motor by reversing the procedure given for dismantling, ensuring the marks on the casing are in line (see fig. T6-7). Test the motor after assembly, if the current consumption exceeds 1.5 A, the armature has an electrical fault and should be renewed.

Gearchange electric actuator – To fit

1. Fit the actuator to the rear extension of the transmission.
2. Torque tighten the bolts.
3. Feed the plugs through the hole in the transmission tunnel. Secure the elbow to the tunnel ensuring that a new gasket is fitted. Clip the cables to the loom and connect the electrical plugs.
4. Connect and adjust the linkage, ensuring a new retaining ring is fitted.
5. Connect the battery.

Transmission – To remove and fit

Transmission - To remove

1. Drive the car onto a ramp.
2. Ensure that both front wheels and one rear road wheel are suitably chocked to prevent the car moving.
3. Switch on the ignition and select neutral position with the gearchange selector lever. This ensures that the transmission and propeller shaft are not locked in the park position.
4. Switch off the ignition and remove the gearchange fuse (fuse A6 on fuse panel F2) from the fuse board.
5. Disconnect the battery.
6. Jack up the un-chocked rear road wheel to enable the propeller shaft to be rotated.
7. Remove the centre body crossmember and disconnect the propeller shaft at the gearbox end.
8. Lower the rear road wheel and suitably chock.
9. Raise the bonnet.
10. Drain the transmission fluid (see Section T3).
11. Remove the dipstick and filler tube clip. Disconnect the vacuum modulator pipe.
12. Disconnect the speedometer electronic impulse transmitter electrical connections, noting the cable colours to assist when fitting. Slacken and remove the transmitter retaining nut and withdraw the transmitter.
13. Disconnect the detent solenoid electrical connection.
14. Disconnect the operating rod from the side of the transmission case.
15. Remove the bolts securing the gearchange actuator to the rear extension and remove the actuator.
16. Remove the front section of the exhaust system and catalytic converter. Also the grass-fire shields (if fitted).

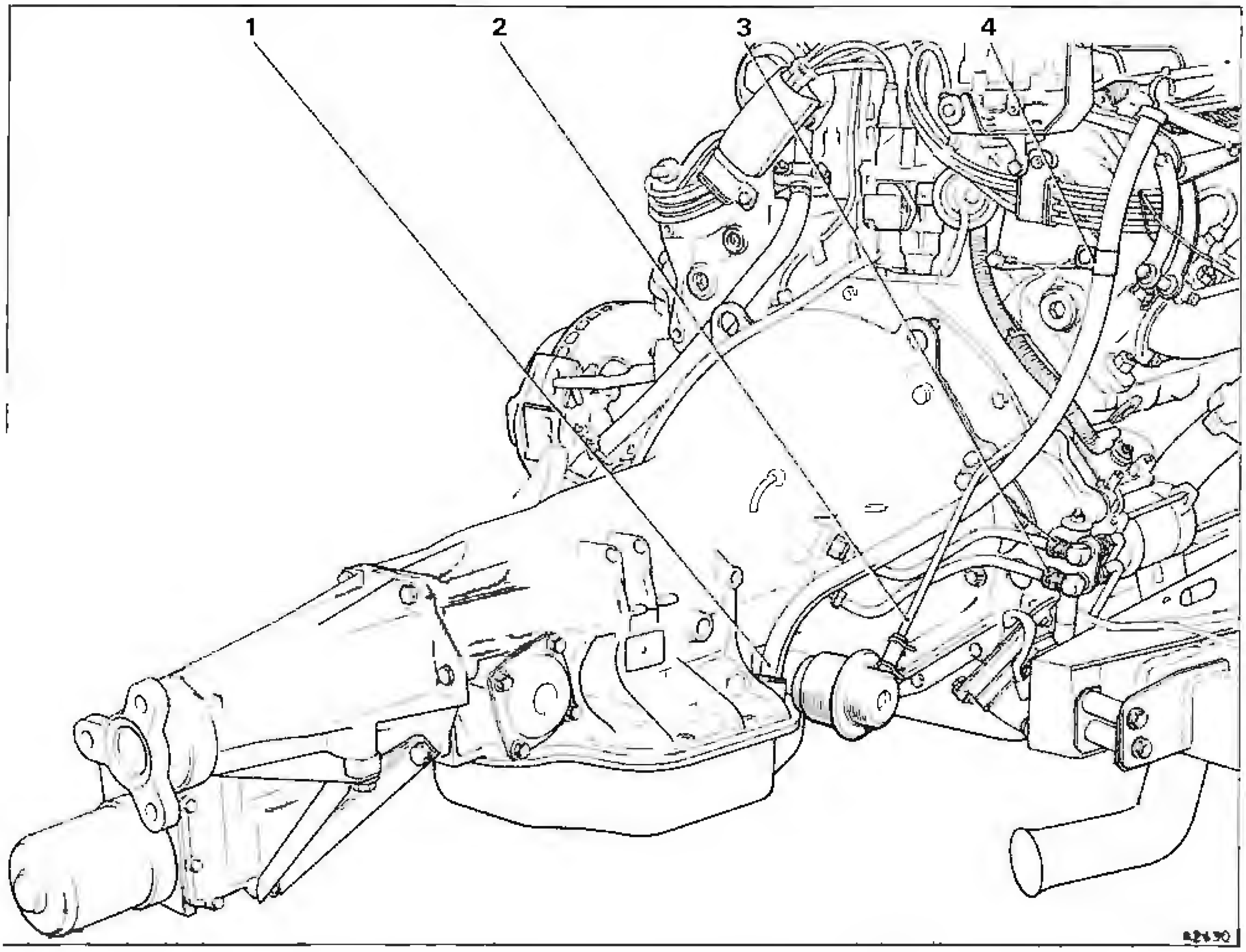


Fig. T7-1 Transmission disconnecting points – Right-hand side

1 Dipstick/filler tube
2 Modulator pipe
3 Transmission oil cooler pipe connections
4 Dipstick/filler tube clip

17. Remove the EGR feed pipe (if fitted).

18. On left-hand drive cars remove the throttle linkage cross-shaft.

19. Disconnect the two transmission fluid pipes from the rear engine mounting plate, leading to and from the heat exchanger situated in the engine coolant radiator.

Note There may be a small quantity of transmission fluid in the pipes which will drain out when the pipes are disconnected. Therefore, ensure a suitable container is available.

20. Remove the engine speed sensor (1989 model year Bentley Turbo R).

21. Remove the setscrews which secure the front cover plate and bell housing bottom cover. Remove the plate and cover.

22. Scribe correlation marks onto the converter and flexplate/four segment timing wheel (as applicable). Then, remove the setscrews which secure the engine flexplate/timing wheel to the converter.

Note Take care not to damage the flexplate/four segment timing wheel or starter ring when turning the torque converter to gain access to the setscrews.

23. Using a suitable platform to fit around the transmission sump, support the transmission with the aid of a trolley jack and extension.

24. Remove the setscrews which secure the transmission to the adapter.

25. Carefully move the transmission towards the rear of the car until the dowels in the transmission are clear of the mounting plate. Remove the dipstick/filler tube.

26. Fit the retaining clamp RH 7952 to prevent the converter from becoming disengaged from the transmission.

Note The retaining clamp must be used, otherwise the converter may fall as the transmission is being removed.

27. Lower the jack until the transmission is clear of the body. Then, remove the transmission from beneath the car.

28. If overhaul work is to be carried out, remove the retaining clamp and withdraw the converter.

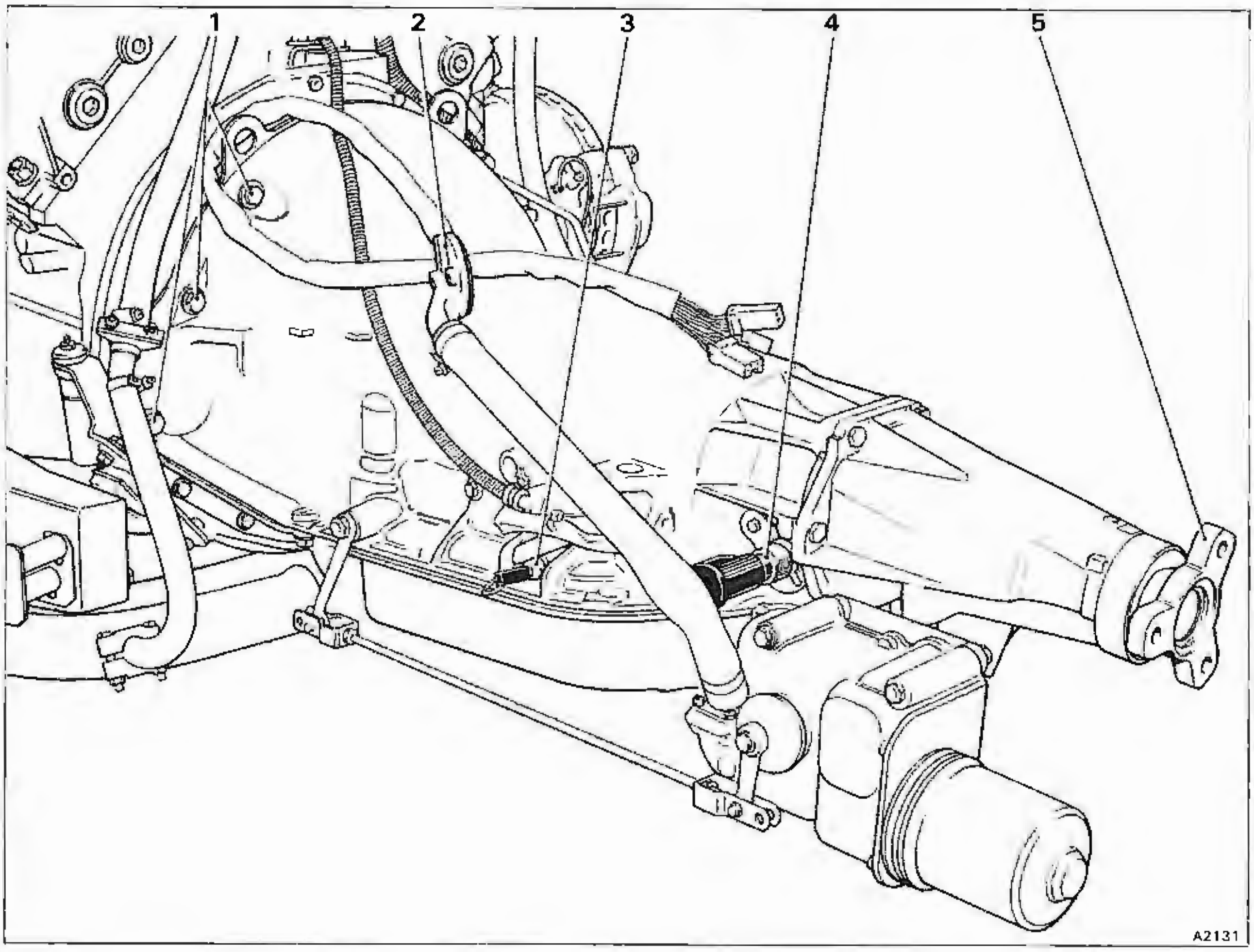


Fig. T7-2 Transmission disconnecting points – Left-hand side

1 Transmission securing setscrews
2 Gearchange actuator connections
3 Detent solenoid connection
4 Electronic impulse transmitter
5 Coupling flange

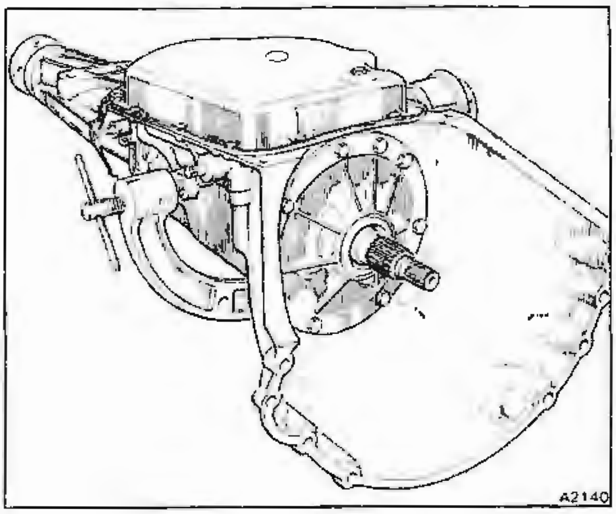


Fig. T7-3 Transmission in holding fixture

Note A converter containing oil weighs approximately 23 kg (50 lb).

29. Fit the transmission into the holding fixture RH 7955 as shown in figure T7-3.

Transmission - To fit

Fit the transmission by reversing the procedure given for removal, noting the following.

1. Ensure the mating faces of the transmission and the mounting plate are clean and free from damage.
2. Torque tighten the various nuts, bolts, and setscrews to the figures quoted in Section T23 and Chapter P.
3. A liberal coating of Retinax A grease should be applied all over the converter pilot spigot prior to fitting the converter.
4. Rotate the converter until the correlation marks (scribed during removal) are aligned. Then, fit the setscrews. **Do not** lever on the starter ring when rotating the converter.
5. If a new transmission is being fitted, the heavy spot marked on the rear face of the flexplate/four segment timing wheel by a radial line of either white or yellow paint, must be positioned as close as possible to the light spot (white letter L) on the converter.
6. After completion of the fitting operation, fill the transmission with fluid (see Section T3).
7. Finally, road test the car for satisfactory operation.

Torque converter

The torque converter serves two primary functions. It acts as a fluid coupling to transmit engine torque smoothly to the transmission. It also multiples the engine torque when additional performance is required.

The torque converter comprises three basic elements; a pump, a turbine, and a stator (see fig. T8-1).

The converter cover is welded to the pump to seal all three members in an oil filled housing.

On turbocharged cars, the vanes are welded to the outer casing and the converter to flexplate securing lugs are more positively secured for added strength.

An engine driven flexplate/four segment timing wheel bolts directly onto the converter cover in six places. Therefore, the converter pump is mechanically connected to the engine and turns whenever the engine rotates.

When the engine is running and the converter pump is rotating, oil is picked up at the centre of the pump and discharged at the rim, between the pump blades.

The pump shell and blades are designed so that the oil leaves the pump rotating clockwise, towards the turbine blades. As the oil strikes the turbine blades, it causes the turbine to rotate.

When the engine is idling, the converter pump rotates slowly and the force of oil is not sufficient to rotate the turbine with any efficiency. This situation enables the car to stand in gear with the engine idling. As the engine throttle is opened, the pump speed increases and the force of oil striking the turbine causes it to transmit torque to the gear train. After the oil has imparted its forca to the turbine, the oil follows the contour of the turbine shell and blades, leaving the centre of the turbine, rotating anti-clockwise.

Because the turbine member has absorbed the force required to reverse the direction of the clockwisa rotating oil it now has greater torque than is being delivered by the angine.

To prevent the anti-clockwise spinning oil from striking the pump blades at an angle that would hinder its rotation, a stator assembly is interposed between the pump and the turbine. The purpose of the stator is to redirect the oil returning from the turbine so that its direction is altered to suit that of the pump.

The energy of the oil is then used to assist the engine in turning the pump. This increases the force of the oil driving the turbine and as a result, multiplies the torque.

The force of the oil flowing from the turbine to the stator blades tends to rotate the stator anti-clockwise. However, a clutch on which the stator is mounted, prevents this.

As both turbine and car speeds increase, the direction of the oil leaving the turbine changes. The oil flows clockwise against the rear side of the stator vanes. If the stator was fixed, the flow of the oil would be impeded, but the clutch allows the stator to rotate on its shaft. Once the stator becomes inactive there is no further torque multiplication and the converter functions as a fluid coupling at a ratio of 1:1.

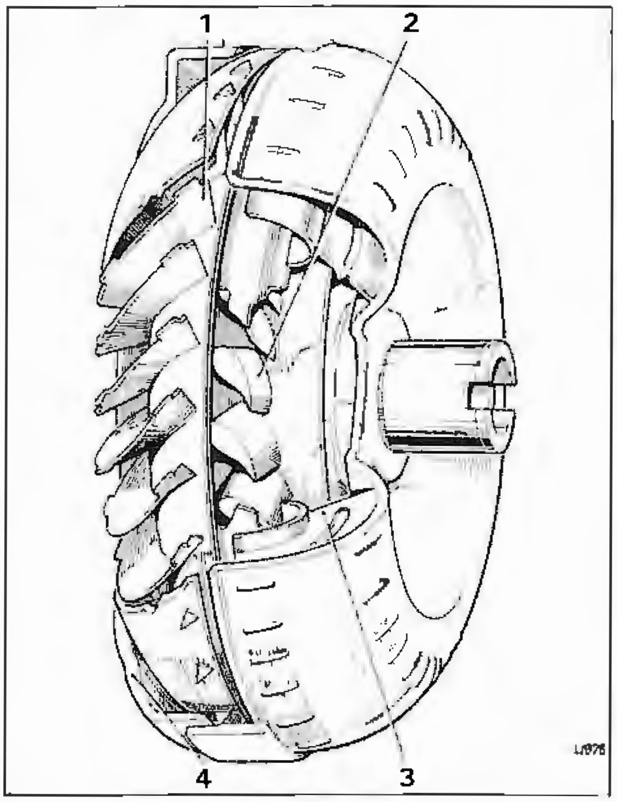


Fig. T8-1 Torque converter
1 Turbine
2 Stator
3 Pump
4 Converter cover

Torque converter – To remove

1. Remove the transmission as described in Section T7.

Note Ensure that the converter holding clamp RH 7952 is fitted otherwise the converter may fall when the transmission is removed.

2. Position a drip tray underneath the converter.
3. Remove the converter retaining clamp from the bell housing end of the transmission casing; remove the converter.

Caution The converter and oil weigh approximately 23 kg (50 lb). Therefore, care should be taken when removing the converter to ensure that it is not dropped or damaged.

Torque converter – To inspect

After removing the torque converter from the transmission visually inspect as follows.

1. Examine the converter for signs of damage.
2. Examine the neck of the converter for wear.
3. Examine the pump drive slots for wear.

For a more detailed procedure of inspection refer to Section T22 – Fault diagnosis.

Torque converter – To fit

1. Fit the converter to the transmission, ensuring that the driving slots engage with the tangs in the transmission oil pump.
2. Fit the converter holding clamp RH 7952.

Vacuum modulator and valve

The vacuum modulator is secured to the right-hand side of the transmission case and is connected by a pipe to the engine induction system. The modulator consists of a metal case which encloses an evacuated metal bellows, a diaphragm, and two springs. These components are arranged so that when fitted, the bellows and an external spring apply a force that acts on the modulator valve to increase modulator pressure. Engine vacuum and an internal spring act in the opposite direction to decrease modulator pressure.

To reduce the effect of altitude on shift points, the effective area of the diaphragm is different than that of the bellows. Atmospheric pressure acts on the resulting differential area to reduce modulator pressure.

The vacuum modulator fitted to a transmission can vary dependent upon 'model year' and original build specification of the car. It is therefore, of utmost importance to ensure that the correct parts are fitted to a transmission should replacement parts be required.

To identify the modulator check the prefix letters of the tranmsission i.e. RHA, RKA, RMAB, and RNAB (blue modulator); RDA, RJA, RLA, RMA, and RNA (brown modulator).

On naturally aspirated cars only, a restrictor is fitted at the bottom of the modulator pipe and an error in assembly at this point could result in a blocked signal line. Especially, on cars fitted with emission control systems.

On turbocharged cars, a 'T' piece and a one-way valve are used in the vacuum modulator line to prevent pressure build-up. With normal vacuum the system works as other modulator systems, but when pressure builds-up, the one-way valve opens and allows pressure relief into the compressor side of the turbocharger.

Modulator pressure is directed to the 1-2 regulator valve which reduces it proportionally. This tends to hold the 1-2 shift valve in the closed or down-change position. Modulator pressure is directed also to the 2-3 modulator valve to apply a variable pressure proportional to modulator pressure. This tends to hold the 2-3 shift valve in the closed, or down-change position. As a result, the gearchange points can be delayed to take place at higher road speeds with heavy throttle application.

Main line oil pressure is controlled in drive range so that it will vary with torque input to the transmission. Since torque input is a product of engine torque and converter ratio, modulator pressure is directed to a pressure regulator boost valve, to adjust main line (pump) pressure for changes in either engine torque or converter ratio.

To regulate modulator pressure (and in turn line pressure), with the torque converter ratio (which decreases as car speed increases), governor pressure is directed to the modulator valve to reduce modulator pressure with increases in car speed. In this way, line pressure is regulated to vary with torque input to the transmission for smooth changes with sufficient capacity for both heavy and light acceleration.

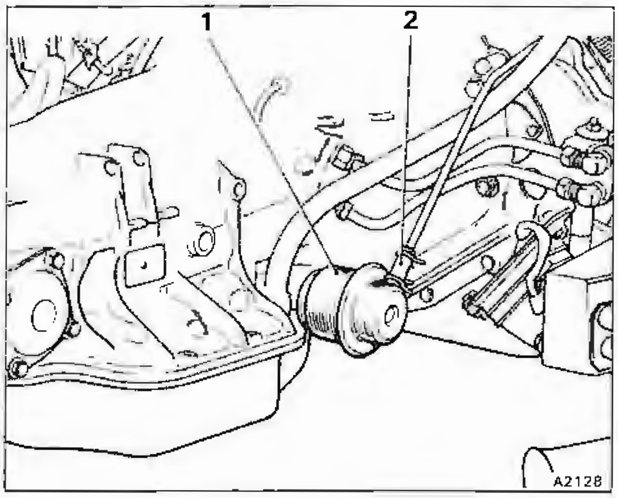


Fig. T9-1 Vacuum modulator and vacuum pipe
1 Vacuum modulator
2 Vacuum pipe

Vacuum modulator and valve – To remove

The vacuum modulator can be removed from the transmission without removing the transmission from the car. The following instructions apply whether or not the transmission has been removed.

1. Place a drip tray beneath the vacuum modulator.
2. Disconnect the vacuum pipe at the modulator end if the transmission is in the car (see fig. T9-1).
3. Remove the setscrew and retainer which secure the modulator to the transmission.
4. Remove the modulator and 'O' ring; discard the 'O' ring.
5. Remove the modulator valve from the transmission case.

Vacuum modulator and valve – To inspect

1. Examine the vacuum modulator for signs of distortion.
2. Examine the 'O' ring seat for damage.
3. Apply suction to the vacuum tube on the modulator and check for leakage.
4. Examine the modulator valve for scores or damage.
5. Ensure that the valve will move freely in the case bore.

6. Examine the modulator for damaged bellows. The modulator plunger is under approximately 71 N (16 lbf) pressure. If the bellows are damaged, very little pressure will be applied to the plunger.

Vacuum modulator and valve – To fit

1. Fit the valve into the bore in the case with the stem outward.
2. Fit a new 'O' ring to the modulator.
3. Fit the modulator to the case with the vacuum pipe connection toward the front of the car.
4. Fit the retainer together with the retaining setscrew and torque tighten (see Section T23).
5. Connect the vacuum pipe, ensuring that the restrictor is fitted.

Governor assembly

The governor assembly (see fig. T10-1) fits into the rear of the transmission casing on the right-hand side. The car speed signal for the gear changes is supplied by the governor, which is driven by a gear on the transmission output shaft.

The assembly comprises a regulating valve, two primary weights, two secondary weights, secondary springs, body, and driven gear. The weights are arranged so that only the secondary weights act on the valve. The primary weights contribute to the secondary weights through the secondary springs.

On turbocharged cars, the governor springs and weights are uprated, and therefore should not be interchanged with any other transmissions.

Slight changes in output shaft rev/min at low speeds result in small governor pressure changes.

The primary weights add additional force to the secondary weights to obtain greater changes in pressure as road speed and output shaft rev/min increase. As the primary weights move out at higher car speeds they reach a stop and no longer become effective. From this point, the secondary weights and springs only are used to apply pressure on the governor valve.

Drive oil pressure is fed to the governor where it is regulated by the governor and gives an oil pressure that is proportional to the road speed of the car.

To initiate the gear change from first to second, governor oil pressure is directed to the end of the 1-2 shift valve. It then acts against spring pressure which is holding the valve in the down-change (closed) position.

As the road speed of the car and subsequently the governor oil pressure increases sufficiently to overcome the spring resistance, the 1-2 shift valve train moves, allowing drive oil to flow into the intermediate clutch passage and through an orifice to apply the intermediate clutch. This makes the intermediate clutch effective which moves the transmission into second gear. Further increases in road speed and governor pressure will cause the transmission to change into third gear when governor pressure overcomes the 2-3 shift valve spring pressure.

Governor pressure is directed also to the modulator valve to regulate modulator pressure as described in Section T9.

Governor lubrication is provided by a flat in the governor sleeve which allows oil to pass to the moving parts of the governor.

Governor assembly – To remove

The governor assembly can be removed from the transmission whether the transmission is fitted to the car or not.

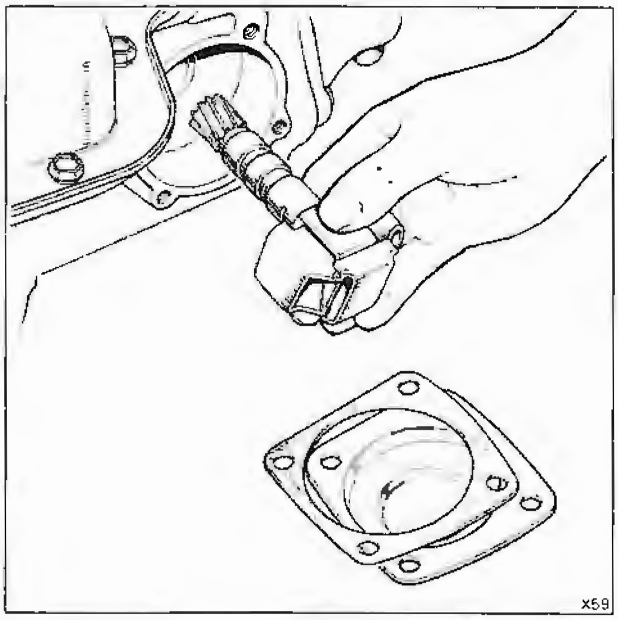


Fig. T10-1 Removing the governor assembly

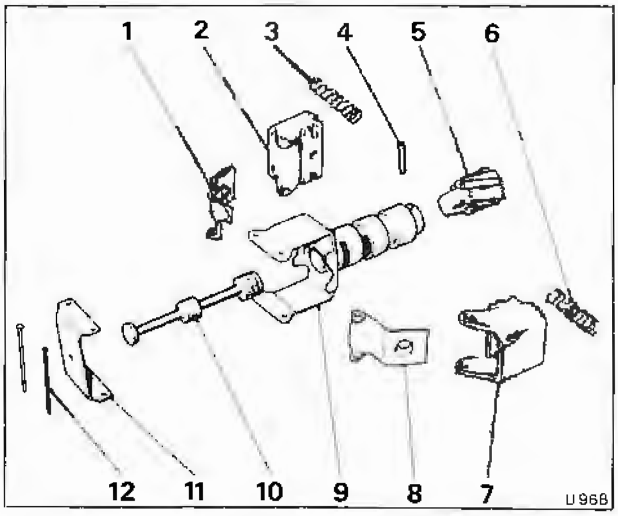


Fig. T10-2 Governor assembly – exploded

1 Spring retainer (secondary weight)
2 Weight (primary)
3 Spring
4 Gear retaining pin
5 Driven gear
6 Spring
7 Weight (primary)
8 Spring retainer (secondary weight)
9 Sleeve and carrier assembly
10 Valve
11 Thrust cap
12 Retaining pins

1. Position a drip tray beneath the governor cover plate.
2. Remove the four setscrews which secure the plate to the case; remove the plate and discard the gasket.
3. Withdraw the governor assembly from the case (see fig. T10-1).

Possible causes of governor binding or locking are the pipes to the control valve unit. These may have been fitted too deep into the transmission case, so entering the governor bore.

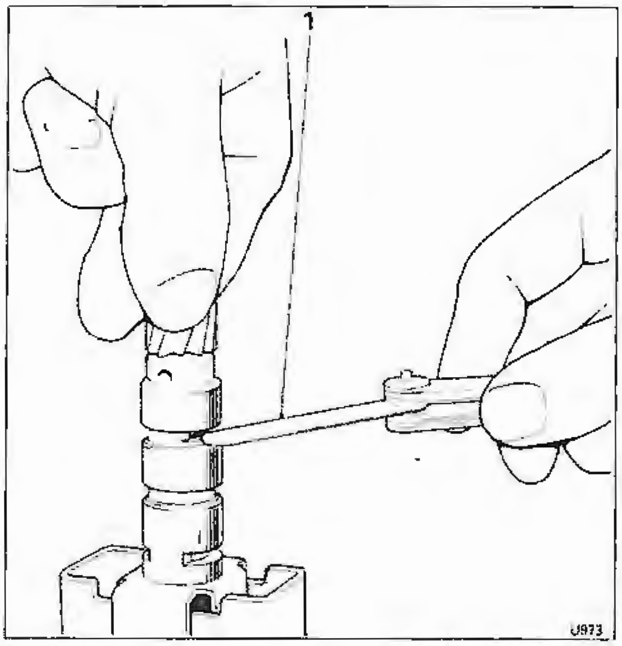


Fig. T10-3 Check valve opening (inlet)
1 0,51 mm (0.020 in) feeler gauge

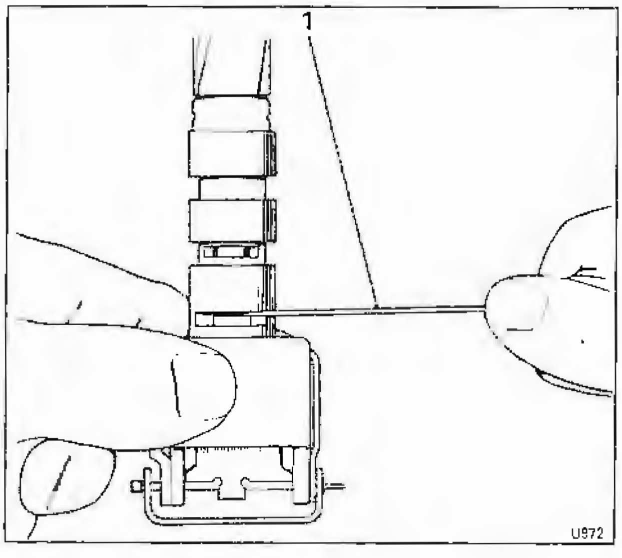


Fig. T10-4 Check valve opening (exhaust)
1 0,51 mm (0.020 in) feeler gauge

Therefore, if difficulties are experienced when removing the governor assembly, withdraw the pipes approximately 3,17 mm (0.125 in).

Governor assembly – To dismantle
All the governor assembly components, with the exception of the driven gear, are selectively assembled and each assembly is calibrated. Therefore, it is recommended that if the governor assembly becomes unserviceable, it can be renewed as an assembly. If the driven gear is damaged, it can be renewed separately.

It is necessary to dismantle the governor assembly in order to renew the driven gear. Dismantling may be necessary also to thoroughly clean the governor should dirt cause it to malfunction. In such cases proceed as follows.
1. Cut off one end from each of the governor weight retaining pins.
2. Remove the pins, thrust cap, governor weights, and springs (see fig. T10-2). The weights are interchangeable and need not be marked for identification.
3. Carefully remove the governor valve from the sleeve.

Governor assembly – To inspect
1. Wash all the components in clean paraffin, then dry them with compressed air.
2. Examine the governor sleeve for scores or burrs.
3. Ensure that the governor sleeve will slide freely into its bore in the transmission casing.
4. Examine the valve for scores and burrs.
5. Ensure that the valve will slide freely in the governor sleeve bore.
6. Examine the driven gear for damage. Ensure that the gear is secure on the shaft.
7. Examine the springs for damage or distortion.
8. Ensure that the weights operate freely in their retainers.
9. Hold the governor as shown in figures T10-3 and T10-4. Then, check that there is a minimum of 0,51 mm (0.020 in) at the inlet and exhaust openings.

Governor driven gear – To renew
1. Drive out the gear retaining pin as shown in figure T10-5.
2. Support the governor sleeve on two 2,77 mm (0.109 in) thick plates inserted in the exhaust slots in the sleeve.
3. Position the plates on the bed of a press with provision for the gear to pass through. Then, using a long drift, press the gear out of the sleeve.
4. Thoroughly clean the governor sleeve to remove any swarf which may be present from the original gear assembly operation.

Note Ensure that the new gear is the correct one for the transmission casing in which it is to be fitted.

