Sub-frames and Suspension

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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.

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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.

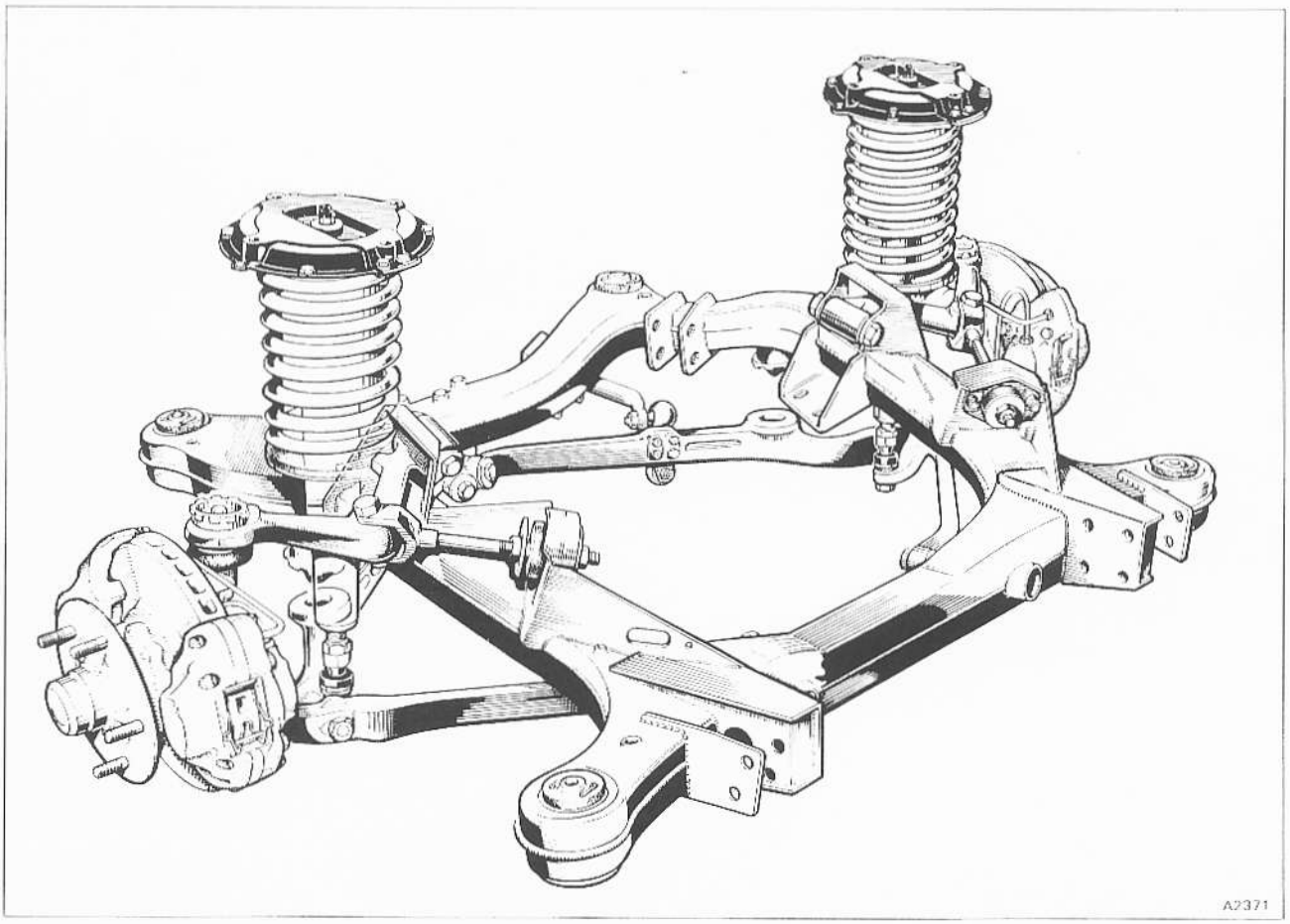

Fig. H3-1 Front sub-frame and suspension assembly

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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

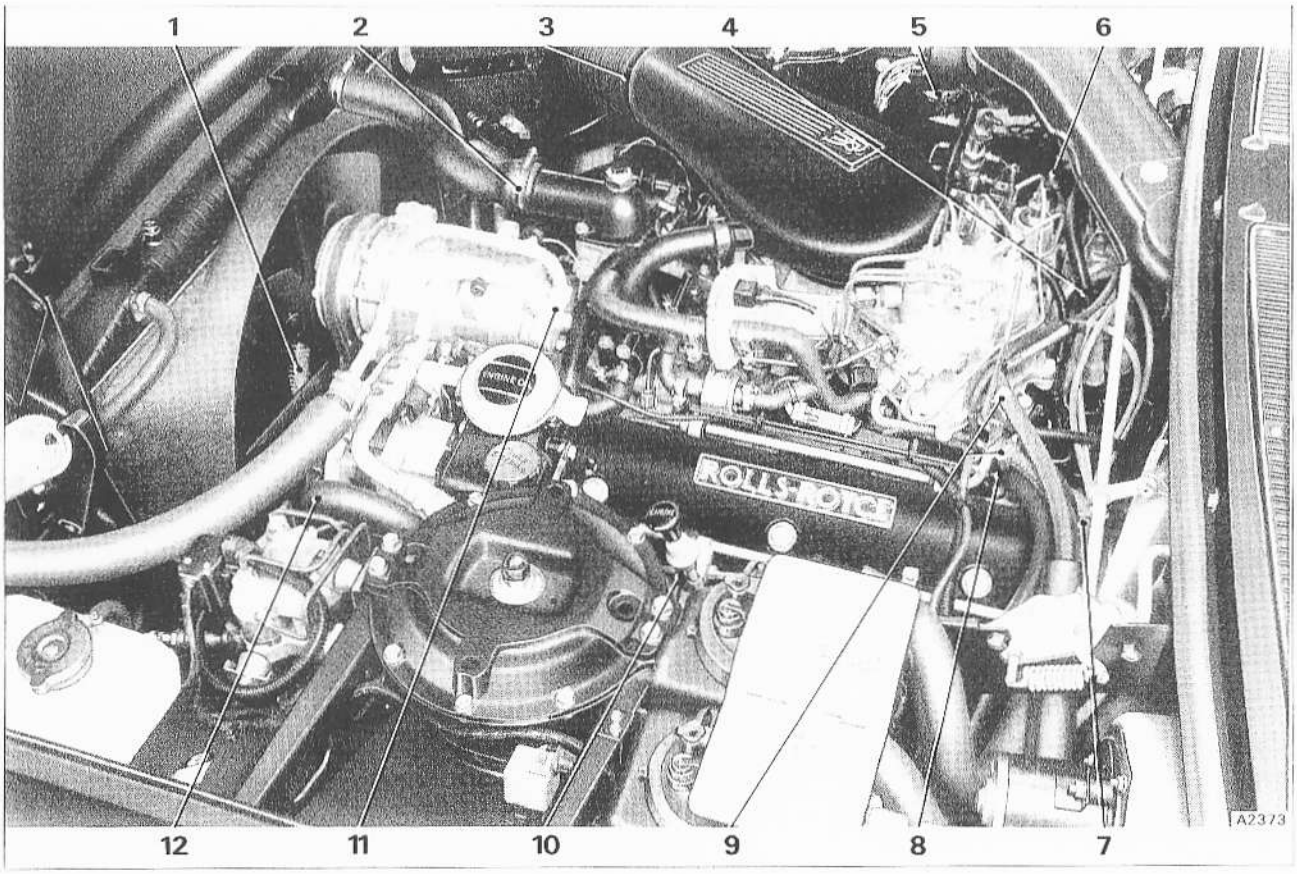

Fig. H3-2 Component disconnection points

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

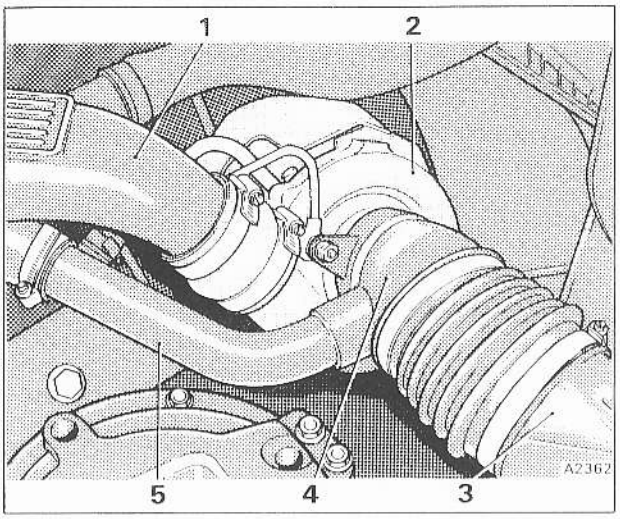

Fig. H3-3 Air intake (Bentley Turbo R prior to 1989 model year)
1 Air intake elbow
2 Turbocharger
3 Air intake filter housing
4 Turbocharger intake adapter
5 Dump pipe

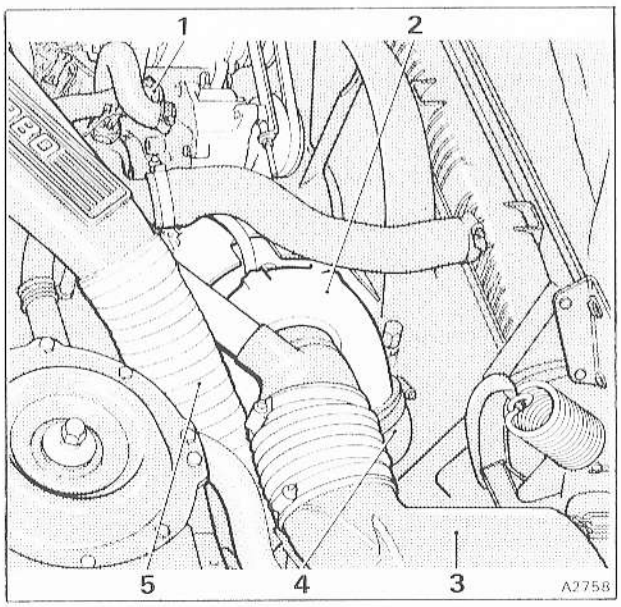

Fig. H3-4 Air intake (Bentley Turbo R 1989 model year)
1 Air pump feed hose
2 Turbocharger
3 Air intake filter housing
4 Air duct to intercooler
5 Air intake from intercooler

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

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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.

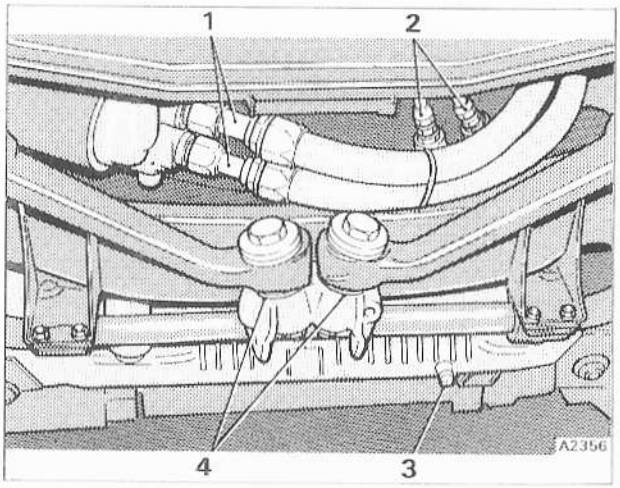


Fig. H3-5 Engine and transmission oil cooler pipes
1 Engine oil filter to cooler pipes
2 Transmission unit oil cooler pipes
3 Radiator drain plug
4 Lower triangle lever shims

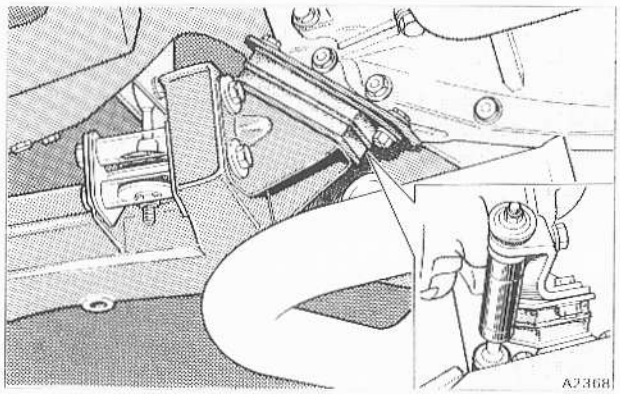


Fig. H3-6 Sub-frame to longeron tie-bar
Inset – Engine stabilus damper

Engine and torque converter transmission – To remove from the sub-frame

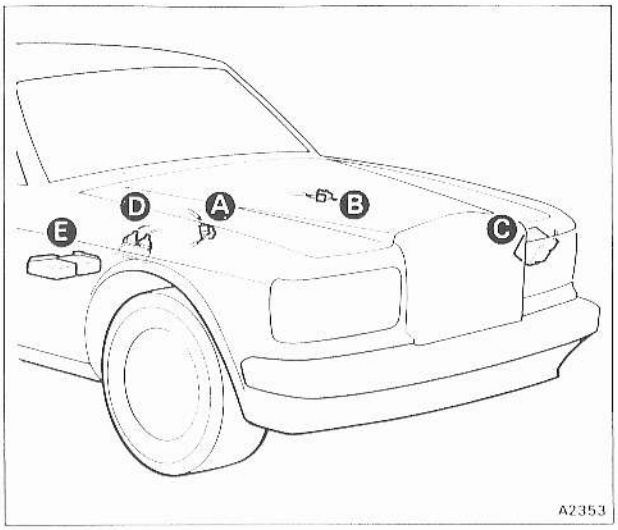
1. Remove the exhaust system downtake pipes from the engine exhaust manifolds.
2. Disconnect the steering pumps supply hose from the steering rack. Allow any oil to drain into a container.
3. On cars fitted with the small dampers adjacent to the rear engine mounts, disconnect the top of the dampers from 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.

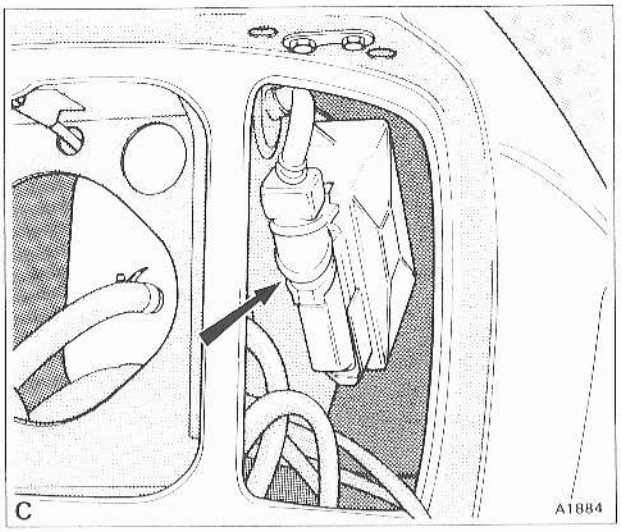
Engine and torque converter transmission – To fit into the sub-frame

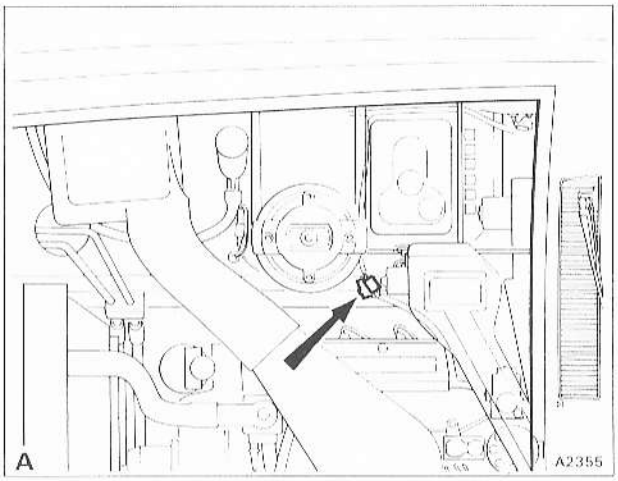
Fit the engine and transmission unit by reversing the removal procedure noting the following.

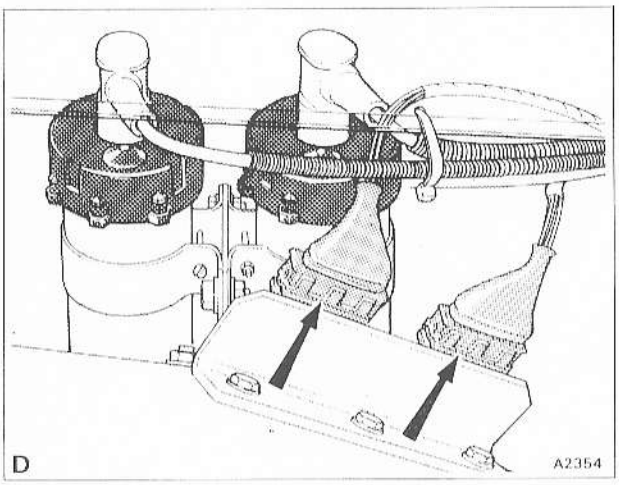
1. If new rear engine mounts are fitted, always ensure they are of the correct type. Two types of rubber are used and although they are visually the same the hardness rating of the rubber used is different. Always identify the mounts by the part number. For further information refer to Section H2.
2. 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.

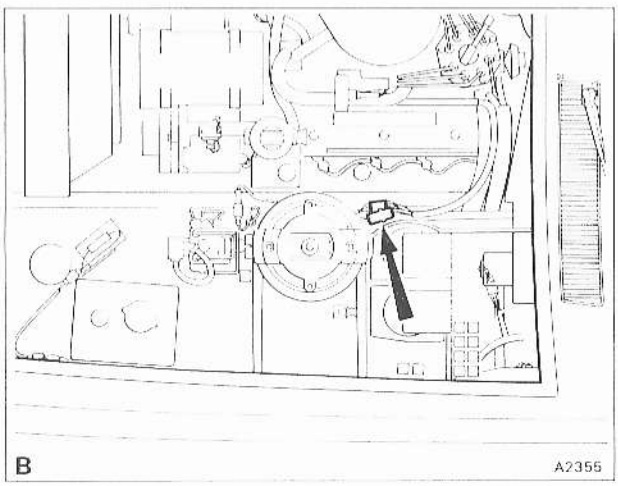
On 1989 model year cars the distance between the











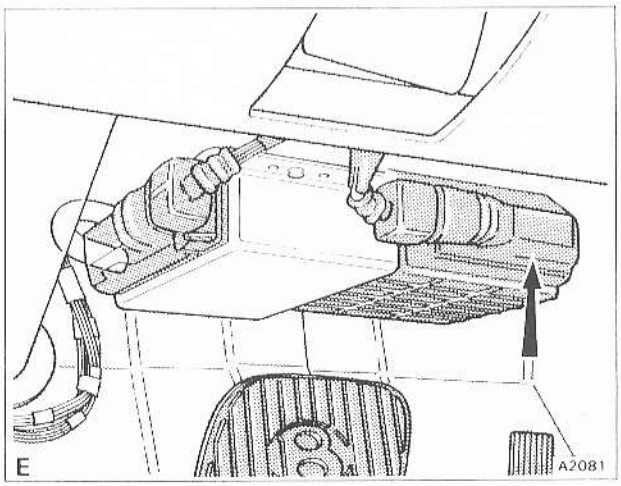
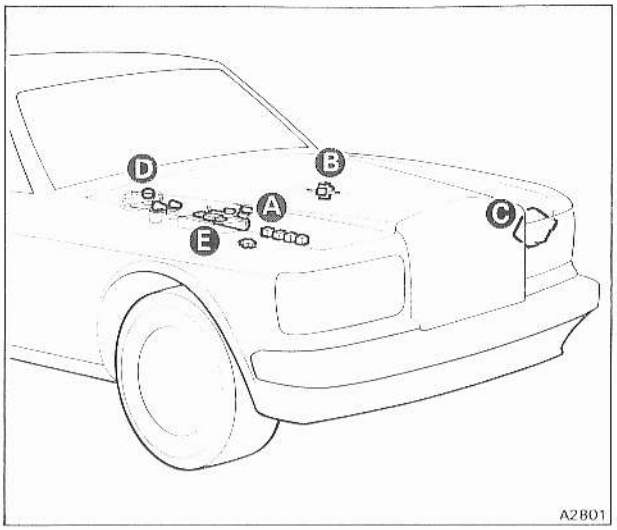
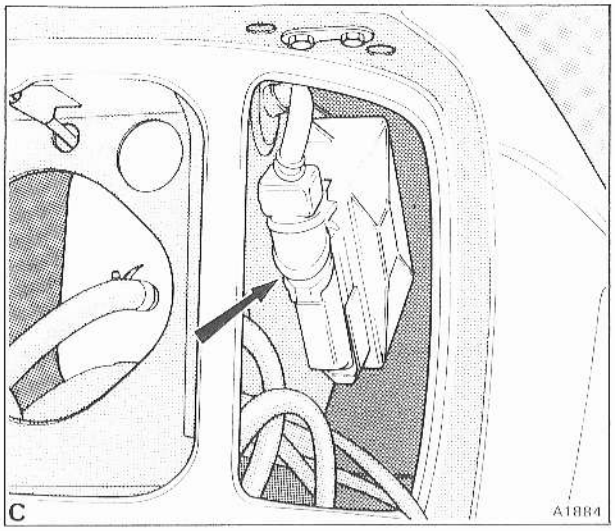
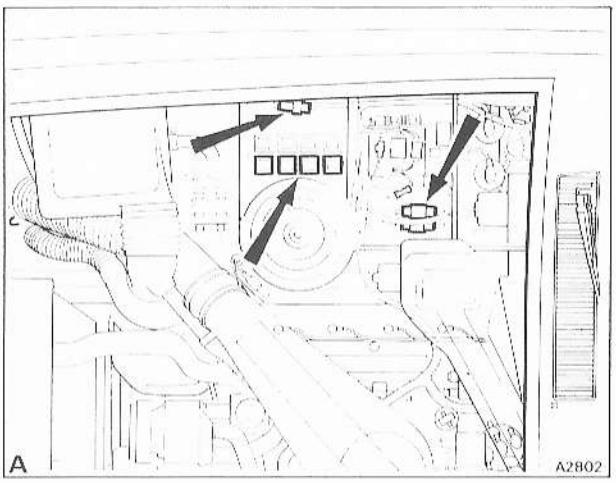