5. Support the governor sleeve on the two 2,77 mm (0.109 in) plates.

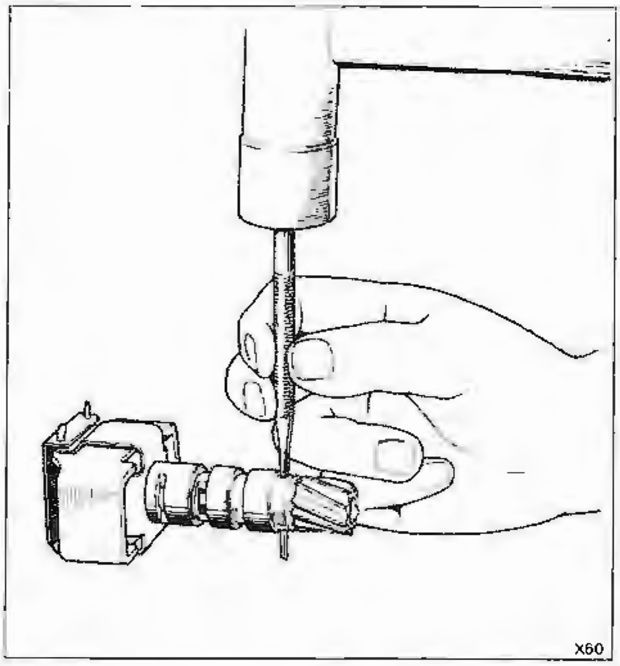


Fig. T10-5 Removing governor driven gear retaining pin

6. Position the new gear in the sleeve. Then, using a suitable drift, press the gear into the sleeve until it is nearly seated.
7. Carefully remove any swarf which may have shaved off the gear hub. Then, press the gear down until it abuts the sleeve.
8. Mark the position of a new hole on the sleeve at 90° to the original hole, then using a drill of 3,17 mm (0.125 in) diameter, drill a new hole through the sleeve and gear.
9. Fit the gear retaining pin.
10. Thoroughly wash the gear and sleeve assembly in clean paraffin and dry with compressed air.

Governor assembly – To assemble

1. Lightly oil the valve then fit it into the governor sleeve.
2. Fit the governor weights, springs, and thrust cap onto the governor sleeve.
3. Align the pin holes in the thrust cap, governor weight assemblies, and governor sleeve.
4. Fit new pins and crimp both ends of the pins.
5. Ensure that the governor weights are free to operate on the pins and check that the valve moves freely in the sleeve bore.

Governor assembly – To fit

Ensure that the oil feed hole to the rear extension bush is not obstructed.

1. Lightly lubricate the governor sleeve and gear. Fit the governor assembly into the transmission case.
2. Fit the cover, together with a new gasket.
3. Fit the four setscrews and torque tighten (see Section T23).
4. When installing the governor assembly ensure that a clearance of approximately 6,35 mm (0.250 in) is maintained between the governor pipes and transmission case, at a point 25,40 mm (1 in) from the right-angle bend of the pipes.

Speedometer drive

The speedometer drive is secured to the left-hand side of the tranmission casing by a setscrew and retainer. It is driven by a gear on the transmission output shaft at a ratio of 38:19. The driven gear has 38 teeth and is colour coded blue for identification purposes.

On turbocharged cars prior to 1989 model year, the drive ratio changes to either 35:21 or 36:21 to suit the 18/41 axle ratio and the type of tyres fitted. If Avon tyres are fitted, the driven gear has 35 teeth and is colour coded pink. If Pirelli tyres are fitted, the driven gear has 36 teeth and is colour coded white.

On 1989 model year turbocharged cars, the axle ratio is either 18/41 (non-catalyst exhaust system) or 16/43 (catalyst exhaust system). Avon tyres are the standard fitment, therefore, on non-catalyst cars the driven gear has 35 teath (35:21 ratio) and is colour coded pink. On catalyst cars, the driven gear has 41 teeth (41:21 ratio) and is colour coded yellow.

Speedometer drive - To remove

1. Slacken and withdraw the hexagon nut securing the electronic impulse transmitter to the speedometer drive assembly.
2. Remove the setscrew and retainer; then withdraw the speedometer drive. Discard the 'O' ring.

Speedometer drive - To dismantle

1. Withdraw the driven gear.
2. Remove the circlip from within the housing.
3. Tap out the oil seal from the housing. Discard the oil seal.

Speedometer drive - To assemble

To assemble the speedometer drive, reverse the procedure given for dismantling noting the following.

1. The housing and driven gear are clean and free from any defects.

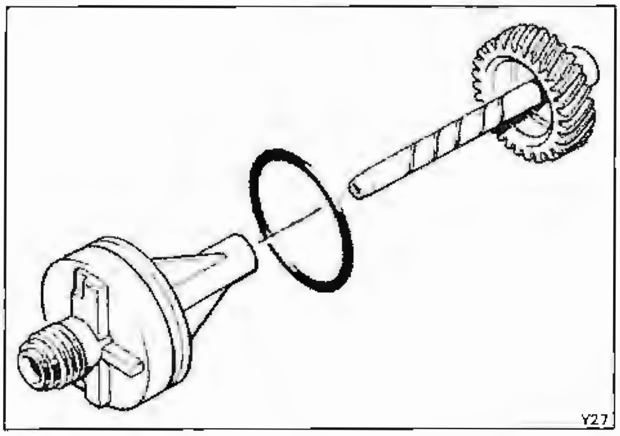


Fig. T11-1 **Speedometer drive**

2. Lightly lubricate the gear shaft before passing it through the oil seal.

Speedometer drive - To fit

1. Fit a new 'O' ring to the groove in the speedometer drive housing.
2. Lightly lubricate the 'O' ring to ease the fitting of the speedometer drive; fit the drive to the case.
3. Fit the retainer and setscrew. Torque tighten the setscrew to the figures quoted in Section T23.
4. Connect the electronic impulse transmitter.

Sump and intake strainer

Sump – To remove
Transmission fitted in the car
1. Position the car on a ramp and raise to a suitable working height.
2. Place a clean container having a minimum capacity of 3 litres (5 Imp pt, 6 US pt) beneath the drain plug.
3. Remove the drain plug and allow the oil to drain from the sump.
4. Remove the setscrews securing the sump and lower the sump. Discard the gasket.
5. Clean the sump with paraffin and dry with compressed air.

Transmission removed from the car
1. Position the transmission in the holding fixture RH 7955 with the sump upwards.
2. Carry out Operations 4 and 5 as described with the transmission fitted in the car.

Sump – To fit
To fit the sump reverse the procedure given for removal noting the following.
1. Ensure a new gasket is fitted.
2. Torque tighten the setscrews to between 8 Nm and 14 Nm (0,9 kgf m and 1,4 kgf m; 6 lbf ft and 10 lbf ft).
3. When filling the transmission with fluid refer to Section T3.

Note The amount of fluid added depends on whether the intake strainer has been removed.

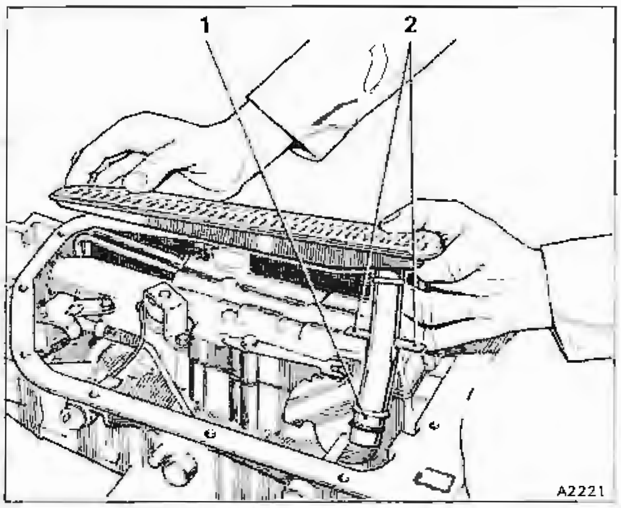


Fig. T12-1 Removing intake pipe and strainer assembly
1 Intake pipe with 'O' ring
2 Location tabs

Intake strainer – To remove
1. Remove the sump.
2. Remove the setscrew securing the intake strainer to the valve body assembly.
3. Remove the intake strainer assembly (see fig. T12-1).
4. Remove the intake pipe from the strainer and discard the strainer and 'O' ring.

Intake strainer – To fit
1. Fit a new 'O' ring to the intake pipe and lubricate the 'O' ring with clean transmission fluid.
2. Ensure that a new rubber seal is fitted to the pipe bore in the new intake strainer. Then, fit the intake pipe into the strainer.
3. Fit the intake strainer assembly to the transmission and torque tighten the setscrew to 14 Nm (1,4 kgf m; 10 lbf ft).
4. Fit the sump and fill with fluid. When filling the transmission with fluid refer to Section T3.

Control valve unit

The control valve unit comprises a cast iron body containing shift valves and regulator valves that control the gear changes. The unit is secured to an oil spacer (guide) plate on the bottom face of the transmission.

Control valve unit – To remove
Before removing the control valve unit from a transmission installed in a vehicle, **take extreme care,** as the front servo piston and related parts may fall from the transmission due to the normal freeness of the Teflon oil sealing rings.

The control valve unit may be removed with the transmission in the car. The oil must be drained and the sump removed to gain access to the control valve unit.

1. Unscrew the setscrew which secures the detent spring and roller assembly. Remove the spring and roller assembly.
2. Remove the setscrews that secure the control valve unit to the transmission case.

Do not remove the solenoid securing screws, as the solenoid holds the spacer (guide) plate and gasket in position, therefore, keeping the check balls in their correct positions.

3. Remove the control valve unit, together with the two governor pipes (see fig. T13-1).

Caution Ensure that the manual valve does not slide out of its bore. Take care to retain the front servo piston, should it come out with the control valve assembly.

Remove the governor screen assembly from the end of the governor feed pipe or governor feed pipe hole.

4. Withdraw the governor pipes from the control valve assembly; the pipes are interchangeable and need not be marked for identification.

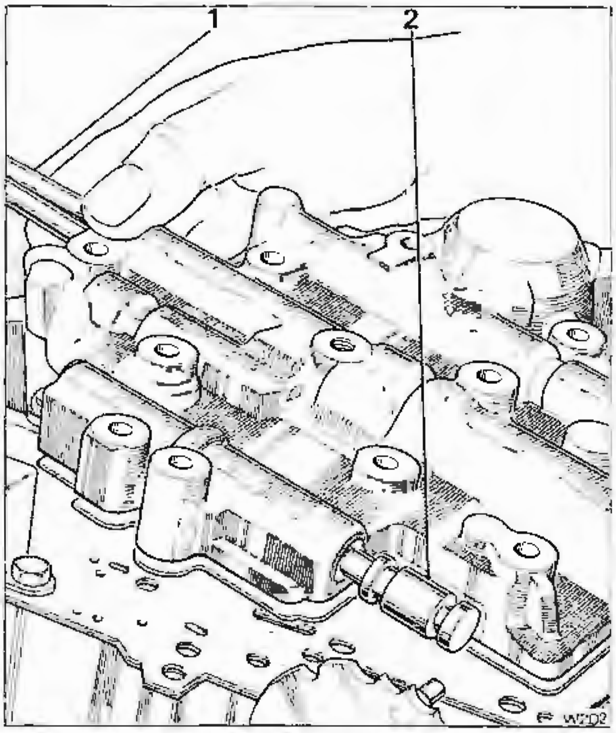


Fig. T13-1 Removing the control valve unit
1 Governor pipes
2 Manual valve

Control valve unit – To dismantle
1. Hold the control valve unit with the cored passages uppermost and the accumulator piston bore to the front, as shown in figure T13-2.
2. Remove the manual valve from its bore.
3. Fit the control valve accumulator installing tool J-21885 onto the accumulator piston.
4. Compress the accumulator piston and remove the 'E' ring retainer.
5. Remove the accumulator control valve and spring.
6. Remove the retaining pin, 1-2 sleeve, regulator valve, and spring from the upper right-hand bore.
7. Remove the 1-2 detent valve and the 1-2 valve.
8. Remove the retaining pin, 2-3 valve spring, 2-3 sleeve, 2-3 modulator valve, and the 3-2 intermediate spring from the middle right-hand bore.
9. Remove the 2-3 shift valve.
10. Remove the retaining pin, bore plug, and the 2-3 spring together with the spacer. Also remove the 3-2 valve from the lower bore.
11. Remove the retaining pin and bore plug from the upper left-hand bore, adjacent to the manual valve bore.
12. Remove the detent valve, detent regulator valve, spring, and spacer.
13. Ensure that the 1-2 accumulator valve in the remaining bore is free, by moving the valve against the spring.
14. Remove the 1-2 accumulator valve retaining pin from the machined surface of the valve body; remove the plug.
15. **RDA, RHA, RJA, RKA, and RLA transmissions**
Remove the 1-2 accumulator secondary spring and 1-2 valve. Then, remove the 1-2 accumulator sleeve, 1-2 primary valve, and spring.
RMA, RMAB, RNA, and RNAB transmissions
Remove the 1-2 accumulator valve and spring.

Control valve unit – To inspect
1. Wash the control valve unit body, valves, and the remainder of the parts in Genklene. **Do not allow the**

valves to knock together as this may cause burrs, or damage to the shoulders of the valves.

2. Examine all valves and sleeves to ensure that they are free from dirt. Any burrs should be carefully removed with a fine stone, or fine emery paper slightly moistened with oil. Do not round-off the shoulders of the valves.
3. When satisfactory, wash the parts and lightly smear all valves and sleeves with clean transmission fluid.
4. All valves and sleeves should be tested in their individual bores to ensure that free movement is obtainable.
5. The valves should fall under their own weight, with perhaps a slight tapping of the valve body to assist them. During these checks, ensure that the valves and valve bores are not damaged.
6. The manual valve is the only valve that can be renewed separately. If other valves are damaged or defective, a new control valve unit must be fitted.
7. Examine the valve body for cracks or scored bores.
8. Ensure that the cored face is free from damage.
9. Examine all springs for collapsed or distorted coils.

Control valve unit – To assemble

Before commencing assembly, ensure that all springs can be positively identified. If the springs are assembled incorrectly the transmission will not function correctly.
During assembly reference should be made to figure T13-2

Note The control valve units of RHA, RJA, RNA, and RNAB transmissions are not interchangeable.

1. Lightly lubricate all parts with clean transmission fluid before assembly.
2. Fit the front accumulator spring and piston into the valve body.
3. Fit the valve body accumulator installing tool J-21885. Align the piston and spring with the bore then compress the spring and piston (see fig. T13-3).
4. Secure the piston with the 'E' ring retainer.
5. **RDA, RHA, RJA, RKA, and RLA transmissions**

a. Fit the 1-2 primary spring into the primary 1-2 accumulator valve.
b. Fit the spring and valve (items 20 and 21) into the lower left-hand bore. Use a retaining pin to hold the valve in its position.
c. Fit the 1-2 accumulator secondary valve and spring into the 1-2 accumulator sleeve. Fit the sleeve into its bore.
d. Fit the bore plug and retaining pin.

5. **RMA, RMAB, RNA, and RNAB transmissions**

a. Fit the 1-2 accumulator primary spring (item 30) and 1-2 accumulator valve.
b. Fit the bore plug and retaining pin.

6. Fit the detent spring and spacer into the top left-hand bore.
7. Compress the spring and hold it with a small screwdriver.
8. Fit the detent regulator valve, wide land first.
9. Fit the detent valve, small land first.
10. Fit the bore plug with the hole facing outwards.

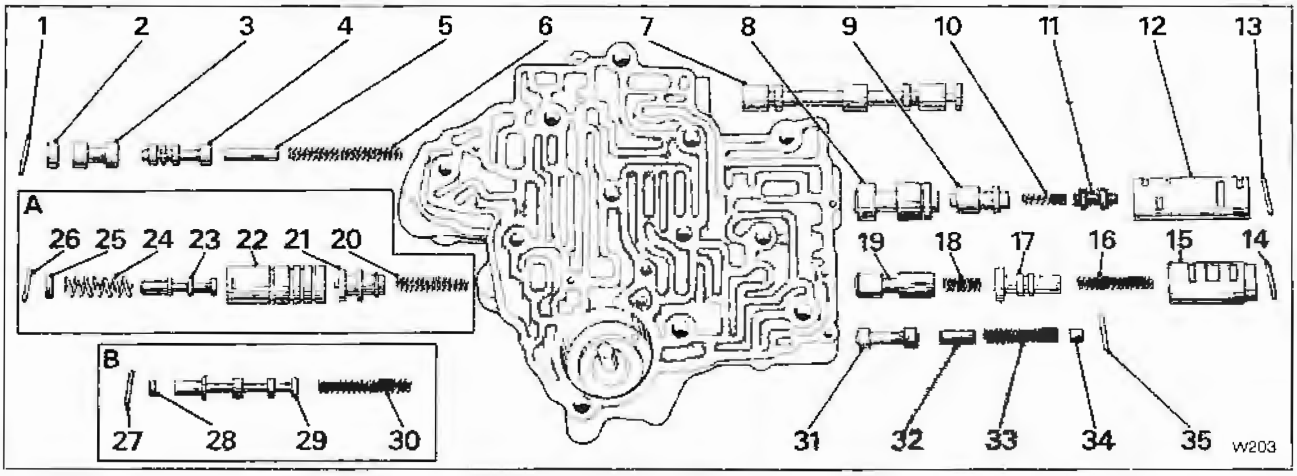


Fig. T13-2 Control valve unit

1	Retaining pin	14	Retaining pin	27	Retaining pin
2	Bore plug	15	2-3 sleeve	28	Bore plug
3	Detent valve	16	2-3 valve spring	29	1-2 accumulator valve
4	Detent regulator valve	17	2-3 modulator valve	30	1-2 accumulator primary spring
5	Spacer	18	3-2 intermediate spring	31	3-2 valve
6	Detent spring	19	2-3 valve	32	Spacer
7	Manual valve	20	1-2 accumulator primary spring	33	3-2 spring
8	1-2 valve	21	1-2 accumulator primary valve	34	Bore plug
9	1-2 detent valve	22	1-2 accumulator sleeve	35	Retaining pin
10	1-2 regulator spring	23	1-2 accumulator secondary valve	A	RDA, RHA, RJA, RKA, and RLA transmissions
11	1-2 regulator valve	24	1-2 accumulator secondary spring	B	RMA, RMAB, RNA, and RNAB transmissions
12	1-2 sleeve	25	Bore plug		
13	Retaining pin	26	Retaining pin		

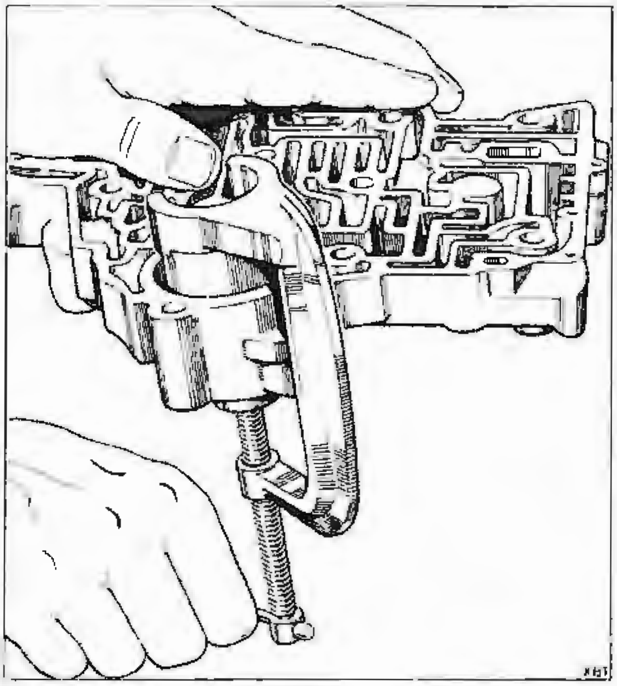


Fig. T13-3 **Fitting the front accumulator piston and spring**

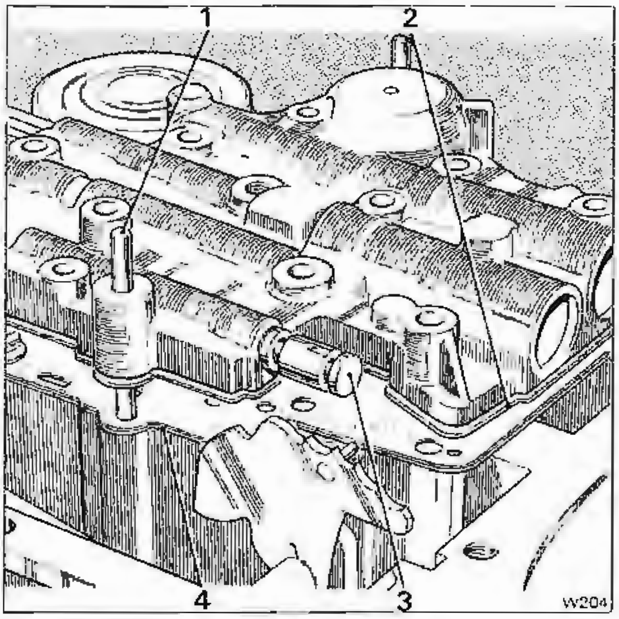


Fig. T13-4 **Fitting the control valve unit**

1 Guide pin
2 Control valve gasket
3 Manual valve
4 Spacer (guide) plate gasket

and fit the retaining pin. Remove the screwdriver.

11. Fit the 3-2 valve (item 31) into the lower right-hand bore.

12. Fit the spacer, the 3-2 spring, and bore plug with the hole facing outwards; secure with the retaining pin.

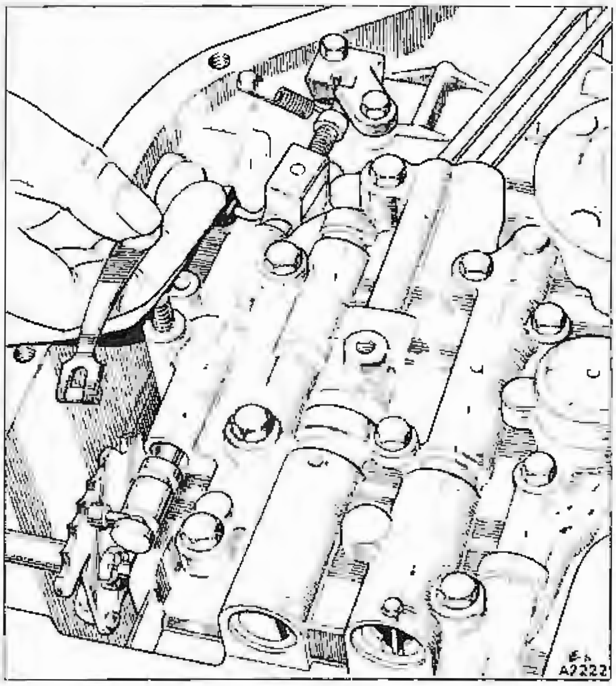


Fig. T13-5 **Fitting the detent spring and roller**

13. Fit the 2-3 shift valve (item 19) with the open end outwards, in the second right-hand bore from the bottom.

14. Fit the 3-2 intermediate spring (item 18).

15. Fit the 2-3 modulator valve into the sleeve, then fit both parts into the valve bore.

16. Fit the 2-3 valve spring and the retaining pin.

17. Fit the 1-2 shift valve (item 8), stem end out, into the third right-hand bore from the bottom.

18. Fit the 1-2 regulator valve, larger stem first, spring, and detent valve into the sleeve. Align the spring in the bore of the detent valve. Fit the parts into the valve bore.

19. Push the sleeve inwards against spring pressure and fit the retaining pin.

20. Fit the manual valve (item 7) with the detent pin groove to the right-hand side.

Control valve unit – To fit

1. Fit the governor pipes to the control valve unit.

Note Fit the governor screen assembly, **open end first** into the governor feed pipe hole (hole nearest the centre of transmission).

2. Fit the front servo piston (if removad) ensuring it is correctly aligned in the bore.

3. Using two guide pins screwed into the casing, fit the control valve unit into position (see fig. T13-4), with a new valve body/spacer plate gasket.

4. Ensure that the gasket and oil spacer (guide) plate are correctly positioned.

Note It is important that only a gasket which is a genuine service part be used.

5. Ensure that the governor pipes are correctly aligned and the feed pipe fits over the governor screen.

6. When installing the governor assembly ensure that a clearance of approximately 6,40 mm (0.250 in) is maintained between the governor pipes and transmission case, at a point 25mm (1 in) from the right-angle bend of the pipes.

Ensure that the manual valve is correctly located by the pin on the detent lever.

7. Remove the guide pins and fit the control valve unit securing setscrews; do not fit the detent spring and roller securing screw.

8. Torque tighten the securing screws (see Section T23).

9. Fit the detent spring and roller assembly (see fig. T13-5). Fit the securing screw and torque tighten to the figures quoted in Section T23.

Rear servo

The rear servo comprises an assembly of pistons and springs. It fits onto the bottom face of the transmission casing, adjacent to the control valve unit and is secured by six setscrews. The purpose of the servo is to act as an accumulator to absorb an amount of intermediate clutch oil, thus cushioning the application of the clutch. It also applies the rear friction band when the transmission is in low range or reverse.

Rear servo – To remove
The rear servo can be removed whether the transmission is fitted to the car or not.

1. Remove the sump (see Section T12).
2. Remove the control valve unit (see Section T13).
3. Remove the setscrews that secure the servo cover to the transmission casing.
4. Remove the cover and discard the gasket.
5. Remove the servo unit from the casing (see fig. T14-1).
6. Remove the servo accumulator spring.

To ensure that the rear band is correctly adjusted when the rear servo is fitted, the apply pin must be checked as follows.

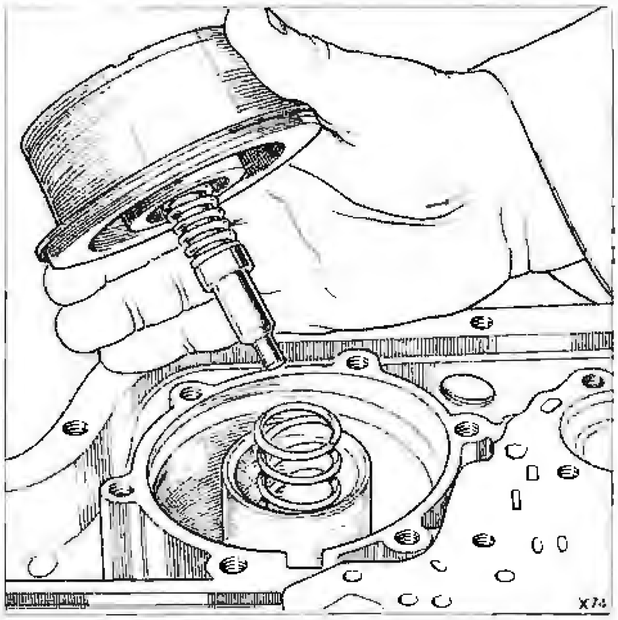


Fig. T14-1 Removing the rear servo

Rear band apply pin – To select

1. Fit the band apply pin selector gauge J-21370-6, onto the bottom face of the transmission casing. The gauge must fit over the rear servo bore with the hexagonal nut on the side of the gauge facing the parking linkage. The smaller diameter end of the gauge pin J-21370-5, should be positioned in the servo pin bore (see fig. T14-2).
2. Secure the gauge with two suitable setscrews (e.g. rear servo cover screws) and torque tighten them to the figures quoted in Section T23.
3. Ensure that the stepped gauge pin moves freely in the tool and in the servo pin bore. The stepped side of the pin must face the front of the transmission case.
4. Band apply pins are available in three lengths as shown in the following chart.

Identification	Length
Three rings	Long
Two rings	Medium
One ring	Short

5. The identification ring is located on the band lug end of the pin. Selecting the correct pin is the equivalent of adjusting the rear band.

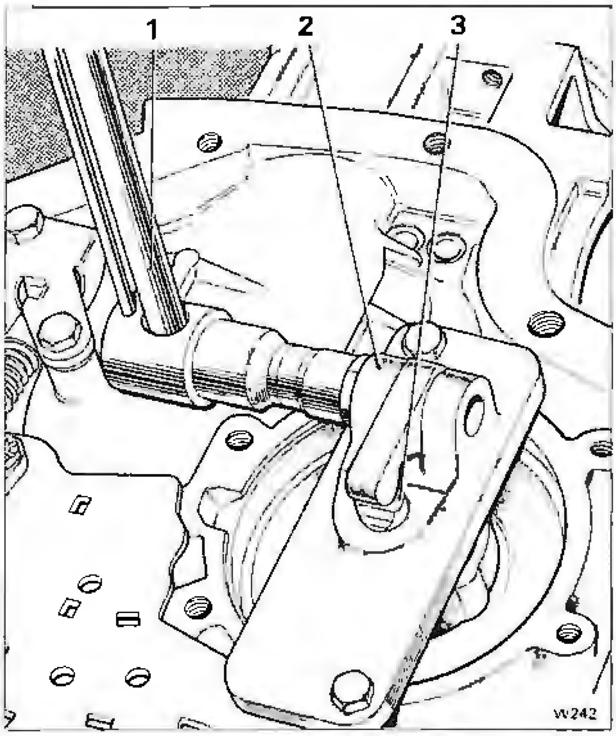


Fig. T14-2 Selecting the band apply pin
1 Torque spanner
2 Gauge
3 Gauge pin

6. To determine the correct size pin to use, apply 34 Nm (3,5 kgf m; 25 lbf ft) to the hexagonal nut on the side of the gauge (see fig. T14-2). This will cause the lever on top of the gauge to depress the stepped gauge pin into the servo pin bore, simulating the actual operation of the servo.
7. Note the relationship between the steps on the gauge pin and the machined surface on the top of the gauge.
8. If the machined surface on top of the gauge is level with, or above the upper step on the gauge pin, a long (3 rings) pin is required.
If the machined surface is between the upper and lower steps on the gauge pin, a medium pin (2 rings) is required.
If the machined surface is level with, or below the lower step on the gauge pin, a short (1 ring) pin is required.
9. If a new pin is required, make a note of the size of the required pin, then remove the gauge.

Rear servo – To dismantle
1. Remove the rear accumulator piston from the rear servo piston (see fig. T14-3).
2. Remove the 'E' ring which retains the rear servo piston on the band apply pin.
3. Remove the rear servo piston and the seal from the band apply pin.
4. Remove the washer, spring, and retainer.

Rear servo – To inspect
1. Check the fit of the oil sealing rings in the accumulator piston. The rings should be free to turn in the grooves.
2. Fit the accumulator piston lower oil sealing ring into its bore in the casing and check the ring-to-bore fit.

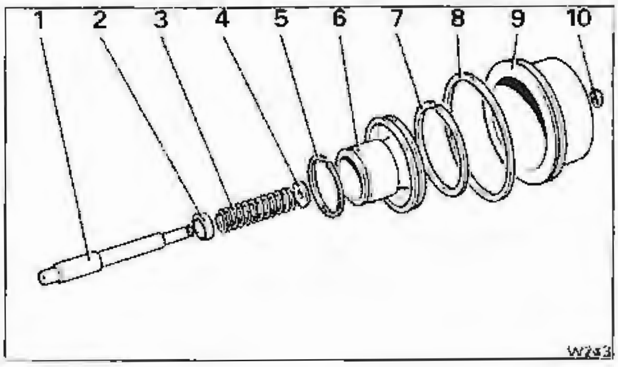


Fig. T14-3 Rear servo and accumulator
1 Servo pin
2 Spring retainer
3 Servo spring
4 Washer
5 Oil sealing ring
6 Accumulator piston
7 Oil sealing ring
8 Servo oil seal
9 Servo piston
10 'E' ring

3. Check the fit of tha band apply pin in each piston.
4. Examine the band apply pin for scores, cracks, or the opening of drilled passages.
5. Examine the accumulator piston for an open bleed passage.
6. Ensure that the pin is the correct size as determined in the procedure described under the heading Rear band apply pin – To select.

Rear servo – To assemble
1. Fit the spring retainer, spring, and washer onto the band apply pin.
2. Fit the servo piston onto the pin and secure it with the 'E' ring.
3. If necessary, fit a new oil seal ring onto the servo piston.
4. Fit the accumulator piston into the servo piston.
Do not remove the Teflon oil seal rings from the rear accumulator piston, unless they require replacement.
If the Teflon inner oil seal ring (small diameter) requires replacement, use the aluminium oil seal ring.
The rear accumulator piston (large diameter) ring groove depth is machined shallower to take the Teflon oil seal ring. Therefore, if replacement is necessary, use only the Teflon oil seal ring.

Rear servo – To fit
1. Using clean transmission fluid, lightly lubricate the inner and outer rear servo bores in the transmission casing.
2. Fit the servo accumulator spring into the servo inner bore.

Note Before fitting the rear servo to the casing, ensure that the rear band apply lug is aligned with the servo pin bore in the transmission casing. If the lug is not aligned, the servo will not apply the rear band.

3. Position the rear servo assembly in the transmission casing.
4. Using hand pressure, push the servo into the transmission casing, ensuring that the servo piston sealing ring is correctly seated in the bore.
5. Fit the cover together with a new gasket.
6. Torque tighten the setscrews to the figures quoted in Section T23.

Detent solenoid, control valve spacer, and front servo

The detent solenoid is secured to the lower face of the transmission casing. It is connected by a cable to a connector on the left-hand side of the transmission. When the solenoid receives a signal from the throttle position switch, an exhaust port is opened. This allows oil at high pressure to be fed to the shift valves to oppose governor pressure (see Section T13).

The control valve spacer fits between the control valve unit and the transmission casing. It forms part of the hydraulic system which contains restrictors and check balls.

The front servo is an assembly of pistons and springs, similar to the rear servo. It fits partly in the transmission casing and partly in the control valve unit. The servo applies the front band in intermediate range (second gear) and low range to provide engine braking. It is used also as an accumulator for the application of the direct clutch and in conjunction with the check balls and orifices, is part of the timing for the release of the direct clutch.

Detent solenoid, control valve spacer, and front servo – To remove

These units may be removed from the transmission whether or not the transmission is fitted to the car.

1. Drain the transmission fluid and remove the sump.
2. Remove the control valve unit and governor pipes (see Section T13).
3. Disconnect the cable from the connector terminal.
4. Remove the setscrews that secure the detent solenoid.
5. Remove the solenoid.
6. Remove the control valve spacer plate and gasket.

Note If the last operation is being carried out with the transmission in the car, lower the control valve spacer plate in a level plane so that the check balls do not fall out. Remove the check balls from the spacer plate.

7. Remove the six check balls (seven on 1988 and 1989 model year cars) from the cored passages in the transmission case (see fig. T15-1).
8. Lift the front servo piston, retaining ring, pin, retainer, and spring from the transmission case. An exploded view of the front servo is shown in figure T15-3.

Front servo – To inspect

1. Examine the servo pin for damage.
2. Examine the oil seal ring groove in the piston for damage.
3. Ensure that the ring is free in the groove.
4. Examine the piston for cracks and other damage.
5. Check the fit of the servo pin in the piston.

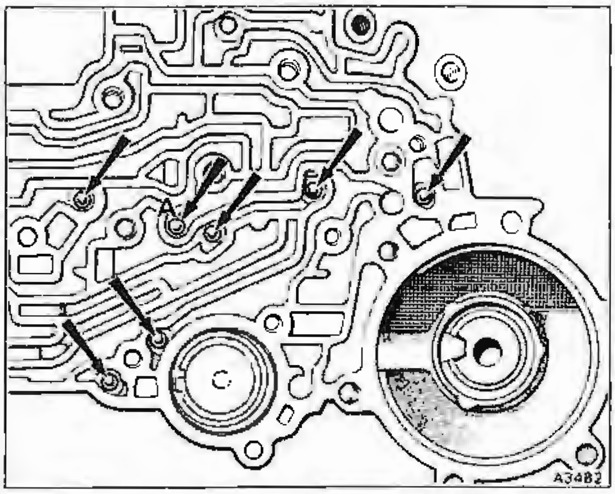


Fig. T15-1 Location of check balls – transmission case
A Additional check ball (1988 and 1989 model year cars)

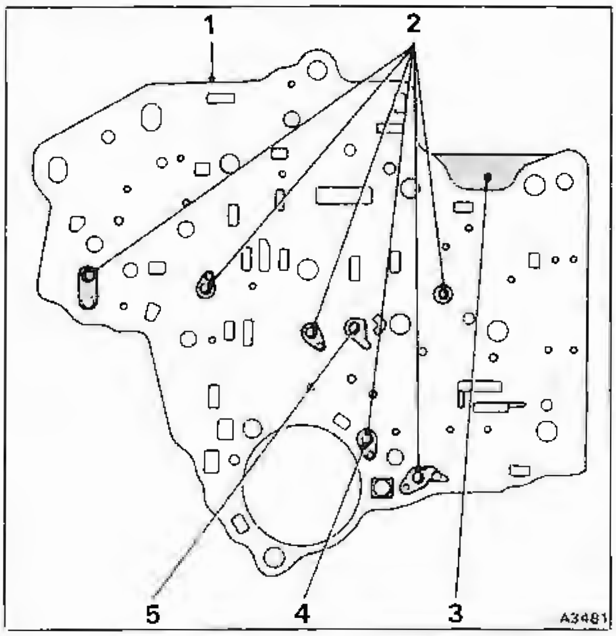


Fig. T15-2 Location of check balls – spacer plate
1 Spacer plate to case gasket
2 Check balls
3 Spacer plate
4 Non-functional ball (omit on RMA, RMAB, RNA, and RNAB transmissions)
5 Non-functional ball – 1988 and 1989 model year cars (omit as item 4)

Detent solenoid, control valve spacer, and front servo – To fit

When overhauling the front servo or front accumulator piston it will be noticed that the Teflon ring allows the piston to slide very freely in its bore. This is a normal characteristic of the ring and does not indicate leakage during operation.

When servicing pistons, the following points should be noted.

Only remove a Teflon oil sealing ring from a piston ring groove if the ring is to be renewed.

Only renew a Teflon oil sealing ring if it shows evidence of leaking during operation or visual damage.

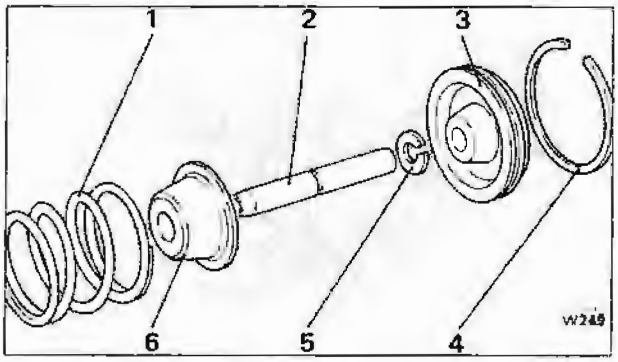


Fig. T15-3 Front servo
1 Spring
2 Pin
3 Piston
4 Oil seal ring
5 Retainer ring
6 Spring retainer

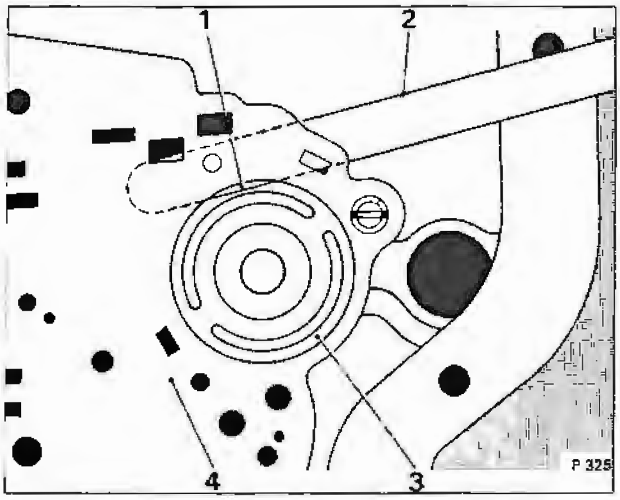


Fig. T15-4 Method of temporarily holding front servo piston in position (transmission in car)
1 Correct position of feeler gauge, allowing the accumulator piston to enter the front servo bore before the feeler gauge is withdrawn
2 Feeler gauge
3 Front servo piston
4 Spacer plate

When changing a front servo Teflon oil sealing ring, renew with an aluminium sealing ring.

1. Fit two guide bolts into the transmission case.
2. Place the six/seven check balls into the ball seat pockets in the case.
3. If the transmission is in the car, place the check balls into the ball seat pockets in the spacer plate.

Note One or two check balls are non-functional, therefore, **on RMA, RMAB, RNA, and RNAB transmissions** omit either one or two balls as shown in figure T15-2.

4. Fit the control valve spacer plate to case gasket (gasket with extension for detent solenoid).
5. Fit the control valve spacer plate.
6. Fit the detent solenoid. Do not tighten the setscrews at this time.
7. Fit the front servo spring and retainer into the bore of the transmission case.
8. Fit the retainer ring onto the front servo pin and install the pin into the case so that the tapered end contacts the forward band. Ensure that the retainer ring is installed in the servo pin groove.
9. Fit a new piston sealing ring to the servo piston, if the ring has been removed.
10. Fit the servo piston onto the band apply pin with the flat side of the piston positioned towards the transmission sump.

If the transmission is in the car, the parts should be assembled as a group (see fig.T15-3) and fitted into the servo bore. A length of straight clean feeler gauge [approximately 0,51 mm (0.020 in)] should be used to hold the servo assembly temporarily in position as shown in figure T15-4. Withdraw the feeler gauge before tightening the control valve body setscrews.

11. Connect the electrical cable from the detent solenoid onto the connector.
12. Fit the control valve as described in Section T13, then torque tighten the setscrews and the detent solenoid setscrews to the figures quoted in Section T23.

Rear extension

Rear extension – To remove
The procedure describes removal of the rear extension when the transmission is fitted to the car.

The procedure is the same when the transmission is removed from the car except that the gearchange actuator and propeller shaft will have been removed.

1. Remove the gearchange electric actuator as described in Section T6.
2. Remove the body crossmember and disconnect the propeller shaft at the gearbox end.
3. Place a drip tray beneath the rear extension.
4. Remove the coupling flange by withdrawing it from the output shaft.
5. Remove the setscrews that secure the rear extension to the transmission casing.
6. Slide the rear extension rearward and downward until it clears the output shaft.

Caution Make certain that the output shaft splines do not damage the oil seal in the end of the rear extension.

7. Remove and discard the gasket from the rear extension.

Rear extension – To inspect
1. Examine the rear extension for cracks or damage.
2. Examine the bush for excessive wear or damage.
3. Examine the oil seal for damage.
4. If a new oil seal is to be fitted, push out the old seal using a suitable drift.
5. Ensure that the seal bore in the rear extension is clean and free from damage and that the seal drainback port is not obstructed.
6. Lightly smear the outer edge of the new seal with Wellseal. Drive in the seal using tool RH 7953.

Note The webbing on the seal installation tool RH 7953 must be undercut by approximately 3,17 mm (0.125 in) as shown in figure T16-1.

7. Fill the space between the seal lips with Shell Retinax A grease, ensuring that the lip edges are coated with grease.
8. Ensure that the rear face of the transmission casing and the front face of the extension are clean and free from burrs.
9. Ensure that the oil feed hole to the rear extension bush is not obstructed.

Rear extension – To fit
1. Fit a new gasket onto the extension housing.
2. Carefully fit the extension casing over the output shaft until the extension abuts the rear of the transmission casing.
3. Ensure that the splines on the output shaft do not touch the oil seal in the end of the extension casing otherwise the seal lip may be damaged.

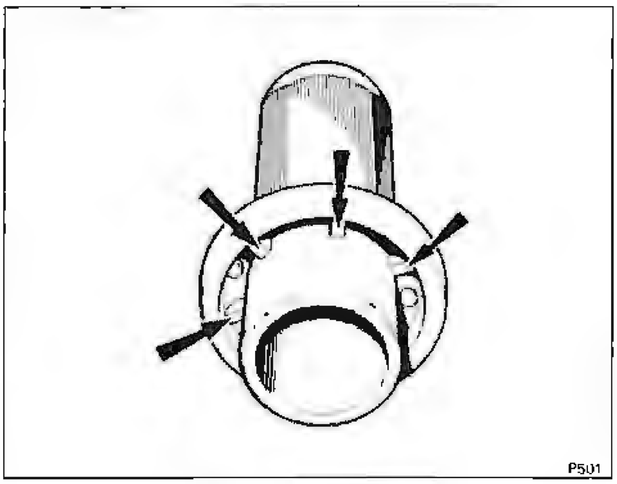


Fig. T16-1 Seal installation tool RH 7953

4. Fit the setscrews and torque tighten them to the figures quoted in Section T23.
5. Fit the coupling flange.
6. Connect the propeller shaft.
7. Fit the body crossmember.
8. Fit the gearchange electric actuator.

Oil pump

The oil pump is an internal/external gear type which is secured to the front face of the transmission casing. Contained within the oil pump cover is an oil pressure regulator valve train. The pump is mechanically connected to the engine flexplate and operates whenever the engine is running.

As the engine flexplate rotates it turns the torque converter pump which is keyed to the inner gear of the oil pump. The inner gear turns the outer gear which causes oil to be lifted from the transmission sump via an oil strainer.

As the gears turn, the oil is carried in pockets formed by the gear teeth, past a crescent shaped projection of the pump. Beyond the crescent, the gear teeth move closer together causing the oil to be forced out at pressure from between the teeth. At this point the oil is delivered through the pump outlet to the pressure system.

The oil pressure is controlled by a pressure regulator valve. As the pressure builds up, the oil is directed through an orifice to the top of the pressure regulator valve. When the correct pressure is reached, the valve moves against spring pressure, opening a passage which feeds the torque converter.

When the torque converter is full, oil passes to the transmission heat exchanger by way of an external pipe. Upon leaving the heat exchanger, the oil is fed by way of a second external pipe to the transmission lubricating system.

As the pressure continues to increase from the pump, the pressure regulator valve moves further to expose a port which directs excess oil back to the suction side of the pump. The pressure regulator valve is spring balanced to regulate line pressure at approximately 4,8 bar (70 lbf/in^2).

Oil pump – To remove

1. Remove the transmission from the car (see Section T7).
2. Remove the retaining clamp RH 7952 and withdraw the converter.

Note The converter and oil weigh approximately 23 kg (50 lb). Therefore care should be taken when removing it to ensure it is not dropped or damaged.

3. Install the transmission in the holding fixture RH 7955 with the pump upwards.
4. Remove the pump attaching setscrews.
5. Fit either the threaded slide hammers J-7004 or removal tool RH 12556 (as applicable) as shown in figure T17-1. Then, remove the pump assembly from the transmission case.

Note If using the slide hammers, operate them simultaneously otherwise the pump will tilt and jam in the case.

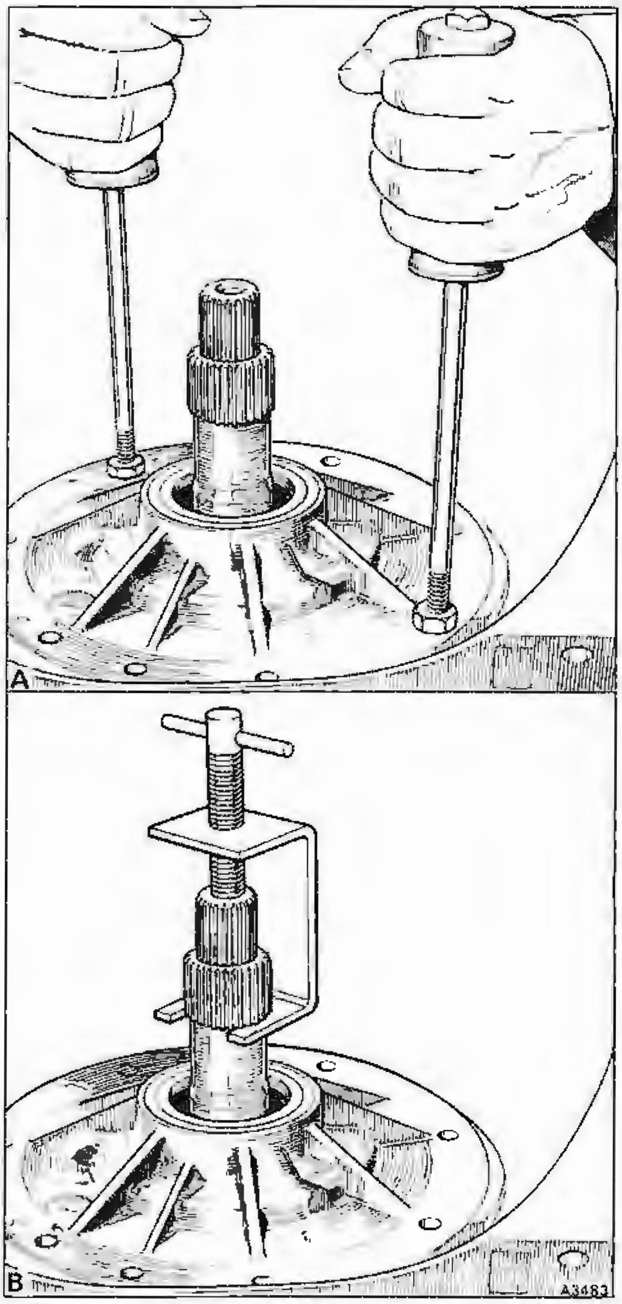


Fig. T17-1 Removing the oil pump
A Slide hammers J-7004
B Removal tool RH 12556

6. Remove and discard the pump to case sealing ring and gasket.

Oil pump – To dismantle

1. Holding the pump assembly firmly on a bench, push the regulator boost valve sleeve, against spring pressure, then remove the circlip (see fig. T17-2).

Note The pressure regulator spring is under pressure and care should be exercised when removing the boost valve and sleeve.

2. Remove the regulator boost valve and sleeve.
3. Remove the pressure regulator spring.
4. Remove the regulator valve, spring retainer, and spacer(s) (if fitted).
5. Remove the setscrews which secure the pump cover to the pump body. Separate the cover and body, noting that the setscrews are of differing lengths.
6. Mark the driving and driven gears to facilitate correct assembly (an indelible pen or pencil is recommended).
7. Remove the gears from the pump body as shown in figure T17-3.
8. Remove the retaining pin and plug from the end of the regulator bore.
9. Remove the oil rings from the pump cover.
10. Remove the pump to forward clutch housing selective washer, noting the thickness to facilitate fitting of a new washer on assembly.

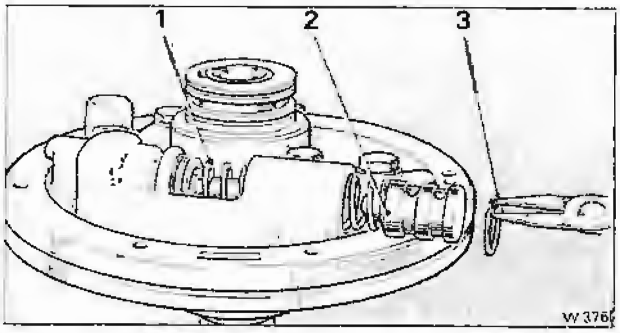


Fig. T17-2 Removing the regulator valve
1 Regulator valve spring
2 Boost valve sleeve
3 Circlip

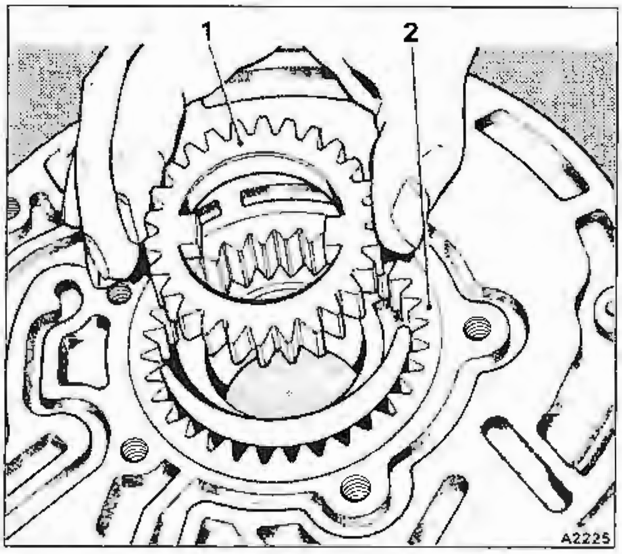


Fig. T17-3 Removing the pump gears
1 Driving gear (tangs uppermost)
2 Driven gear

Oil pump – To inspect

1. Wash all parts in clean paraffin, then dry with compressed air.
2. Examine the pump body gear pocket and the crescent for scoring or other damage.
3. Fit the gears into the pump body, then check the end clearance as shown in figure T17-4. The clearance should be between 0,02 mm and 0,09 mm (0.0008 in and 0.0035 in).
4. Examine the face of the pump body for scores and burrs.
5. Examine the oil passages for blockages and porosity.
6. Examine the threads into which the cover securing setscrews fit.
7. Check the pump cover and body faces for overall flatness.
8. Examine the pressure regulator valve bore for score marks.
9. Ensure that the pressure regulator valve and the boost valve will move freely in their respective bores.

Oil pump – To assemble

1. Fit the oil pump driving and driven gears into the pump body with the alignment marks (made with an indelible pen or pencil) uppermost.

Note If the pump driven gear has a rectangular or triangular identification mark on one tooth, the gear should be installed with the identification mark downwards.

Fit the drive gear with the drive tangs uppermost (see fig. T17-3).

2. Fit the pressure regulator spring retainer, spacer(s) (if fitted), and spring into the pressure regulator bore (see fig. T17-5).

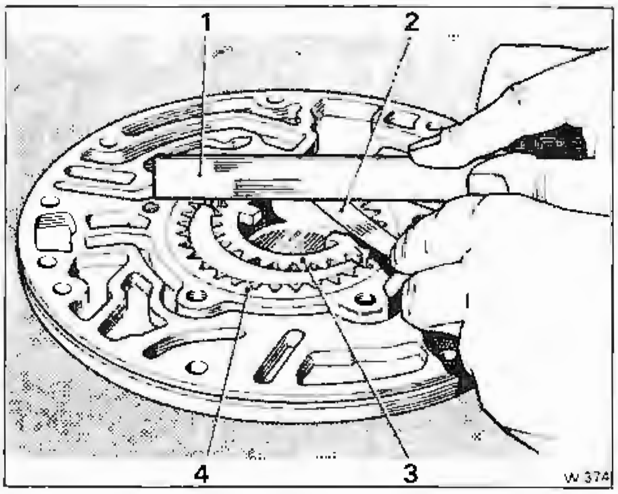


Fig. T17-4 Checking the gear end clearance
1 Straight edge
2 Feeler gauge
3 Inner (driving) gear
4 Outer (driven) gear

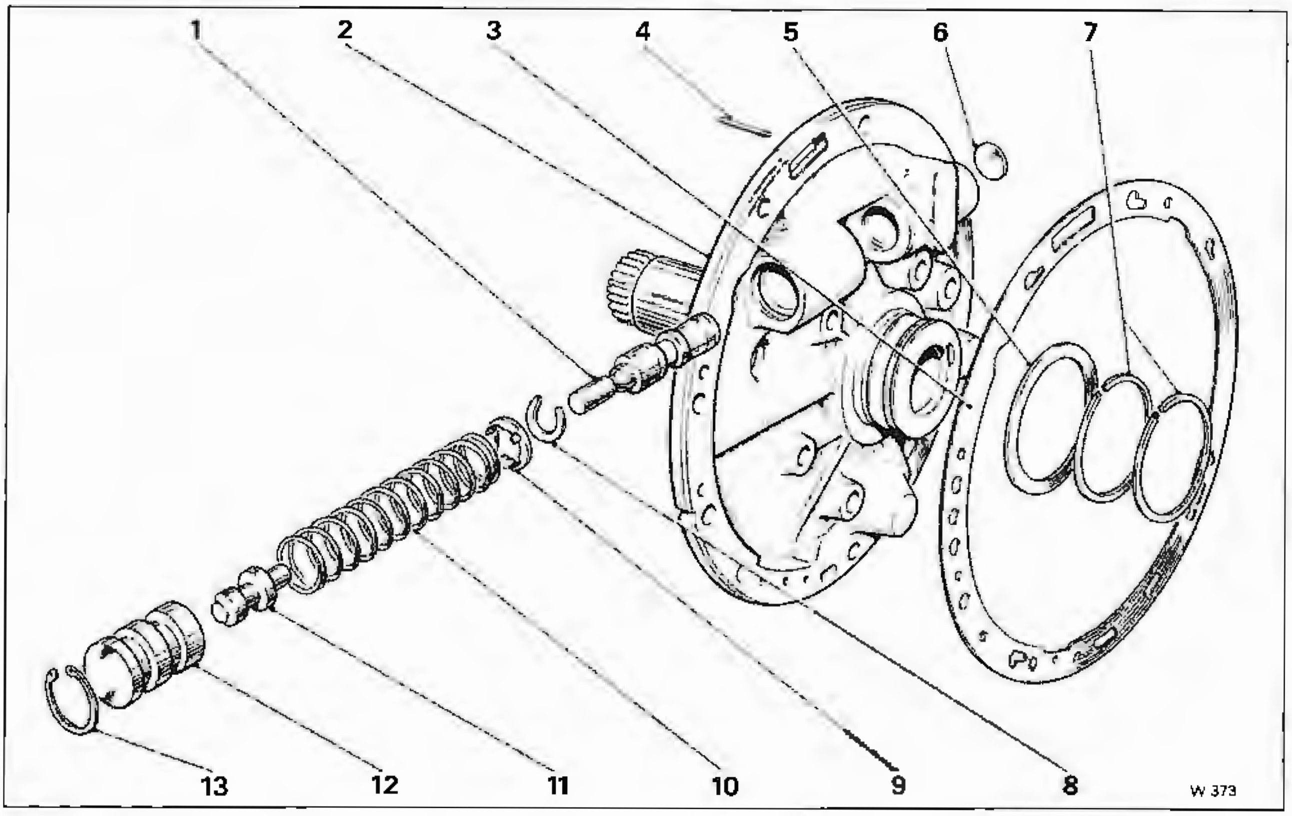


Fig. T17-5 Pump cover
1 Pressure regulator valve
2 Pump cover
3 Gasket
4 Retaining pin
5 Selective washer
6 Bore plug
7 Oil sealing rings
8 Spacer
9 Spring retainer
10 Pressure regulator spring
11 Boost valve
12 Sleeve
13 Circlip

3. Lightly lubricate the pressure regulator valve with clean transmission fluid, then fit the valve into the opposite end of the bore, stem end first.
4. Fit the pressure regulator valve end plug and retaining pin.
5. Lightly lubricate the boost valve and sleeve, then fit the valve into the sleeve (stem end out). Fit both parts into the bore in the pump cover by compressing the sleeve against the pressure regulator valve spring.
6. Retain the sleeve with the circlip.
7. Fit the two oil sealing rings to the pump cover.
8. Lubricate the pump gears with clean transmission fluid then fit the pump cover to the pump body.
9. Fit the cover securing setscrews into their original positions. Leave the setscrews finger tight.
10. Fit the pump body and cover alignment band J-21368 around the pump assembly. Tighten the band to align the cover with the body (see fig. T17-6).
11. With the band in position, tighten the pump body to cover securing setscrews to the figures quoted in Section T23. Remove the alignment band.
12. Fit a new pump to case 'O' ring.

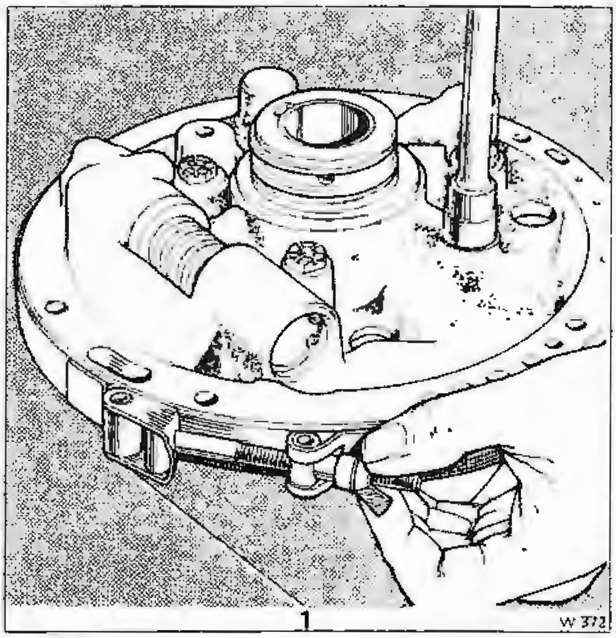


Fig. T17-6 Aligning pump cover with pump body
1 Alignment band

13. If necessary, fit a new front pump oil seal using the installing tool RH 7953.
14. Fit a new selective washer (pump to forward clutch housing), with a corresponding thickness to the one removed.

Oil pump – To fit

1. Fit a new gasket and guide pins into the transmission case.
2. Lubricate the turbine shaft journals with clean transmission fluid. Smear the sealing rings on the pump delivery sleeve with petroleum jelly, ensuring that the rings are correctly located.
3. Fit the pump assembly (see fig. T17-7). Ensure that new seals are fitted to the setscrews.

Do not remove the guide pins until all but two setscrews have been fitted. Leave one setscrew out to assist in checking the end-float.

4. Torque tighten the setscrews to the figures quoted in Section T23.

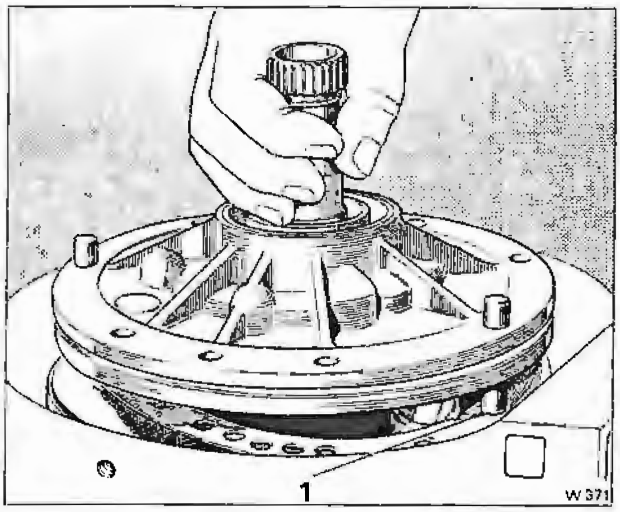


Fig. T17-7 Fitting the oil pump
1 Guide pin

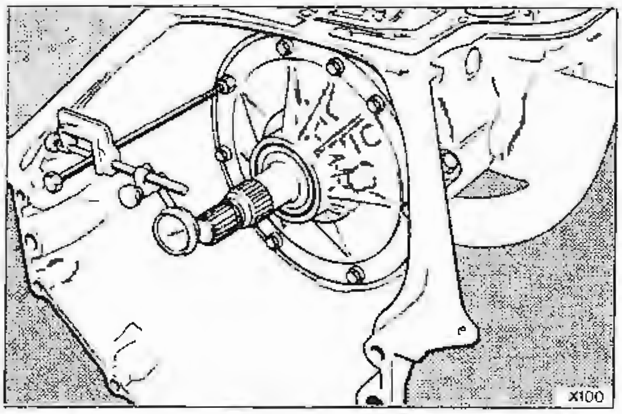


Fig. T17-8 Checking the front unit end-float

Note If the turbine shaft cannot be rotated as the pump is being pulled into position, it is possible that either the forward or direct clutch housings have not been correctly indexed with all the clutch plates. This condition must be corrected before the pump is finally pulled into position.

5. Check the front unit end-float as follows (see fig. T17-8).

a. Fit a slide hammer bolt J-7004 into the one remaining bolt hole.
b. Secure a dial test indicator on the slide hammer bolt. Adjust the indicator to register against the end of the turbine shaft.
c. Hold the output shaft forward whilst pushing the turbine shaft rearward to its stop.
d. Set the dial indicator to zero.
e. Pull the turbine shaft forward, noting the indicator reading (shaft travel).

The end-float should be between 0,08 mm and 0,61 mm (0.003 in and 0.024 in).

If the end-float is not within the limits, select a new washer, referring to the following chart.

Thickness	Colour	Number
1,52 mm to 1,63 mm (0.060 in to 0.064 in)	Yellow	0
1,80 mm to 1,90 mm (0.071 in to 0.075 in)	Blue	1
2,08 mm to 2,18 mm (0.082 in to 0.086 in)	Red	2
2,36 mm to 2,46 mm (0.093 in to 0.097 in)	Brown	3
2,64 mm to 2,74 mm (0.104 in to 0.108 in)	Green	4
2,92 mm to 3,02 mm (0.115 in to 0.119 in)	Black	5
3,20 mm to 3,30 mm (0.126 in to 0.130 in)	Purple	6

Note An oil soaked washer may tend to discolour. Therefore, if necessary, measure the washer to ascertain the thickness.

6. Remove the dial test indicator and slide hammer bolt.
7. Fit the final pump securing setscrew and seal. Torque tighten the setscrew to the figures quoted in Section T23.

Control rods, levers, and parking linkage

The control rods, levers, and parking linkage consist of an assembly of levers and rods which are operated by the electric gearchange actuator. The detent lever is connected to the manual control valve in the control valve unit and is retained in this position by a spring-loaded detent roller (see fig. T18-1).

The parking pawl actuating rod causes the parking pawl to engage the transmission whenever park is selected. This provides a mechanical lock which will hold the car.

When the gear range selector lever on the steering column is moved, with the ignition on, the electric actuator will move the gearchange operating lever to the required position via an adjustable rod. The gearchange operating lever is secured to the outer end of the manual shaft and the detent lever is secured to the inner end of the shaft. Therefore, the detent lever will move a corresponding distance, moving the manual control valve.