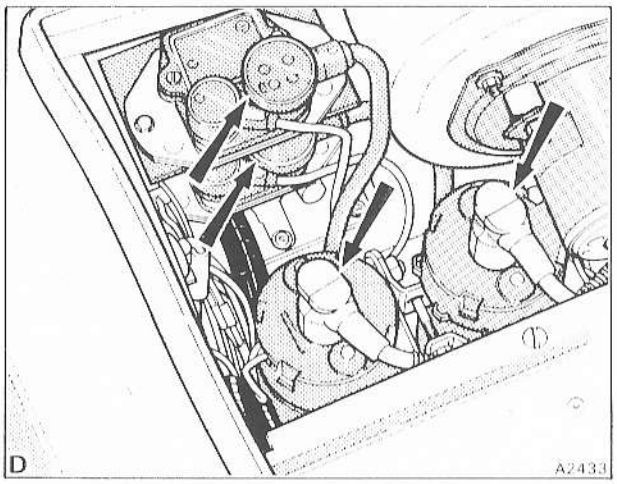
Fig. H3-7 Electrical disconnection points (Cars prior to 1989 model year)

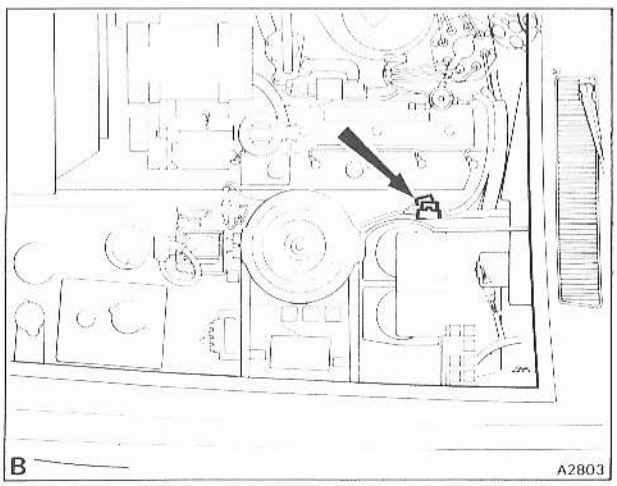
A Loom block and end connectors
B Loom block and end connectors
C Boost control ECU (Bentley Turbo R only)
D Ignition amplifier connectors (Bentley Turbo R only)
E Electronic control unit connectors (Bentley Turbo R only)











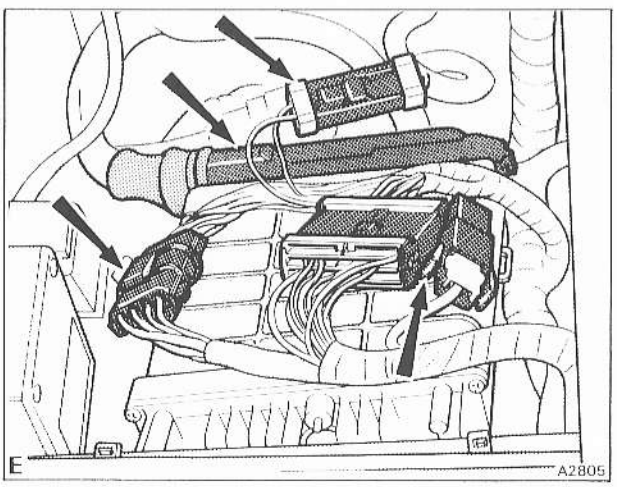


Fig. H3-8 Electrical disconnection points (1989 model year cars)

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.

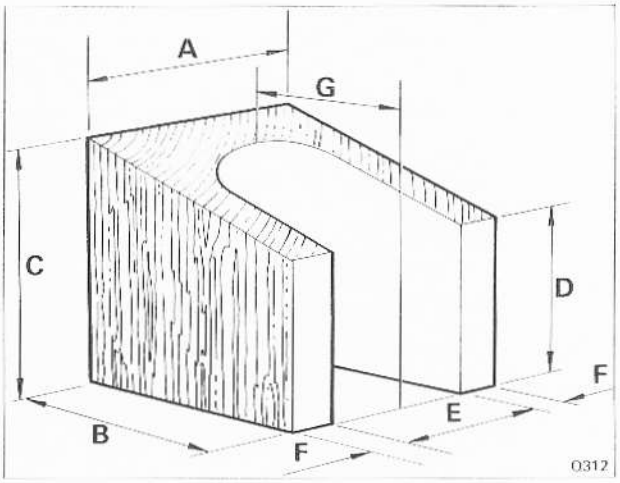


Fig H3-9 Wooden support block

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)

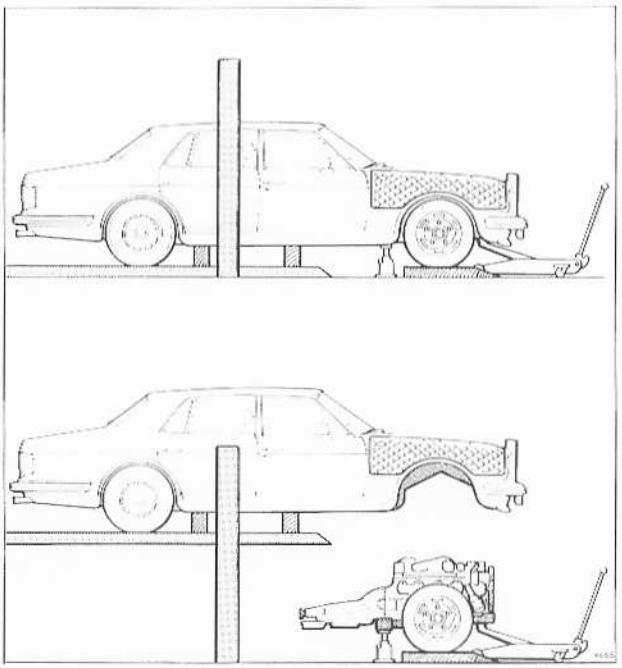


Fig. H3-10 Sub-frame, engine and transmission unit removal

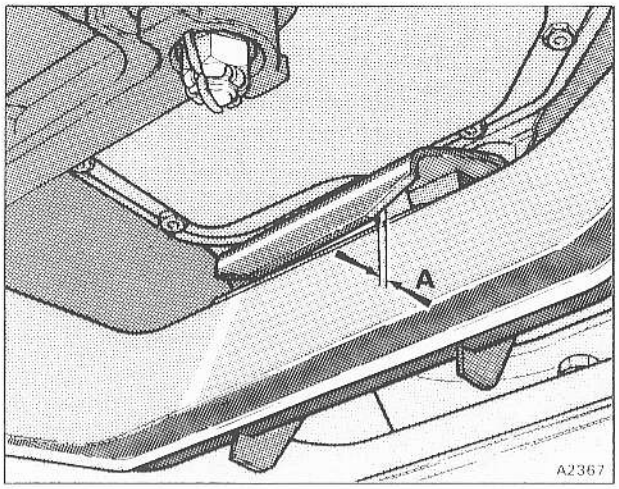


Fig. H3-11 Front engine mount setting
A 1,5 mm to 2,2 mm (0.060 in to 0.090 in)

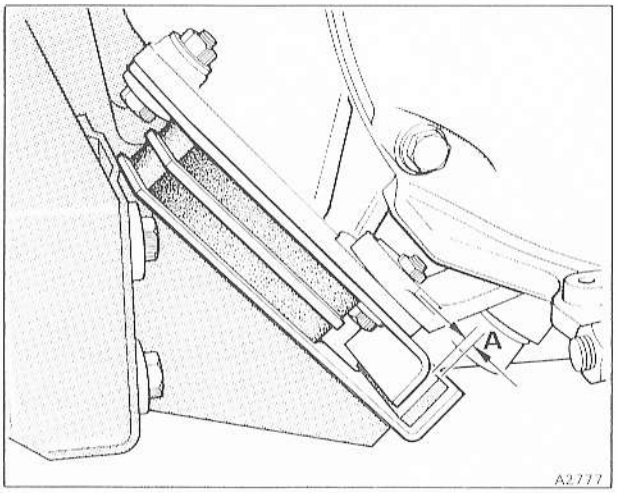


Fig H3-12 Rear engine mount setting (1989 model year cars)
A 4,0 mm to 5,5 mm (0.158 in to 0.216 in)

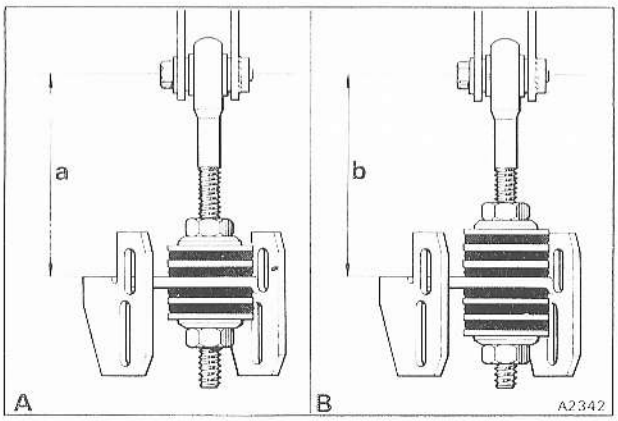


Fig H3-13 Sub-frame to longeron tie-bar setting
A 81,8 mm to 82,9 mm (3.22 in to 3.26 in) (Rolls-Royce four door cars)
B 78,8 mm to 80,0 mm (3.10 in to 3.15 in) (Bentley four door cars)

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.

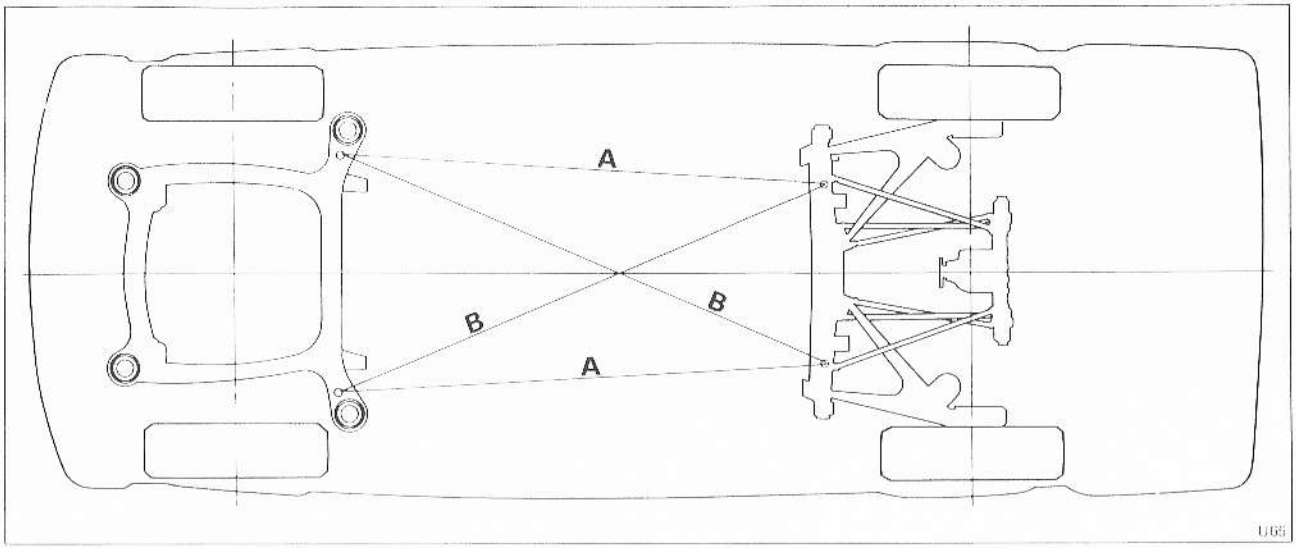


Fig H3-14 Sub-frame alignment
Measurements to be equal within 1,60 mm (0.062 in)

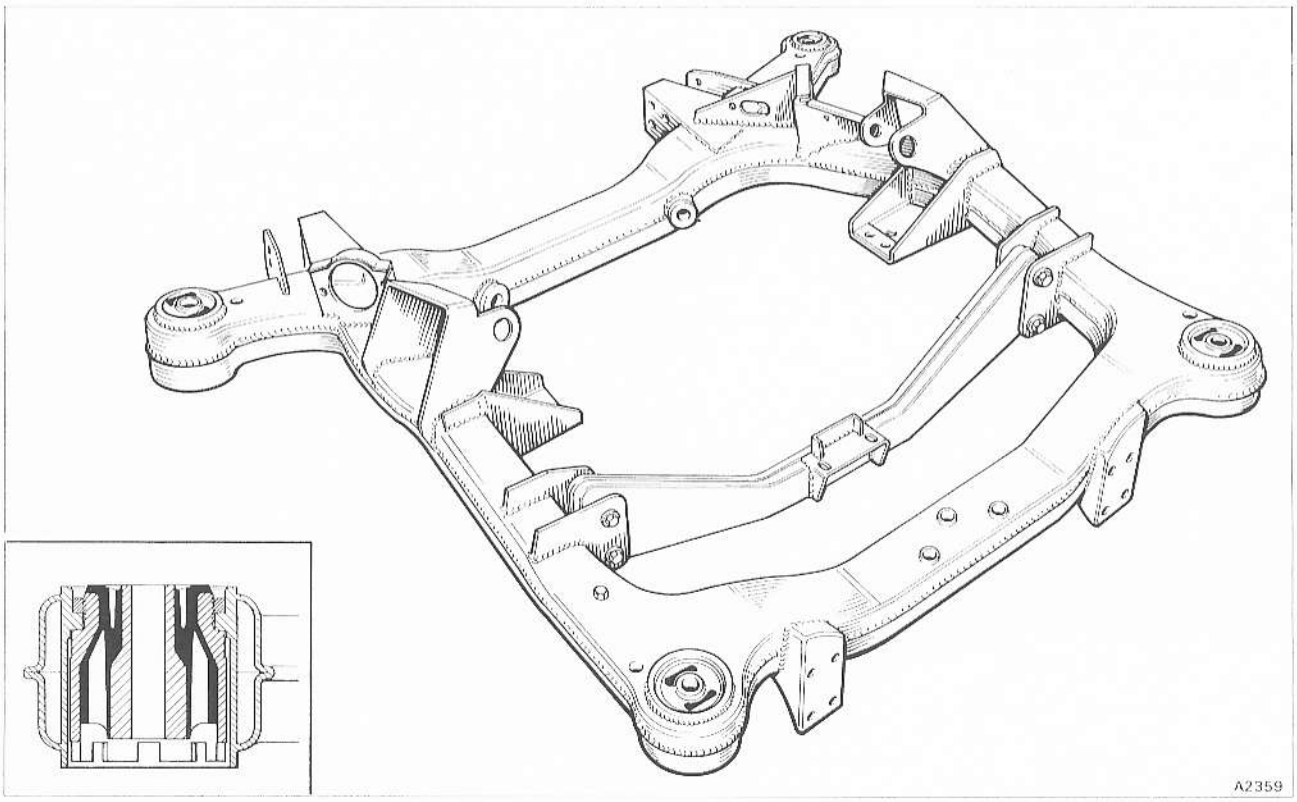


Fig. H3-15 Front sub-frame assembly
Inset – Sub-frame mount

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.

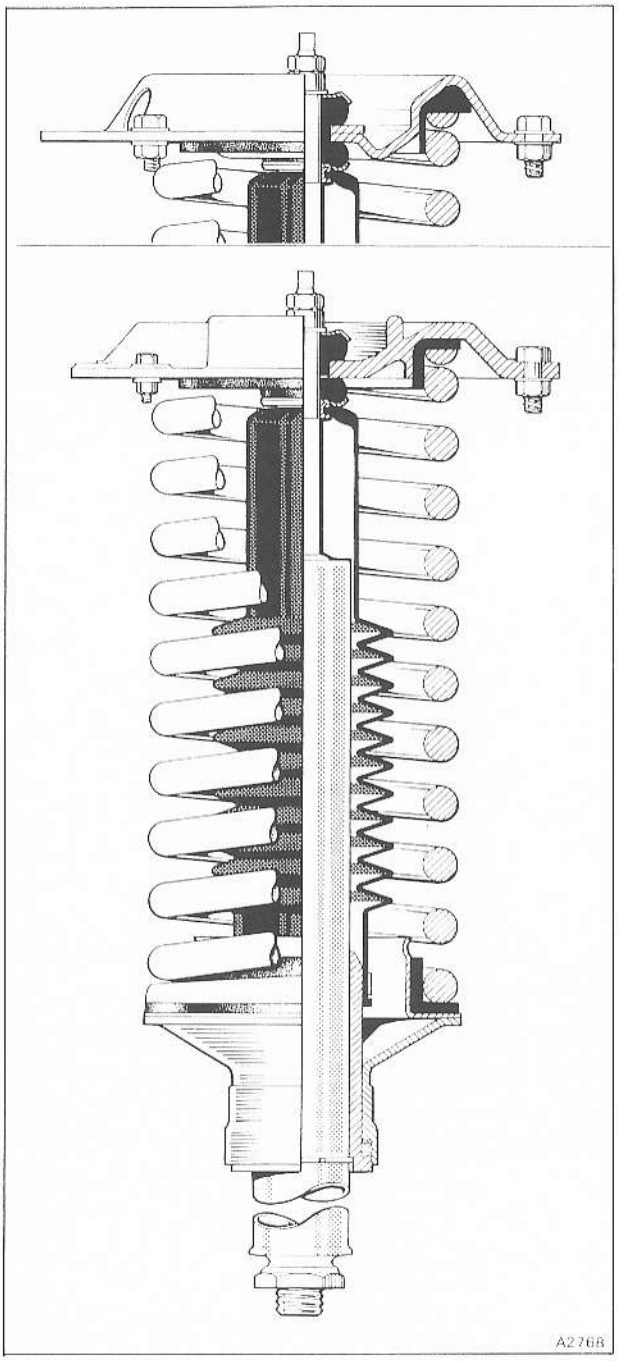


Fig. H4-1 Front road spring and shock damper assembly
Inset – Pressed steel spring plate arrangement

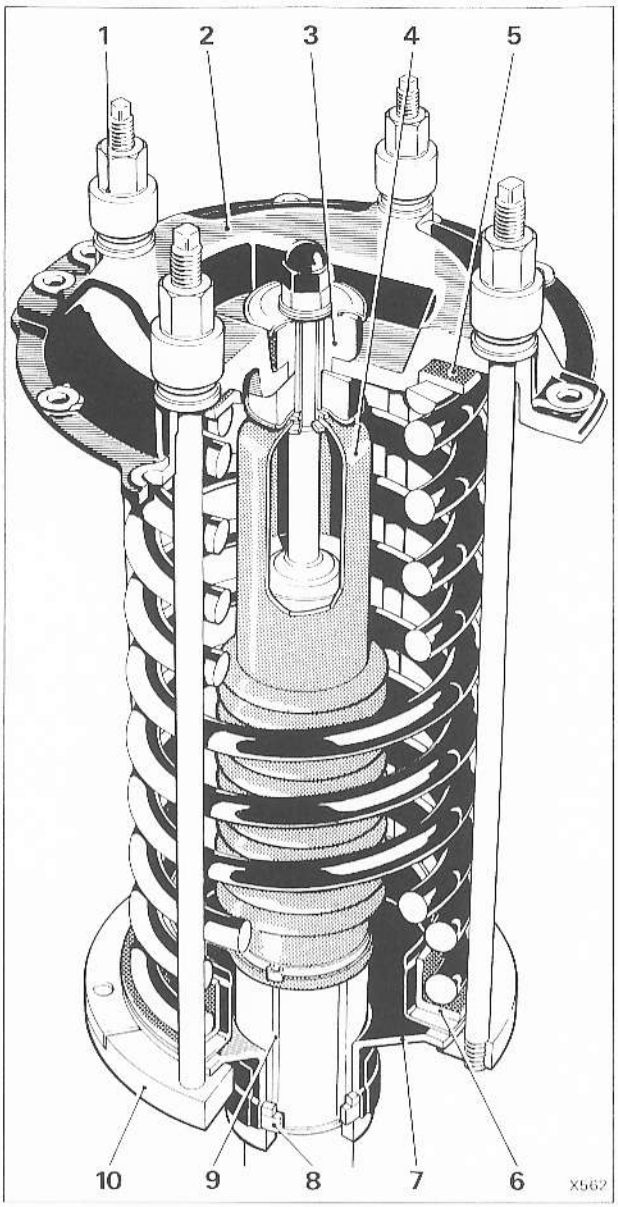


Fig. H4-2 Spring retention tool in position

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.