When the gear selector lever on the steering column is moved to park, the parking pawl actuating rod which is secured to the detent lever causes the parking pawl to engage with a gear ring on the rear unit planet carrier. The rear unit planet carrier is mechanically connected to the transmission output shaft, therefore, the shaft is prevented from rotating.

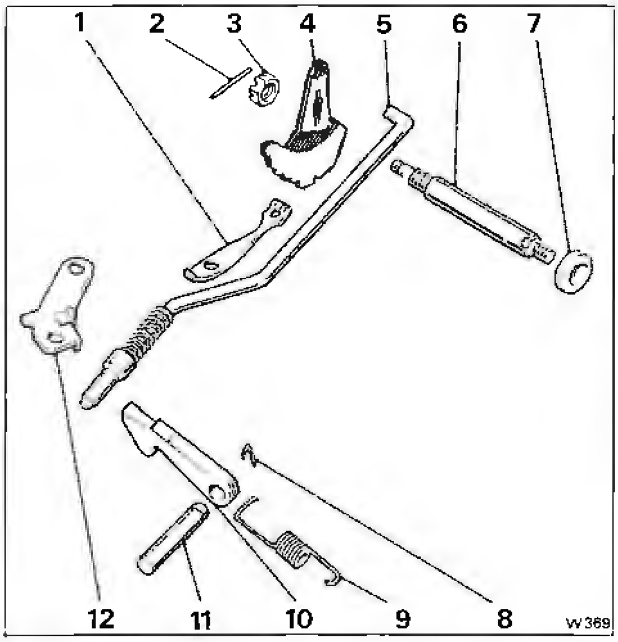


Fig. T18-1 Manual shaft and parking linkage
1 Detent roller and spring assembly
2 Retaining pin
3 Lock-nut
4 Detent lever
5 Parking pawl actuating rod
6 Manual shaft
7 Lip seal
8 Shaft retainer
9 Pawl return spring
10 Parking pawl
11 Pawl shaft
12 Parking lock bracket

Control rods, levers, and parking linkage – To remove

1. The units may be removed from the transmission whether or not the transmission has been removed from the car.
2. If the transmission has not been removed, drain and remove the sump as described in Section T12.
3. If the gearchange electric actuator has not been removed, disconnect the gearchange operating rod by removing the split pin and clevis pin.
4. Remove the split pin and clevis pin from the opposite end of the gearchange operating rod; remove the rod.
5. Remove the lock-nut which retains the gearchange operating lever to the manual shaft; remove the lever.
6. Remove the setscrew that secures the detent spring and roller assembly to the control valve unit; remove the detent spring assembly.
7. Remove the pin which secures the manual shaft to the case.
8. Slacken the lock-nut securing the detent lever to the manual shaft.
9. Remove the detent lever from the manual shaft. Then, remove the lock-nut completely.
10. Remove the parking pawl actuating rod, detent lever, and manual shaft from the case.

Note Do not remove the manual shaft seal unless replacement is required.

11. Remove the setscrews securing the parking lock bracket; remove the bracket.
12. Remove the parking pawl return spring.
13. Operations 14 and 15 are to be completed only if one or more of the parts involved requires replacement.
14. Remove the shaft retainer from the parking pawl shaft. Remove the parking pawl shaft cup plug by placing a screwdriver between the parking pawl shaft and the casing; levering outwards (see fig. T18-2).
15. Remove the parking pawl and the shaft.

Control rods, levers, and parking linkage – To inspect

1. Wash all parts in clean paraffin, then dry them with compressed air.
2. Examine the parking pawl actuator rod for cracks or broken spring retainer lugs.

3. Examine the actuator spring for distortion or damage. Ensure the actuator fits freely on the actuator rod.
4. Examine the parking pawl for cracks or wear.
5. Examine the manual shaft for damaged threads or shaft roughness (oil seal surface).
6. Examine the detent lever for cracks or a loose pin.

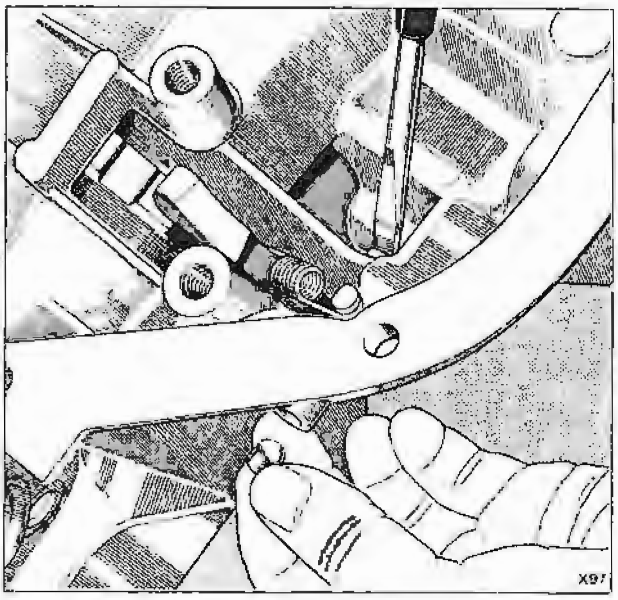


Fig. T18-2 Removing the cup plug

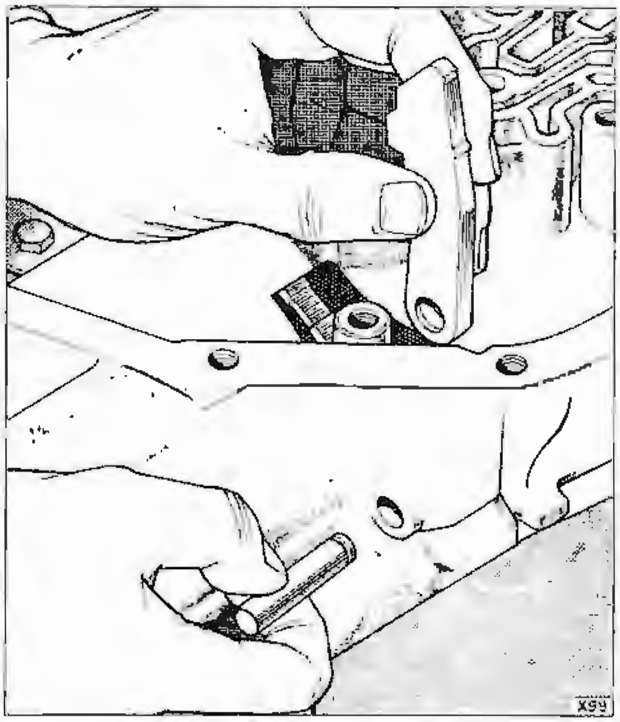


Fig. T18-3 Fitting the parking pawl and shaft

7. Examine the parking pawl shaft for damage to the retainer groove.
8. Examine the parking pawl return spring for distortion or damaged ends.
9. Examine the parking lock bracket for cracks or wear
10. Examine the detent spring and roller assembly for cracks or damage.
11. Examine the gearchange operating rod for signs of bending.
12. Examine the jaws of the operating rod for cracks or damage.

Control rods, levers, and parking linkage – To fit

1. Fit the parking pawl with the tooth towards the centre of the transmission. Then, fit the parking pawl shaft and retainer (see fig. T18-3).
2. Fit the cup plug into the case, using a 9,52 mm (0.375 in) diameter steel rod, to drive the shaft and plug into the case until the shaft bottoms on the case rib.
3. Fit the parking pawl return spring with the squared end hooked around the pawl.
4. Fit the parking lock bracket with the guides over the parking pawl. Torque tighten the setscrews to the figures quoted in Section T23.
5. Fit the actuator rod plunger under the parking lock bracket and over the parking pawl.
6. Fit the opposite end of the actuator rod into the detent lever from the side opposite to the pin.
7. If necessary, fit a new manual shaft to case lip type seal into the case. Use a 19,05 mm (0.750 in) diameter steel rod to seat the seal.
8. Lubricate the manual shaft with Shell Retinax A grease. Fit the shaft into the casa and through the detent lever (see fig. T18-4).
9. Fit the lock-nut onto the manual shaft. Torque tighten the nut to the figures quoted in Section T23.
10. Fit the retaining pin into the transmission casing, aligning it with the groove in the manual shaft (see fig. T18-5).
11. Fit the detent spring and roller assembly. Torque tighten the setscrew to the figures quoted in Section T23.
12. Fit the gearchange operating lever to the manual shaft. Fit the lock-nut and torque tighten to the figures quoted in Section T23.
13. Fit the gearchange operating rod using the clevis pins. Lubricate the clevis pins with Rocol MTS 1000 grease, then fit new split pins.
14. Fit the sump (see Section T12).

Control linkage – To check

1. Remove the split pin and clevis pin from the gearchanga operating rod, at the actuator end.
2. Select park on the gearchange actuator. Push the lower end of the gearchange operating lever fully forward (park position).
3. Ensure that both jaws of the operating rod slide easily about the two levers and check the clevis pin will slide into the jaw and through the lever.
4. Select each of the gear positions in turn on the

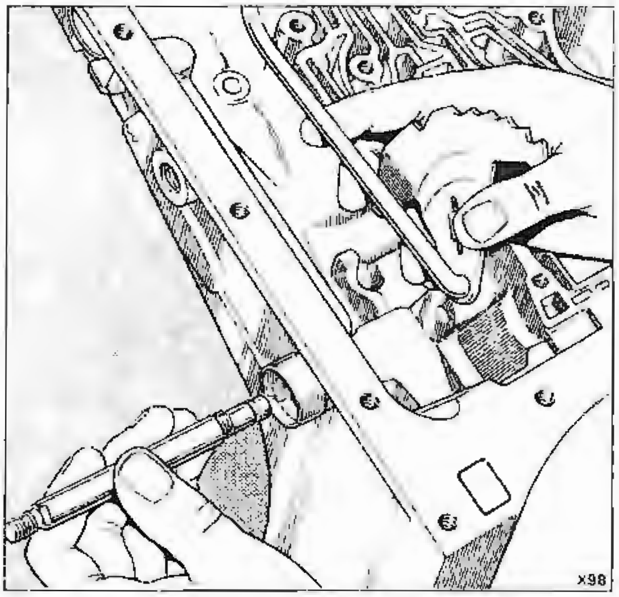


Fig. T18-4 Fitting the manual shaft

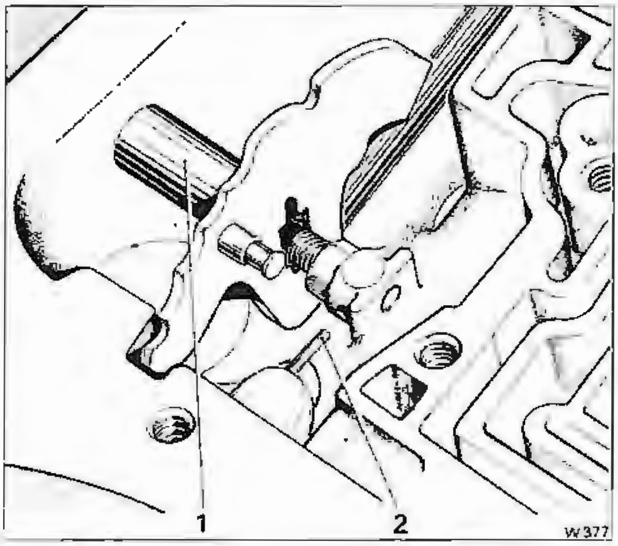


Fig. T18-5 Fitting the manual shaft retaining pin
1 Manual shaft
2 Retaining pin

actuator. At each position, ensure that the clevis pin will slide easily into the jaw and lever.

5. Check that the pin will slide easily into the jaw when low is selected after park, and conversely when park is selected after low.

6. If, in any position the pin will not pass through the jaw and lever, adjust the length of the rod.

7. Finally, lubricate the clevis pin with Rocol MTS 1000 grease. Fit the clevis pin and secure it with a new split pin.

Turbine shaft, forward and direct clutches, sun gear shaft, and front band

The turbine shaft is a splined shaft which connects the torque converter to the forward clutch.

The forward clutch comprises a housing, splined onto the turbine shaft; steel clutch driving plates, which are driven by the clutch housing; composition faced plates, which are splined onto a clutch hub; and a hydraulically operated clutch piston. The mainshaft is splined into the forward clutch hub.

The direct clutch is similar in construction to the forward clutch.

The composition plates are splined to a hub which is integral with the forward clutch back plate. The steel plates are splined to a housing which in turn is splined to the sun gear shaft. The clutch is applied hydraulically by a piston housed in the direct clutch housing.

The front band is a lined steel band which is anchored to the transmission case at one end and is servo operated at the other end. The band fits around the direct clutch housing and when moved by the servo, holds the housing stationary.

Whenever the forward clutch is applied, the drive transmitted by the turbine is connected to the transmission mainshaft. When the forward clutch is released the clutch return springs push back the hydraulic piston, the plates are then released and the connection between the converter and the mainshaft is broken. As a result, the transmission is in neutral.

Whenever the direct clutch is applied, drive from the forward clutch is divided and follows two different paths to the gear unit.

By following one path, the drive continues through the forward clutch to the mainshaft and the rear gear unit internal (annulus) gear. The other path is via the forward clutch back plate, through the direct clutch to the sun gear shaft.

As the direct clutch is applied, clockwise torque from the converter causes an intermediate inner sprag race to overrun the sprag clutch assembly.

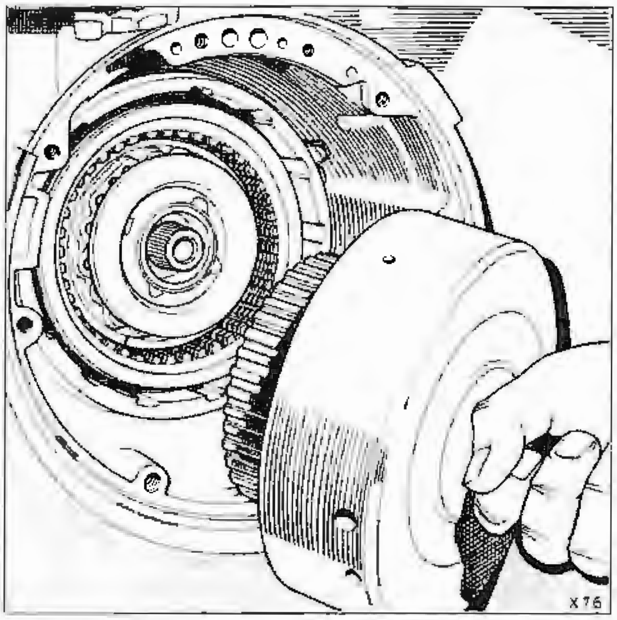


Fig. T19-1 Removing the forward clutch assembly

Turbine shaft, forward and direct clutches, sun gear shaft, and front band – To remove

1. Remove the transmission from the car; withdraw the converter assembly.
2. Remove the oil pump.
3. Withdraw the turbine shaft and the forward clutch from the transmission (see fig. T19-1).
4. Remove the thrust washer from between the forward clutch hub and the direct clutch housing. The washer may come out with the forward clutch.
5. Withdraw the direct clutch and intermediate sprag assembly (see fig. T19-2). The sun gear shaft may come out with the direct clutch assembly.

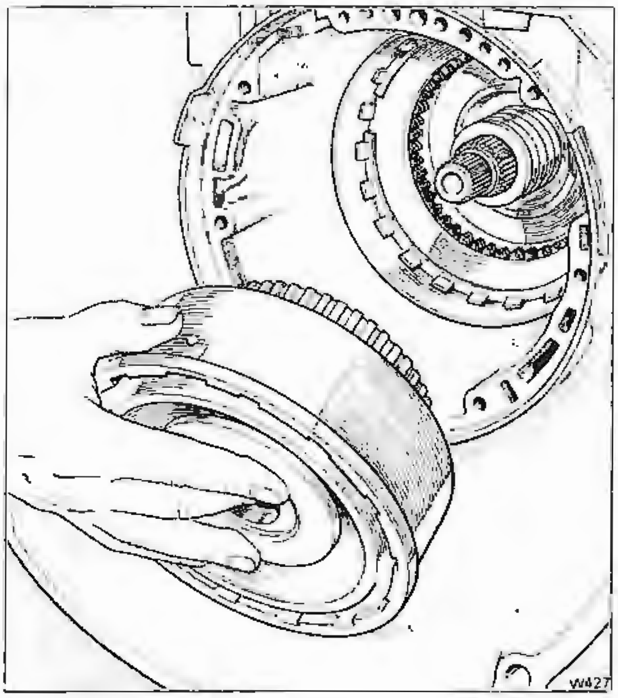


Fig. T19-2 Removing the direct clutch and intermediate sprag assembly

6. Remove the sun gear shaft if not previously removed.
7. Remove the front band.
8. Check the end-float of the rear unit.

Rear unit end-float – To check

1. Remove the transmission rear extension housing.
2. Fit a slide hammer bolt J-7004, or a similar suitable bolt into one of the holes in the end of the transmission case.
3. Mount a dial test indicator onto the bolt so that the indicator stem registers with the end of the output shaft (see fig. T19-3).
4. Set the dial indicator to zero.
5. Move the output shaft in and out, noting the indicator reading to enable the correct end-float adjusting washer to be used when the transmission is assembled. The end-float should be between 0,18 mm and 0,48 mm (0.007 in and 0.019 in).
6. The adjusting washer which controls this end-float is a steel washer with three tabs located between the thrust washer and the rear face of the transmission case.
7. If a different washer thickness is required to bring the end-float within the specified limits, it can be selected with the aid of the following chart.

Thickness	Number
0 mm to 0,41 mm (0 in to 0.016 in)	6
0,41 mm to 0,81 mm (0.016 in to 0.032 in)	5
0,81 mm to 1,22 mm (0.032 in to 0.048 in)	4
1,22 mm to 1,63 mm (0.048 in to 0.064 in)	3
1,63 mm to 2,03 mm (0.064 in to 0.080 in)	2
2,03 mm to 2,44 mm (0.080 in to 0.096 in)	1

Forward clutch and turbine shaft – To dismantle

1. Remove the large snap ring which retains the direct clutch hub to the forward clutch housing. Remove the direct clutch hub.
2. Remove the forward clutch hub. Remove the thrust washers, one from each side of the hub (see fig. T19-4).
3. Remove the composition and steel clutch plates. Remove the clutch apply ring.
4. Place the forward clutch on the bed of a press with the turbine shaft lowermost.
5. Compress the clutch return springs until the retaining snap ring is accessible. Remove the snap ring (see fig. T19-5).
6. Remove the tool, then remove the spring retainer and the sixteen clutch release springs. Keep these springs separate from the direct clutch release springs.
7. Remove the piston from the clutch housing (see fig. T19-6).

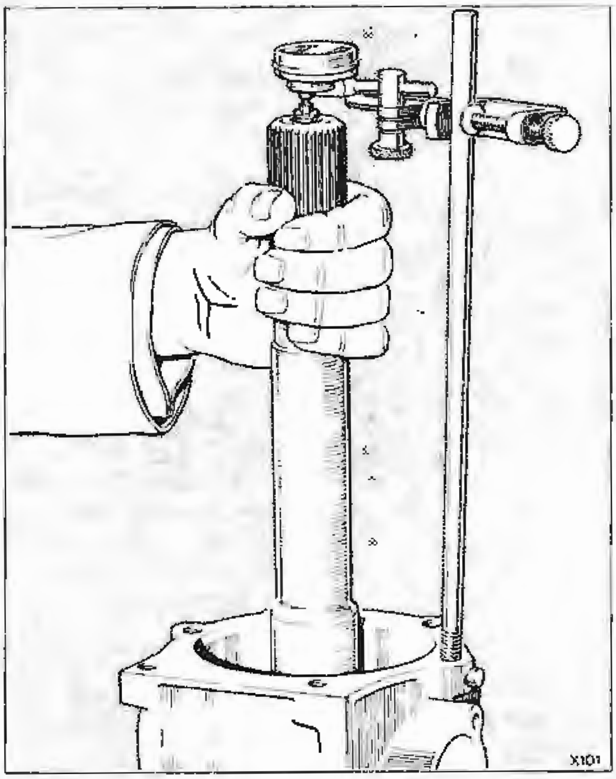


Fig. T19-3 Checking the rear unit end-float

Note The forward and direct clutch pistons are similar. Ensure that the forward clutch piston is identified during dismantling, so that it can be reassembled correctly into the forward clutch housing.

8. Remove and discard the inner and outer seals from the clutch piston.
9. Remove and discard the piston centre seal from the forward clutch housing.
10. It is not necessary to remove the turbine shaft from the forward clutch housing unless either the shaft or the housing is damaged and requires renewal. Therefore, if renewal is required, proceed as follows.
11. Place the forward clutch housing on the bed of a press with the turbine shaft lowermost.
12. Using a drive extension 9,53 mm (0.375 in) in diameter and approximately 76,20 mm (3 in) long, or similar tool as a drive, press the turbine shaft out of the forward clutch housing.

Forward clutch and turbine shaft – To inspect

1. Wash all parts **except** the composition faced clutch plates in clean paraffin. Dry with compressed air. The composition clutch plate surfaces should be examined for,
a. Pitting and flaking.
b. Wear.
c. Glazing.
d. Cracking.
e. Charring.
f. Metal particles embedded in the lining.

If a composition plate exhibits any of these symptoms, fit new plates.

2. The steel plates should be checked for heat discolouration. If the surface is smooth and an even colour is indicated, the plates can be used again. If severe heat spot discolouration or surface scuffing is indicated, fit new plates.

3. Examine the sixteen clutch release springs for collapsed coils or signs of distortion. If any springs show these symptoms, fit sixtean new springs.

Extreme heat or burning in the area of the clutch may have caused the springs to take a heat set. If this condition is found, fit sixteen new springs.

4. Examine the clutch hubs for worn splines. Ensure that the lubrication holes are clear and that the thrust faces are not scored or damaged.

5. Examine the piston for cracks.

6. Examine the clutch housing for wear, scoring, and open oil passages.

7. Ensure that the check ball in the clutch housing is free in its chamber.

8. Ensure that the lubrication holes in the turbine shaft are clear.

9. Examine the splines on the turbine shaft for damage and the shaft for cracks or distortion.

10. Examine the bush journals for damage.

Forward clutch and turbine shaft – To assemble

If the turbine shaft was removed from the forward clutch housing, proceed as follows.

1. Place the clutch housing on the bed of a press with the front face (flat side) uppermost.

2. Lightly lubricate the shorter splined end of the turbine shaft. Then, align the splines with the mating splines in the forward clutch housing. Using the press, carefully press the turbine shaft into the forward clutch housing until the shaft bottoms on the hub of the housing.

Note The shaft should be started in the housing, then the pressure on the press arbor relaxed to allow the shaft to straighten itself. Repeat this operation several times until it is evident that the shaft is squarely aligned with the housing. If the shaft is not started squarely, damage to the shaft or housing splines may occur.

3. Invert the forward clutch housing on the press so that the turbine shaft is downward.

4. Lubricate the new inner and outer clutch piston seals with clean transmission fluid. Lubricate the seal grooves in the piston with petroleum jelly. Then, fit the seals with the seal lip facing away from the return spring pockets.

5. Lubricate a new piston centre seal with clean transmission fluid. Lubricate the seal groove in the forward clutch housing with petroleum jelly. Then, fit the seal with the lip uppermost.

6. Fit the forward and direct clutch inner seal protector J-21362 over the forward clutch hub.

7. Fit the clutch piston inside the forward and direct clutch piston seal protector J-21409. Then, fit the

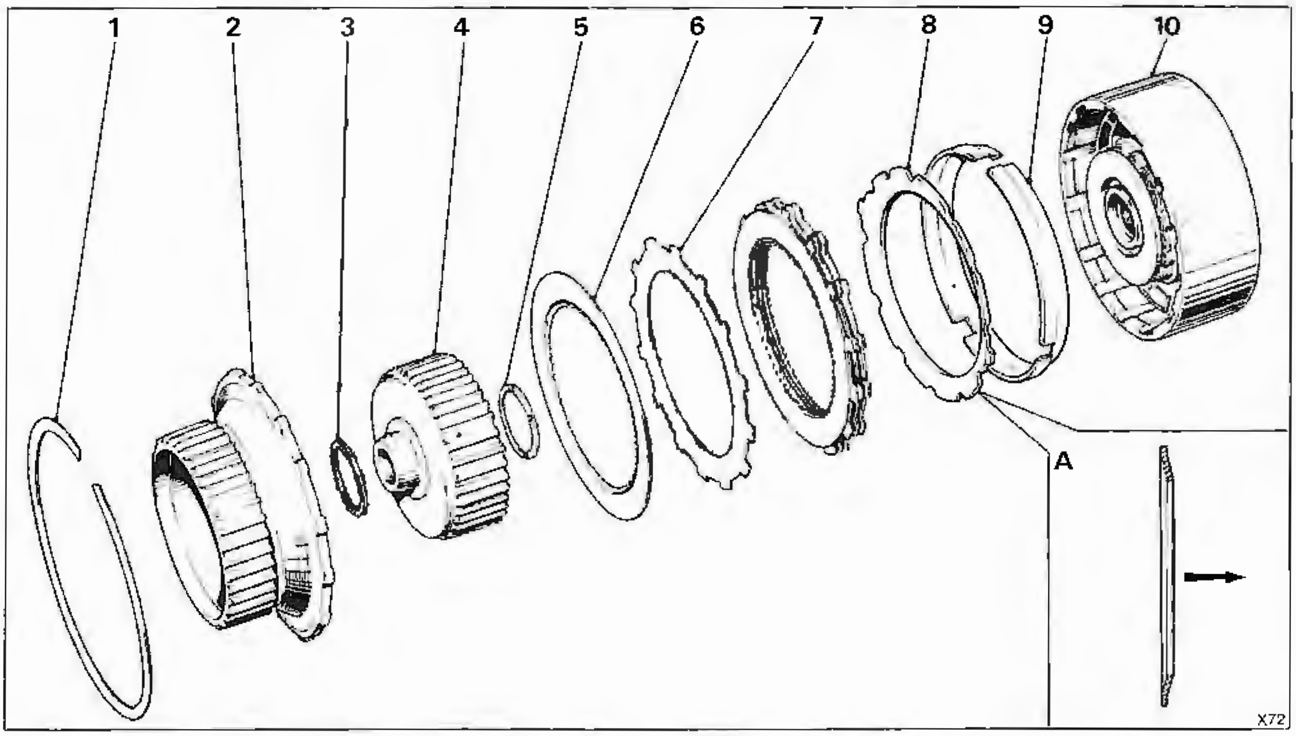


Fig. T19-4 Forward clutch assembly

1 Snap ring
2 Direct clutch hub
3 Thrust washer
4 Forward clutch hub
5 Thrust washer
6 Composition plate
7 Flat steel plate
8 Dished steel plate
9 Apply ring
10 Forward clutch assembly
A Direction of dished steel clutch plate into forward clutch housing

assembly into the forward clutch housing (see fig. T19-7).

8. Fit the clutch piston by rotating it clockwise until it is seated in the housing.

9. Fit the sixteen clutch release springs into the spring pockets in the clutch piston.

10. Place the clutch housing on the bed of a press with the turbine shaft lowermost.

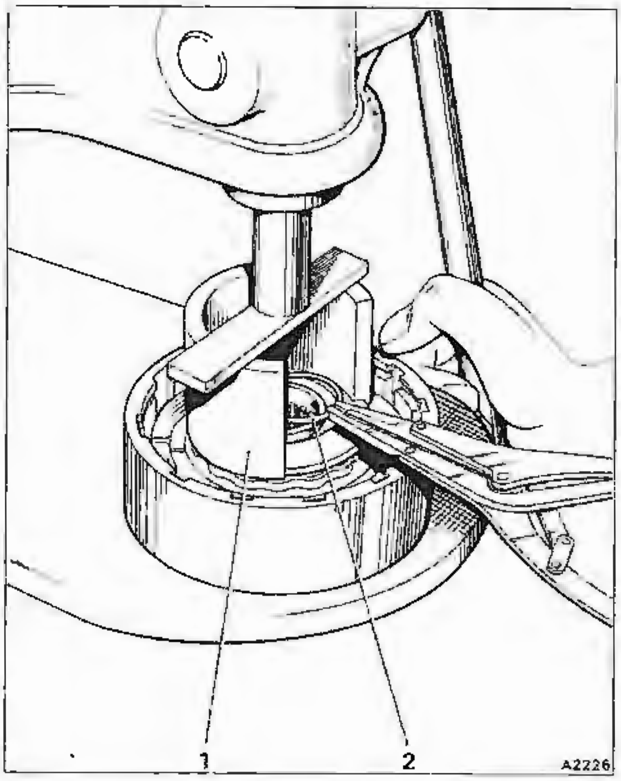


Fig. T19-5 Removing and fitting the forward clutch housing snap ring
1 Clutch spring compressor
2 Snap ring

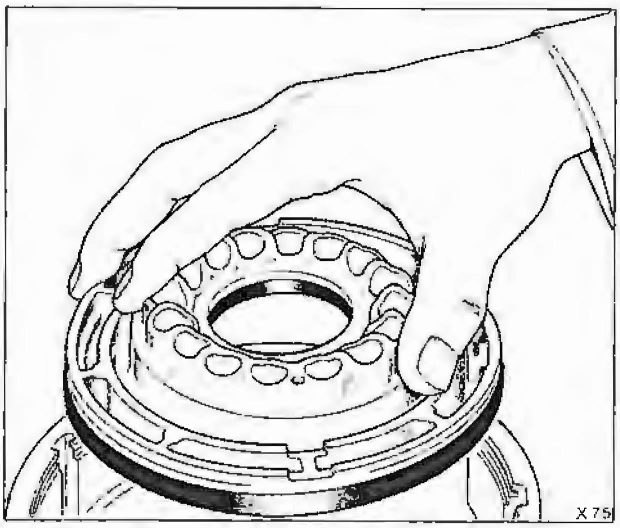


Fig. T19-6 Removing the forward clutch piston

11. Position the spring retainer on the springs.

12. Compress the springs ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring then release the tension on the springs.

Note Ensure that the release springs are not leaning. If necessary, push the springs into an upright position using a small screwdriver.

13. Fit the forward clutch apply ring into the clutch housing.

14. Fit the thrust washers on either side of the forward clutch hub. Retain the washers in position with petroleum jelly. Ensure the bronze washer is fitted to the side of the hub which faces the forward clutch housing.

15. Fit the forward clutch hub into the forward clutch housing.

16. Lubricate the five flat steel clutch plates, the five composition faced plates and the one dished steel clutch plate with clean transmission fluid.

17. Commence by fitting the dished steel plate with the concave side uppermost (away from the clutch piston), then alternate composition and flat steel plates (see fig. T19-4).

18. Fit the direct clutch hub into the forward clutch housing; fit the snap ring.

Direct clutch and intermediate sprag clutch assembly – To dismantle

1. Remove the snap ring which retains the sprag retainer.

2. Remove the retainer (see fig. T19-8).

3. Remove the sprag outer race. Withdraw the sprag clutch assembly from the outer race.

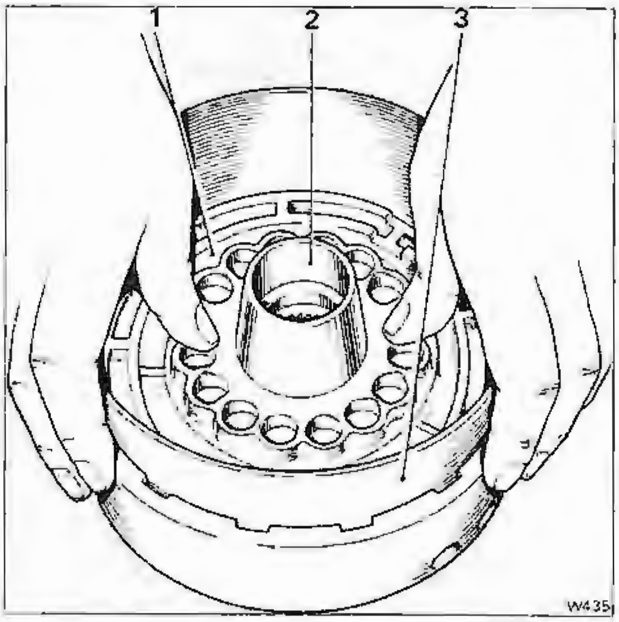


Fig. T19-7 Fitting the forward clutch piston
1 Forward clutch piston
2 Inner seal protector
3 Outer seal protector

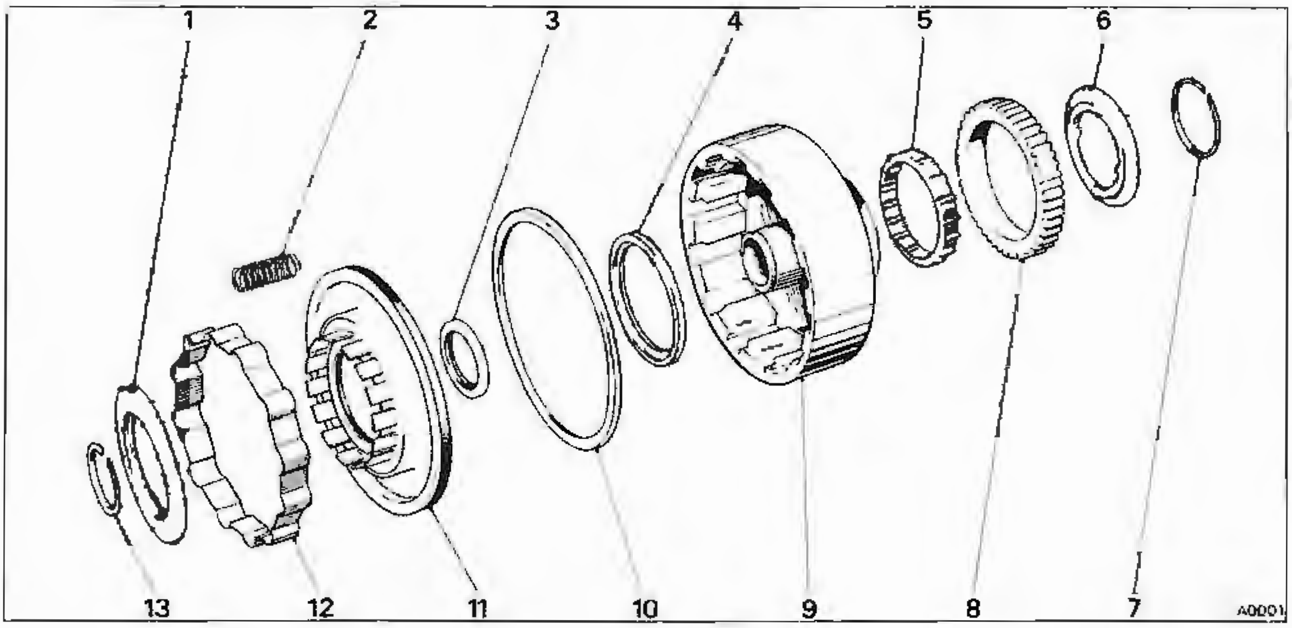


Fig. T19-8 Direct clutch and intermediate sprag assembly
1 Clutch spring retainer
2 Clutch release spring (14)
3 Piston inner seal
4 Piston centre seal
5 Sprag assembly
6 Sprag clutch retainer
7 Snap ring
8 Intermediate clutch outer race
9 Direct clutch housing
10 Piston outer seal
11 Direct clutch piston
12 Apply ring
13 Snap ring

4. Turn the unit over then remove tha large snap ring which retains the direct clutch back plate in the clutch housing. Remove the back plate.
5. Remove the five composition plates, four steel plates, and one waved steel plate from the clutch housing. Remove the clutch apply ring.

On turbocharged cars, remove six composition plates, five flat steel plates, and one waved steel plate.

Note The direct clutch assembly on turbocharged cars is uprated from naturally aspirated cars, therefore it should be kept together as an assembly.

6. Using the clutch spring compressor J-2590, compress the clutch release springs and remove the snap ring (see fig. T19-9).
7. Remove the tool and lift off the spring retainer. Remove the fourteen clutch release springs. Keep these springs separate from the forward clutch release springs.
8. Withdraw the direct clutch piston from the clutch housing.

Note The forward and direct clutch pistons are similar. Ensure that the direct clutch piston is identified during dismantling so that it can be reassembled correctly into the direct clutch housing.

9. Remove and discard the piston inner and outer seals.
10. Remove and discard the piston centre seal from the direct clutch housing.

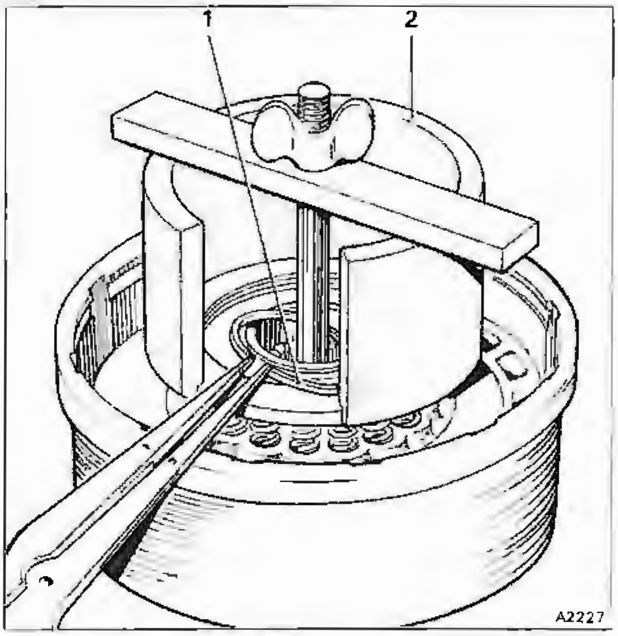


Fig. T19-9 Removing and fitting the direct clutch housing snap ring
1 Snap ring
2 Compressor adapter (seated on retainer)

Direct clutch, sun gear shaft, and intermediate sprag clutch assembly – To inspect

1. Wash all parts **except** the composition faced clutch plates in clean paraffin. Dry with compressed air.
2. Examine the sprag assembly.
3. Examine the inner cam and outer race for scratches or wear.

4. Examine the clutch housing for cracks. Ensure that the oil passages are clear. Check for excessive wear on the clutch plate driving lugs.
5. Examine the composition faced and steel clutch plates.
6. Composition plates should be dried with compressed air and the composition surfaces inspected for.
a. Pitting and flaking.
b. Wear.
c. Glazing.
d. Cracking.
e. Charring.
f. Metal particles embedded in the lining.

If a composition faced plate exhibits any of these symptoms, fit new plates.

7. Steel plates should be inspected for heat discolouration. If the surface is smooth and an even colour is indicated, the plates can be used again. If severe heat spot discolouration or surface scuffing is indicated, fit new plates.
8. Examine the back plate for scratches or other damage.
9. Examine the sun gear shaft for cracks. Examine the splines for damage, the bushes for scoring, and the ground bush journals for damage. Ensure the oil feed hole is clear.
10. Examine the housing for free operation of the check ball.
11. Examine the piston for cracks.
12. Examine the **fourteen** springs for collapsed coils or distortion. If any of these springs requires replacement, fit **sixteen** new springs.
13. Examine the front friction band for wear at the anchor and apply lugs, also for the presence of metallic particles in the band lining. Examine the band lining for cracks, flaking, burning, and for the lining becoming loose.

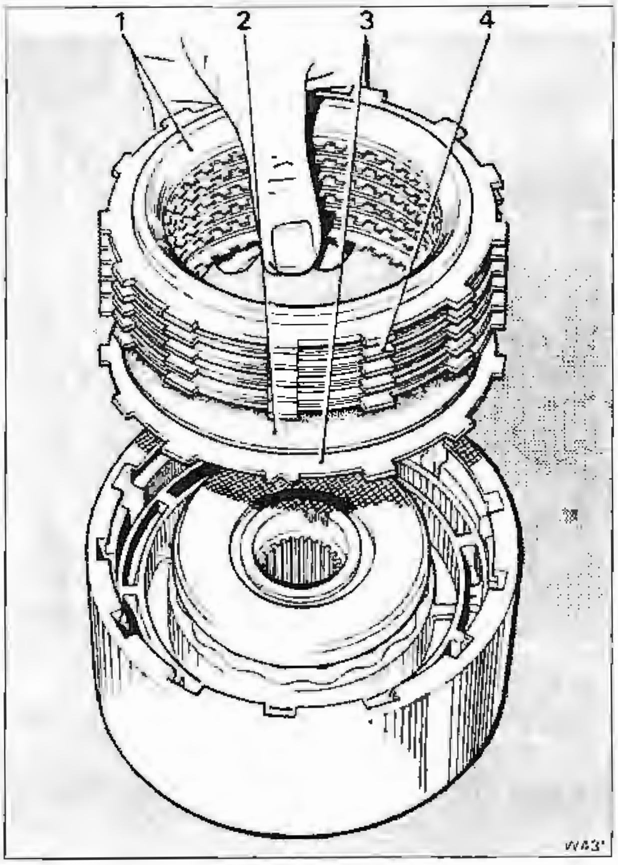


Fig. T19-10 Fitting the direct clutch plates
1 Backing plate
2 Composition plate
3 Waved steel plate
4 Flat steel plate

Direct clutch and intermediate sprag clutch assembly – To assemble

1. Lubricate the new inner and outer clutch piston seals with clean transmission fluid. Lubricate the seal grooves in the direct clutch piston. Fit the seals with the lips facing away from the spring pockets.
2. Lubricate a new centre seal with clean transmission fluid. Lubricate the seal groove in the direct clutch housing, then fit the seal with the lip uppermost.

Note Production built transmissions use a direct clutch housing with a check ball. If the housing requires replacement and the replacement housing does not contain a check ball, replace the direct clutch piston with the service piston which has a check ball. **Either the direct clutch housing and/or the piston must contain a check ball otherwise damage may occur to the direct clutch and related parts.**

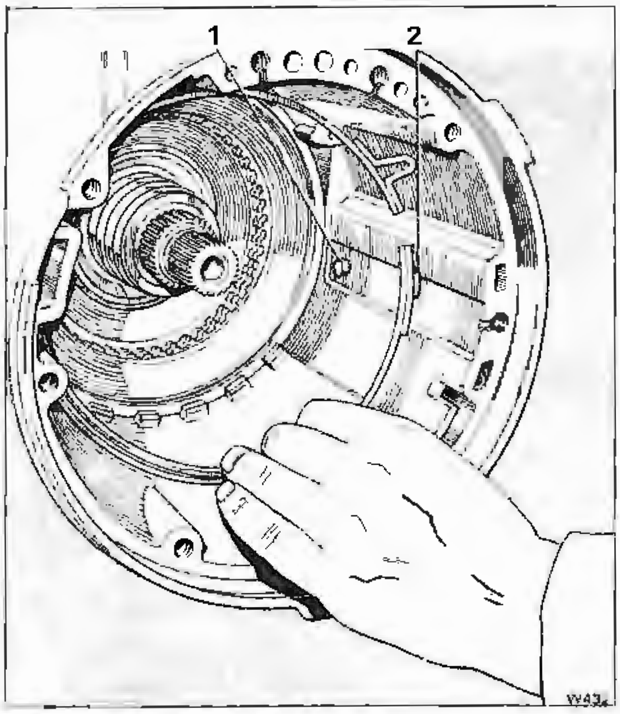


Fig. T19-11 Fitting the front band
1 Anchor pin
2 Front band location

3. Fit the inner seal protector J-21362 over the direct clutch hub.
4. Fit the outer seal protector J-21409 into the clutch housing and fit the piston, turning it clockwise as it is pushed down. Remove the tools.
5. Fit the **fourteen** clutch release springs into the spring pockets in the clutch piston, leaving two pockets directly opposite one another with no springs. If replacement springs are to be fitted, fit all **sixteen**.
6. Position the spring retainer over the springs.
7. Using the clutch spring compressor J-2590, compress the springs ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring, then remove the tool.

Note Ensure that the clutch release springs are not leaning. If necessary, push the springs into an upright position using a small screwdriver.

8. Fit the direct clutch apply ring into the clutch housing.
9. Lubricate the four flat steel clutch plates, five composition faced plates and one waved steel plate with clean transmission fluid. Then fit the plates into the clutch housing (see fig. T19-10). Commence with the waved steel plate and then alternate composition and steel plates.

On turbocharged cars, one waved steel plate, five flat steel plates, and six composition plates are fitted.

Note Do not use radially grooved composition plates at this point of the assembly.

10. Fit the direct clutch backing plate over the clutch plates and fit the large snap ring.
11. Turn the clutch unit over and fit the sprag clutch assembly onto the intermediate clutch inner cam.
12. Fit the intermediate sprag outer race with a clockwise turning motion.

Note When fitted, the outer race should not turn anti-clockwise.

13. Fit the sprag clutch retainer (cup side down) and fit the snep ring.

Turbine shaft, forward and direct clutches, sun gear shaft, and front band – To fit

1. Fit the front band so that the band anchor hole fits over the band anchor pin and the band apply lug faces the servo hole (see fig. T19-11).
2. Fit the sun gear shaft with the longer splined end innermost.
3. Fit the direct clutch housing and intermediate sprag assembly onto the centre support as follows.
4. Ensure that the ends of the oil sealing rings on the centre support are interlocked, and that the rings are lubricated.
5. Carefully slide the direct clutch housing onto the centre support sleeve. At the same time engage the housing internal splines with the splines on the sun gear shaft.
6. Ensure that the clutch housing hub bottoms on the sun gear shaft. Also ensure that the splines on the forward end of the sun gear shaft are flush with the splines in the direct clutch housing.

Note It will be necessary to rotate the clutch housing to allow the sprag outer rece to line up with the intermediate clutch plates. If necessary, remove the direct clutch driving and driven plates to facilitate the handling of the housing.

7. Fit the bronze thrust washer onto the forward clutch hub; retain the washer in position with petroleum jelly.
8. Position the transmission horizontally in the transmission holding fixture. Fit the forward clutch assembly and the turbine shaft.
9. Ensure that the mainshaft bottoms on the end of the forward clutch hub.
10. It will be necessary to rotate the clutch housing to allow the direct clutch driving hub to line up with the clutch plates in the direct clutch.
11. When the forward clutch is correctly seated it should be approximately 31,75 mm (1.250 in) from the oil pump face in the transmission casing.

Note The missing internal splines in the forward clutch hub are lubrication passages and do not have to be aligned with any particular splines on the mainshaft.

12. Fit the oil pump.

Intermediate clutch, gear unit, centre support, and reaction carrier

The intermediate clutch comprises three steel plates (1 waved and 2 flat), three composition plates, and an apply piston.

The steel plates are slotted directly into the transmission casing. The composition plates engage in splines machined in the intermediate clutch outer race.

The compound planetary gear unit consists of an internal gear, which is splined onto the mainshaft; an output planet carrier and pinions; an output shaft, which is mechanically connected to the output carrier; and a sun gear, which is splined onto the sun gear shaft.

The centre support is keyed and bolted to the transmission casing and forms part of the reaction carrier roller assembly. The oil delivery sleeve, which supplies oil pressure to the direct clutch and the intermediate roller is an integral part of the centre support. The support also houses the piston that applies the intermediate clutch.

The reaction carrier comprises a housing, a set of planet pinions, and the outer race of the low roller.

When the mainshaft rotates, the splined internal gear is driven clockwise. This causes the rear planet pinions to idle clockwise and drive the sun gear anti-clockwise.

The front and rear sun gears are integral so they turn as one. As a result, the front planet pinions also idle clockwise and drive the front internal gear clockwise.

The front internal gear is an integral part of the output carrier and is thus connected to the output shaft. This reacts with a force on the front pinions which are trying to drive the front internal gear clockwise. This reaction tends to rotate the front carrier assembly anti-clockwise instead of allowing the force to turn the internal gear and output shaft against the weight of the car.

To make the gear set effective in driving the car, a roller assembly is used to hold the carrier against anti-clockwise rotation. This roller assembly is in effect a one-way clutch which allows a rotating part to turn one way only.

The roller assembly is fitted in such a manner that its elements will lock and prevent the reaction carrier from rotating anti-clockwise. This provides the required reaction and causes the front planet pinions to drive the front internal gear and output shaft in reduction at a ratio of approximately 2.5:1. This gear ratio, coupled with a maximum torque converter reduction of approximately 2.2:1 gives an overall ratio of almost 5.5:1 in first gear.

As the speed of the car increases, less torque multiplication is required so that the coupling will become more efficient. Therefore, it is desirable to move to a lower ratio. This is accomplished with the aid of the intermediate sprag assembly, intermediate clutch, and sun gear shaft.

A sprag assembly is a device having irregular shaped members wedged between inner and outer races, similar to a roller assembly. It permits a part to rotate in one direction only.

When the intermediate clutch is applied, the drive plates become locked to the reaction plates and by doing so they lock the intermediate sprag outer race to the transmission case.

This, in effect, holds the clutch housing, sun gear shaft, and sun gear against anti-clockwise rotation. When the sun gear is stationary, the power flow is as follows.

Converter output is transmitted clockwise through the forward clutch to the mainshaft and rear internal gear. As the rear internal gear turns clockwise, the rear pinions rotate clockwise on their pins and 'walk around' the stationary sun gear. This moves the output carrier and output shaft clockwise in reduction at a ratio of approximately 1.5:1 (or second gear).

The front gear unit is not required for second gear operation. However, because the output carrier is integral with the front internal gear, the front internal gear runs clockwise in reduction. This causes the front planet pinions to run clockwise around the stationary sun gear, turning the reaction carrier clockwise. This clockwise rotation of the reaction carrier causes the rear roller assembly to overrun or to become ineffective.

As the speed of the car increases further, a lower ratio is again required. The transmission is moved to third or direct gear. This is achieved by applying the direct clutch as well as the forward clutch so that both the rear internal gear and the sun gear rotate at the same speed.

In order to obtain reverse, a rear friction band is used. This band locks the reaction carrier against clockwise rotation which would cause the low or rear roller to overrun. Power flow through the transmission in reverse is as follows.

Turbine torque from the converter is transmitted to the forward clutch housing; the forward clutch is released, thus disconnecting the flow of power to the mainshaft and rear internal gear. Instead of power flowing through the forward clutch, it flows from the turbine shaft through the forward clutch housing and through the direct clutch hub to the direct clutch which is applied. This applies power to the sun gear shaft and sun gear, turning them clockwise. With the sun gear driving clockwise, the front pinions revolve anti-clockwise as idlers. This drives the front internal gear and output shaft anti-clockwise or in a reverse direction. The overall ratio in reverse with maximum converter ratio and gaar reduction is approximately 4.4:1.

In intermediate range (second gear) with the accelerator pedal released, the car will slow down, using the engine as a brake. In this situation however, the rear wheels will drive the transmission through the output shaft and as a result, the intermediate sprag would attempt to overrun. To prevent this happening the front band is applied to the direct clutch housing, holding it stationary, thus keeping the transmission in second gear to provide effective engine braking.

For even greater engine braking, the transmission can be placed into low range. At speeds below approximately 64km/h (40 mile/h) the transmission will move to first gear. When the car is in first gear and the throttle is closed, the low roller tends to overrun. When the low/reverse band is applied, the reaction carrier is prevented from overrunning the roller and the transmission is retained in first gear.

Intermediate clutch, gear unit, centre support, and reaction carrier – To remove

Before the intermediate clutch, gear unit, and their associated parts can be removed, the transmission must be removed from the car.

Remove the following units.

1. Sump, strainer, and intake pipe assembly.
2. Control valve unit.

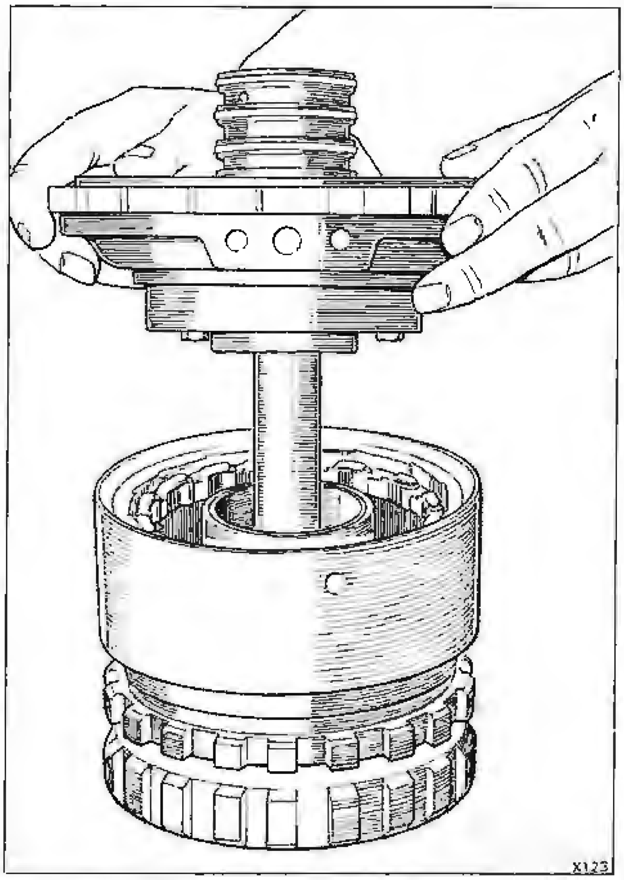


Fig. T20-1 Removing the centre support assembly

3. Rear servo.
4. Control valve spacer, check balls, and front servo.
5. Oil pump.
6. Turbine shaft, forward clutch, direct clutch, sun gear shaft, and front band.
7. Remove the centre support bolt from the transmission case. This is the socket-headed cap-screw located in the lower face of the transmission case at the rear of the control valve unit oil passages.
8. Remove the snap ring which secures the intermediate clutch back plate.
9. Remove the back plate then withdraw the three composition plates and the one waved and two flat steel plates.
10. Remove the snap ring which retains the centre support in the case.
11. Remove the complete gear unit assembly by lifting with the removal tool J-21795 and a slide hammer J-7004.
12. Remove the output shaft thrust washer from either the output shaft or the case.
13. Hold the gear unit assembly with the output shaft pointing down (i.e. through a suitable hole in the work bench).
14. Remove the rear unit selective washer from the transmission case.
15. Remove the support to case spacer.
16. Remove the rear band assembly. To facilitate removal, rotate the band lugs away from the pins and pull the band assembly out of the transmission case.
17. Remove the centre support assembly from the reaction carrier (see fig. T20-1).
18. Withdraw the centre support to reaction carrier thrust washer.

Note The thrust washer and the race may have adhered to the back of the centre support. If so, remove them from the centre support.

19. Remove the reaction carrier and roller clutch assembly from the output carrier (see fig. T20-2). Remove the roller clutch assembly and spacer ring from the reaction carrier.

Centre support and intermediate clutch piston – To dismantle

1. Remove and discard the four oil seal rings from the centre support (see fig. T20-3).
2. Remove the snap ring (see fig. T20-4).
3. Remove the spring retainer and the clutch release springs.
4. Remove the intermediate clutch piston from the centre support.
5. Remove and discard the inner and outer seals from the clutch piston.

Note **Do not** remove the three setscrews which secure the roller clutch inner race to the centre support.

Centre support and intermediate clutch piston – To inspect

1. Wash all parts in clean paraffin, then dry with compressed air.

2. Examine the roller clutch inner race for scratches and indentations. Ensure that the lubrication hole is clear.
3. Examine the bush for scoring or wear.

Note Ensure that the **rear** spiral oil groove (looking from the front of the centre support) is in a clockwise direction (see fig. T20-5).

If replacement is necessary proceed as follows.

a. With the aid of the fitting/removal tools J-21465-6 and J-8092, drive out the old bush.

b. **From the front of the centre support,** align the elongated slot in the bush with the drilled hole in the oil delivery sleeve (groove nearest to the intermediate piston).

c. Drive the bush squarely into the bore, until the bush is flush to 0,25 mm (0.010 in) below the top of the oil delivery sleeve.

4. Ensure that the oil ring grooves are clean and are not damaged.
5. Using compressed air check that the lubrication passages are clear and are not interconnected.
6. Examine the piston bore in the centre support for scratches or damage.
7. Examine the piston seal grooves for damage and ensure that they are clean.
8. Examine the piston for cracks or porosity.
9. Examine the springs for collapsed coils or signs of distortion. Check the spring length against that of a new spring before deciding whether to renew the complete set of springs.

Centre support and intermediate clutch piston – To assemble

1. Lubricate a new inner and a new outer seal with clean transmission fluid. Lubricate the seal grooves in the intermediate clutch piston and fit the seals with the lips facing away from the spring pockets.
2. Fit the intermediate clutch inner seal protector J-21363 over the centre support hub.
3. Fit the intermediate clutch piston (see fig. T20-6). Ensure that it seats fully in the centre support.
4. Fit the spring guide and the three clutch release springs into the pockets in the clutch piston.
5. Position the spring retainer centrally over the springs.
6. Compress the spring retainer, ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring.
7. Fit four new oil sealing rings onto the centre support.

Gear unit – To dismantle (see fig. T20-7)

1. Remove the centre support to sun gear races and thrust bearing. The outer race may have been removed with the centre support.
2. Remove the sun gear from the output carrier assembly.
3. Remove the reaction carrier to output carrier thrust washer and front internal gear ring.
4. Invert the gear unit on the bench so that the mainshaft is pointing downwards.

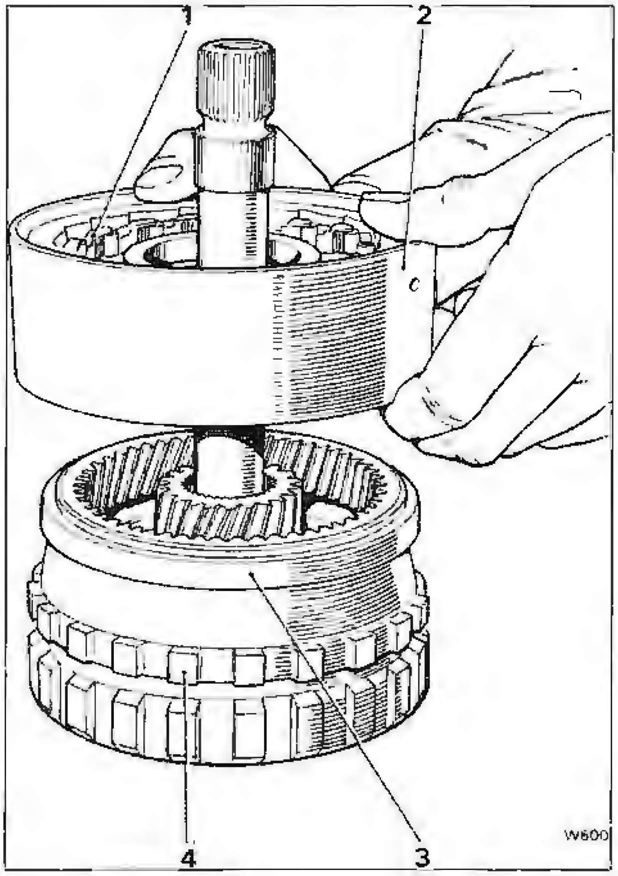


Fig. T20-2 Removing the reaction carrier assembly
1 Roller clutch assembly
2 Reaction carrier
3 Gear ring
4 Output carrier

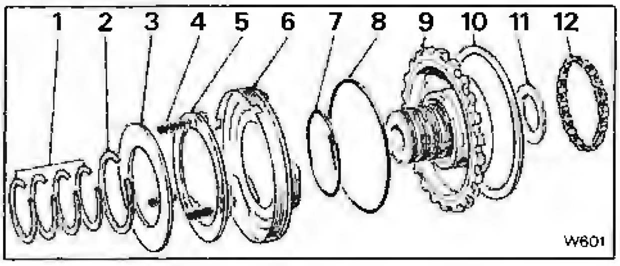


Fig. T20-3 Centre support assembly
1 Oil seal rings
2 Snap ring
3 Intermediate clutch spring retainer
4 Intermediate clutch release springs
5 Intermediate clutch spring guide
6 Intermediate clutch piston
7 Intermediate clutch inner seal
8 Intermediate clutch outer seal
9 Centre support assembly
10 Support to case spacer
11 Thrust washer
12 Roller clutch assembly

5. Remove the snap ring which retains the output shaft in the output carrier; remove the output shaft.
6. Remove the thrust bearing and races from the rear internal gear.
7. Withdraw the rear internal gear and mainshaft from the output carrier; remove the thrust bearing and races from the inner face of the rear internal gear.
8. Remove the snap ring from the end of the mainshaft, then remove the rear internal gear.

Output shaft – To inspect
1. Wash the output shaft in clean paraffin, then dry with compressed air.
2. Examine the bushing for wear.
3. Examine the bearing and thrust washer faces for damage.

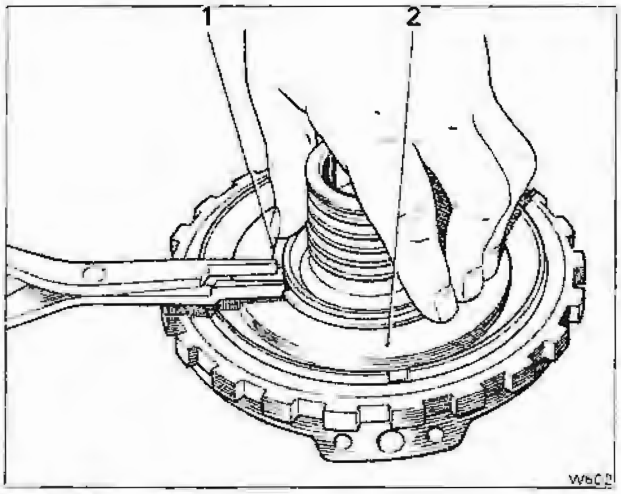


Fig. T20-4 Removing and fitting the intermediate clutch piston snap ring
1 Snap ring
2 Spring retainer

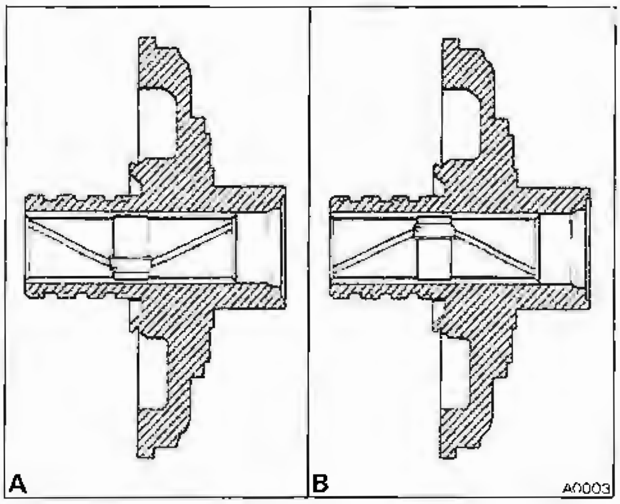


Fig. T20-5 Centre support bush
A Correctly fitted
8 Incorrectly fitted

4. Examine the governor drive gear for rough or damaged teeth.
5. Examine the splines for damage.
6. Examine the drive lugs for damage.
7. Examine the speedometer drive gear for rough or damaged teeth. If a gear is badly worn or damaged, it can be renewed as follows.

Speedometer drive gear – To remove
It should be noted that a nylon speedometer drive gear is installed **only** at the factory. All replacement drive gears are manufactured from steel.
1. If a **nylon gear** is fitted to the shaft, depress the retaining clip and slide the gear off the output shaft (see fig. T20-8).
2. If a **steel gear** is fitted to the shaft, install the speedometer drive gear removal tools J-21427 and J-9578 (see fig. T20-9).
Tighten the bolt on the puller until the gear is free on the shaft.
Remove the tools and the gear from the shaft.

Speedometer drive gear – To fit
1. To a fit a **nylon gear,** align the slot in the speedometer drive gear with the hole in the output shaft, then install the retaining clip.
2. To fit a **steel gear,** lightly lubricate the bore of the gear, then fit the gear over the output shaft.
Press the gear down the shaft using a suitable length of tube and a press, until the distance from the rear face of the gear to the end of the output shaft measures 291,30 mm (11.469 in). Refer to figure T20-10.

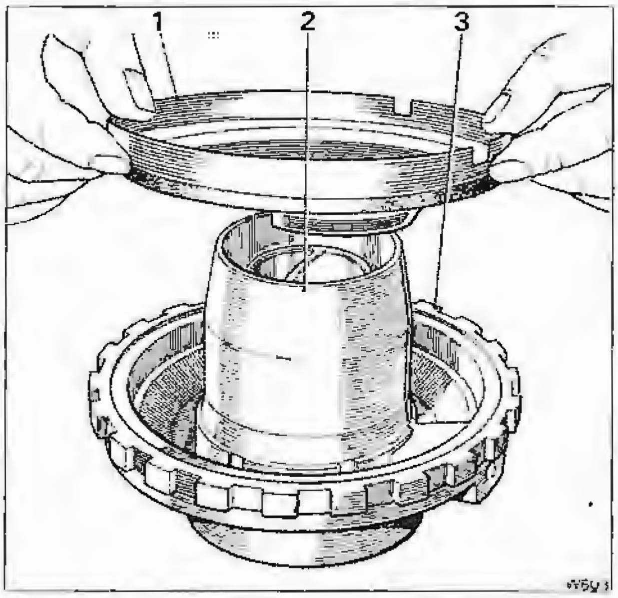


Fig. T20-6 Fitting the intermediate clutch piston
1 Intermediate clutch piston
2 Guide sleeve
3 Centre support

Mainshaft – To inspect

1. Wash the mainshaft in clean paraffin, then dry with compressed air.
2. Examine the shaft for cracks or distortion.
3. Examine the splines for damage.
4. Examine the ground journals for scratches or damage.
5. Examine the snap ring groove for damage.
6. Ensure the oil lubrication holes are clear.