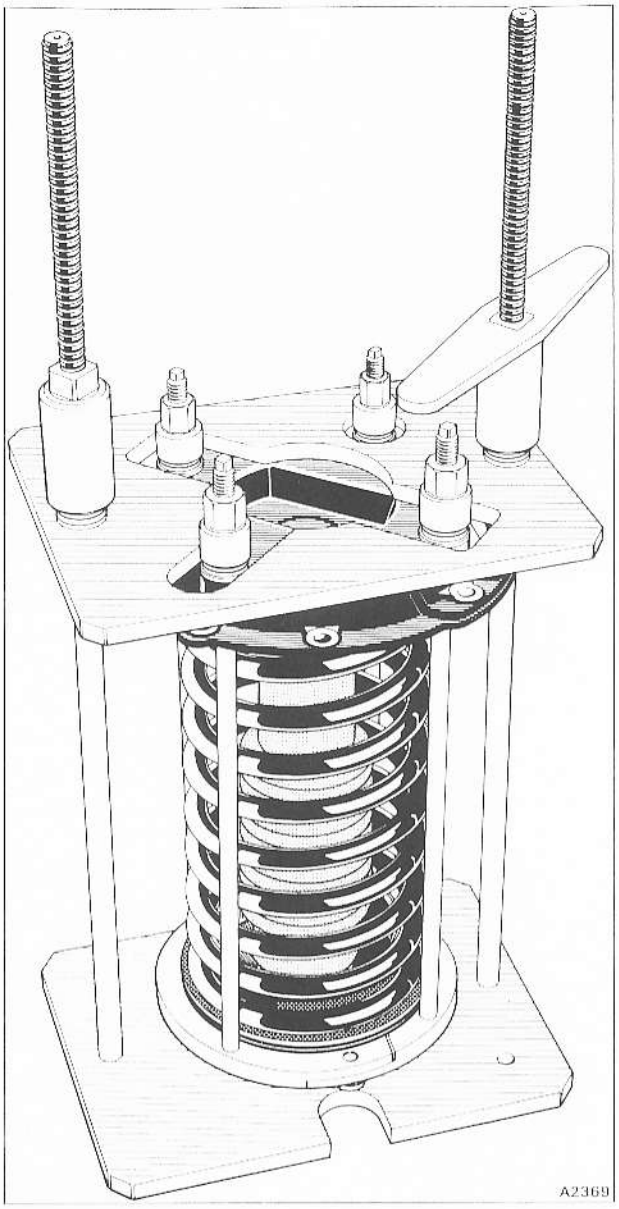


Fig. H4-3 Spring compression tool

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.

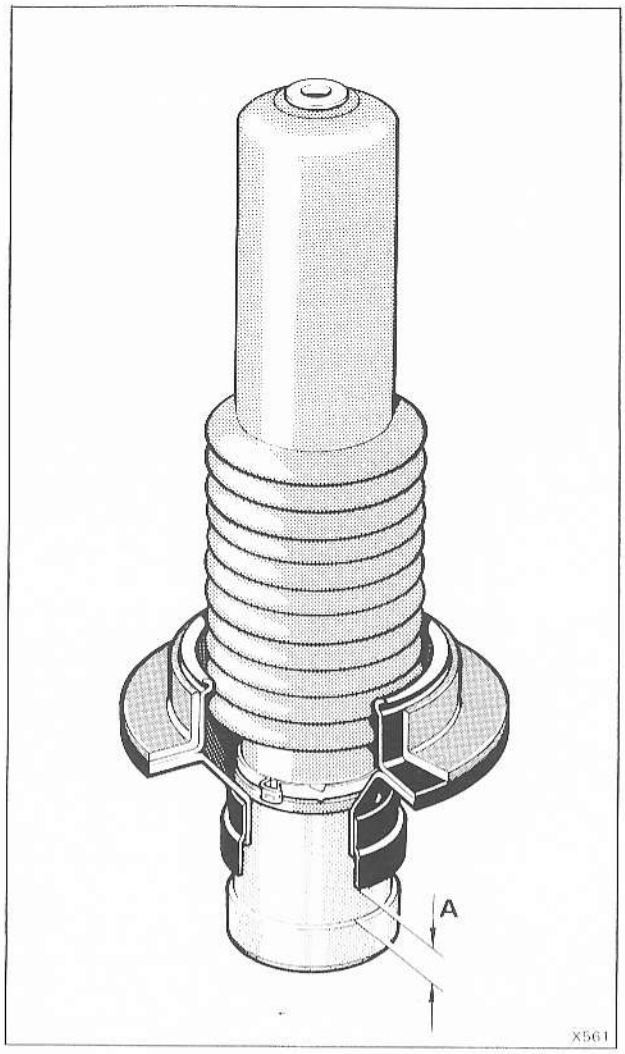


Fig. H4-4 Spring support plate, collar, and sleeve assembly
A 19 mm (0.75 in)

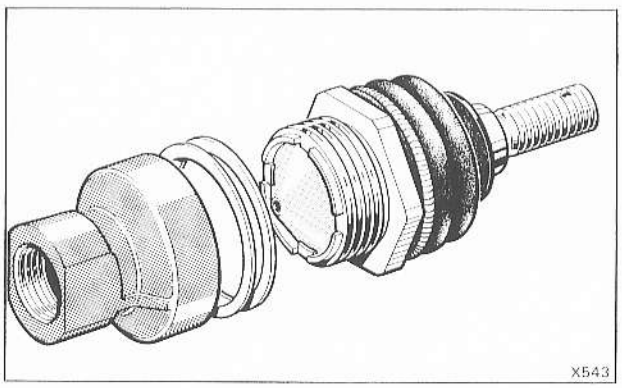


Fig. H4-5 Damper ball joint assembly

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.

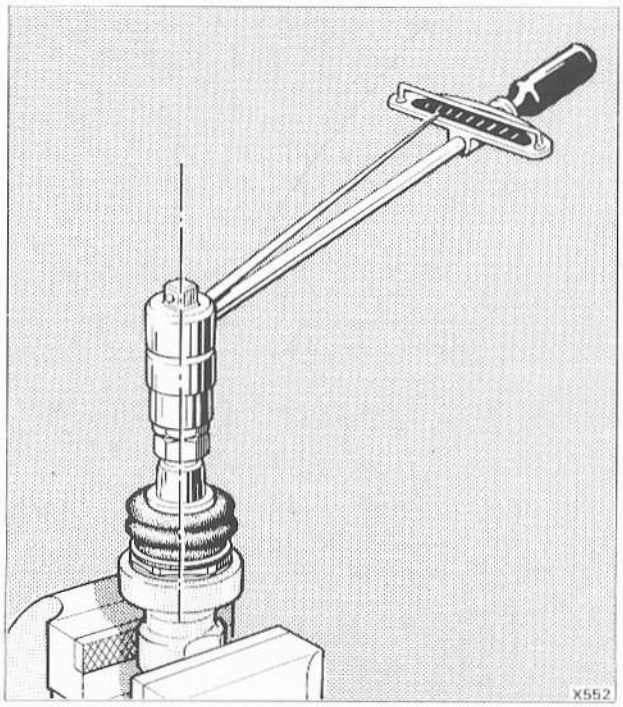


Fig. H4-6 Checking the ball joint pre-load

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).

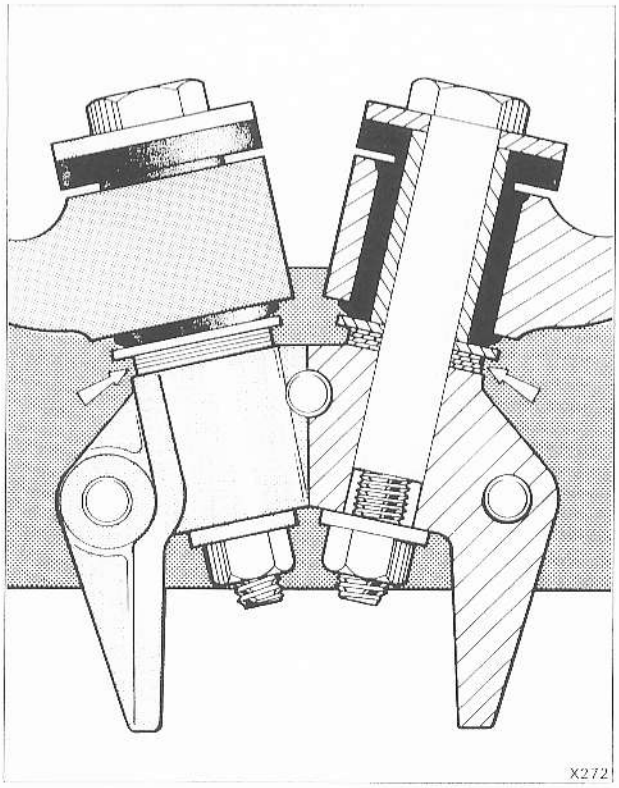


Fig. H5-1 Front triangle lever mount (shims arrowed)

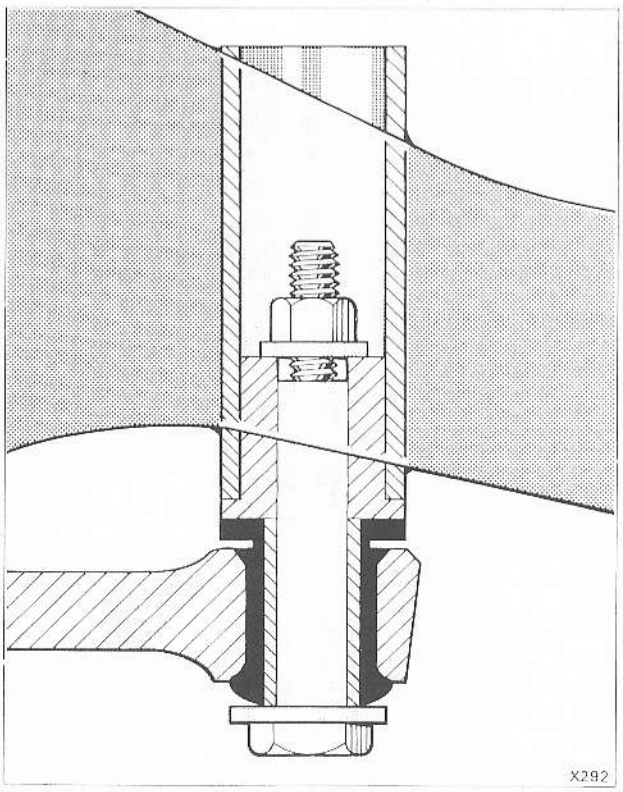


Fig.H5-2 Rear triangle lever mount

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 car (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.

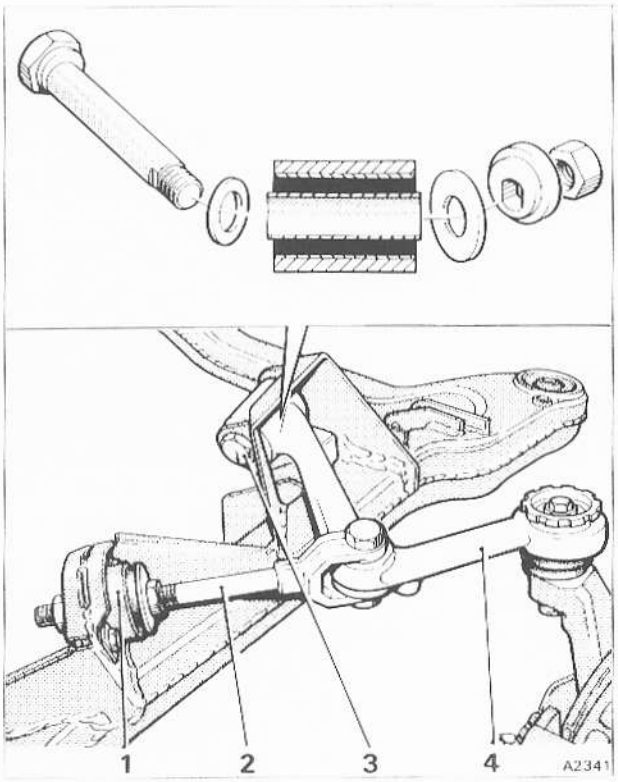


Fig. H5-3 Compliance assembly
1 Compliance mount
2 Compliance rod
3 Pivot bolt
4 Compliance lever

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.

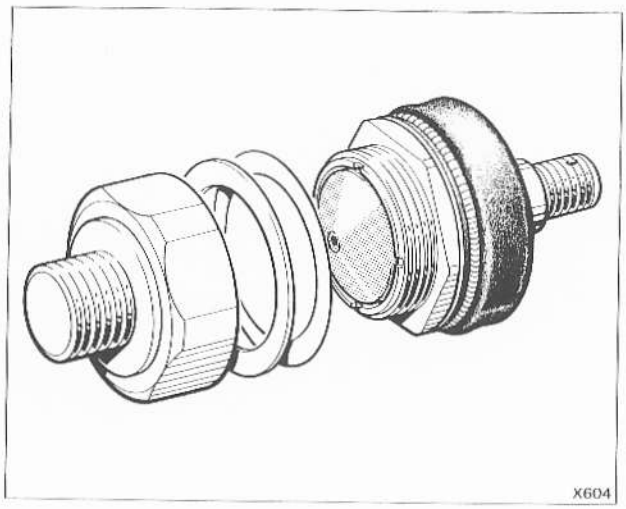


Fig. H5-4 Lower ball joint assembly

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

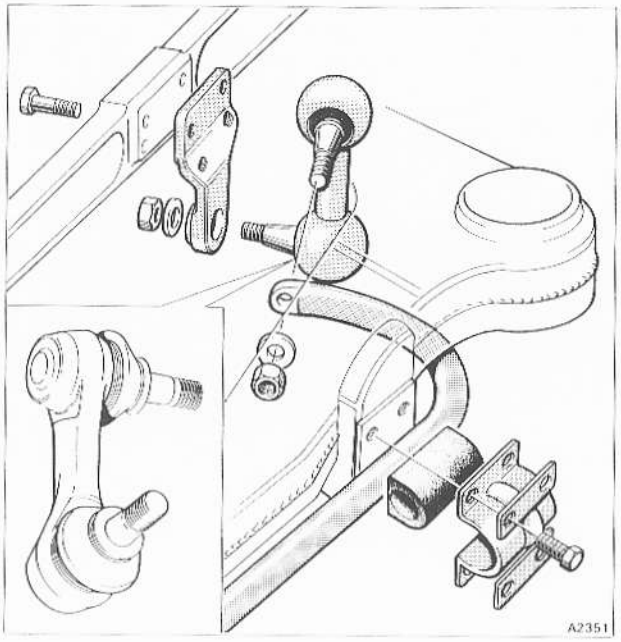


Fig. H5-5 Front stabilizer components
Inset–Link fitted to Bentley cars other than Continental

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.

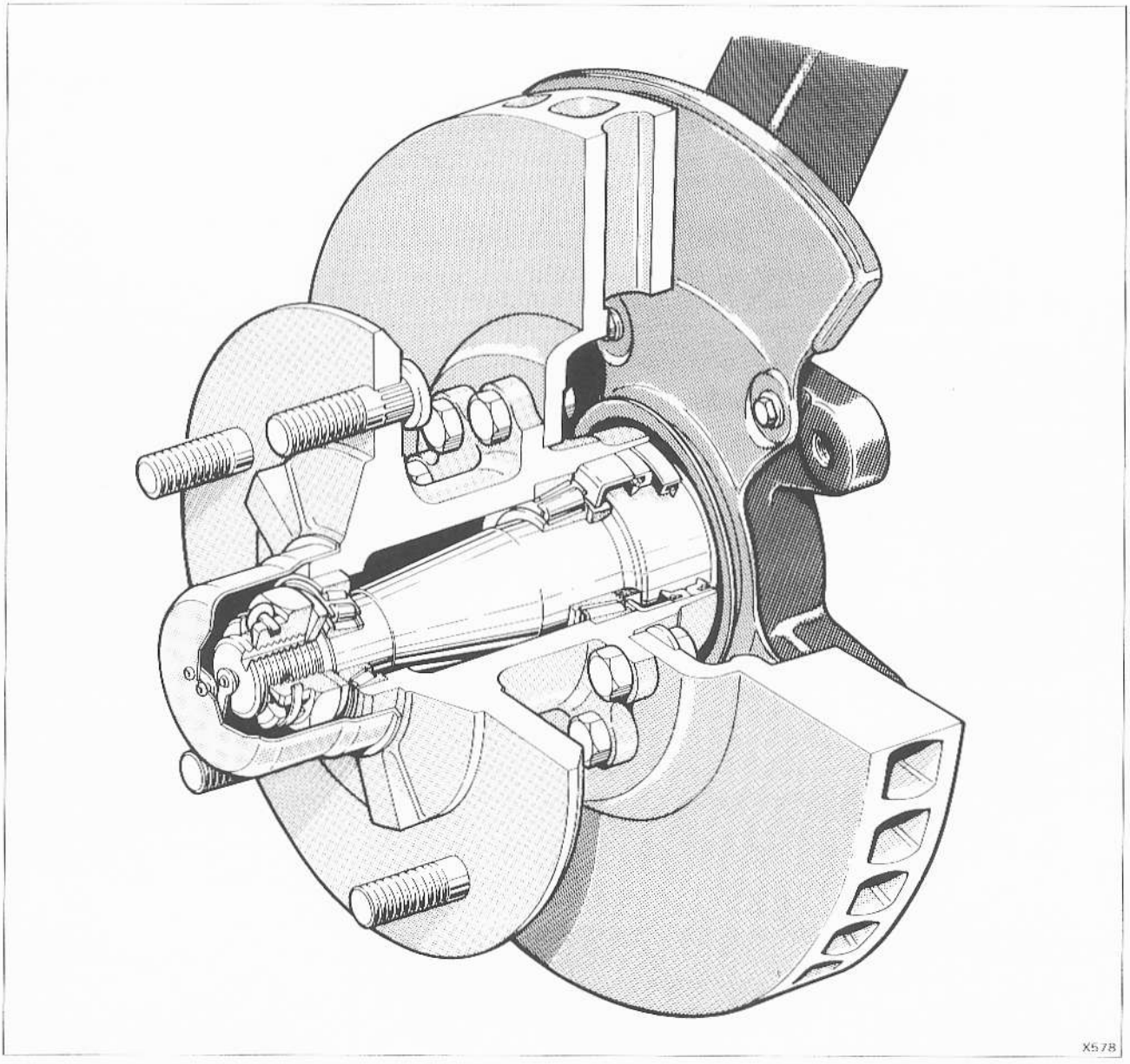


Fig. H6-1 Front hub assembly (Cars not fitted with anti-lock braking)

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.