Rear internal gear and sun gear – To inspect

1. Wash the rear internal gear and the sun gear in clean paraffin, then dry with compressed air.
2. Examine all the gear teeth for wear or damage.
3. Examine the splines for damage.
4. Examine the gears for cracks.

Output carrier assembly – To inspect

1. Wash the output carrier assembly in clean paraffin, then dry with compressed air.
2. Examine the front internal gear for damaged teeth.
3. Examine the pinion gears for damage, rough bearings, or excessive side movement.
4. Check the end-float of the pinions with the aid of a feeler gauge (see fig. T20-11). The end-float should be between 0,23 mm and 0,61 mm (0.009 in and 0.024 in).
5. Examine the parking pawl lugs for cracks or damage.
6. Examine the splines which drive the output shaft for damage.
7. Examine the front internal gear ring for flaking or cracks.

Reaction carrier assembly – To inspect

1. Examine the surface on which the rear band applies, for signs of burning or scoring.
2. Examine the roller outer race for scoring or wear
3. Examine the thrust washer surfaces for signs of scoring or wear.
4. Examine the bush for damage. If the bush is damaged, the carrier must be renewed.

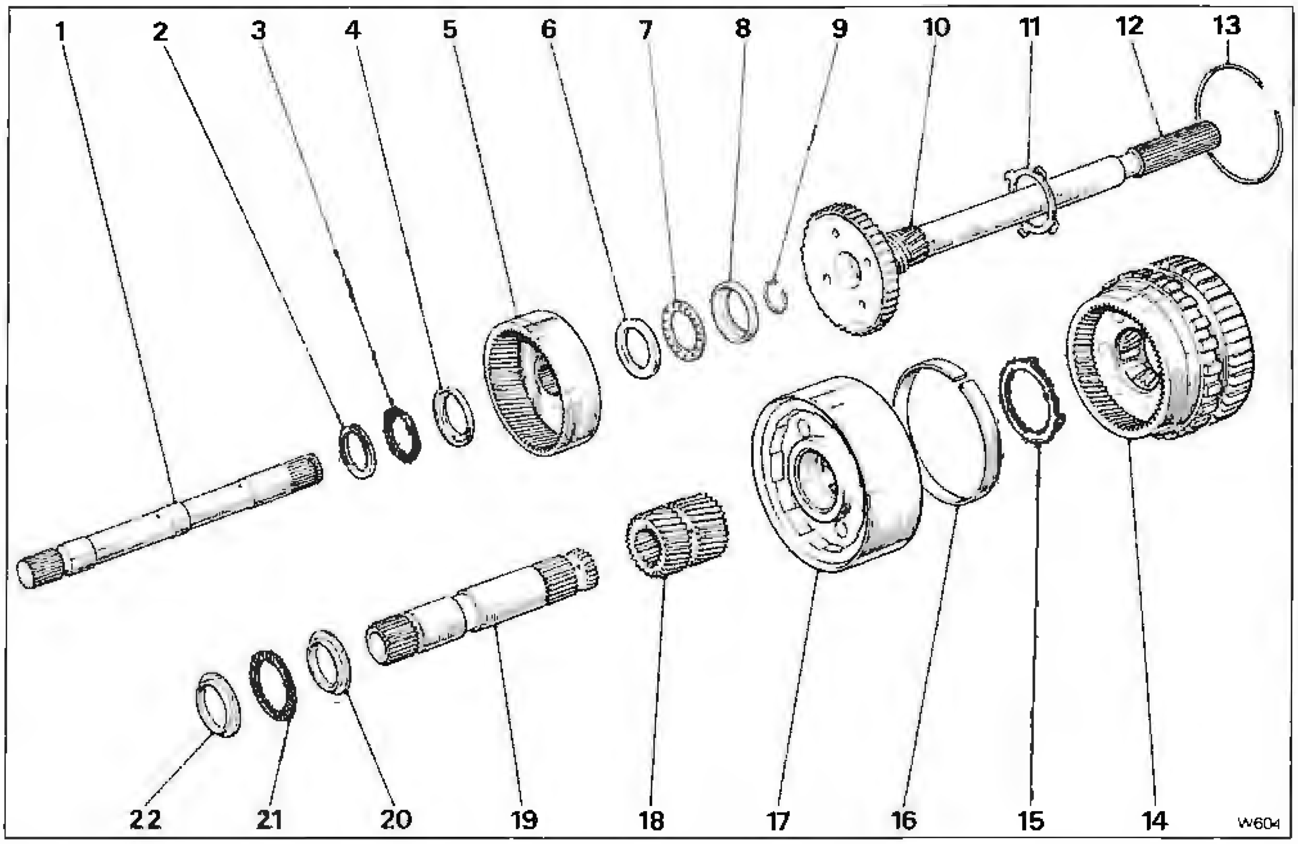


Fig. T20-7 Gear unit

1 Main shaft
2 I/D flanged race
3 Thrust bearing
4 O/D flanged race
5 Rear internal gear
6 I/D flanged race
7 Thrust bearing
8 O/D flanged race
9 Snap ring
10 Speedometer drive gear
11 Thrust washer
12 Output shaft
13 Snap ring
14 Output carrier assembly
15 Thrust washer
16 Front internal gear ring
17 Reaction carrier assembly
18 Sun gear
19 Sun gear shaft
20 I/D flanged race
21 Thrust bearing
22 I/D flanged race

5. Examine the pinion gears for damage, rough bearings, or excessive side movement.
6. Check the pinion end-float. This should be between 0,23 mm and 0,61 mm (0.009 in and 0.024 in).

Pinion gears – To renew

1. Support the carrier assembly on its **front** face.
2. Using a 12,70 mm (0.50 in) diameter drill, remove the stake marks from the end of the pinion pins. Ensure that the drill does not remove any metal from the carrier as this will weaken the component and could result in a cracked carrier.
3. Using a tapered punch, drive or press the pinions out of the carrier.
4. Remove the punch, gears, thrust washers, and needle roller bearings.
5. Examine the pinion thrust faces in the pinion gear pockets for burrs and stone off as necessary. Thoroughly wash the carrier in clean paraffin and dry with compressed air.
6. Ensure that the new gears are clean and free from burrs, then fit the eighteen needle bearings into each pinion gear. Use petroleum jelly to retain the bearings and use a pinion pin as a guide when fitting the bearings.
7. Fit a bronze and a steel thrust washer on each side of the pinion gear, with a steel washer next to the gear. Hold the washers in place with a smear of petroleum jelly.

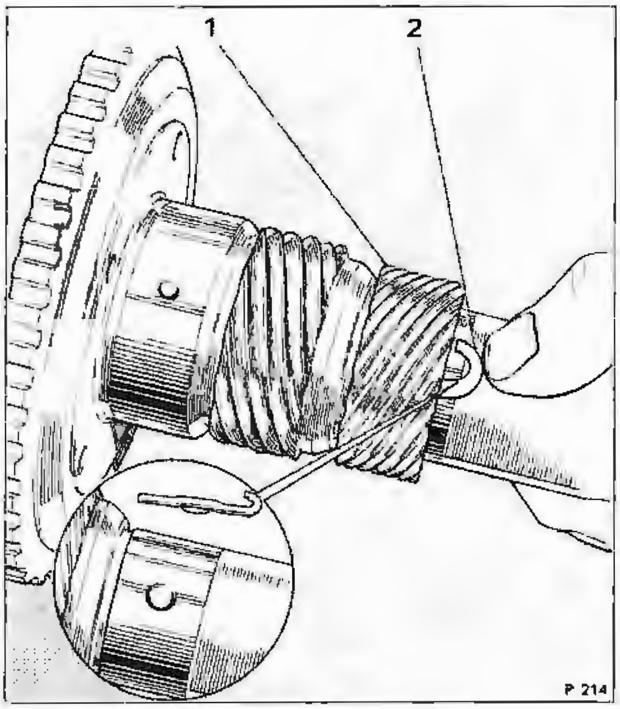


Fig. T20-8 **Removing a nylon speedometer drive gear**
1 Nylon gear
2 Retaining clip

On output carrier assemblies only, a steel and a bronze washer are always fitted on the thrust side, but two steel washers may be fitted on the non-thrust side. However, if the pinion end-float is outside the tolerance given, the washers should be replaced with a steel and a bronze on both sides (see fig. T20-12). **This is essential on RJA transmissions.**

8. Fit the pinion gear assembly into position in the carrier, then fit a pilot pin through the rear face of the assembly to centralize and hold the parts in position.
9. Drive a new pinion pin into position from the front, rotating the pinion whilst the pin is being driven in.
10. Ensure that the headed end of the pin is flush or below the face of the carrier.
11. Secure the punch to be used for staking the pins in a bench vice, so that it can be used as an anvil.
12. Support the carrier with the head of the pin resting on the punch. Then, using a chisel with a radiused end stake the opposite end of the pin in three places (see fig. T20-13).

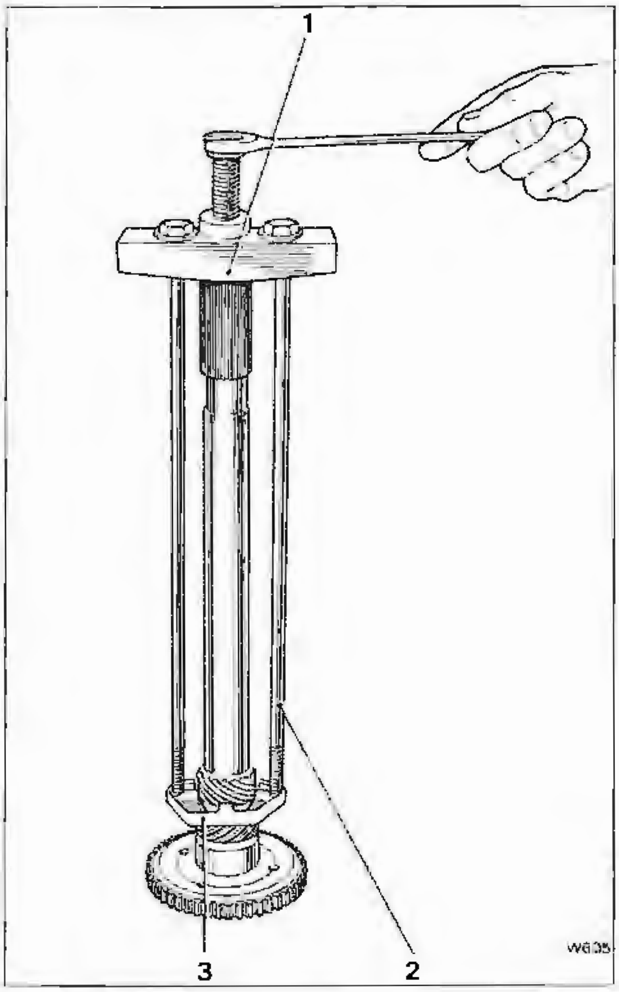


Fig. T20-9 **Removing a steel speedometer drive gear**
1 J-9578
2 Removal bolts
3 J-21427

Note Both ends of the pin must lie below the face of the carrier, otherwise a foul may occur between the pin and the adjacent component.

13. Repeat the procedure for the remaining pins.

Roller clutch – To inspect

1. Wash the assembly in clean paraffin, then dry with compressed air.
2. Examine the roller clutch for damaged rollers or springs.
3. Examine the roller cage for damage.

Intermediate clutch plates and rear band – To inspect

1. Examine the condition of the composition faced and steel plates. **Do not** diagnose a composition drive plate by colour.
2. Dry composition faced plates with compressed air and inspect the composition face for.

a. Pitting and flaking.
b. Wear.
c. Glazing.
d. Cracking.
e. Charring.
f. Metal particles embedded in the lining.

If any of the above conditions are evident, replacement is required.

3. Wipe the steel plates dry and check for heat discolouration. If the surface is smooth and an even colour is indicated, the plates should be used again. If severe heat spot discolouration or surface scuffing is indicated, the plates must be replaced.

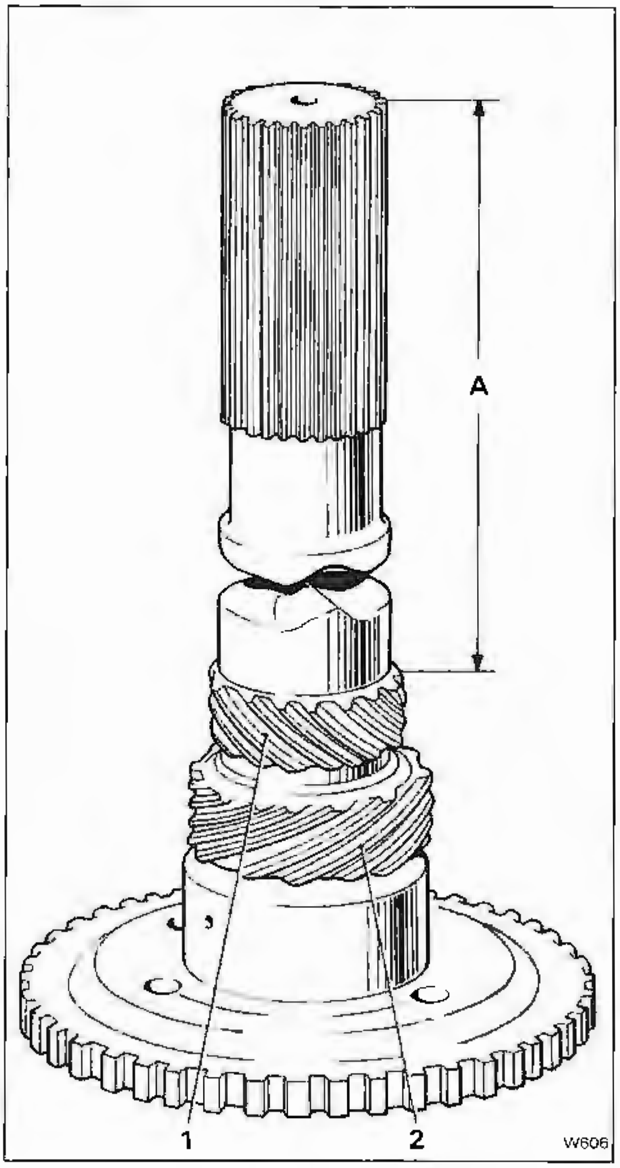


Fig. T20-10 Output shaft
1 Speedometer driving gear
2 Governor driving gear
A 291,30 mm (11.469 in)

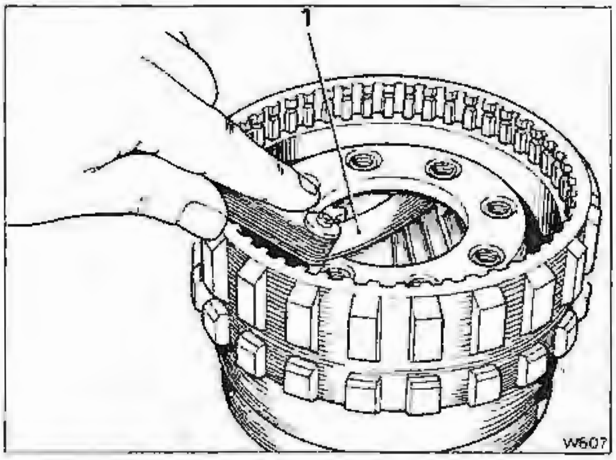


Fig. T20-11 Checking the output carrier pinion end-float
1 0,23 mm to 0,61 mm (0.009 in to 0.024 in)

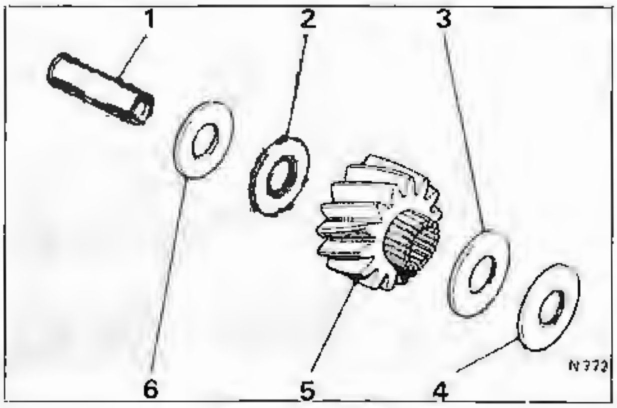


Fig. T20-12 Planet pinion gear
1 Pinion pin
2 Steel washer
3 Steel washer
4 Bronze washer
5 Planet pinion
6 Bronze washer

4. Examine the rear band for cracks or distortion.
5. Examine the ends of the band for damage at the anchor lugs and the apply lug.
6. Examine the lining for cracks, flaking, and burning.
7. Ensure that the lining is secured to the band.

Gear unit and centre support – To assemble

1. Ensure that all parts are clean. Lightly lubricate with clean transmission fluid all bushes, journals, gears, bearings, etc.
2. Fit the rear internal gear onto the mainshaft; fit the circlip.

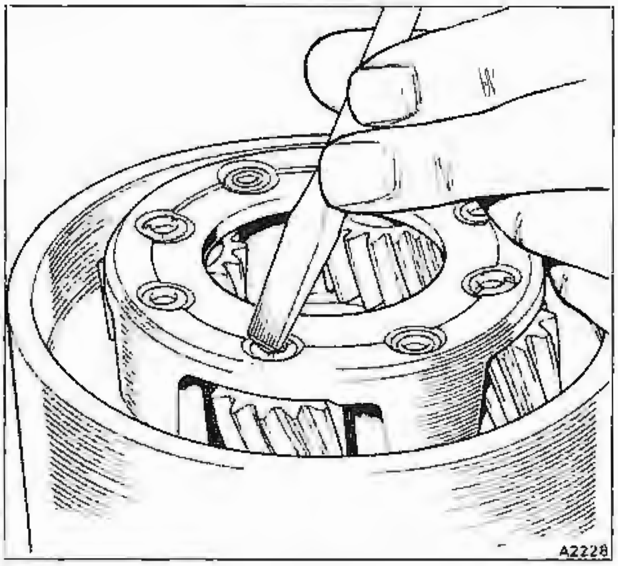


Fig. T20-13 Staking a pinion pin

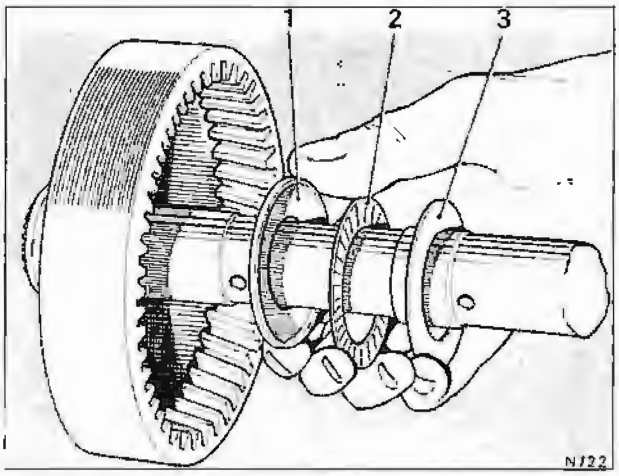


Fig. T20-14 Fitting the races and thrust bearing to the inner face of the rear internal gear
1 O/D flanged race
2 Thrust bearing
3 I/D flanged race

3. Fit the races and thrust bearing onto the inner face of the rear internal gear, retaining them with a smear of petroleum jelly (see fig. T20-14).
4. Fit the large diameter race first with the outer flange uppermost.
5. Fit the thrust bearing into the race.
6. Fit the smaller diameter race over the bearing with the inner flange towards the bearing.
7. Ensure that the pinion gears are adequately lubricated. Then, fit the output carrier onto the mainshaft so that the pinion gears mesh with the rear internal gear.
8. Position the assembly with the mainshaft pointing downwards through a hole in the bench. Take care not to damage the shaft.
9. Fit the races and thrust bearing onto the outer face of the rear internal gear, retaining them with a smear of petroleum jelly. The small diameter (flanged I/D) race must be fitted first with the flange uppermost (see fig. T20-15).
10. Fit the thrust bearing into the race.
11. Fit the large diameter (flanged O/D) race against the bearing with the flange cup over the bearing.
12. Fit the output shaft into the output carrier and fit the circlip.

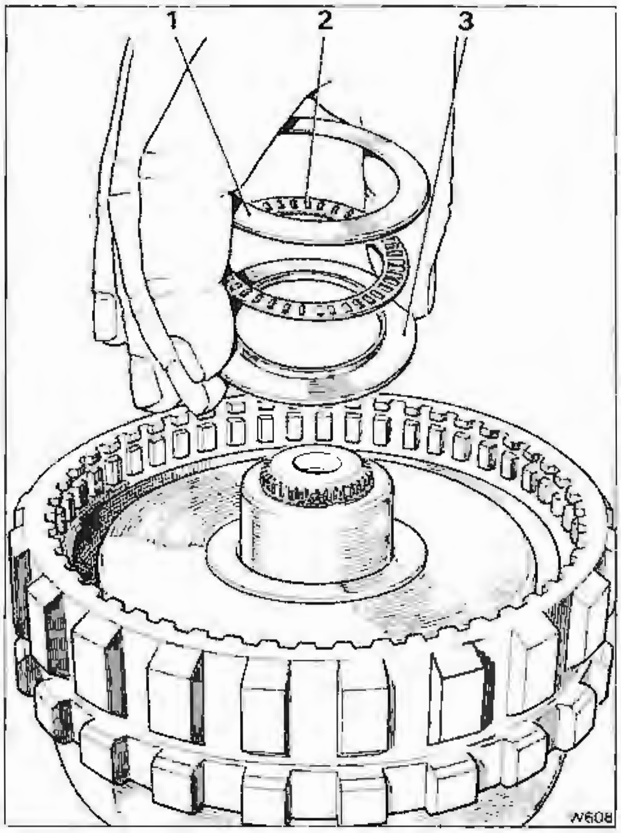


Fig. T20-15 Fitting the races and thrust bearing to the outer face of the rear internal gear
1 O/D flanged race
2 Thrust bearing
3 I/D flanged race

13. Smear the output shaft to case metal thrust washer with petroleum jelly, than fit the washer into position.
14. Turn the assembly over so that the output shaft points downwards.
15. Smear the reaction carrier to output carrier thrust washer with petroleum jelly. Then, fit the washer into the output carrier so that the bent tabs engage in the tab pockets.

Note The factory built transmissions use a non-metal washer, however, the service replacement thrust washer is metal.

16. Fit the sun gear; ensure that the end with the chamfered inside diameter faces downwards.
17. Fit the gear ring over the output carrier.
18. Fit the sun gear shaft with the longest splined end first.
19. Ensure that the reaction carrier pinion gears are adequately lubricated. Then, fit the reaction carrier onto the output carrier as shown in figure T20-16. Mesh the pinion gears with the front internal gear.

Note When a new output carrier and/or reaction carrier is being installed and the front internal gear ring prevents assembly of the carriers, replace the front internal gear ring with the service ring.

20. Smear the centre support to sun gear thrust reces and bearing with petroleum jelly and fit as follows (see fig. T20-17).

a. The large outer diameter race, with the centre flange up, over the sun gear shaft.

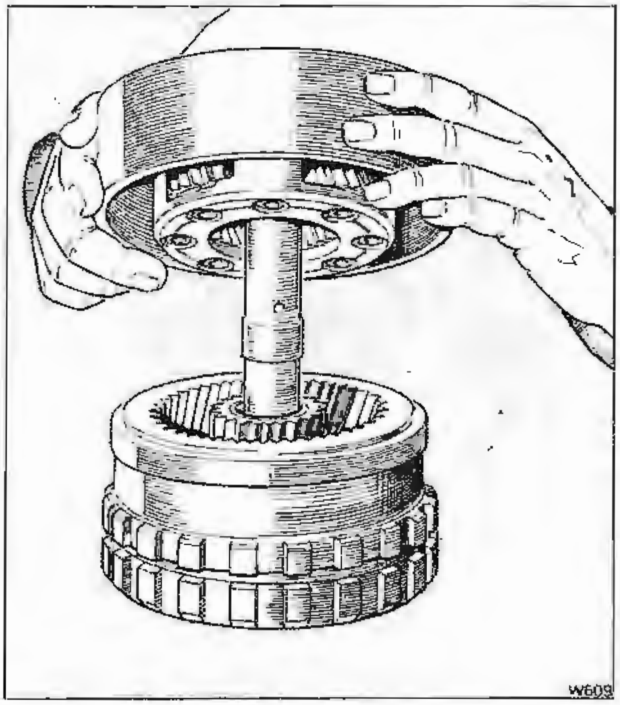


Fig. T20-16 Fitting the reaction carrier to the output carrier

b. The thrust bearing onto the large race.

c. The small diameter race, with the centre flange up.

21. Smear the centre support to reaction carrier thrust washer with petroleum jelly, then fit the washer into the recess in the centre support.

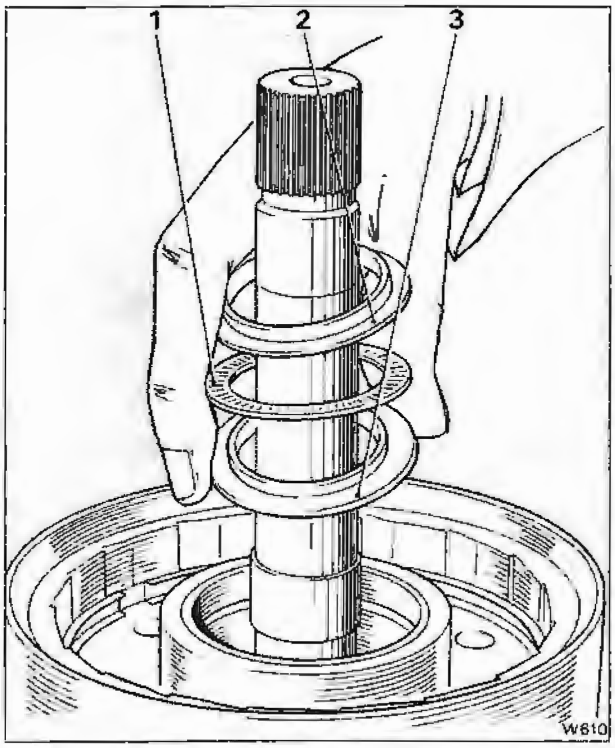


Fig. T20-17 Fitting the races and thrust bearing to the sun gear
1 Thrust bearing
2 I/D flanged race
3 I/D flanged race

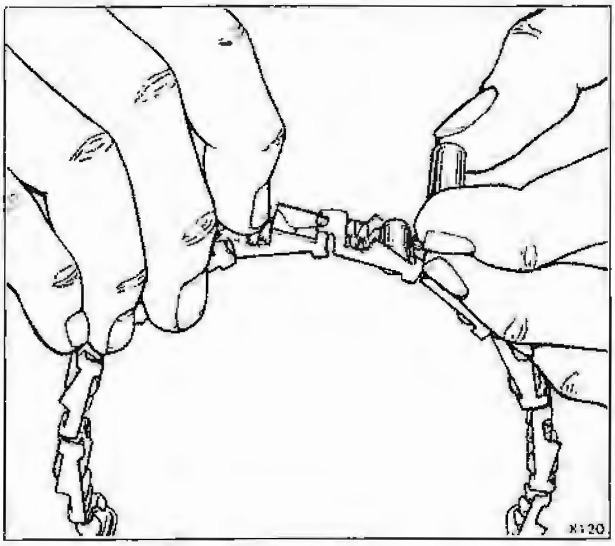


Fig. T20-18 Fitting a roller to the roller clutch cage

22. Fit the rollers that may have come out of the roller clutch cage, by compressing the energizing spring with the forefinger and inserting the roller from the outside (see fig. T20-18).

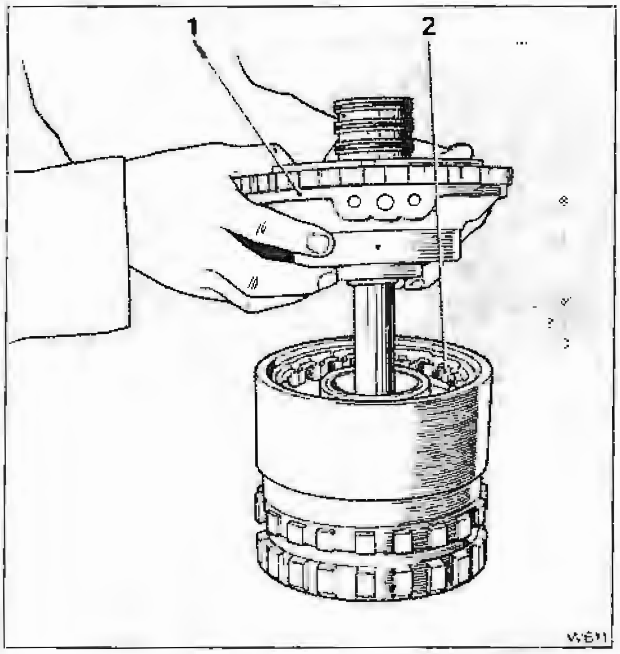


Fig. T20-19 Fitting the centre support into the reaction carrier (roller clutch)
1 Centre support
2 Roller clutch

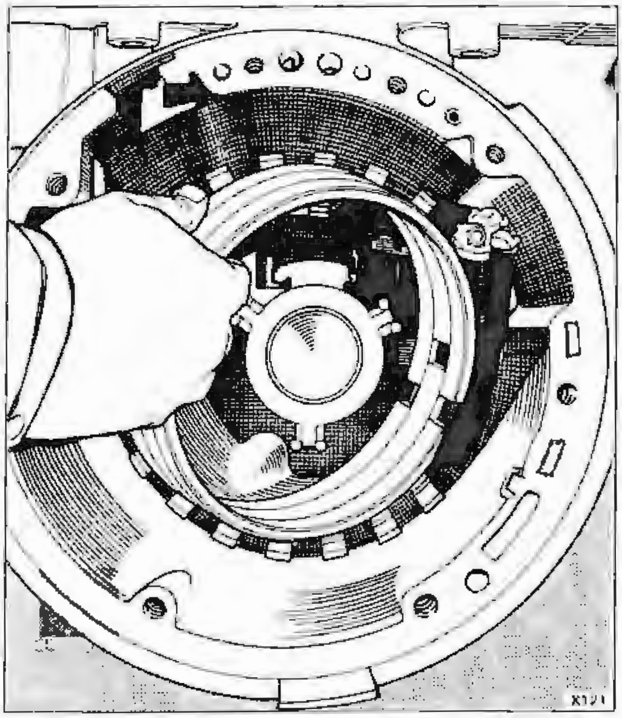


Fig. T20-20 Fitting the rear band

Note Ensure that the energizing springs are not distorted and that the curved end leaf of the springs are positioned against the rollers.

23. Fit the spacer ring and roller clutch assembly into the reaction carrier.

24. Fit the centre support assembly into the roller clutch (see fig. T20-19).

Note With the reaction carrier held, the centre support should turn **anti-clockwise only.**

Intermediate clutch, gear unit, centre support, and reaction carrier – To fit

1. Fit the rear band assembly into the transmission case so that the band lugs engage with the anchor pins (see fig. T20-20).

2. Inspect the support to case spacer for burrs or raised edges. If necessary, remove the burrs, etc., with a stone or fine emery cloth. Ensure that the spacer is clean.

3. Fit the support to case spacer against the shoulder at the bottom of the case splines and the gap adjacent to the band anchor pin.

Note Do not confuse this spacer [1,02 mm (0.040 in) thick and with boths sides flat] with either the centre support to case snap ring (one side bevelled) or the intermediate clutch backing plate to case snap ring [2,36 mm (0.093 in) thick with both sides flat].

4. Fit the previously selected rear unit adjusting washer (see Section T19) into the slots provided inside the rear of the transmission case. Retain the washer with a smear of petroleum jelly.

5. Fit the transmission case into the holding fixture (if it has been removed). Do not over-tighten the fixture side pivot pin as this will cause binding when the gear unit is fitted.