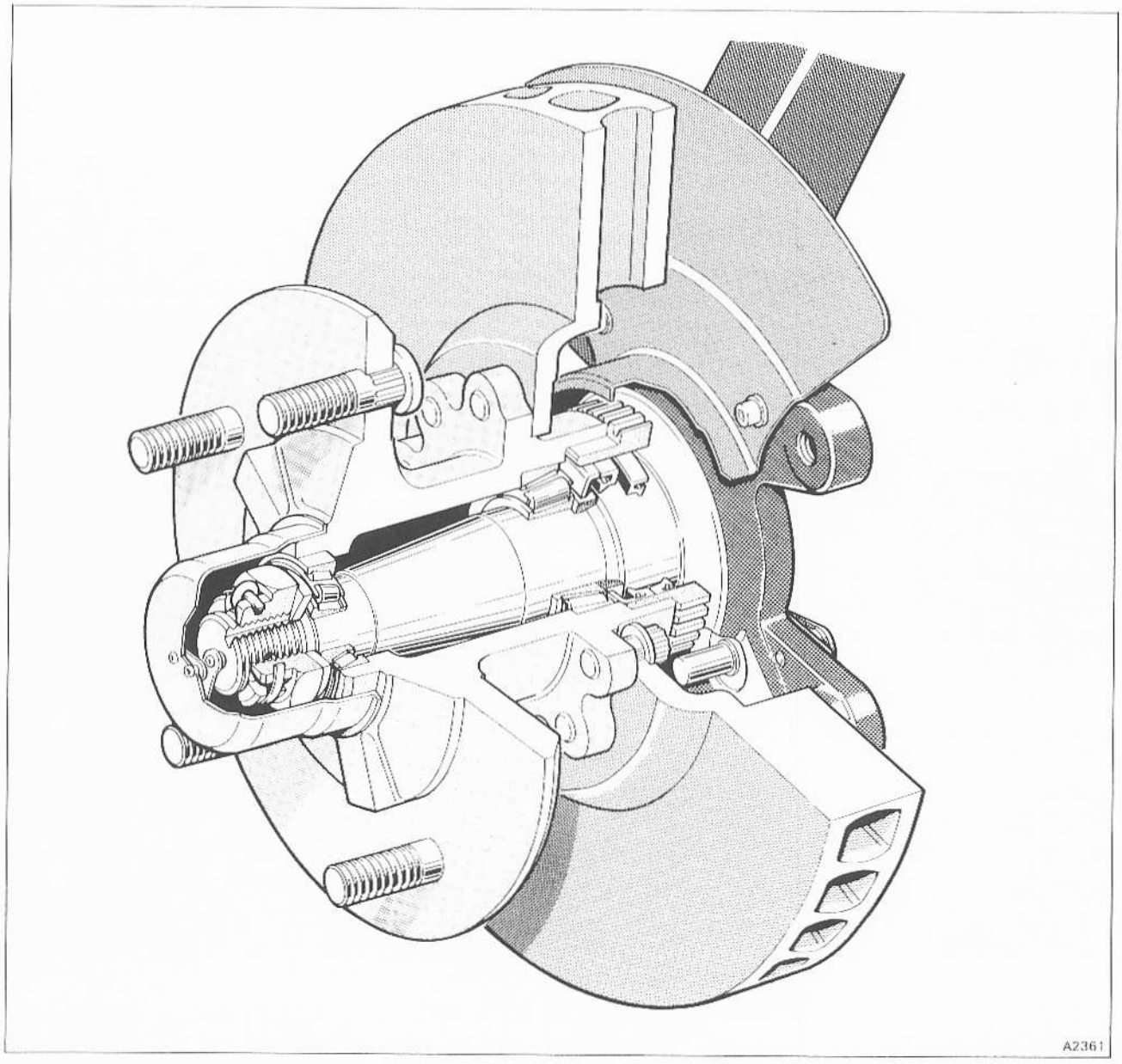


Fig. H6-2 Front hub assembly (Cars fitted with anti-lock braking)

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 axle 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.

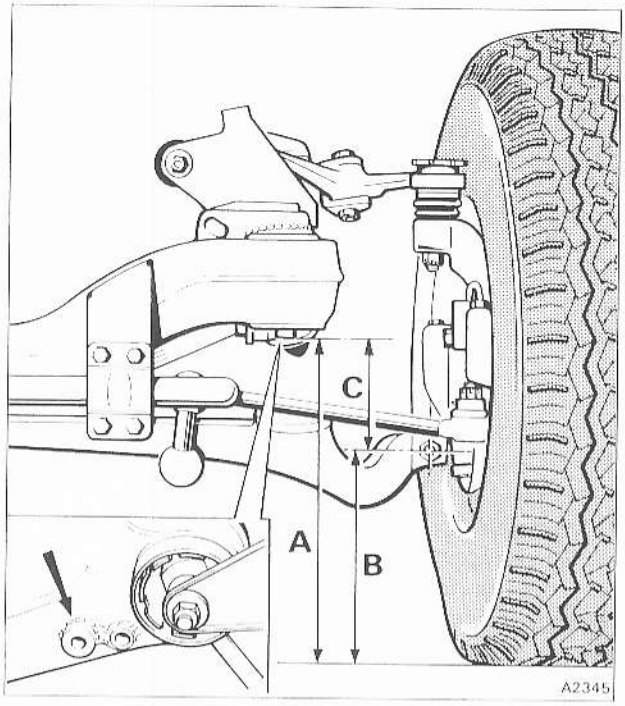


Fig. H7-1 Front height setting

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.

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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.

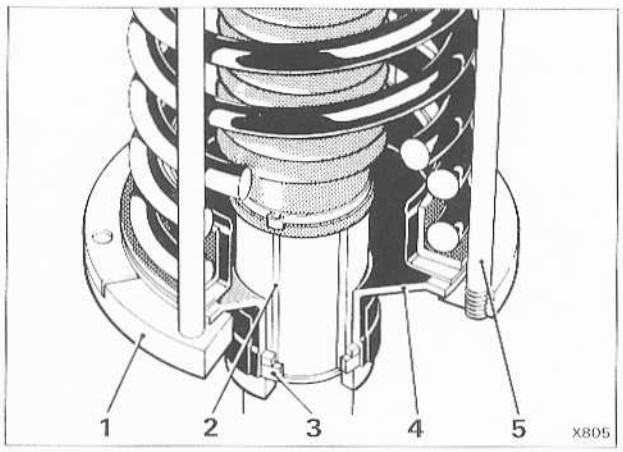

Fig. H7-2 Front height adjustment
1 Spring retention tool support plate
2 Spring support collar
3 Adjustment collets
4 Spring support
5 Retention tool stud (4)

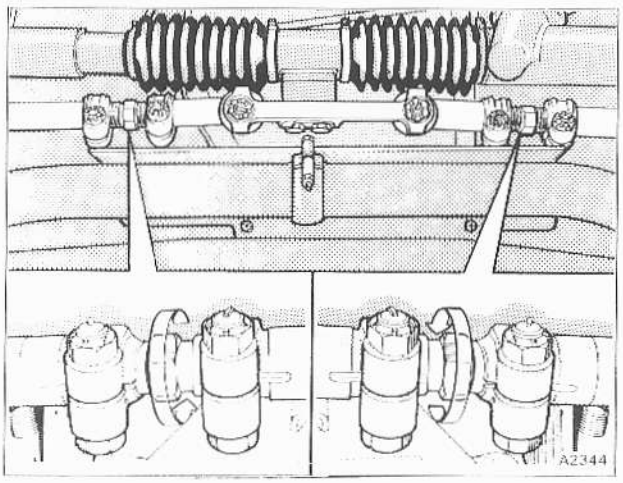

Fig. H7-3 Track rod toe-in adjustment

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′.

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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.

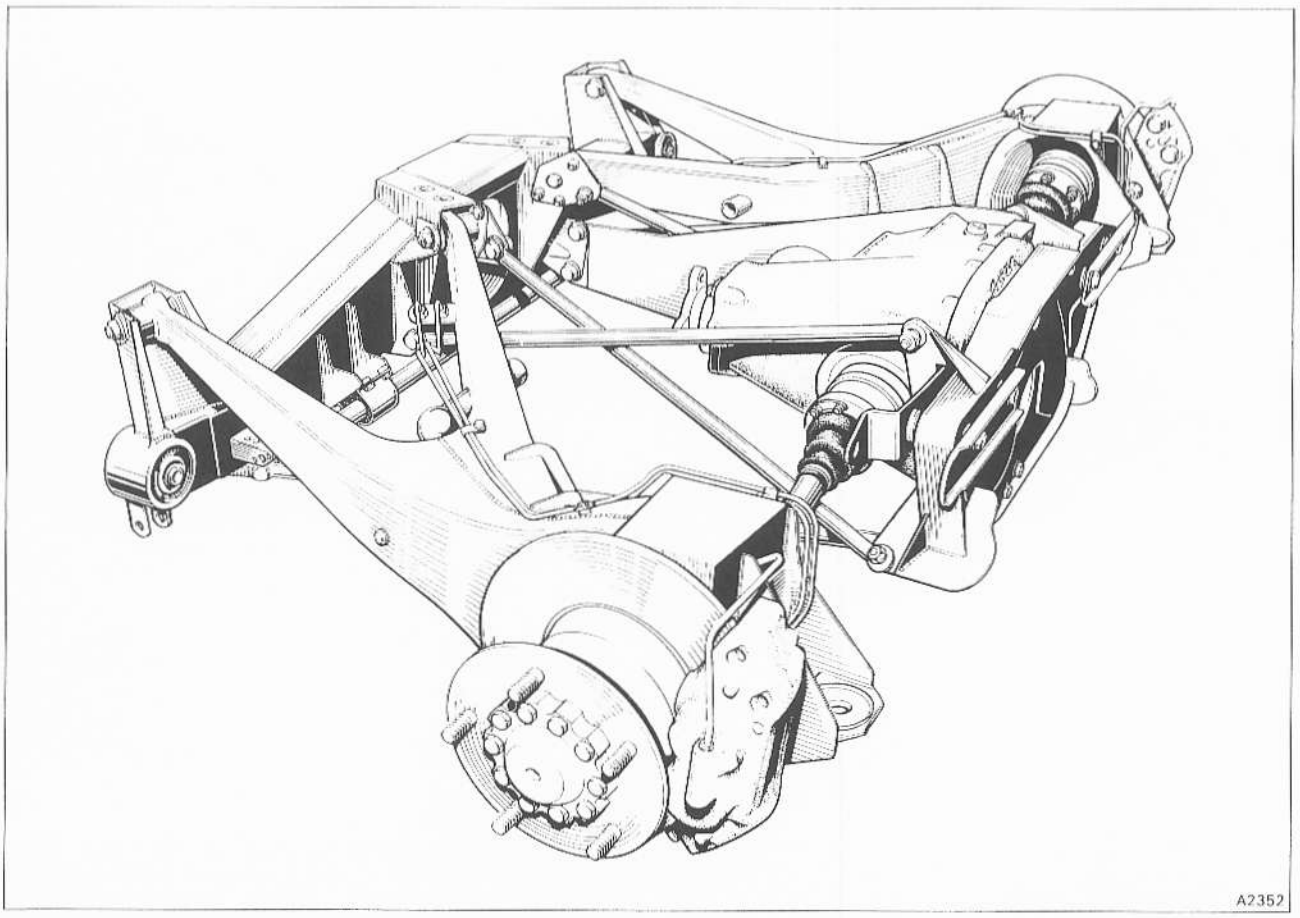

Fig. H8-1 Rear sub-frame and associated components

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

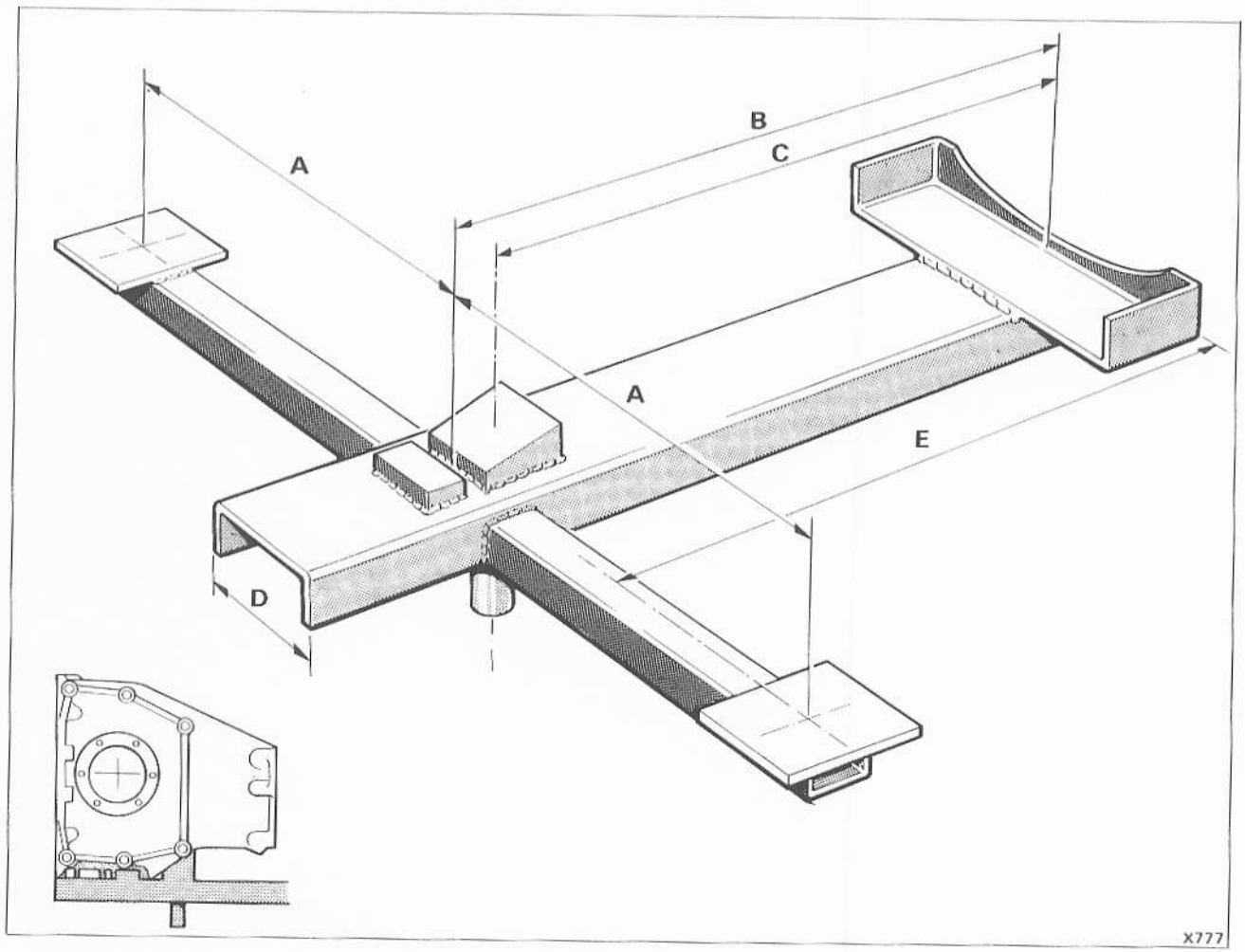

Fig. H8-2 Rear sub-frame removal jig general dimensions

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 lever 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 examine 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.

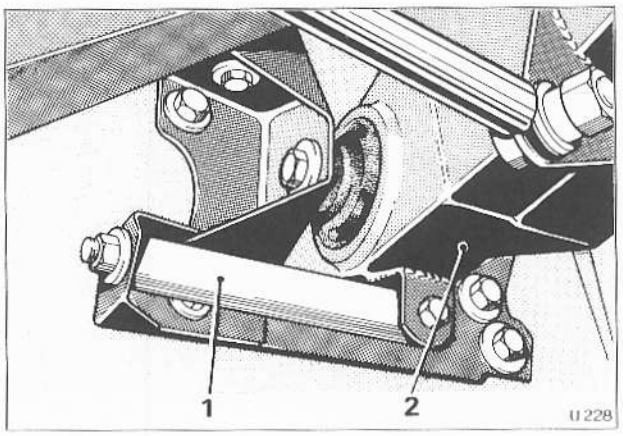

Fig. H8-3 Jury bolt in position
1 Jury bolt
2 Rear crossmember

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 alignment is correct fit and torque tighten the frame tube securing bolts to between 102 Nm and 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-frame settings and necessitating the removal of the sub-frame 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

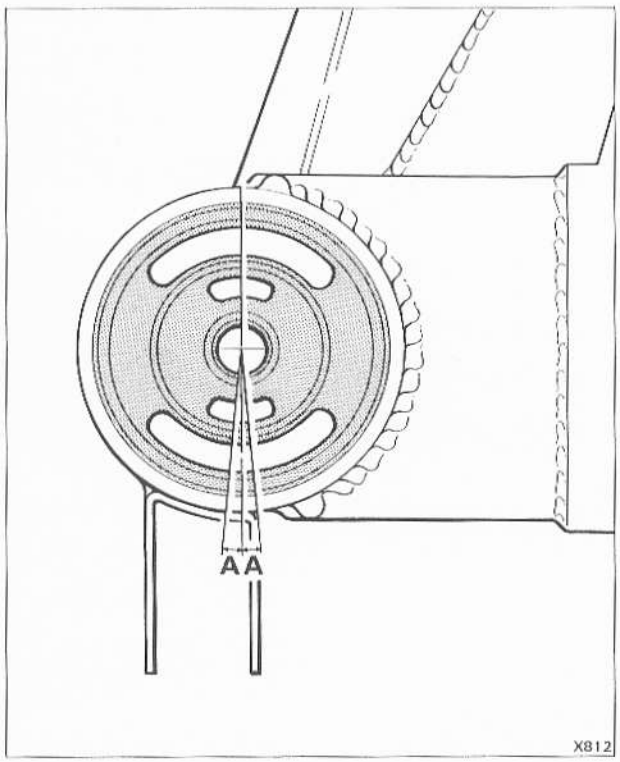

Fig. H9-1 Rear crossmember mount alignment
A Holes to be within 5° of vertical centre line

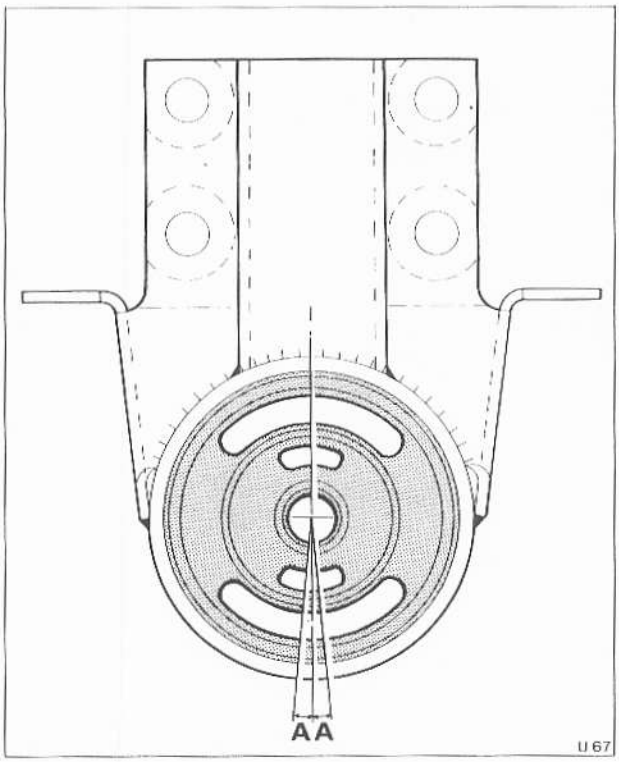

Fig. H9-2 Final drive crossmember mount alignment
A Holes to be within 5° of vertical centre line

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.

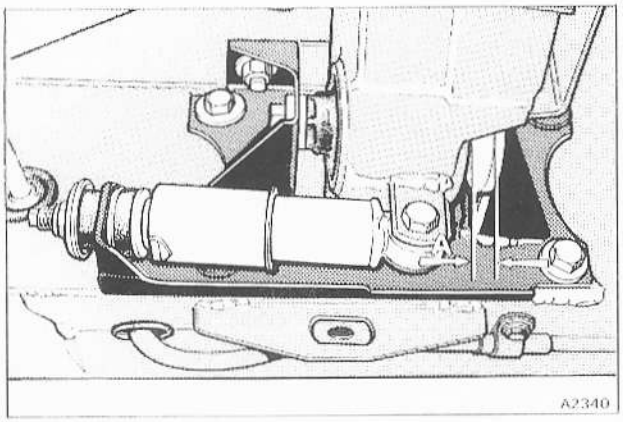

Fig. H9-3 Rear crossmember mount setting
A 10,60 mm to 12,07 mm (0.40 in to 0.475 in)

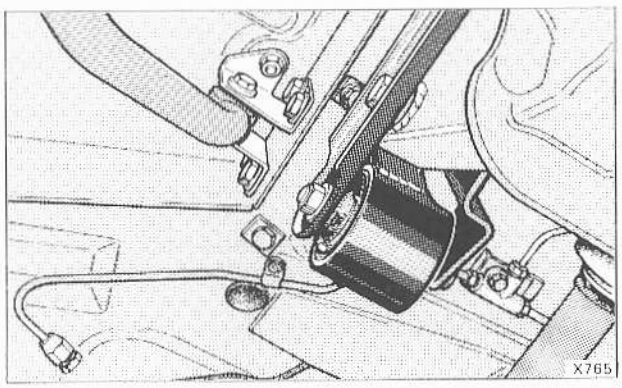

Fig. H9-4 Final drive crossmember mount
(left-hand shown)

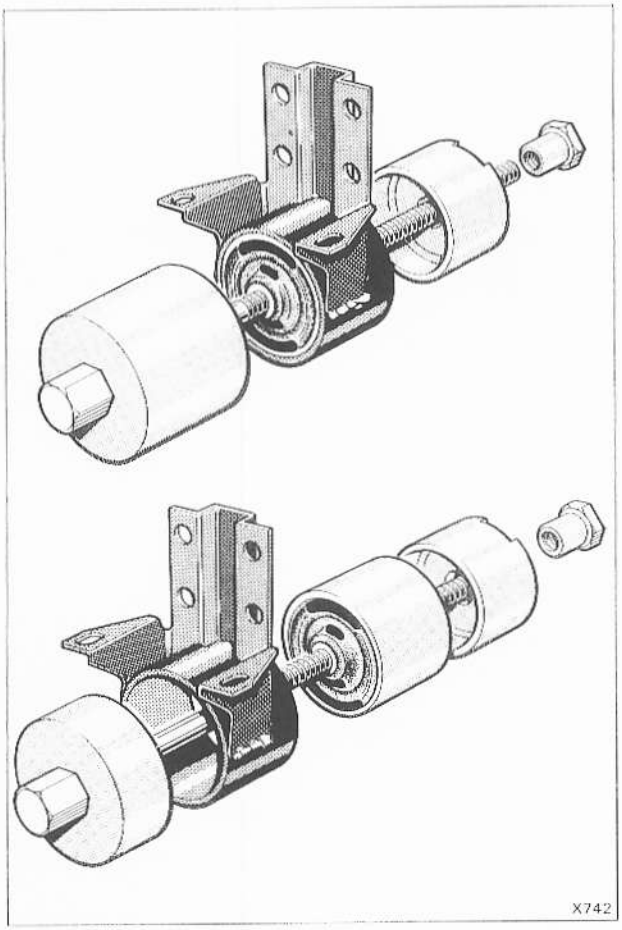

Fig. H9-5 Mount extraction and insertion tool RH9291

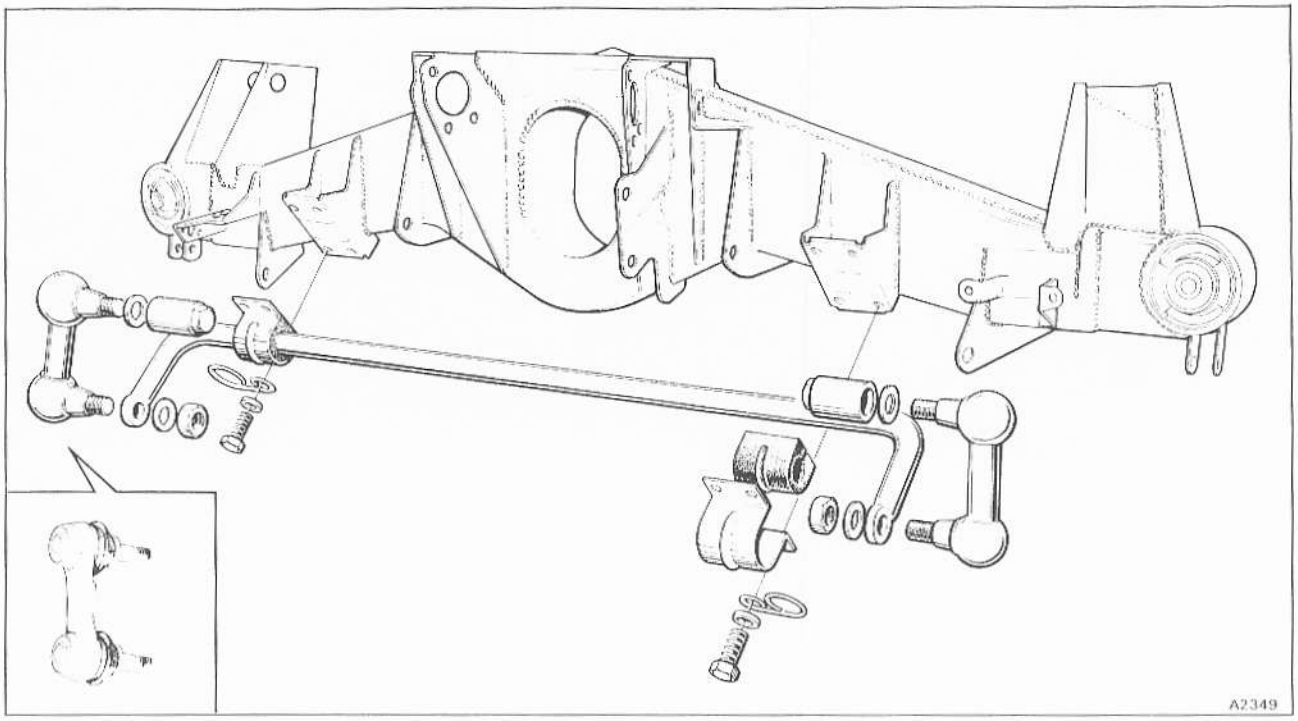

Fig. H9-6 Rear stabilizer components
Inset-Link fitted to Bentley cars other than Bentley Continental

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.

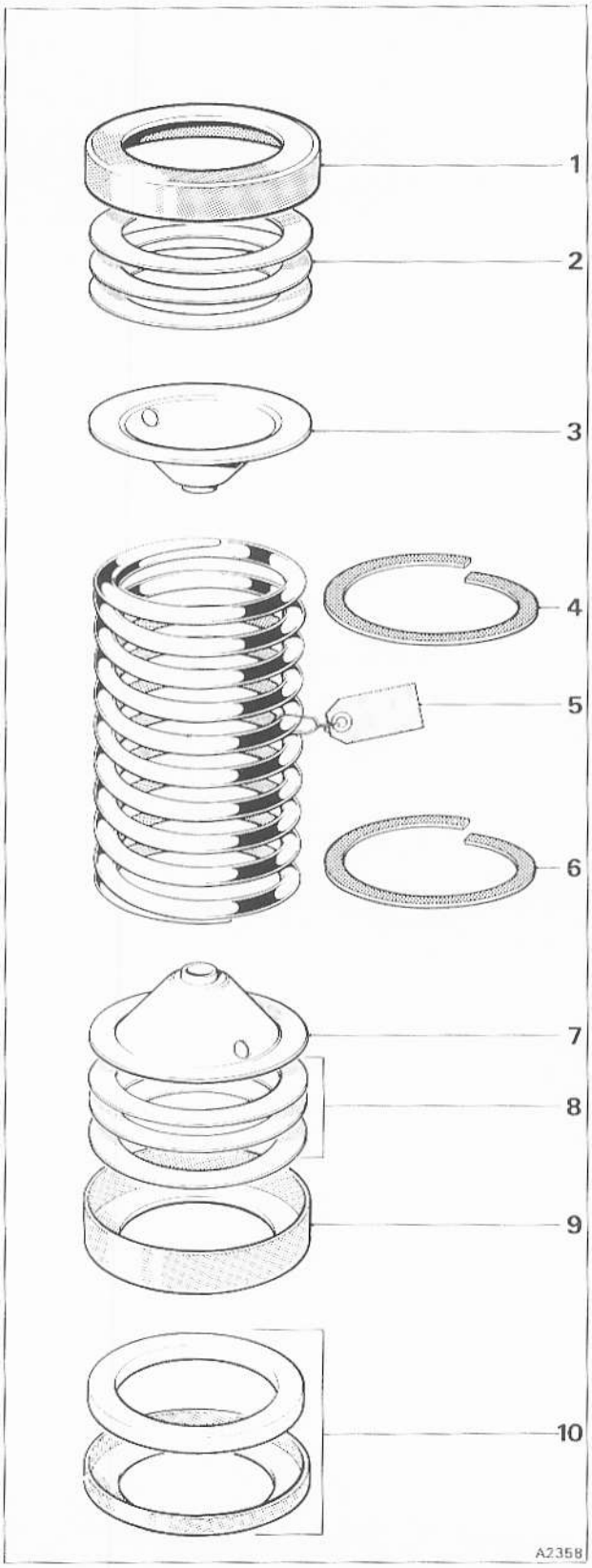

Fig. H10-1 Rear road spring assembly

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.

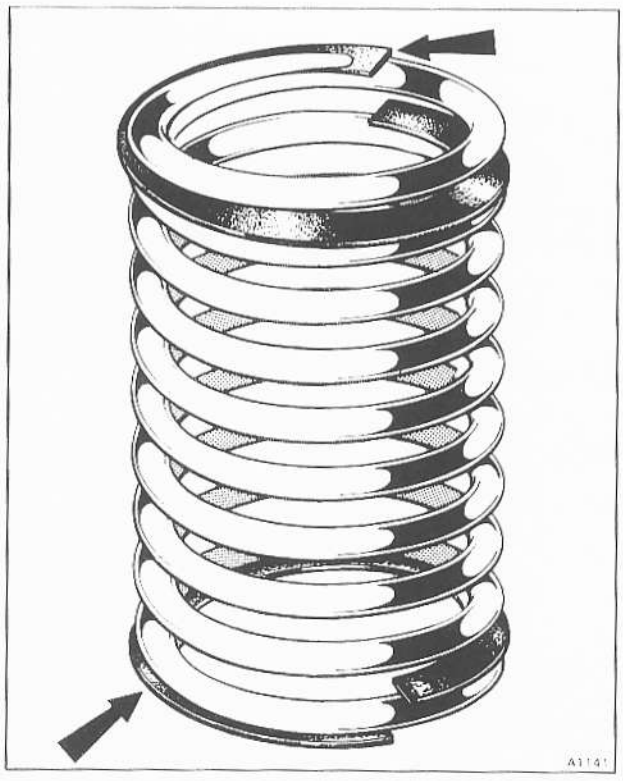

Fig. H10-2 Flexible strip location

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

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	N	34,7	69,4	104,2	138,9	173,3	208,0	242,8	277,5
increase/decrease	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	mm	1,78	3,56	5,33	7,11	8,89	10,67	12,45	14,22
increase/decrease	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	N	312,2	346,9	381,6	416,4	451,1	485,8	520,2	555,0
increase/decrease	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	mm	16,00	17,78	19,56	21,34	23,11	24,89	26,67	28,45
increase/decrease	in	0.630	0.700	0.770	0.840	0.910	0.980	1.050	1.120

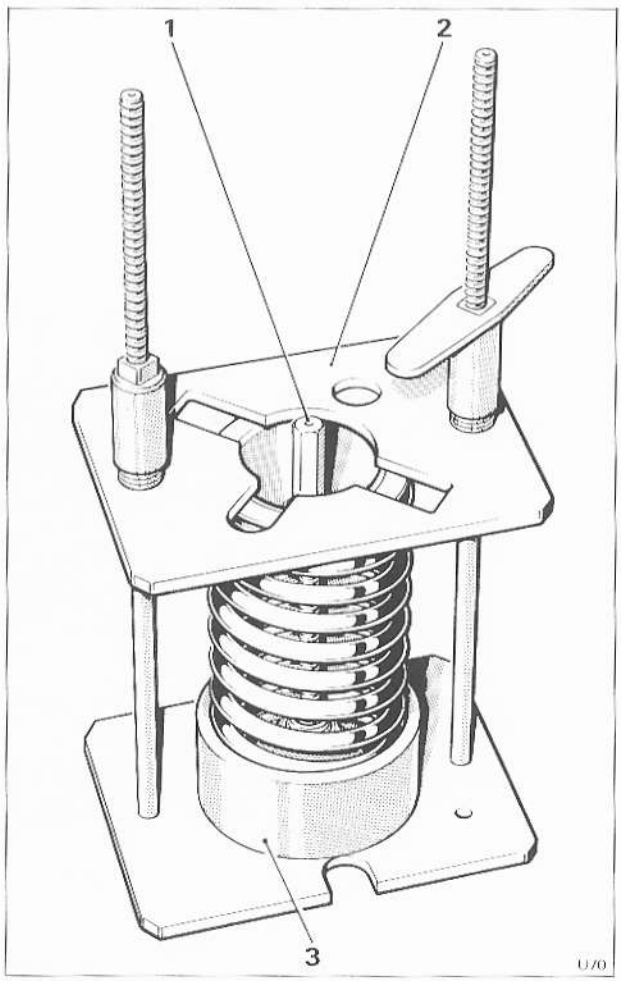

Fig. H10-3 Spring compression tools in position
1 Tool RH9299 and thrust washer
2 Tool RH7909
3 Adapter block RH9504

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 the 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/in^2) is indicated on the pressure gauge.

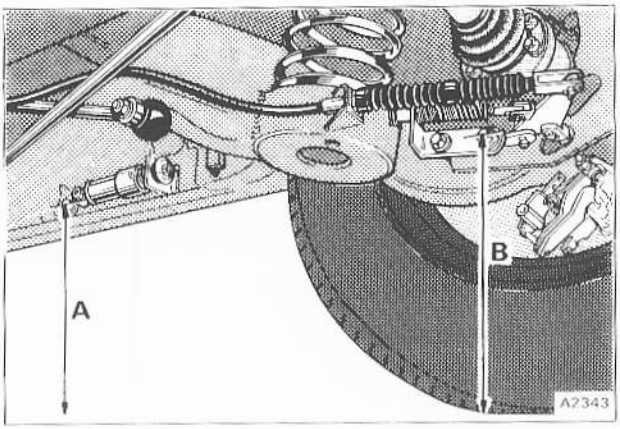

Fig. H11-1 Rear ride height setting
- A Floor to centre of body bracket setscrew
- B Floor to centre of parking brake linkage bracket setscrew

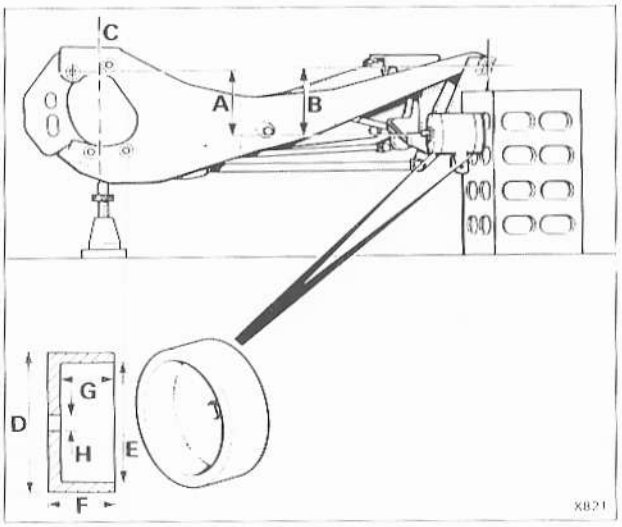

Fig. H11-2 Camber and toe-in setting
- A 134,9 mm (5.312 in)
- B 141,8 mm (5.582 in)
- C Wheel centre line
- D 76,2 mm (3.00 in)
- E 66,8 mm (2.63 in)
- F 25,4 mm (1.00 in)
- G 15,2 mm (0.625 in)
- H 9,9 mm (0.391)