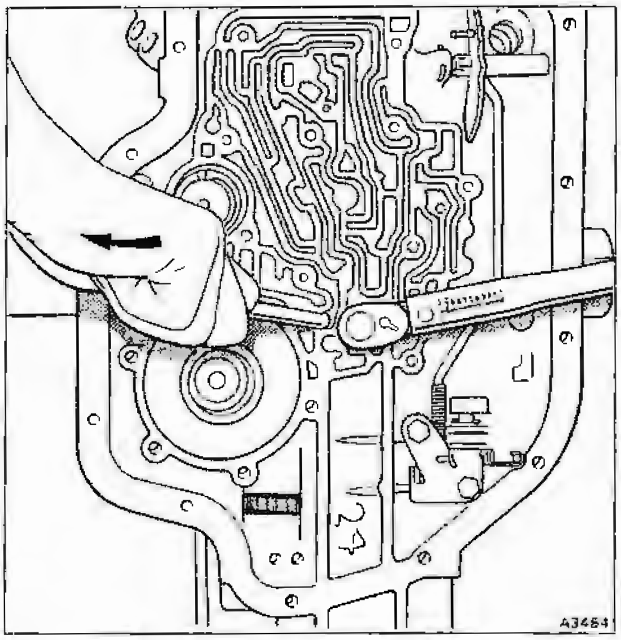


Fig. T20-21 Locating the centre support

6. Fit the gear unit assembly into the case. Align the slots. Then, carefully guide the assembly into the case, making certain that the centre support bolt hole is properly aligned with the hole in the case. Ensure that the tangs on the output shaft to case thrust washer are positioned in the pockets.
7. Lubricate the centre support retaining snap ring with clean transmission fluid. Fit the snap ring into the transmission case with the bevelled side uppermost and the flat side against the centre support. Position the location gap adjacent to the front band anchor pin.
8. With the transmission in a vertical position (see fig. T20-21), fit the case to centre support bolt by placing the centre support locating tool J-23093 into the case direct clutch passage. Ensure that the handle of the tool is pointing to the left as viewed from the valve body side and parallel to the bell housing mounting face.
9. Apply pressure to the tool handle as shown in figure T20-21, which will tend to rotate the centre support anti-clockwise as viewed from the bell housing end of the transmission.
10. While holding the centre support firmly anti-clockwise against the case splines, torque tighten the case to centre support bolt to the figures quoted in Section T23, using a $^3/_8$ in UNC 12 point thin wall, deep socket.

Note When using the locating tool, take care not to create burrs on the case valve body mounting face.

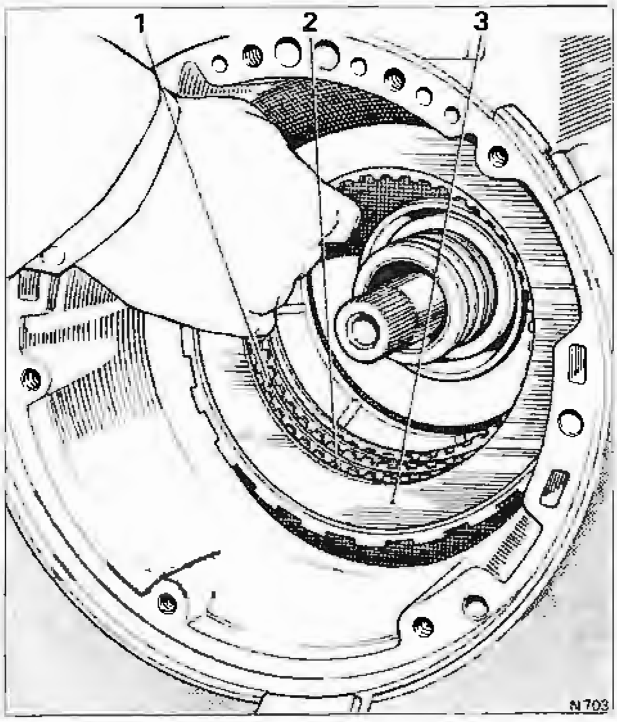


Fig. T20-22 Fitting the intermediate clutch plates
1 Steel plate
2 Composition plate
3 Back plate

11. Lubricate the one waved, two flat steel plates, and three composition intermediate clutch plates with clean transmission fluid, then fit the clutch plates. Commence with the waved steel plate, then fit alternate composition and flat steel plates (see fig. T20-22).
12. Fit the intermediate clutch backing plate with the ridge uppermost.
13. Fit the intermediate clutch backing plate to case snap ring, ensuring that the ring gap is opposite the band anchor pin. Both sides of this snap ring are flat and it is 2,36 mm (0.093 in) thick.
14. Check the rear unit end-float (see Section T19).

Transmission case

The transmission case is an alloy die casting which houses the main transmission components. It also forms the bell housing which encloses the torque converter.

The lower inner face of the case forms part of the hydraulic passages onto which the control valve unit is fitted. The oil pump is fitted to a machined face at the front of the case. This machined face contains oil passages which convey transmission fluid from the pump to various points in the case (see fig. T21-1).

The bore in the rear of the case contains a bush in which the ouput shaft rotates.

Transmission case – To inspect

1. When the transmission has been completely dismantled, the case should be thoroughly washed in clean paraffin, then dried with compressed air.
2. Ensure that all the oil passages are flushed out.
3. Take care not to create burrs on the ends of the passages.

Note If the case assembly requires replacement, ensure that the centre support to case spacer is removed from the old case and fitted in the new case.

4. Inspect the case assembly for cracks, internal porosity or cross channel leaks in the valve body face passages.
5. Check the retention of the band anchor pins.
6. Inspect all threaded holes for thread damage.

Note Stripped threads in bolt holes are repairable with Heli-coil inserts (see fig. T21-3 and Heli-coil chart).

7. Inspect the intermediate clutch plate lugs for damage.
8. Inspect the snap ring grooves for damage.
9. Inspect the bore of the governor assembly for scratches or scoring.
10. Inspect the modulator valve bore for scoring or damage.
11. Inspect the intermediate clutch cup plug for retention and sealing. If necessary, fit a new plug.

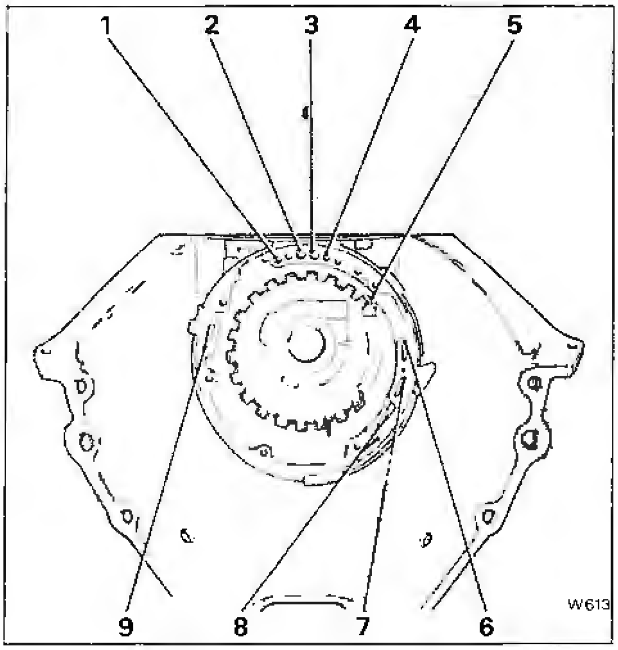


Fig. T21-1 Transmission case oil passages
1 Reverse
2 Line
3 Drive
4 Modulator
5 Intermediate clutch cup plug
6 To cooler
7 Cooler return
8 Vent
9 Pump intake

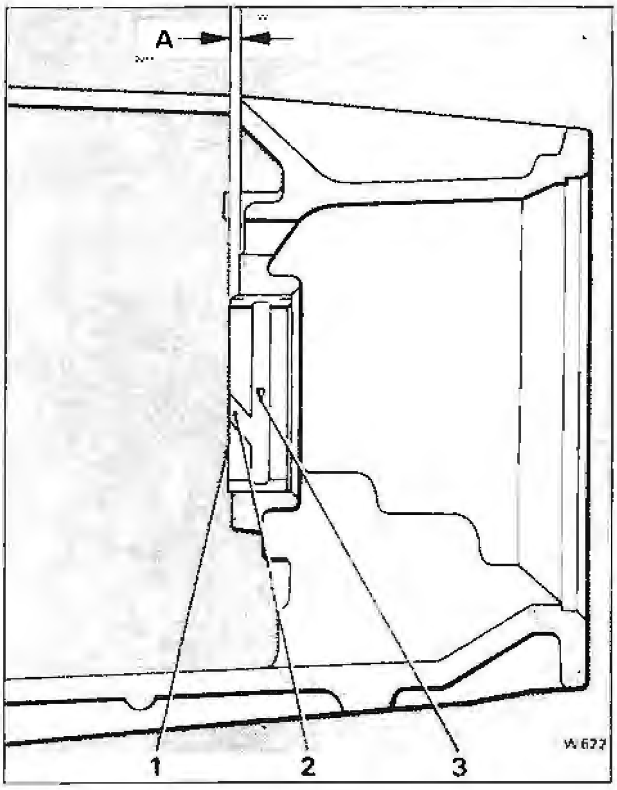


Fig. T21-2 Fitting a new case bush
1 Bush
2 Oil groove in direction shown
3 Stake mark
A 1,02 mm to 1,40 mm (0.040 in to 0.055 in)

External damage
External damage is usually caused by handling, road hazards, or the converter to flexplate setscrews becoming loose as a result of incorrect fitting. Therefore, when external damage is evident, fit a new case.

Internal damage
If internal damage is due to the incorrect installation of the spacer and/or the snap rings resulting in damage to the snap ring grooves, fit a new case and ensure that the snap rings are assembled correctly.

High oil pressure (faults usually located in the pressure regulator valve system) can also result in internal damage. If this is the cause, fit a new case and rectify the problem.

If the case bushing is found to be worn or scored, fit new bushing (see fig. T21-2).

Repair procedure for minor case porosity
1. Bring the transmission fluid up to the normal operating temperature approximately 77°C (170°F).
2. Locate the source of the oil leak.
3. Thoroughly clean the area to be repaired with cleaning solvent and a brush; dry the area with compressed air. A clean, dry soldering acid brush may be used to clean the area and also to apply the epoxy cement.
4. Following the manufacturer's instructions, mix a sufficient amount of epoxy cement 3M Scotch Weld 2216 or equivalent.

Note Observe the manufacturer's precautions regarding handling.

5. While the transmission is still at operating temperature, apply the epoxy cement to the area under repair. Ensure that the area is completely covered.
6. If 3M Scotch Weld 2216 has been used, allow 1 hour to pass before starting the engine. Equivalent epoxy cements may take longer to cure, therefore, always check the manufacturer's instructions.
7. Finally, bring the transmission fluid up to the normal operating temperature of approximately 77°C (170°F) and check the transmission for leaks.

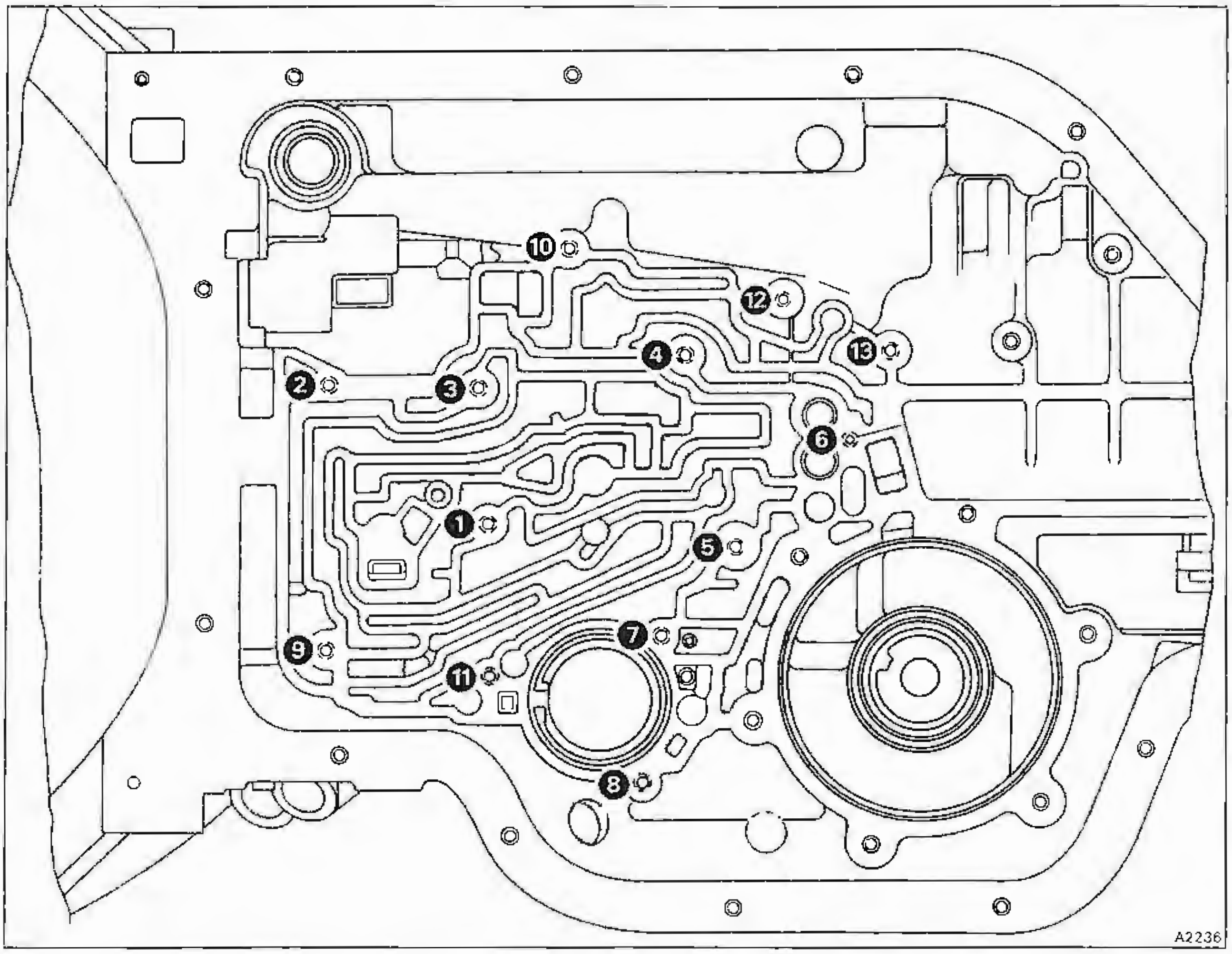


Fig. T21-3 Heli-coil identification – View of underside of transmission case

Intermediate clutch cup plug – To fit

1. Place the transmission case in the holding fixture RH 7955 and position it with the front end facing upwards.

2. Ensure that the intermediate clutch cup plug hole is thoroughly clean and enter the intermediate clutch cup plug into the hole, open end out. Drive the plug into the case until it is flush or slightly below the top of the hole using a 9,52 mm (0.375 in) diameter rod, approximately 254 mm (10 in) long.

Note Ensure that the diameter of the rod is large enough to locate on the lip edge of the plug and not the bottom of the plug.

3. Stake the plug securely in the case.

Heli-coil information

Transmission out of car and partially or completely dismantled

Location	Hole number	Drill size	Tap size	Heli-coil size
Pump to case	All	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	1 to 4 (see fig. T21-3)	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	5 and 6 (see fig. T21-3)	6,76 mm (0.266 in)	1/4-20 UNC-2B	1/4 - 20 STI-NC
Converter to flexplate	All	10,30 mm (0.406 in)	M10-1.5	M10-1.5 x 1½D

Transmission in car and partially dismantled

Location	Hole number	Drill size	Tap size	Heli-coil size
Rear extension to case	All	9,93 mm (0.391 in)	3/8-16 UNC-2B	3/8 - 16 STI-NC
Governor cover to case	All	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Modulator retainer to case	–	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Speedometer driven gear assembly to case	–	6,20 mm (0.244 in)	M6-1.0	M6-1.0 x 2D
Oil sump to case	All	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Rear servo cover to case	All	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Parking lock bracket to case	All	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	7 to 10 (see fig. T21-3)	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 1B STI-NC
Valve body to case	11 (see fig. T21-3)	6,76 mm (0.266 in)	1/4-20 UNC-2B	1/4 - 20 STI-NC
Solenoid to case	12 and 13 (see fig. T21-3)	6,76 mm (0.266 in)	1/4-20 UNC-2B	1/4 - 20 STI-NC

Case bushing – To remove

1. Support the case in the holding fixture and thread the extension handle J-21465-13, into the bushing removal tool J-21465-8. Then, using drive handle J-8092, remove the bush.

Case bushing – To fit

1. Obtain the following tools.
   Removal/fitting tool J-21465-8.
   Adapter J-21465-9.
   Drive handle J-8092.
   Extension J-21465-13.
2. Support the transmission case.
3. Assemble the tools. Then, using the adapter, press the bush into the case until it is between 1,02 mm and 1,40 mm (0.040 in and 0.055 in) **above** the selective thrust washer face as shown in figure T21-2.

Note Ensure that the bush is fitted with the lubrication passage facing the front of the transmission case.

4. Stake the bush in the oil groove using tool J-21465-10.

Heli-coils

Refer to figure T21-3 and the Heli-coil information chart, for the correct drill and tap sizes, before commencing any repair work.

1. Blank off the area around the hole to be heli-coiled (if possible), to contain any small particles of metal.
2. Drill out the old threads and clean any particles from the hole.

Note Drill out only to the depth of the original hole. When drilling hole No. 4 (see fig. T21-3), the drill may go through to the inside of the case. Located just behind this hole are the intermediate clutch splines. Therefore, the burrs **must** be removed from the clutch splines.

3. Tap the hole with the Heli-coil tap.
4. Fit the standard insert (STI) Heli-coil.
5. Break off the tang from the bottom of the Heli-coil.
6. Ramove any blanks, etc., as described in Operation 1 and **ensure that all particles of metal, etc., are removed.**

Fault diagnosis

Accurate diagnosis of transmission problems begins with a thorough understanding of normal transmission operation. In particular it is essential to know which units are involved in the various gears and speeds, so that the specific unit or fluid flow can be isolated and investigated further.

The following sequence of tests may help to simplify the diagnosis of defects and should be performed first.

1. Check the fluid level.
2. Warm-up the engine and transmission to obtain normal operating temperature, approximately 77°C (170°F).
3. Check the control linkage.
4. Check the throttle position switch.
5. Check the vacuum lines and fittings.
6. Fit a pressure gauge and road test the car.

Note If possible, test the car with the customer as a passenger. It is possible that the condition which the customer requires correcting is a normal function of the transmission, thus, unnecessary work can be avoided.

Symptom	Possible cause	Action
1. No drive in drive range	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3). Check for external leaks or the vacuum modulator diaphragm leaking.
	2. Control linkage.	2. Check and adjust the control linkage (see Section T18).
	3. Low oil pressure.	3. (a) Check the vacuum modulator. (b) Check for a restricted intake strainer, a leak at the intake pipe, grommet, or the 'O' ring damaged or missing. (c) Check that the oil pump assembly pressure regulator is not sticking. Also check the pump drive gear tang has not been damaged by the converter. (d) Check the case for porosity around the intake bore. (e) Check the items listed on page T22-13.
	4. Control valve assembly.	4. Check for the manual valve being disconnected from the detent lever.
	5. Forward clutch.	5. (a) Check the forward clutch apply piston for cracks, the seals damaged or missing, or the clutch plates burnt (see page T22-14). (b) Check the oil seal rings (missing or broken) on the pump cover. (c) Check for a leak in the feed circuit or the pump to case gasket mis-positioned or damaged. (d) Check the clutch housing check ball is not sticking or missing.
	6. Roller clutch assembly.	6. Check the clutch assembly for broken springs or damaged cage.

Printed in England

Symptom	Possible cause	Action
1. No drive in drive range (continued)	7. Actuator inoperative.	7. (a) Check the gearchange fuse (fuse A6 on fuse panel F2). (b) Check the charge condition of the battery. (c) Check the operation of the actuator (see Section T6).
2. (a) No drive in reverse range. (b) Slips in reverse range	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Actuator inoperative.	2. (a) Check the gearchange fuse (fuse A6 on fuse panel F2). (b) Check the charge condition of the battery. (c) Check the operation of the actuator (see Section T6).
	3. Control linkage.	3. Check and adjust the control linkage (see Section T18).
	4. Oil pressure.	4. Check the items listed on page T22-13.
	5. Control valve assembly.	5. (a) Check that the valve body/spacer plate gaskets are not damaged or incorrectly fitted. (b) Check that the 2-3 valve train is not sticking open (this would also cause a 1-3 up-change in drive range). (c) Low/reverse check ball missing from the case (this will also cause no overrun braking in low range).
	6. Rear servo and accumulator.	6. (a) Check for a damaged rear piston seal. (b) Check for a short band apply pin (this may also cause no overrun braking or slipping in overrun braking – low range).
	7. Forward clutch.	7. Check that the clutch unit will release (if it does not release this will also cause drive in neutral).
	8. Direct clutch.	8. (a) Check the outer seal for damage. (b) Check the clutch plates (if burnt, it may be caused by the check ball sticking in the piston). (c) Check the items listed on page T22-15.
	9. Rear band.	9. Check the band for burnt or loose linings, apply pin or anchor pins not engaged, or the band broken.
3. Drive in neutral	1. Control linkage.	1. Check and adjust the control linkage (see Section T18).
	2. Forward clutch.	2. (a) Check that the clutch is releasing, if the clutch does not release it

Symptom	Possible cause	Action
3. Drive in neutral (continued)		will also cause no reverse. (b) Check the items listed on page T22-14.
	3. Pump assembly.	3. Transmission fluid pressure leaking into the forward clutch apply passage.
4. Will not hold in park	1. Control linkage.	1. Check and adjust the control linkage (see Section T18).
	2. Internal parking linkage.	2. (a) Check the parking brake lever and actuator assembly. (b) Check the chamfer on the actuator rod sleeve. (c) Check the parking pawl (broken or inoperative). (d) Check that the parking pawl return spring is not broken, missing, or incorrectly hooked.
5. No engine braking in intermediate range – 1st gear	1. Control valve assembly.	1. Check the low-reverse check ball (missing from case).
	2. Rear servo.	2. (a) Check for a damaged oil seal ring, bore, or piston. (b) Rear band apply pin short or improperly assembled.
	3. Rear band.	3. (a) Rear band broken or burnt (check for cause). (b) Check the rear band assembly engages correctly on the anchor pins and/or servo pin.
6. No engine braking in intermediate range – 2nd gear	1. Front servo and accumulator.	1. (a) Check for leaking or broken oil sealing rings. (b) Check for scored bores. (c) Check for a sticking servo piston.
	2. Front band.	2. (a) Check to ensure that the front band is not burnt or broken. (b) Check to ensure that the front band is engaged correctly on the anchor pin and/or servo pin.
7. No detent down-changes **Note** Position the car on a ramp. Switch on ignition, but do not start the engine.	1. Transmission case electrical plug.	1. (a) Disconnect the electrical connections. (b) Connect a test lamp to the detent solenoid terminal of the disconnected wiring loom. (c) Depress the accelerator fully, from the normal driving position. (d) Light off. Incorrectly adjusted or faulty throttle position switch. Faulty electrical circuit. (e) Light on. Check the operation of the detent solenoid. If the solenoid cannot be heard to operate this may be due to.

Symptom	Possible cause	Action
7. No detent down-changes (continued)		(i) Faulty electrical connection. (ii) Sticking detent valve train. (iii) Restricted oil passage.
	2. Control valve assembly.	2. (a) 3-2 valve sticking, spring missing, or broken. (b) Detent valve train sticking.
8. Transmission noisy	1. Noise in park, neutral, and all drive ranges.	1. (a) Check for pump cavitation. (i) Transmission fluid level low or high, top-up etc. as necessary (see Section T3). (ii) Restricted or incorrect strainer assembly. (iii) Intake 'O' ring damaged or intake pipe split. (iv) Porosity at pump face intake port. (v) Pump to transmission case gasket incorrectly fitted. (vi) Coolant in the transmission fluid. (b) Check pump assembly for. (i) Defective or damaged gears. (ii) Drive gear incorrectly assembled. (iii) Crescent interference. (iv) Seal rings damaged or worn. (c) Check converter for. (i) Damage. (ii) Loose bolts, converter to flywheel. (iii) Cracked or broken flexplate.
	2. Noise in first, second, and/or reverse.	2. (a) Check that the transmission does not contact the body. (b) Check planetary gear train for. (i) Gears or thrust bearings damaged. Thoroughly clean thrust bearings and thrust races. Closely inspect needles and surfaces for pitting and roughness. (ii) Front internal gear ring damaged.
	3. Noise during acceleration in any gear.	3. (a) Check that the transmission fluid lines to and from the cooler are not fouling. (b) Check that the engine mounts are not loose or broken.
	4. Squeak at low vehicle speeds.	4. Check the speedometer driven gear shaft seal (lubricate or replace).
	5. Slight creaking noise, when accelerating gently from the stationary position.	5. Check for the converter pilot spigot fretting in the crankshaft tail bore (lubricate the spigot liberally with Retinax A grease or equivalent).

Symptom	Possible cause	Action
8. Transmission noisy (continued)	6. Clutch noise, during application. (a) Neutral to drive and/or park to drive.	6. (a) Check the condition of the forward clutch plates.
	(b) 1-2 up-change in intermediate and drive ranges.	(b) Check the condition of the intermediate clutch plates.
	(c) 2-3 up-change in drive range, neutral to reverse, and park to reverse.	(c) Check the condition of the direct clutch plates.
	7. Converter noise in reverse, drive, intermediate, and low ranges. The noise level is generally lower in park and neutral.	7. Check for damaged needle bearings in the converter.
9. 1st and 2nd ranges only (no 2-3 up-change)	1. Incorrect vacuum.	1. Check the items listed on page T22-14, Incorrect vacuum at modulator.
	2. Governor system.	2. Check line pressure.
	3. Control valve assembly.	3. (a) Check for the 2-3 shift valve train sticking (valves should fall under their own weight). (b) Check for damaged, leaking, or incorrectly fitted gaskets between the control valve unit, oil spacer plate, and case.
	4. Direct clutch burnt.	4. (a) Check the modulator bellows. (b) Check the centre support for the oil seal rings missing or broken. (c) Check that the direct clutch piston seals are not missing, cut, or incorrectly assembled. (d) Check that the piston check ball is not sticking or missing.
	5. Throttle position switch.	5. Check that the throttle position switch is not faulty, causing the solenoid to be activated all the time.
	6. Detent solenoid.	6. Check that the solenoid is not sticking open.
10. (a) No 1-2 up-change. (b) Delayed up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Throttle position switch.	2. Check that the throttle position switch is not faulty, causing the solenoid to be activated all the time.
	3. Detent solenoid.	3. Check that the solenoid is not sticking open.

Symptom	Possible cause	Action
10. (a) No 1-2 up-change. (b) Delayed up-change (continued)	4. Governor assembly.	4. (a) Check for the governor valve sticking. (b) Check that the driven gear is not loose, damaged, or worn (also check the output shaft drive gear, if the driven gear shows damage). (c) Check that the driven gear securing pin is not loose, broken, or missing.
	5. Control valve assembly.	5. (a) Check that the 1-2 shift valve train is not sticking in the closed position. (b) Check that the governor feed channels are not blocked, leaking, or the pipes out of position. (c) Check that the valve body spacer plate gaskets are not leaking, damaged, or incorrectly fitted.
	6. Case.	6. (a) Check for the intermediate clutch plug leaking or blown out. (b) Check for porosity between channels. (c) Check that the governor feed channel is not blocked, the governor bore scored or worn allowing a cross pressure leak.
	7. Intermediate clutch.	7. (a) Check that the clutch piston seals are not cut, improperly fitted, or missing. (b) Check that the centre support oil rings are not missing or broken. (c) Check that the orifice cup plug is fitted.
11. Rough 1-2 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Vacuum modulator.	2. (a) Check for loose fittings, restrictions in line, or the modulator assembly inoperative. (b) Check that the modulator valve is not sticking.
	3. Oil pressure.	3. (a) Check that the oil pump regulator or boost valve has not jammed. (b) Check for the pump to case gasket being incorrectly fitted or damaged.
	4. Check condition of engine.	4. Tune the engine.
	5. Control valve assembly.	5. (a) Check that the 1-2 accumulator valve train is not sticking. (b) Check that the valve body to case bolts are not loose. (c) Check that the valve body spacer plate gaskets are not damaged, incorrectly fitted, or the wrong gasket fitted.

Symptom	Possible cause	Action
11. Rough 1-2 up-change (continued)	6. Case.	6. (a) Check the intermediate clutch ball (missing or not sealing). (b) Check for porosity between channels.
	7. Rear servo accumulator assembly.	7. (a) Check the oil seal rings for damage. (b) Check that the piston has not jammed. (c) Check that the spring is not broken or missing. (d) Check that the servo bore is not damaged.
	8. Intermediate clutch.	8. (a) Check that only one waved plate has been fitted. (b) Check that the clutch plates are not burnt.
12. Slipping 1-2 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Control linkage.	2. Check and/or adjust.
	3. Check condition of engine.	3. Tune the engine.
	4. Vacuum line and components.	4. Check the vacuum system for response at the modulator.
	5. Line pressure.	5. (a) Check the oil pressure (it should vary and respond rapidly to quick changes in throttle openings). (b) Check the vacuum modulator for possible failure. (c) Check that the modulator valve is not sticking.
	6. Control valve assembly.	6. (a) Check for the 1-2 accumulator valve train sticking. (b) Check for porosity in the valve body or case. (c) Check the valve body attaching bolts for tightness.
	7. Front accumulator.	7. Check the oil seal ring (damaged or missing).
	8. Rear accumulator.	8. Check the oil seal ring (damaged or missing) or the case bore damaged.
	9. Oil pump	9. (a) Check that the pump to case gasket is not misaligned or damaged. (b) Check that the pressure regulator valve is not sticking.
	10. Case.	10. (a) Check that the intermediate clutch plug is not leaking excessively. (b) Check for porosity between channels.
	11. Intermediate clutch.	11. (a) Check the piston seals (damaged or missing). Also check for burnt clutch plates.

Symptom	Possible cause	Action
12. Slipping 1-2 up-change (continued)		(b) Check the centre support for leaks in the feed circuit (oil rings or grooves damaged). Also, for an excessive leak between the tower and the bush, or the orifice bleed hole blocked. (c) Check that the centre support bolt has seated properly in the case. (d) Check that only one waved plate has been fitted.
13. Rough 2-3 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Check condition of engine.	2. Tune the engine.
	3. Oil pressure – High.	3. (a) Check the vacuum modulator assembly. (b) Check that the modulator valve is not sticking. (c) Check that the oil pump regulator valve and boost valve are operating correctly.
	4. Front servo accumulator or assembly.	4. (a) Check that the accumulator spring is not missing or broken. (b) Check that the accumulator piston is not sticking.
	5. Direct clutch.	5. (a) Check that only one waved clutch plate has been fitted. (b) Check the direct clutch for leakage to the outer area of the clutch piston. (c) Check the centre support for damage.
14. Slipping 2-3 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Control linkage.	2. Check and/or adjust.
	3. Check condition of engine.	3. Tune the engine.
	4. Oil pressure – Low.	4. (a) Check the vacuum modulator assembly. (b) Check the modulator valve. (c) Check the oil pump pressure regulator valve and/or the boost valve for operation. (d) Check the oil pump to case gasket for damage or incorrect location.
	5. Control valve assembly.	5. (a) Check the front accumulator piston pin for a leak at the swaged end. (b) Check for sticking valves. (c) Check for damage or leaking oil passages. (d) Check the spacer plate for damage, blocked direct clutch feed orifice, or misaligned gasket.

Symptom	Possible cause	Action
14. Slipping 2-3 up-change (continued)	6. Case.	6. Check the case for porosity cross leaks.
	7. Direct clutch.	7. (a) Check the piston seals and check ball for leaks. (b) Check the centre support oil seal rings for damage and for an excessive leek between the tower and bush. (c) Check that only one waved plate has been fitted.
	8. Front servo.	8. (a) Check for a broken or missing front servo spring. (b) Check for a leak at the servo pin.
15. (a) Delayed up-changes. (b) No up-changes	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Control linkage.	2. Check and/or adjust.
	3. Throttle position switch.	3. Disconnect the white/green wire from the connector on the side of the transmission case. Test the up-changes. (a) If the up-changes occur, the problem is in the throttle position switch or wiring. (b) If the fault persists continue to Operation 4.
	4. Incorrect modulator vacuum.	4. Connect a gauge to the lower end of the modulator vacuum pipe and check for normal vacuum. (a) If the vacuum is low or not present, check for leaks and restrictions. (b) If the fault persists continue to Operation 5.
	5. Incorrect line pressure.	5. Connect a gauge to the trensmission adapter and check the line pressure in drive range with an engine speed of 1000 rev/min. Normal pressure is between 4,5 bar and 5,2 bar (65 lbf/in^2 and 75 lbf/in^2). **Note** Normal line pressure in drive range with the car stationary should vary from approximately 4,5 bar (65 lbf/in^2) at idle speed to 10,3 bar (150 lbf/in^2) at full throttle. The pressure increases as the engine vacuum decreases.
	6. Line pressure between 6,6 bar and 7,6 bar (95 lbf/in^2 and 110 lbf/in^2).	6. Check the complete detent system.
	7. Line pressure between 9,3 bar and 10,3 bar (135 lbf/in^2 and 150 lbf/in^2).	7. With the correct vacuum at the modulator, check. (a) Modulator valve. (b) Pressure regulator components.