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

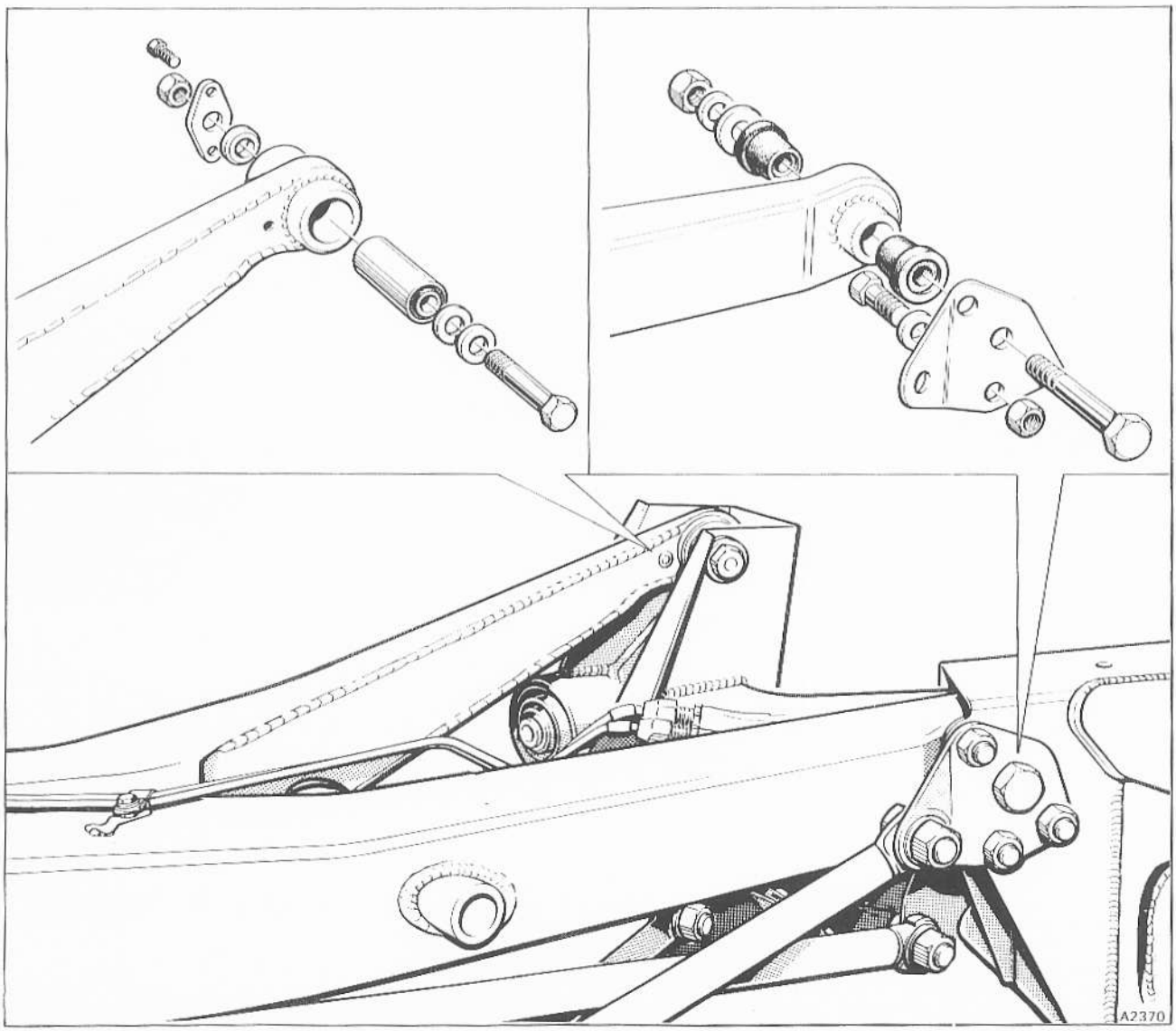

Fig. H11-3 Trailing arm pivot components

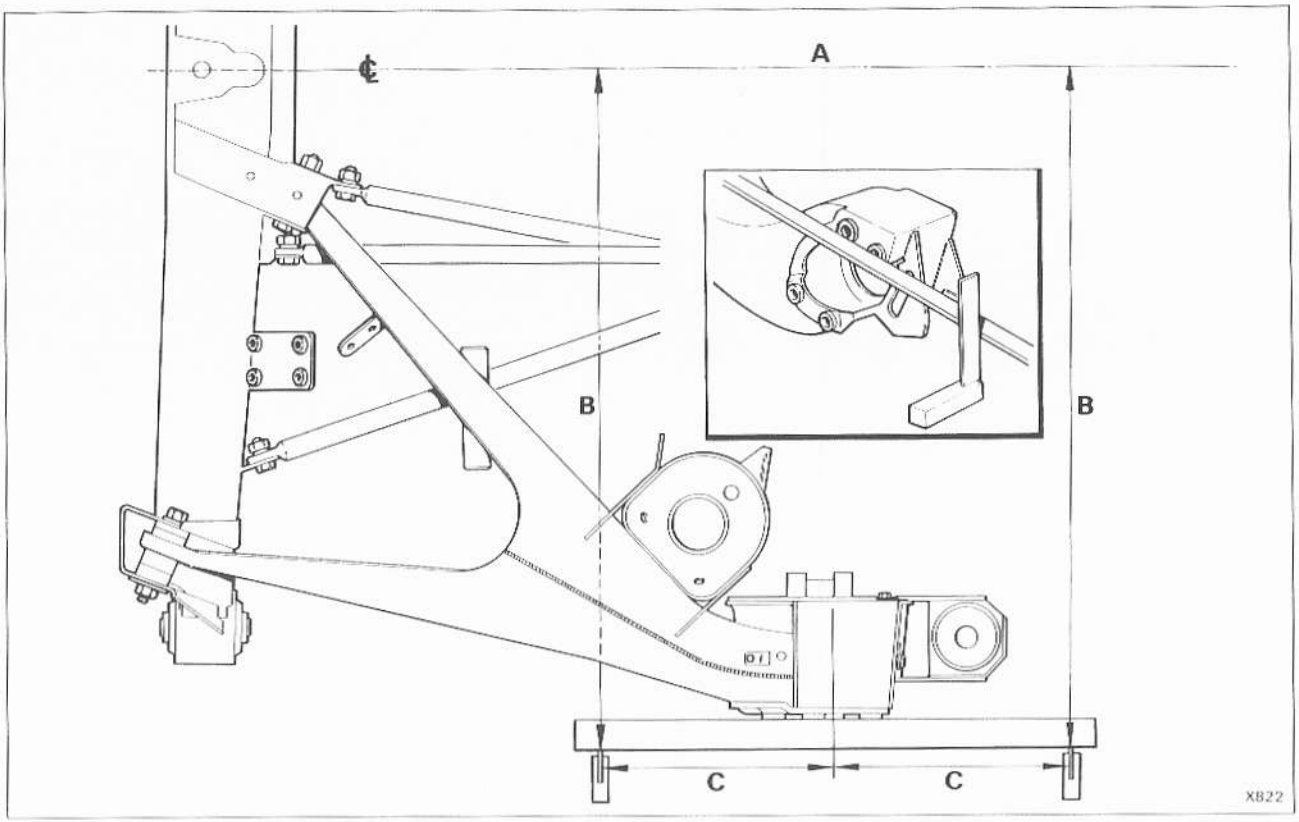

Fig. H11-4 Checking the toe-in setting

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 damage 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.

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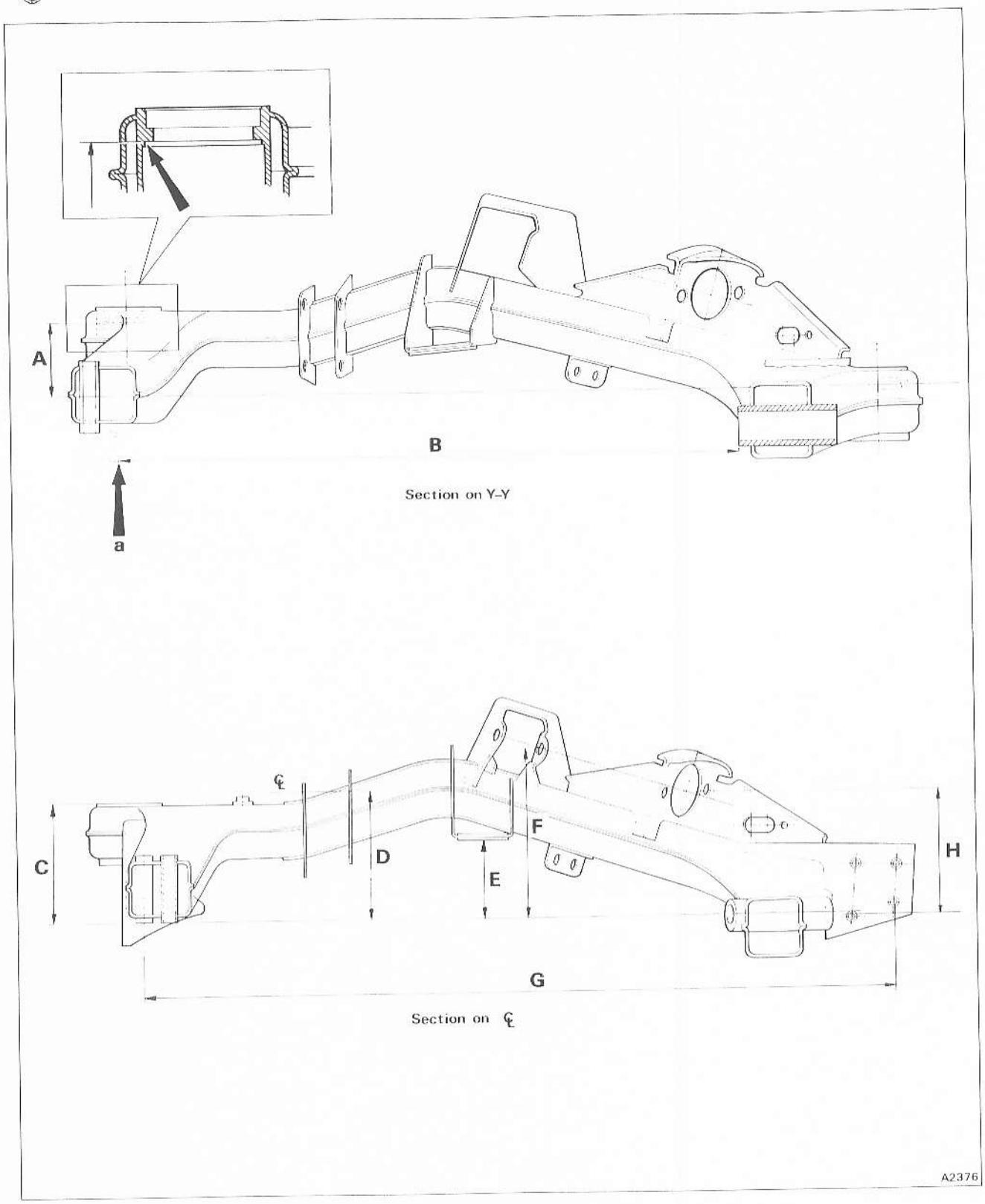

Fig. H12-1 Front sub-frame (side elevation)

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)

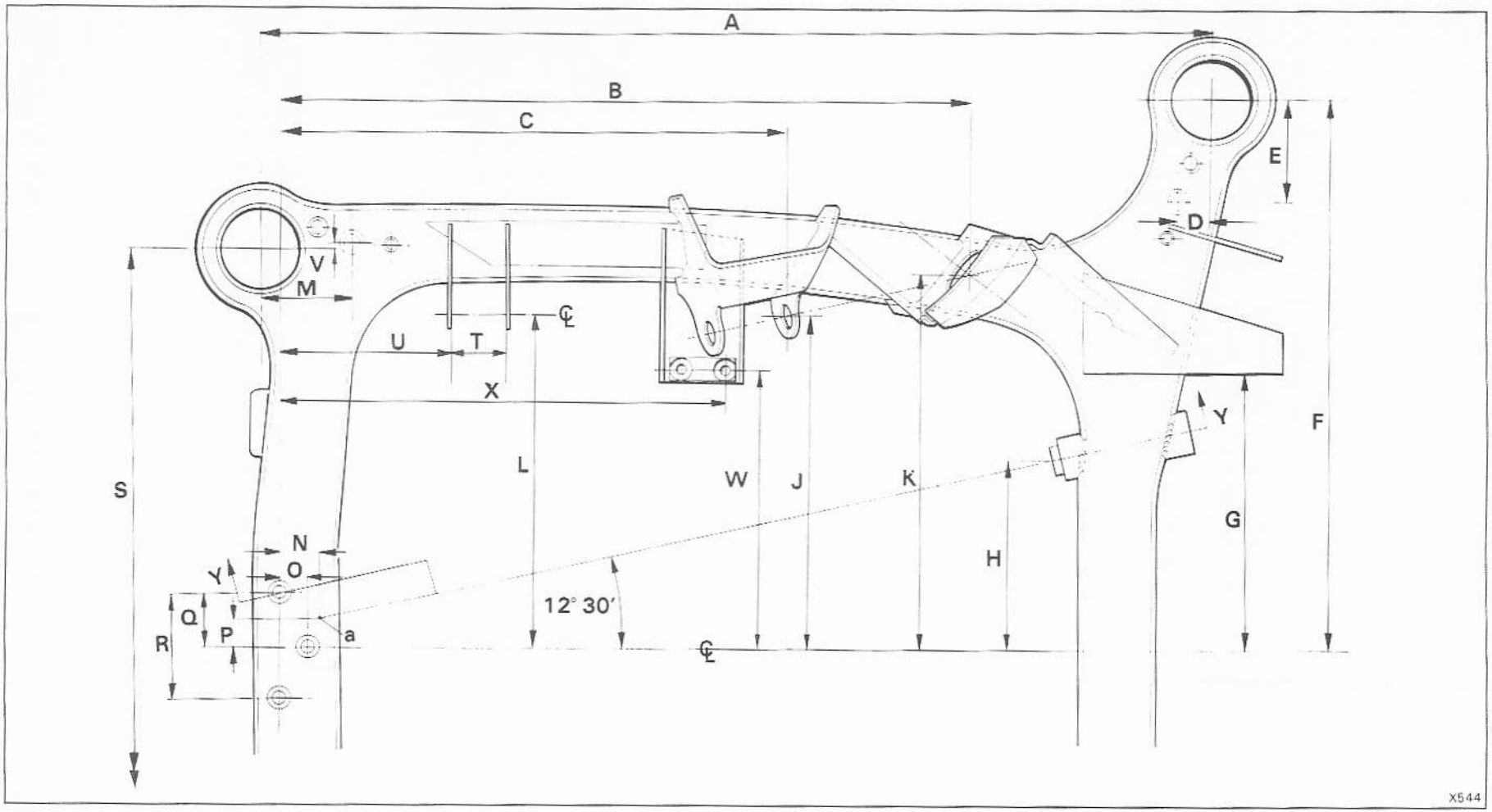

Fig. H12-2 Front sub-frame (plan view)

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)

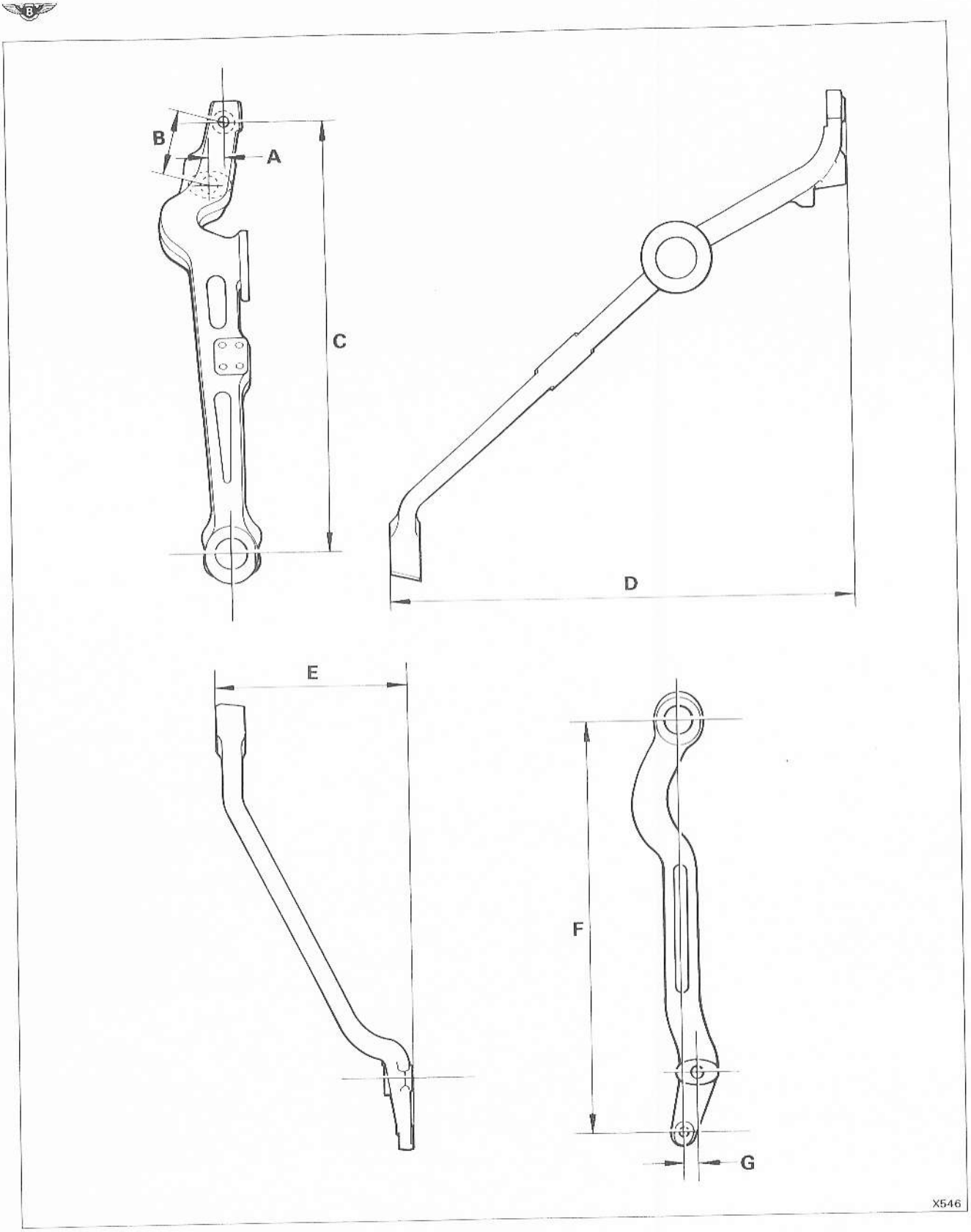

Fig. H12-3 Triangle levers

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)

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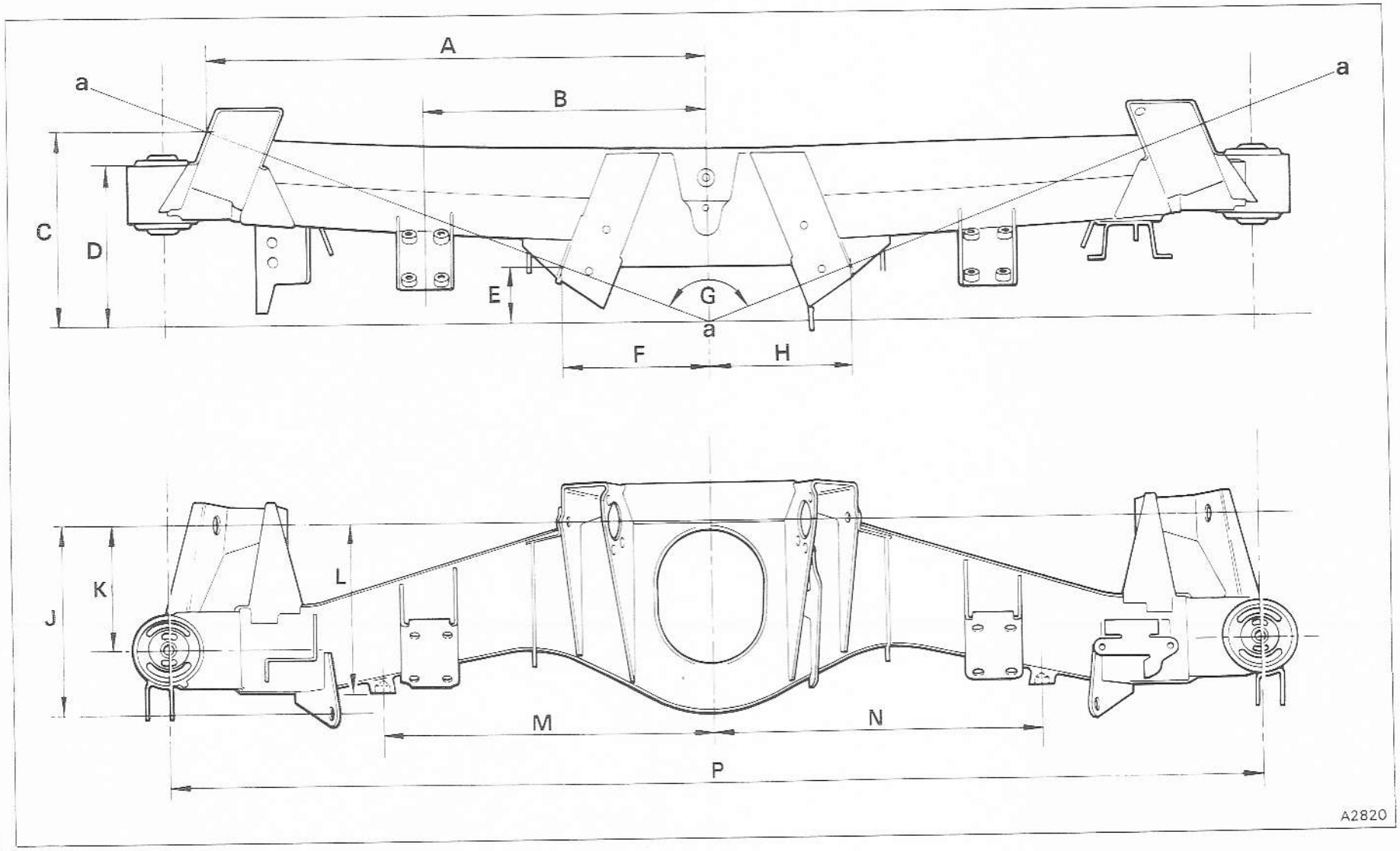


Fig. H12-4 Rear crossmember

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

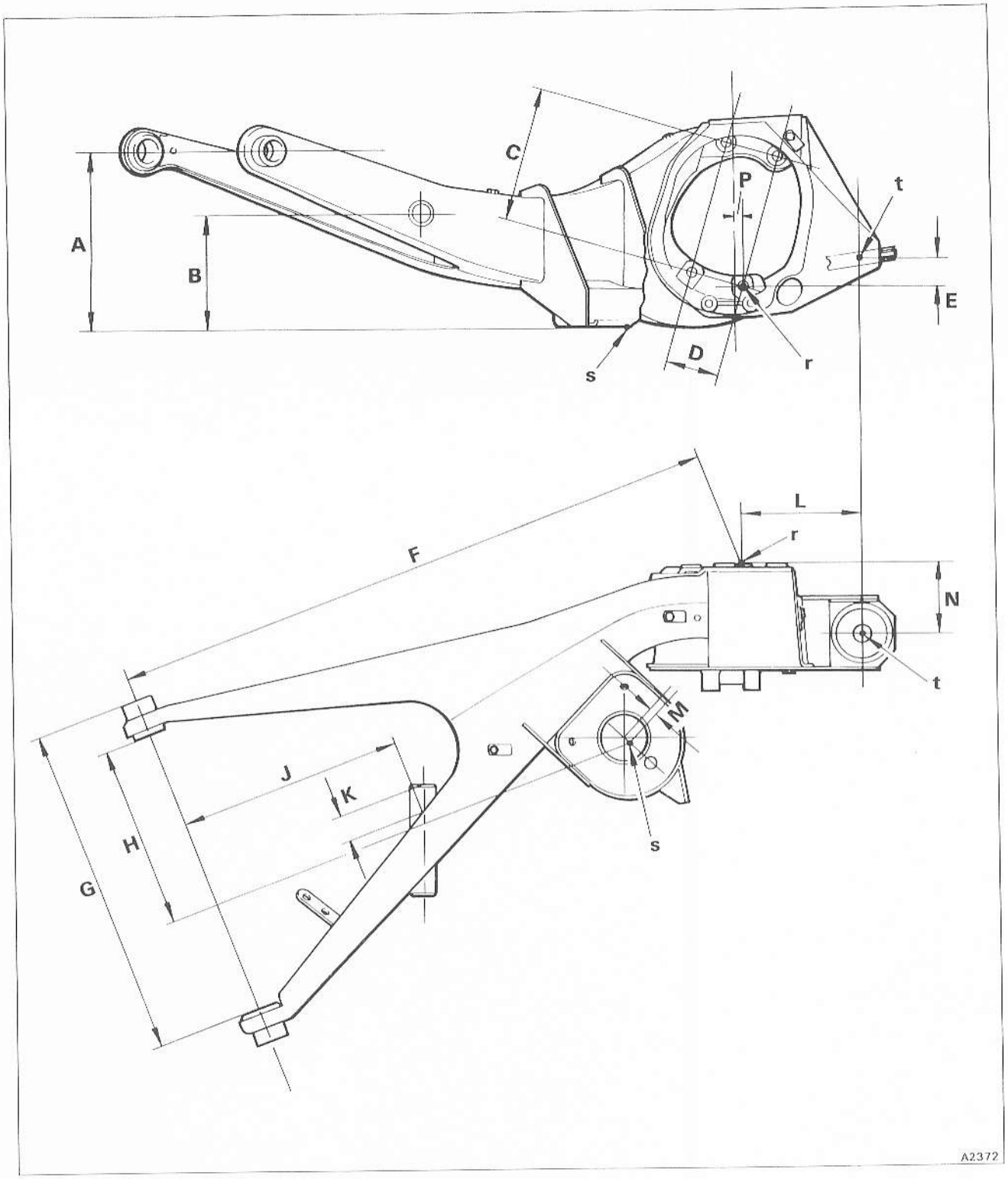


Fig. H12-5 Trailing arms (right-hand shown)

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

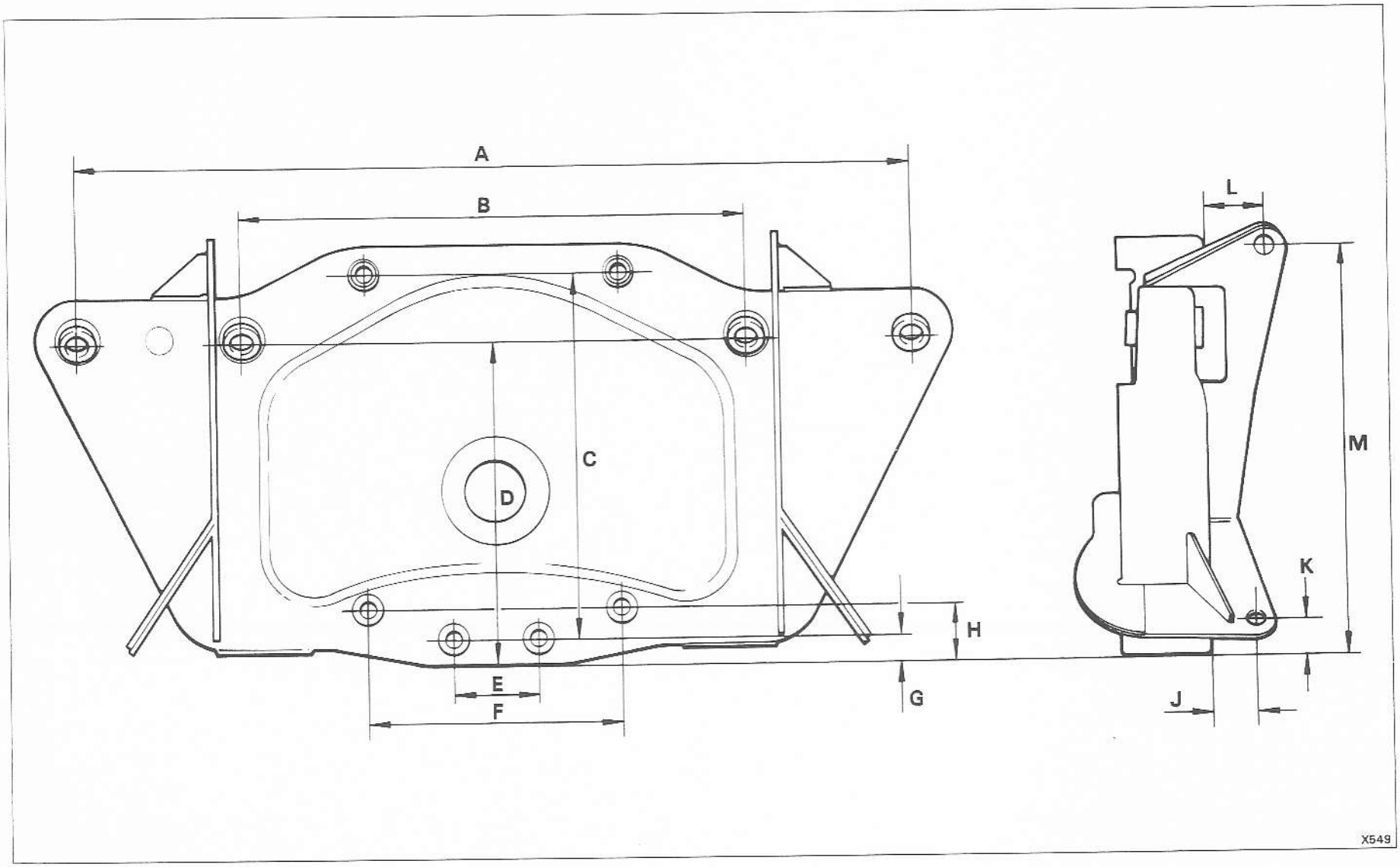


Fig. H12-6 Final drive crossmember

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)

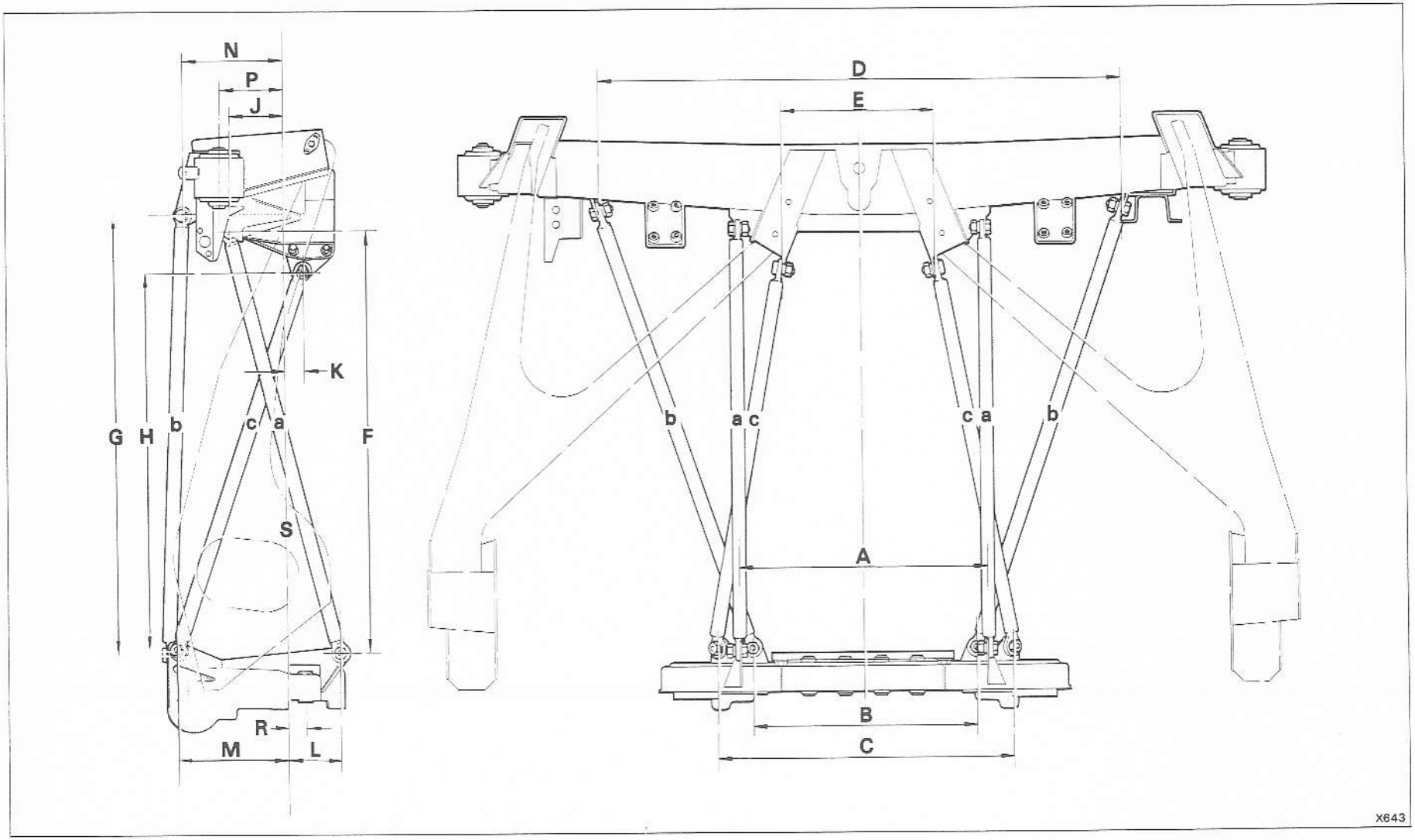


Fig. H12-7 Rear sub-frame assembly

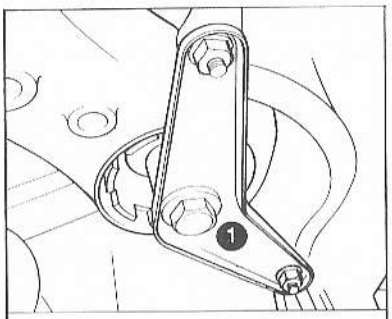
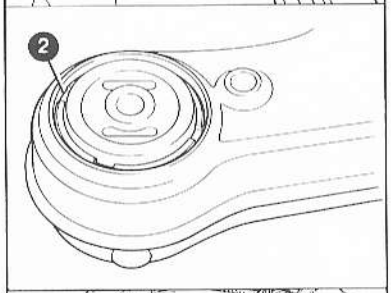
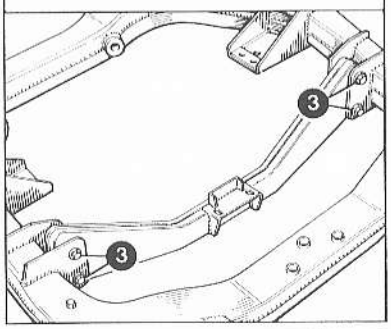
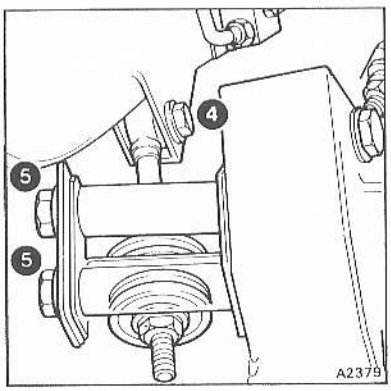
A 381,00 mm (15.00 in)
B 350,52 mm (13.80 in)
C 482,60 mm (19.00 in)
D 819,15 mm (32.250 in)
E 233,68 mm (9.20 in)
F 655,65 mm (25.813 in)
G 690,58 mm (27.188 in)
H 577,04 mm (22.718 in)
J 91,44 mm (3.60 in)
K 22,23 mm (0.875 in)
L 76,20 mm (3.00 in)
M 177,80 mm (7.00 in)
N 165,10 mm (6.50 in)
P 96,82 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

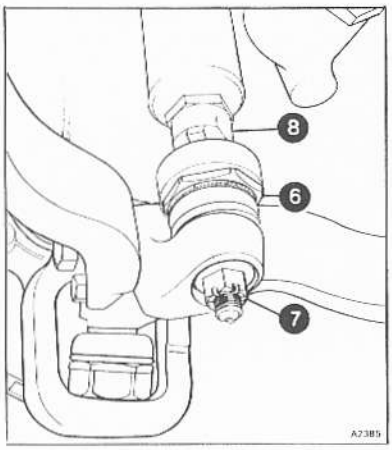
Introduction
This section contains the special torque tightening figures applicable to Chapter H.

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.

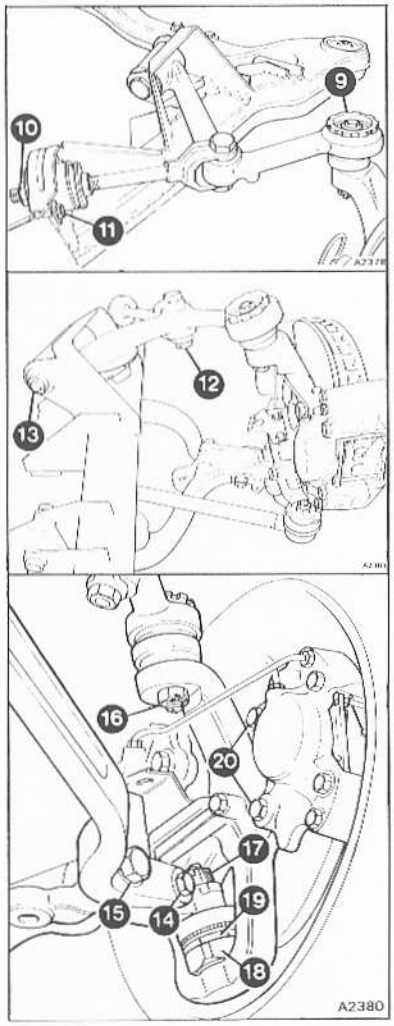
Section H3	Ref.	Component	Nm	kgf m	lbf ft
	1	Sub-frame mounting setscrews	82-88	8,3-9,0	60-65
	2	Resilient mount locking ring	169-203	17,2-20,7	125-150
	3	Front engine mounting crossmember bolts	115-122	11,7-12,4	85-90
	4	Tie bar to longeron bolt	22-24	2,2-2,5	16-18
	5	Tie bar mounting bracket setscrews	40-43	4,0-4,4	29-32

Section H4



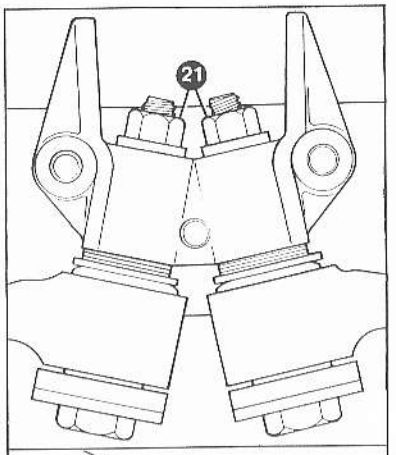
Ref.	Component	Nm	kgf m	lbf ft
6	Damper ball joint to housing	163-176	16,6-18,0	120-130
7	Damper ball pin castellated nut	57-61	5,8-6,2	42-45
8	Ball joint housing to damper stem	95-108	9,7-11,0	70-80

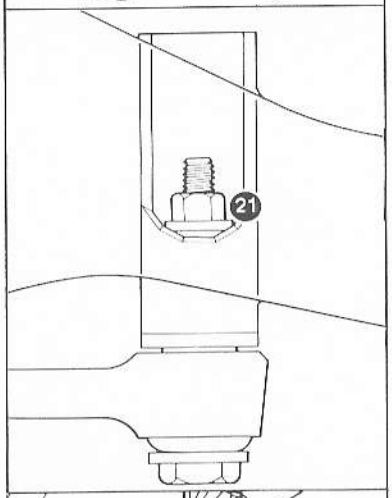
Section H5

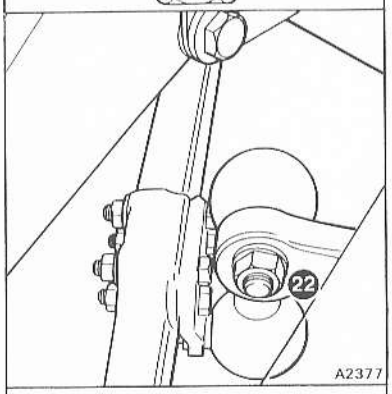


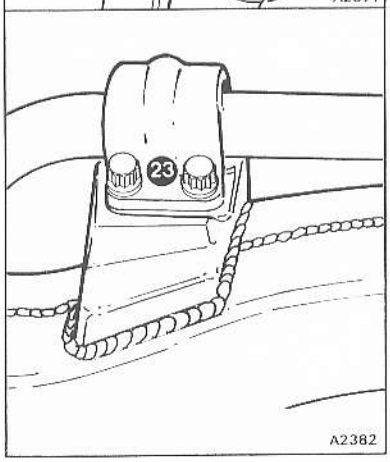
9	Upper ball joint locking ring	203-237	20,7-24,2	150-175
10	Compliance mount nut	99-106	10,1-10,8	73-78
11	Compliance mount setscrews	40-43	4,0-4,4	29-32
12	Compliance rod bolt	99-106	10,1-10,8	73-78
13	Compliance lever eccentric bolt	99-106	10,1-10,8	73-78
14	Lower triangle lever bolt	82-88	8,3-9,0	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

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

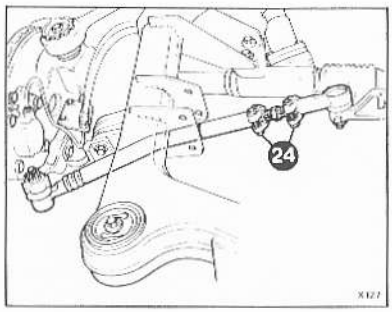






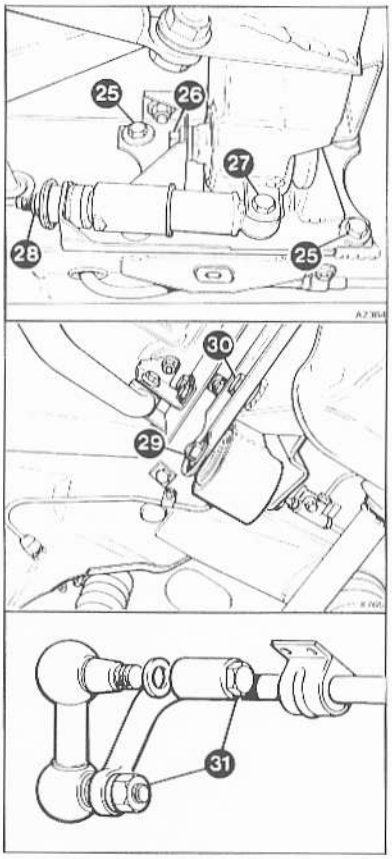


Section H7



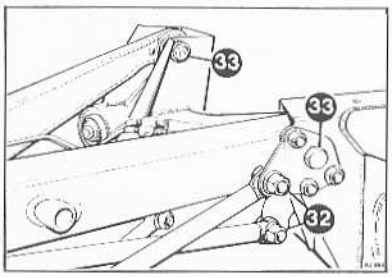
Ref.	Component	Nm	kgf m	lbf ft
24	Steering track rod adjuster clamp bolts	45-54	4,6-5,5	33-40

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.

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Final drive

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Final drive

Introduction

The final drive assembly comprises a central differential gearcase which houses the hypoid crown wheel, pinion, and differential housing gears.

The final drive case is attached to a crossmember, which is mounted to the body by the use of rubber mounts.

Final drive torque reaction is controlled by a torque arm bolted to the final drive case and rear suspension crossmember.

The drive-shafts which are fitted to the final drive gearcase, utilize constant velocity joints (see fig. J2-1).

Warning **Never disconnect the torque arm or the frame tubes connecting the final drive crossmember to the rear suspension crossmember without removing all suspension load from the rear sub-frame assembly.** For details refer to Torque arm – To remove.

A fully adjusted final drive casing assembly is available as a service exchange unit. This is supplied without the drive-shaft assemblies, but is fitted with both side bearing housings.

When fitting a drive-shaft assembly, it is essential that the side bearing housings supplied with the final drive unit are fitted to the drive-shafts. The fitting of any other bearing housing will result in an incorrectly adjusted final drive assembly.