Symptom	Possible cause	Action
15. (a) Delayed up-changes. (b) No up-changes (continued)	8. Normal line pressure between 4,5 bar and 5,2 bar (65 lbf/in^2 and 75 lbf/in^2).	8. Remove the governor assembly; check for freedom of operation and presence of dirt, etc. Clean if necessary.
	9. Detent system.	9. (a) Check that the detent solenoid is not loose or defective. (b) Check that the solenoid feed orifice is not blocked.
16. 1-2 up-change – Full throttle only	1. Throttle position switch.	1. Check that the throttle position switch is not sticking.
	2. Detent solenoid.	2. (a) Check that the solenoid securing bolts are torque tightened. (b) Check that the solenoid is not sticking open.
	3. Control valve assembly.	3. (a) Check the valve body spacer plate gasket for. (i) Leaks. (ii) Damage. (iii) Incorrectly fitted. (b) Check that the detent valve train has not jammed. (c) Check that the 3-2 valve has not jammed.
	4. Case.	4. Check the case for porosity.
17. Slips in all ranges	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Control linkage.	2. Check and/or adjust.
	3. Oil pressure.	3. (a) Check that the vacuum modulator valve is not sticking. (b) Check that the oil strainer assembly is not blocked or leaking, or the grommet or 'O' ring missing or damaged. (c) Check the oil pump assembly for the regulator or boost valve sticking, or for a cross leak. (d) Check that the oil pump to case gasket is not damaged or incorrectly fitted.
	4. Case.	4. Check the case for cross leaks or porosity.
	5. Forward and direct clutches slipping.	5. (a) If the clutches appear burnt, look for the cause in 'Burnt clutch plates' on page T22-14. (b) Check the oil pump sealing rings on the pump cover for wear or damage.
18. No part throttle down-changes	1. Oil pressure.	1. Check the vacuum modulator assembly, modulator valve, and pressure

Symptom	Possible cause	Action
18. No part throttle down-changes (continued)		regulator valve, etc., for leaks, sticking valves, and restrictions.
	2. Control valve assembly.	2. Check that the 3-2 valve is not sticking, or the spring missing or broken.
19. Low or high up-changes	1. Oil pressure.	1. (a) Check the engine vacuum at the transmission end of the modulator pipe. (b) Check for loose vacuum connections at the engine and transmission. Also, check the modulator valve, pressure regulator valve train, etc., for leaks, sticking valves, and restrictions.
	2. Governor.	2. (a) Check that the governor valve is not sticking. (b) Check the feed holes, lines, etc., for leaks or restrictions, or the pipes damaged or misaligned.
	3. Detent solenoid.	3. Check that the solenoid is not sticking open, or become loose, etc., as this will cause late up-changes.
	4. Control valve assembly.	4. (a) Check the detent valve train for free movement or restrictions. (b) Check the 3-2 valve train. (c) Check the 1-2 valve train, if the 1-2 regulator valve is sticking this would cause a constant 1-2 shift point, regardless of throttle opening. (d) Check that the valve body spacer plate gaskets are not misaligned, or the spacer plate holes missing or blocked.
	5. Case.	5. Check the case for porosity, intermediate plug leaking or missing.
20. Torque converter leaks	1. Converter welding.	1. Check the converter welding and if at all suspect, fit a new converter.
	2. Damaged or worn converter hub.	2. Inspect the converter hub for wear, also, scoring that can damage the seal.
21. Torque converter vibrations	1. Converter/flexplate out of balance, or cracked.	1. (a) Isolate the cause of the vibration. (b) Alter the position of the converter on the flexplate 60° at a time until the out of balance condition is corrected. (c) Replace the converter/flexplate.
	2. Converter balance weight.	2. Check the converter for the loss of balance weight(s), change the converter if a balance weight is lost.
	3. Crankshaft pilot.	3. (a) Check to ensure that the converter

Symptom	Possible cause	Action
21. Torque converter vibrations (continued)		to crankshaft pilot is not broken. (b) Change the converter if the pilot is broken.
22. Torque converter slipping or noisy. (Most converter noise occurs under light throttle in drive range with the brakes applied)	1. Loose flexplate to converter setscrews.	1. (a) Check the flexplate and converter for damage. (b) If **no damage** is apparent, tighten the bolts. (c) If **damage** is apparent replace the components.
	2. Cracked flexplate.	2. (a) Check for a cracked flexplate (engine to case dowel pins missing can result in a cracked flexplate). (b) Replace the damaged components.
	3. Items listed under Operation 21 – Torque converter vibrations.	3. See items listed under Operation 21 – Torque converter vibrations.
	4. Fretting of the converter pilot spigot in the crankshaft tail bore.	4. Apply a liberal coating of Shell Retinax A grease or its equivalent, over the spigot.
	5. Converter balance weights lifting (spot welds breaking and one end lifting up and catching on the case).	5. (a) Check for welds breaking on the balance weights. (b) Change the converter if the balance weights have broken away.
	6. Internal damage to converter.	6. (a) Check the thrust roller bearing, thrust races, and roller clutch for damage. Fit a new converter if damage is apparent.
	7. Converter fluid.	7. (a) Check the colour of the fluid, if it has the appearance of aluminium paint, the converter is damaged internally. (b) Check that anti-freeze has not contaminated the converter fluid. (c) Fit a new converter.
	Note It is not necessary to change the converter if a failure in some other part of the transmission has resulted in the converter containing dark discoloured fluid. The full flow strainer used in the transmission will remove all harmful residue from	

Symptom	Possible cause	Action
22. Torque converter slipping or noisy (continued)	failures (other than converter to pump failures) before the oil is pumped into the converter.	
		Correct the transmission problem, then change the intake stainer and fluid.

High line pressure

If either the idle or full throttle pressure check is high, the cause may be as follows.

1. **Vacuum leak**
a. Full leak (vacuum line disconnected).
b. Partial leak in the line from the engine to the modulator.
c. Incorrect engine vacuum.
d. Leak in vacuum operated accessories.

2. **Damaged modulator**
a. Sticking valve.
b. Water in modulator.
c. Incorrect operation of modulator.

3. **Detent system**
a. Throttle position switch incorrectly adjusted or shorted.
b. Detent wiring shorted.
c. Detent solenoid sticking open.
d. Detent feed orifice in spacer plate blocked.
e. Detent solenoid loose.

4. **Pump**
a. Pressure regulator and/or boost valve sticking.
b. Incorrect pressure regulator spring.
c. Excessive number of pressure regulator valve spacers.
d. Faulty pump casting.
e. Pressure boost valve installed incorrectly or otherwise defective.
f. Aluminium bore plug defective.
g. Pressure boost bush defective.

5. **Control valve assembly**
a. Spacer plate-to-case gasket incorrectly fitted.
b. Incorrect plate-to-case gasket.

Low line pressure

If either the idle or full throttle pressure checks are low, the cause may be as follows.

1. **Transmission oil level low**

2. **Modulator assembly**

3. **Intake strainer**
a. Blocked or restricted.
b. 'O' ring on intake pipe omitted or damaged.
c. Incorrect strainer fitted.

Note When checking the intake strainer, it should be noted that there is no approved method for either checking or cleaning the strainer. If the performance of the strainer is suspect, a **new strainer must be fitted.**

4. **Split or leaking intake pipe**

5. **Pump**
a. Pressure regulator or boost valve sticking.
b. Gear clearance, damaged or worn (pump will become damaged if the drive gear is installed the wrong way or if the converter pilot does not enter the crankshaft freely).
c. Pressure regulator spring weak.
d. Insufficient spacers in pressure regulator.
e. Pump to case gasket incorrectly positioned.
f. Defective pump body and/or cover.

6. **Leaks in the internal circuit**
a. Forward clutch leak (pressure normal in neutral and reverse – pressure low in drive).
(i) Check pump rings.
(ii) Check forward clutch seals.
b. Direct clutch leak (pressure normal in neutral, low, intermediate, and drive – pressure low in reverse).
(i) Check centre support oil seal rings.
(ii) Check direct clutch outer seal for damage.
(iii) Check rear servo and front accumulator pistons and rings for damage or missing.

7. **Case assembly**
a. Porosity in intake bore area.
b. Check case for intermediate clutch plug; leak or blown out.
c. Low – reverse check ball incorrectly positioned or missing (this condition will cause no reverse and no overrun braking in low range).

Incorrect vacuum at modulator

1. **Engine**
a. Requires tune-up.
b. Loose vacuum fittings.
c. Vacuum operated accessory leak.

2. **Vacuum line to modulator**
a. Leak.
b. Loose fitting.
c. Restricted orifice, or incorrect orifice size.
d. Carbon build-up at modulator vacuum fitting.
e. Pinched line.
f. Grease or varnish material in pipe (no or delayed up-change – cold).

Oil leaks

1. **Transmission oil sump leaks**
a. Securing bolts not correctly torque tightened.
b. Improperly installed or damaged sump gasket.
c. Oil sump gasket mounting face not flat.

2. **Case extension leak**
a. Securing bolts not correctly torque tightened.
b. Rear seal assembly damaged or incorrectly installed.
c. Gasket (extension to case) damaged or incorrectly installed.
d. Porous casting.

3. **Case leak**
a. Modulator assembly 'O' ring damaged or incorrectly installed.
b. Electrical connector 'O' ring damaged or incorrectly installed.
c. Governor cover, gasket, and bolts damaged or loose; case face leak.
d. Damage or porosity. Leak at speedometer driven gear housing or seal.
e. Manual shaft seal damaged or incorrectly installed.
f. Line pressure tap plug stripped.
g. Vent pipe (refer to item 5).
h. Porous case or crack at pressure plug boss.

4. **Front end leak**
a. Front seal damaged (check converter neck for score marks, etc., also for pump bushing moved forward), garter spring missing.
b. Pump securing bolts and seals damaged; bolts missing or loose.
c. Converter (leak in weld).
d. Pump 'O' ring seal damaged. Also check pump oil ring groove and case bore.
e. Porous casting (pump or case).
f. Pump drain back hole not open.

5. **Oil comes out of vent pipe**
a. Transmission overfilled.
b. Water in oil.
c. Strainer 'O' ring damaged or incorrectly assembled causing oil to foam.
d. Foreign material between pump and case or between pump cover and body.
e. Case porous, pump face incorrectly machined.
f. Pump porous.
g. Pump to case gasket misaligned.
h. Pump breather hole blocked or missing.
i. Hole in intake pipe.
j. Check ball in forward clutch missing or sticking.

6. **Modulator assembly**
a. Diaphragm defective.

Control valve assembly – Governor line pressure check

1. Install a line pressure gauge.
2. Install a tachometer in accordance with the manufacturer's instructions.
3. Disconnect the vacuum line to the modulator.
4. With the car on a ramp (rear wheels off the ground), footbrake off, in drive, check line pressure at 1000 rev/min.
5. Slowly increase the engine revolutions to 3000 rev/min and determine if a line drop occurs of 0,7 bar (10 lbf/in^2) or more.
6. If a pressure drop of 0,7 bar (10 lbf/in^2) or more occurs, dismantle, clean, and inspect the control valve assembly.
7. If the pressure drop is less than 0,7 bar (10 lbf/in^2).
a. Inspect the governor.
   (i) Sticking valve.
   (ii) Weight freeness.
   (iii) Restricted orifice in governor valve.
b. Governor feed system.
   (i) Check screen in governor feed pipe hole in case assembly.
   (ii) Check for restrictions in governor pipe.

Burnt clutch plates

Burnt clutch plates can be caused by incorrect usage of clutch plates. Also, anti-freeze in transmission fluid can cause severe damage, such as large pieces of composition clutch plate material peeling off.

1. **Forward clutch**
a. Check the ball in the clutch housing for damage, sticking, or missing.
b. Clutch piston cracked, seals damaged, or missing.
c. Low line pressure.
d. Manual valve misaligned.
e. Restricted oil feed to forward clutch. (Clutch housing to inner and outer areas not drilled, restricted or porosity in pump).
f. Pump cover oil seal rings missing, broken, or undersize; ring groove oversize.
g. Case valve body face not flat or porosity between channels.
h. Manual valve bent and centre land not ground properly.

2. **Intermediate clutch**
a. Rear accumulator piston oil ring, damaged, or missing.
b. 1-2 accumulator valve sticking in control valve assembly.
c. Intermediate clutch piston seals damaged or missing.
d. Centre support bolt loose.
e. Low line pressure.
f. Intermediate clutch plug in case missing.
g. Case valve body face not flat or porosity between channels.
h. Manual valve bent and centre land not ground properly.

3. **Direct clutch**
a. Restricted orifice in vacuum line to modulator (poor vacuum response).
b. Check ball in direct clutch piston damaged, sticking, or missing.
c. Defective modulator bellows.
d. Centre support bolt loose (bolt may be tight in support but not holding support tight to case).
e. Centre support oil rings or grooves damaged or missing.
f. Clutch piston seals damaged or missing.
g. Front and rear servo pistons and seals damaged.
h. Manual valve bent and centre land not cleaned up.
i. Case valve body face not flat or porosity between channels.
j. Intermediate sprag clutch installed backwards.
k. 3-2 valve, 3-2 springs, or 3-2 spacer pin installed in wrong location in 3-2 valve bore.

Note If direct clutch plates and front band are burnt, check manual linkage.

Vacuum modulator assembly
The following procedure is recommended for checking modulator assemblies in service before replacement is undertaken.

1. **Vacuum diaphragm leak check**
Check with a vacuum pump or insert a pipe cleaner into the vacuum connector pipe as far as possible and check for the presence of transmission oil. If oil is found, replace the modulator.

Note Petrol or water vapour may settle in the vacuum side of the modulator. If this is found **without** the presence of oil, the modulator should **not** be changed.

2. **Atmospheric leak check**
Apply a liberal coating of soap bubble solution to the vacuum connector pipe seam and the crimped upper to lower housing seam. Using a short piece of rubber tubing, apply air pressure to the vacuum pipe by blowing into the tube and observe for leak bubbles. If bubbles appear, replace the modulator.

Note Do not use any method other than human lung power to apply air pressure, as pressures over 0,4 bar (6 lbf/in^2) may damage the modulator.

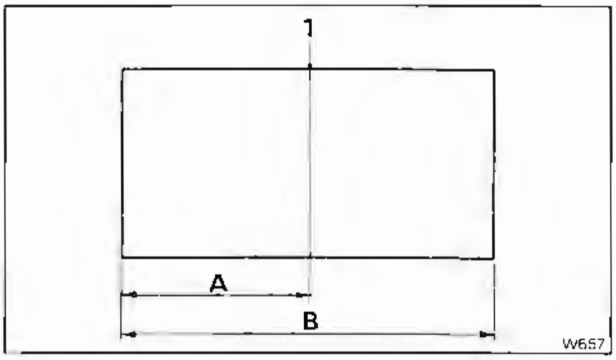


Fig. T22-1 Comparison gauge
1 Scribed centre line
A 12,70 mm (0.50 in)
B 25,40 mm (1.0 in)
Note Round bar between 9,52 mm and 10,32 mm (0.375 in and 0.406 in) diameter. Ends to be square within 0,39 mm (0.015 in)

3. **Bellows comparison check**
Make a comparison gauge (see fig. T22-1), and compare the load of a known good modulator with the assembly in question.
a. Install the modulator that is known to be acceptable on either end of the gauge.
b. Install the modulator in question on the opposite end of the gauge.
c. Holding the modulators in a horizontal position, bring them together under pressure until either modulator sleeve end just touches the line in the centre of the gauge. The gap between the opposite modulator sleeve end and the gauge line should not be greater than 1,59 mm (0.062 in). If the distance is greater than this amount the modulator in question should be replaced.

4. **Sleeve alignment check**
Roll the main body of the modulator on a flat surface and observe the sleeve for concentricity to the body. If the sleeve is concentric and the plunger is free, the modulator is acceptable. Once the modulator assembly passes all of the above tests, it is an acceptable part and should be fitted again.

Detent (down-change) solenoid circuit - To check
Before checking the detent solenoid circuit, make certain that the throttle position switch is properly adjusted as described in the Engine Management Systems Manual - TSD 4737, Chapter K, and the battery is in a fully charged condition.

Naturally aspirated cars
1. With the transmission gear range selector lever in park, turn the ignition switch to the RUN position but **do not start the engine.** The ignition switch has to be in the RUN position throughout the checking procedure. However, switch off the ignition when removing cables from switches, etc.

2. Working under the car, slowly advance the throttle linkage. One click should be heard from the transmission of full throttle.
3. Allow the throttle to return to the closed position. One click should be heard from the transmission.
4. If the system performed as described previously, the detent circuit is operating properly. If the system does not perform as described, proceed to Operation 5.
5. Disconnect the white/green cable from the detent solenoid terminal on the side of the transmission case. Connect a multi-meter into the circuit between the white/green cable and a good earth. Ensure that the multi-meter registers 12V+ when the throttle linkage is in the full throttle position, operated from the normal driving position. The reading should fall to zero when the thottle is released.
a. If the system operates as described previously, but did not perform properly during Operations 1 to 3 inclusive, replace the solenoid after first checking to see that the internal wiring is operational.
b. If the multi-meter fails to register 12V+ with the throttle in the wide open position, the circuit is open, proceed to Operation 6.
c. If the multi-meter registers 12V+, with the throttle closed, the circuit is closed. Replace the throttle position switch and recheck the system.
6. Remove the yellow/purple cable from the throttle position switch plug and socket. Connect a multi-meter between the cable removed and a good earth. At full throttle ensure that the multi-meter registers 12V+.
a. If the multi-meter registers 12V+, reconnect the yellow/purple cable to the switch plug and socket. Recheck the system.
b. If the multi-meter fails to register a voltage, proceed to Operation 7.
7. Remove the white feed cable from the throttle position switch plug and socket. Connect a multi-meter between the cable removed and a good earth.
a. If the multi-meter registers 12V+, replace the throttle position switch. Recheck the system.
b. If the multi-meter fails to register a voltage, proceed to Operation 8.
8. Check fuse B3 on fuse panel F1 on the main fuseboard.
a. If the fuse is intact, it will be necessary to locate the fault in the wiring. Test for circuit continuity from the white feed cable at the throttle position switch plug and socket, to fuse B3 on fuse panel F1 on the main fuseboard.

Turbocharged cars prior to 1989 model year

1. Carry out Operations 1 to 4 inclusive as described for Naturally aspriated cars.
2. Disconnect the white/green cable from the detent solenoid terminal on the side of the transmission case. Connect a multi-meter into the circuit between the white/green cable and a good earth. Ensure that the multi-meter registers 12V+ when the throttle linkage is in the full throttle position, operated from the normal driving position. The reading should fall to zero when the throttle is released.
a. If the system operates as described previously, but did not perform properly during Operation 1, replace the solenoid after first checking to see that the internal wiring is operational.
b. If the multi-meter fails to register 12V+ with the throttle in the wide open position, check for continuity of the white/green cable from the detent solenoid terminal to the kick-down relay.
3. Check fuse B3 on fuse panel F1 on the main fuseboard. If the fuse is intact, proceed as follows.
a. Ensure that the multi-meter registers 12V+ on both white cables at the kick-down relay.
b. If the multi-meter fails to register 12V+ on both cables, check for continuity of the white cables from the kick-down relay to fuse B3 on fuse panel F1.
4. If the multi-meter registers 12V+ on the white cables, proceed as follows.
a. Disconnect the throttle position switch plug and socket. Then, ensure that there is continuity of the yellow/purple cable from the throttle position switch plug to the kick-down relay. Alternatively, remove the yellow/purple cable from the plug and apply an intermittent earth to this cable. The contacts of the kick-down relay should be heard 'making' and 'breaking' during this operation. Connect the yellow/purple cable, if removed from the plug.
5. With the throttle **closed** and the throttle position switch plug and socket disconnected, check the throttle position switch and its loom as follows.
a. Connect a multi-meter between the blue/purple and black cables. Ensure that a continuity reading is obtained.
b. With the throttle in the wide open position, connect a multi-meter between the yellow/purple and black cables. Ensure that a continuity reading is obtained.
If continuity readings are not obtained, the throttle position switch or its loom is faulty.
c. Connect a multi-meter between the black cable in the throttle position switch socket on the engine loom and a good earth. Ensure that a continuity reading is obtained.

1989 model year turbocharged cars

1. Carry out Operations 1 to 4 inclusive as described for Naturally aspirated cars.
2. Disconnect the white/green cable from the detent solenoid terminal on the side of the transmission case. Connect a multi-meter into the circuit between the white/green cable and a good earth. Ensure that the multi-meter registers 12V+ when the throttle linkage is in the full throttle position, operated from the normal driving position. The reading should fall to zero when the throttle is released.
a. If the system operates as described previously, but did not perform properly during Operation 1, replace the solenoid after first checking to see that the internal wiring is operational.
b. If the multi-meter fails to register 12V+ with the throttle in the wide open position, check for continuity of the white/green cable from the detent solenoid terminal to the kick-down relay.
3. Check fuse A4 on fuse panel F1 on the main fuseboard. If the fuse is intact, proceed as follows.

a. Ensure that the multi-meter registers 12V+ on both white/slate cables at the kick-down relay.
b. If the multi-meter fails to register 12V+ on both cables, check for continuity of the white/slate cables from the kick-down relay to fuse A4 on fuse panel F1.
4. If the multi-meter registers 12V+ on the white/slate cables, proceed as follows.
a. Disconnect the throttle position switch plug and socket and ensure that there is continuity of the yellow/purple cable from the throttle position switch plug to the kick-down relay. Alternatively, remove the yellow/purple cable from the plug and apply an intermittent earth to this cable. The contacts of the kick-down relay should be heard 'making' and 'breaking' during this operation. Connect the yellow/purple cable, if removed from the plug.
5. With the throttle **closed** and the throttle position switch plug and socket disconnected, check the throttle position switch and its loom as follows.
a. Connect a multi-meter between the blue/purple and black cables. Ensure that a continuity reading is obtained.
b. With the throttle in the wide open position, connect a multi-meter between the yellow/purple and black cables. Ensure that a continuity reading is obtained.

If continuity readings are not obtained, the throttle position switch or its loom is faulty.

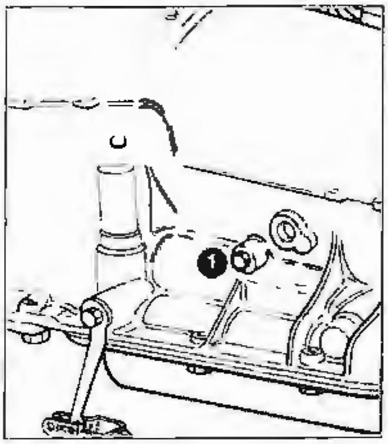
c. Connect a multi-meter between the black/pink cable in the throttle position switch socket on the engine loom and a good earth. Ensure that a continuity reading is obtained.

Special torque tightening figures

Introduction
This section contains the special torque tightening figures applicable to Chapter T.
For standard torque tightening figures refer to Chapter P.

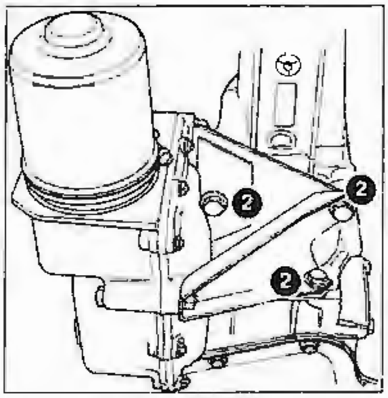
Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

Section T4



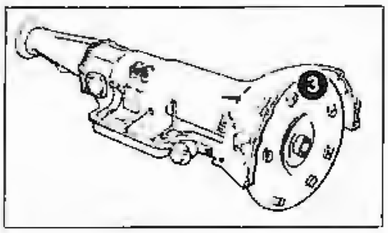
Ref.	Component	Nm	kgf m	lbf ft
1	Line pressure plug	20	2,0	15

Section T6



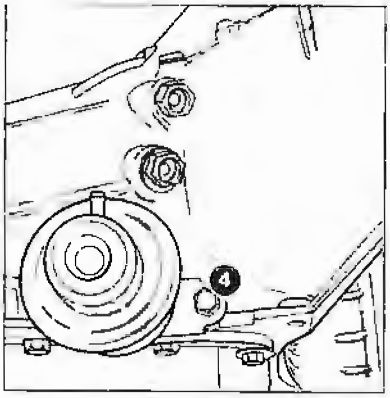
Ref.	Component	Nm	kgf m	lbf ft
2	Setscrew – Actuator mounting bracket to rear extension	52	5,3	38

Section T7



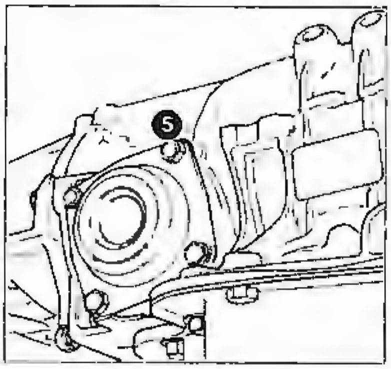
Ref.	Component	Nm	kgf m	lbf ft
3	Setscrew – Engine flexplate to torque converter	41	4,1	30

Section T9



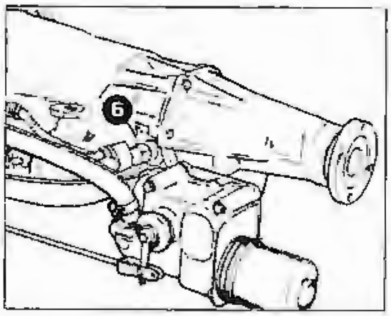
Ref.	Component	Nm	kgf m	lbf ft
4	Setscrew – Vacuum modulator retainer to case	25	2,5	18

Section T10



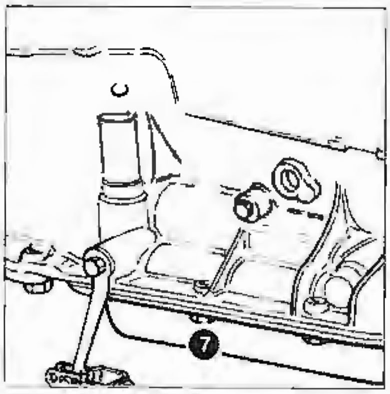
Ref.	Component	Nm	kgf m	lbf ft
5	Setscrew – Governor to case	25	2,5	18

Section T11



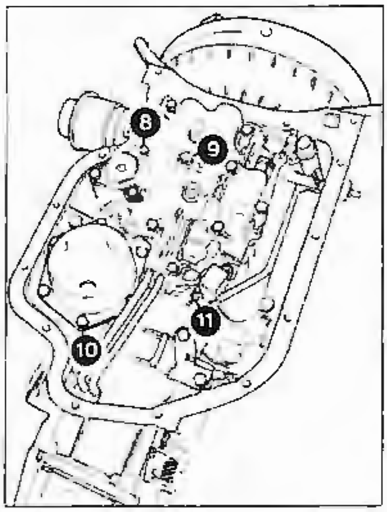
Ref.	Component	Nm	kgf m	lbf ft
6	Setscrew – Speedometer drive to case retainer	17	1,7	13

Section T12



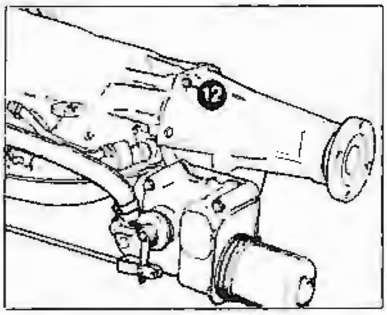
Ref.	Component	Nm	kgf m	lbf ft
7	Setscrew – Sump to case	8-14	0,9-1,4	6-10

Sections T13, T14, and T15



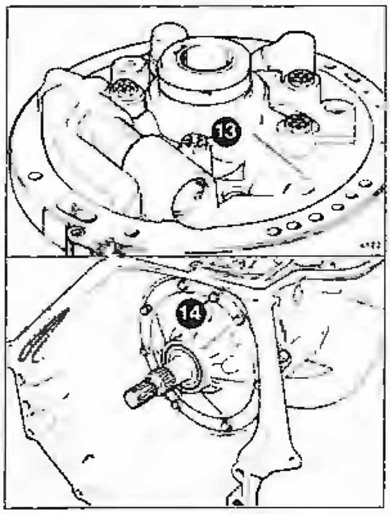
Ref.	Component	Nm	kgf m	lbf ft
8	Setscrew (¼ UNC) – Control valve unit to case	11	1,1	8
9	Setscrew (5/16 UNC) – Control valve unit to case	11	1,1	8
10	Setscrew – Rear servo cover to case	25	2,5	18
11	Setscrew – Solenoid to case	11	1,1	8

Section T16



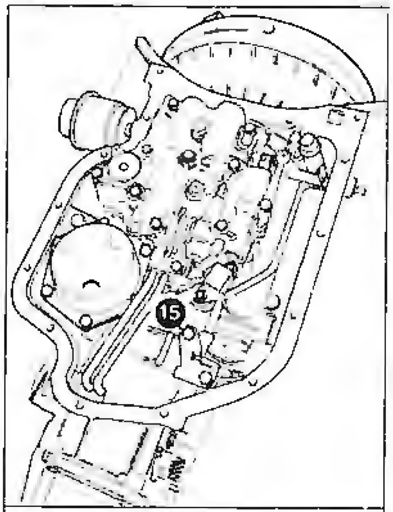
Ref.	Component	Nm	kgf m	lbf ft
12	Setscrew –Rear extension to case	32	3,2	23

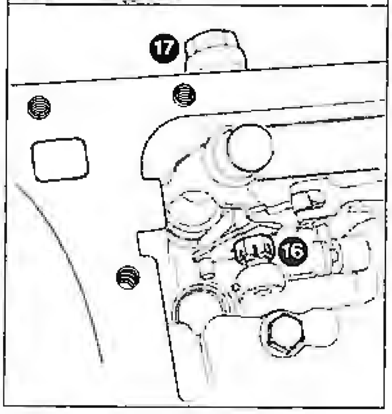
Section T17



Ref.	Component	Nm	kgf m	lbf ft
13	Setscrew – Pump body to cover	25	2,5	18
14	Setscrew – Pump to case	25	2,5	18

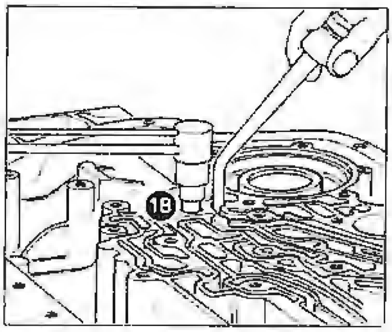
Section T18





Ref.	Component	Nm	kgf m	lbf ft
15	Setscrew – Parking lock bracket to case	25	2,5	18
16	Nut – Manual shaft to detent lever	25	2,5	18
17	Nut – Gearchange lever to manual shaft	28	2,8	20

Section T20



Ref.	Component	Nm	kgf m	lbf ft
18	Setscrew – Case to centre support	30	3,0	22

Workshop tools

Workshop tools with either R or RH prefix letters are obtainable from the Parts Distribution Centre at Crewe. However, certain other tools prefixed with the letter 'J' may be obtained from the Kent-Moore or General Motors Organization.

R 5244	Oil pressure gauge
R 5280	Adapter – air checking
RH 7674	Circlip and snap ring pliers
RH 7794	Universal handle – case bush
RH 7914	Adapter – oil pressure tapping
RH 7952	Retaining clamp – converter
RH 7953	Insertion tool – oil pump and rear extension housing oil seals
RH 7955	Holding fixture – transmission
RH 7956	Base – holding fixture (used with RH 7955)
RH 12556	Extractor – oil pump
J-2590	Spring compressor – forward and direct clutches
J-7004	Slide hammers
J-9578	Removal tool – steel speedometer gear (used with J-21427)
J-21362	Inner seal protector – forward and direct clutches
J-21363	Inner seal protector – intermediate clutch
J-21368	Alignment band – oil pump body and cover
J-21370-5	Selector pin – rear servo (used with J-21370-6)
J-21370-6	Band apply pin selector gauge – rear servo (used with J-21370-5)
J-21409	Outer seal protector – forward and direct clutches
J-21427	Removal tool – steel speedometer gear (used with J-9578)
J-21465-8	Removal tool – case bush (used with J-21465-13 and RH 7794)
J-21465-9	Adapter – fitting case bush (used with J-21465-8 and J-21465-13)
J-21465-10	Staking tool – case bushing
J-21465-13	Extension – case bushing
J-21795	Removal tool – gear unit assembly
J-21885	Fitting and removal tool – control valve accumulator piston
J-23093	Locating tool – centre support to case

Printed in England