Final drive – To remove

1. Drive the car on a ramp. 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. Insert the spring retainer tool RH9299 into each rear suspension spring (see Chapter H). Compress the springs to remove all spring load from the trailing arms.
4. Depressurize the hydraulic systems as described in Chapter G.

Note Under no circumstances should operations to remove the final drive be carried out while spring or strut loads are applied to the rear sub-frame.

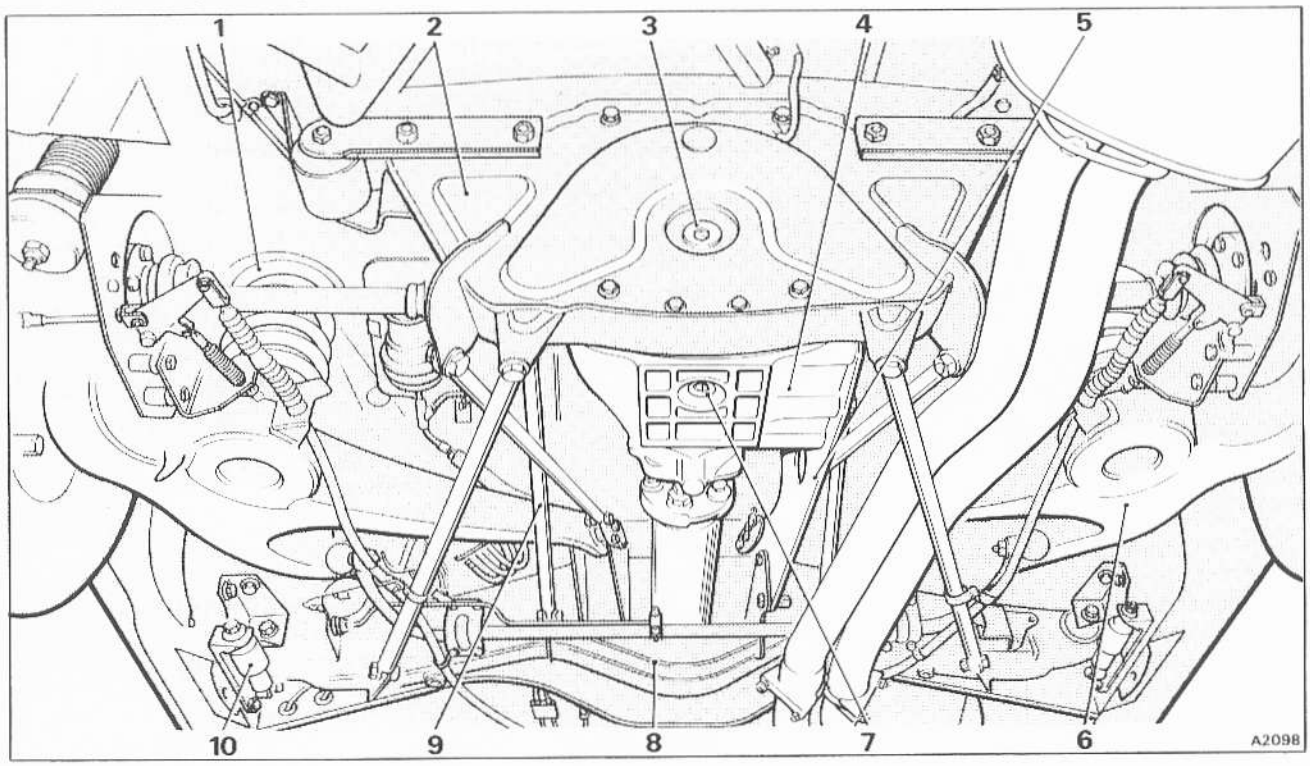

Fig. J2-1 Final drive in position

1 Suspension spring
2 Final drive crossmember
3 Oil filler and level plug
4 Final drive unit
5 Torque arm
6 Trailing arm
7 Oil drain plug
8 Rear suspension crossmember
9 Frame tubes (6)
10 Crossmember damper

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.

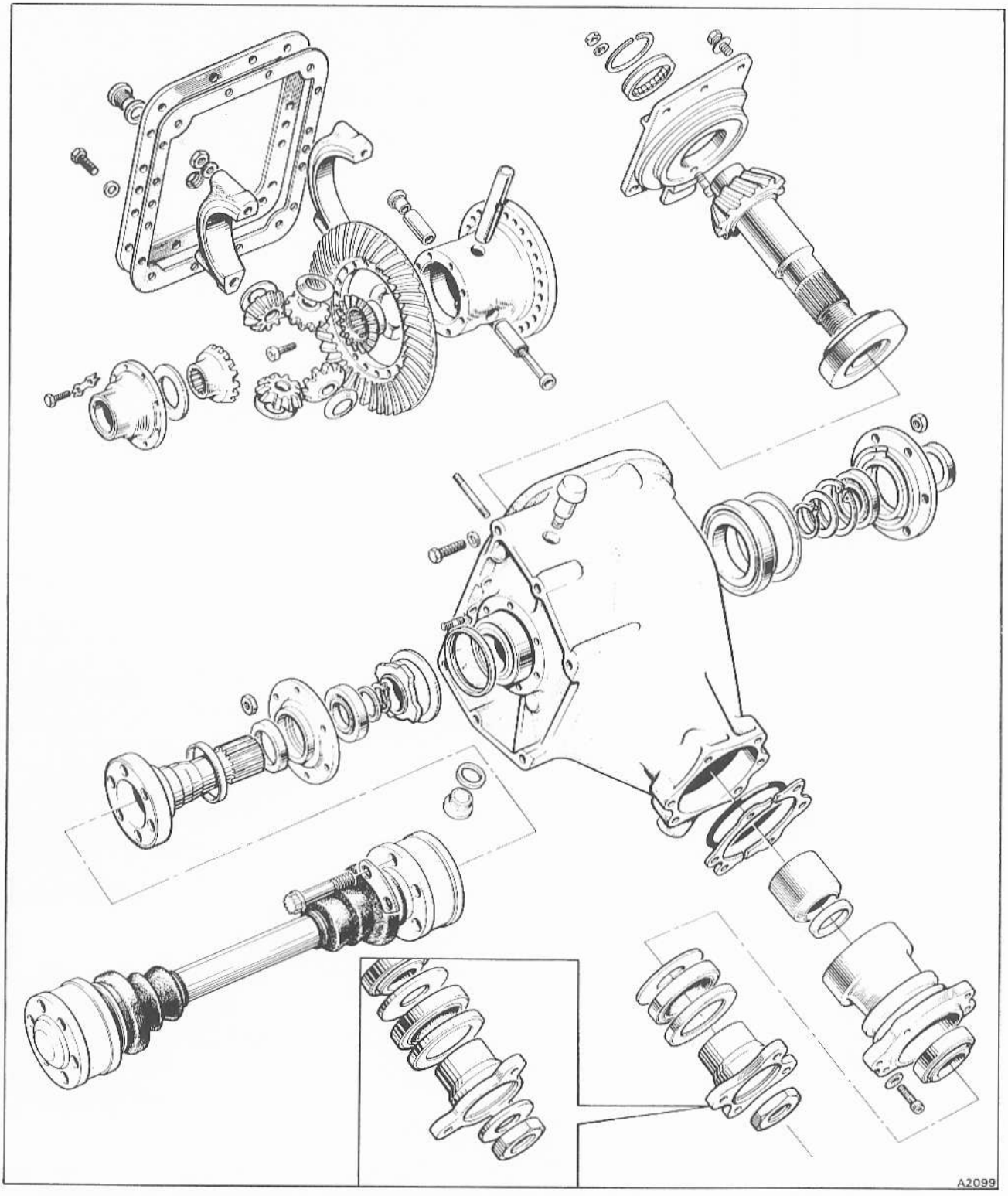

Fig. J2-2 Final drive assembly

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.

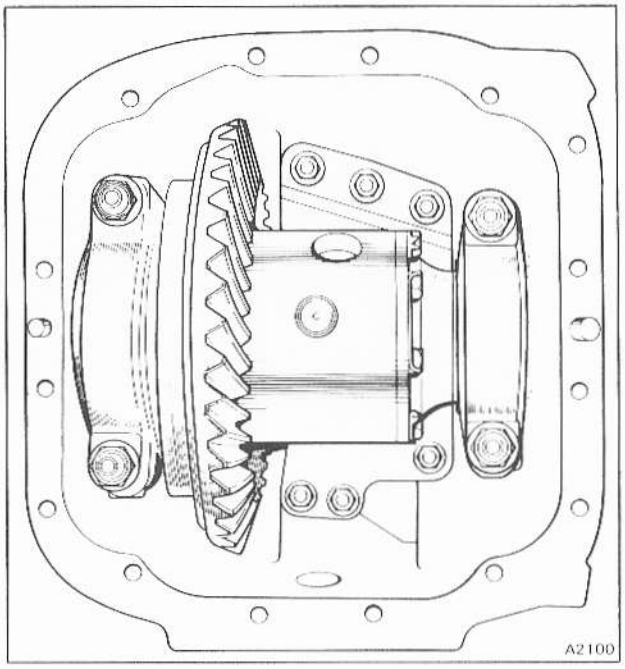

Fig. J2-3 Differential and crown wheel in position

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.

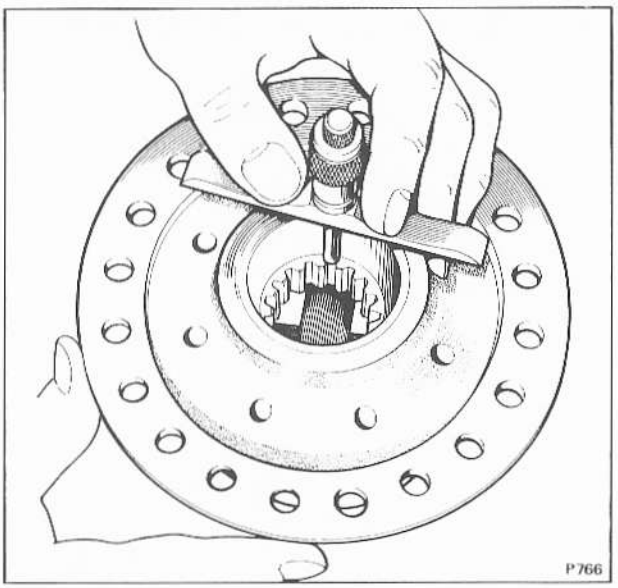

Fig. J2-4 Splined bevel pinion measurement

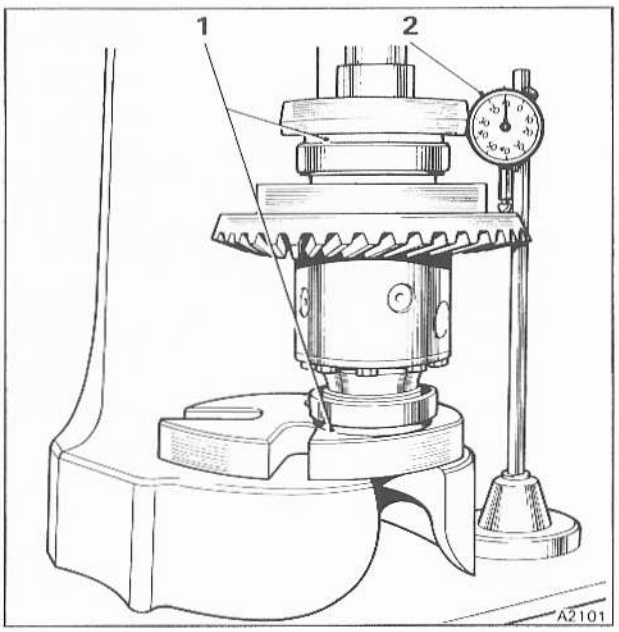

Fig. J2-5 Checking the crown wheel run-out
1 Adjusting washers
2 Dial test indicator

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.

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.

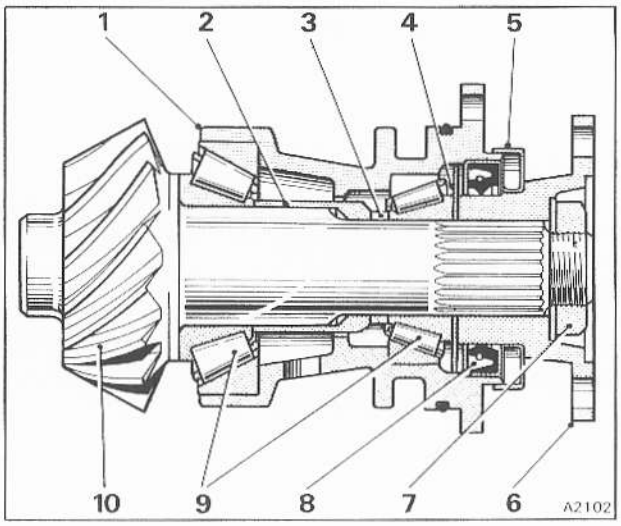

Fig. J2-6 Pinion assembly

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.

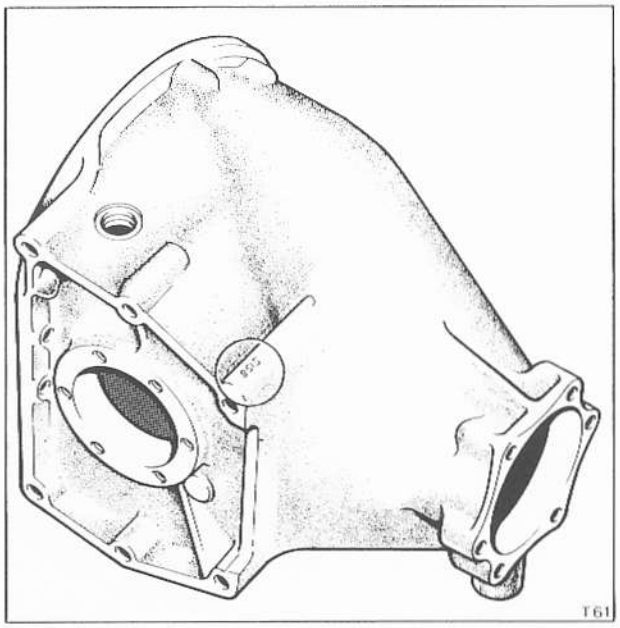

Fig. J2-7 Stamped dimension on case

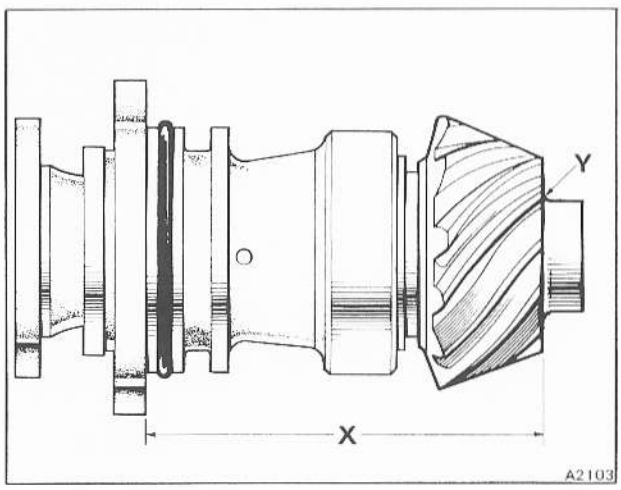

Fig. J2-8 Pinion housing measurement

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

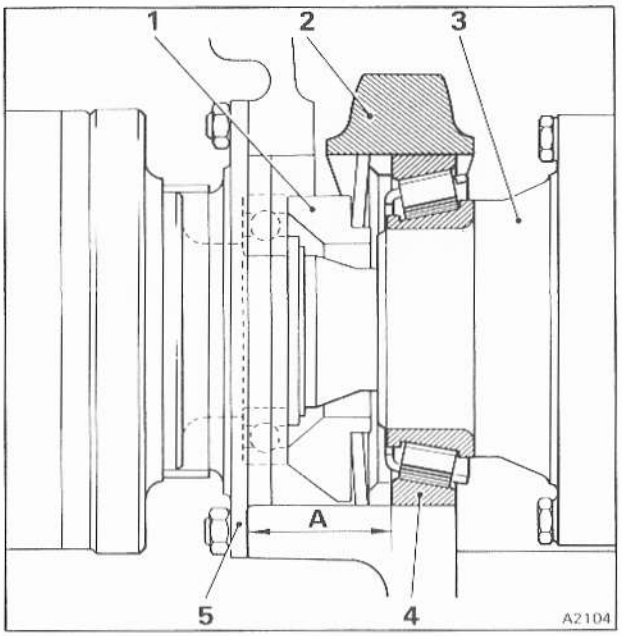

Fig. J2-9 Casing flange to bearing measurement
1 Belleville washer and spacer assembly
2 Bearing cap
3 Differential housing end cap
4 Bearing
5 Side bearing housing

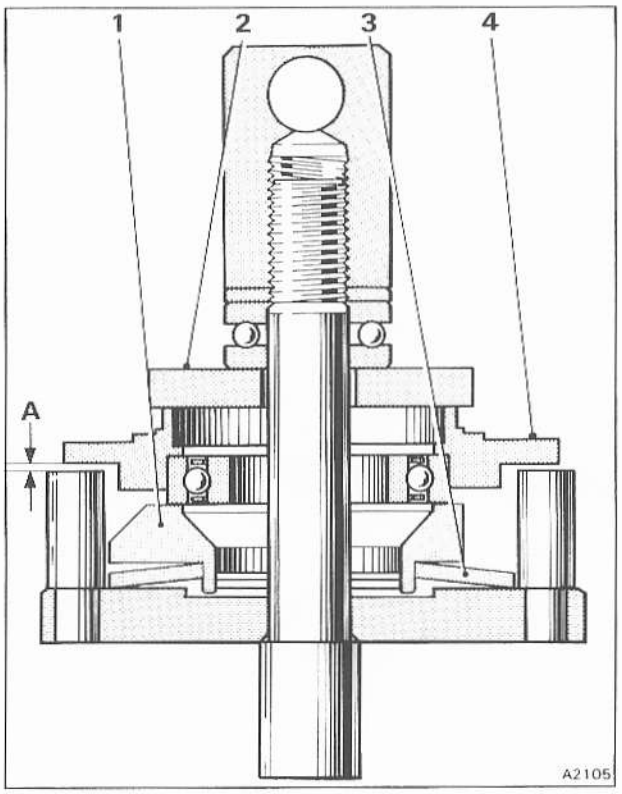

Fig. J2-10 Right-hand housing belleville washer setting
1 Spacer
2 Tool (RH 9578)
3 Belleville washer
4 Right-hand side housing
A Measured gap

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

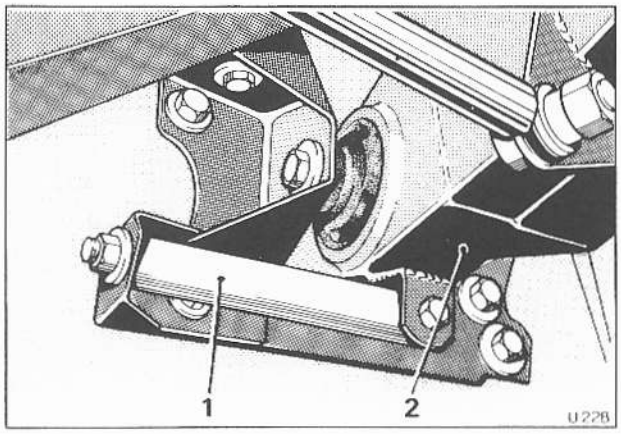

Fig. J2-11 Jury bolt in position
1 Jury bolt
2 Rear suspension crossmember

'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.

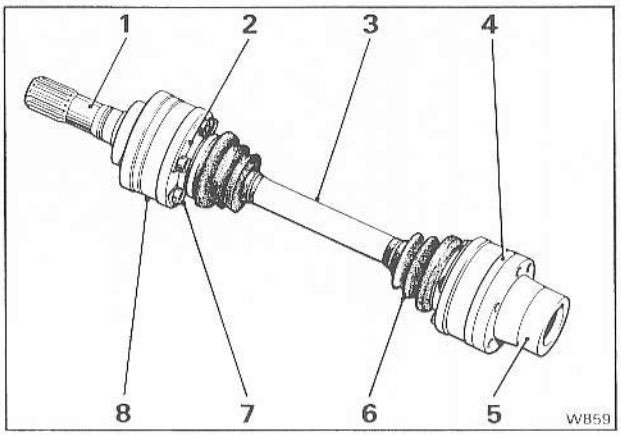

Fig. J3-1 Constant velocity joint

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.

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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,

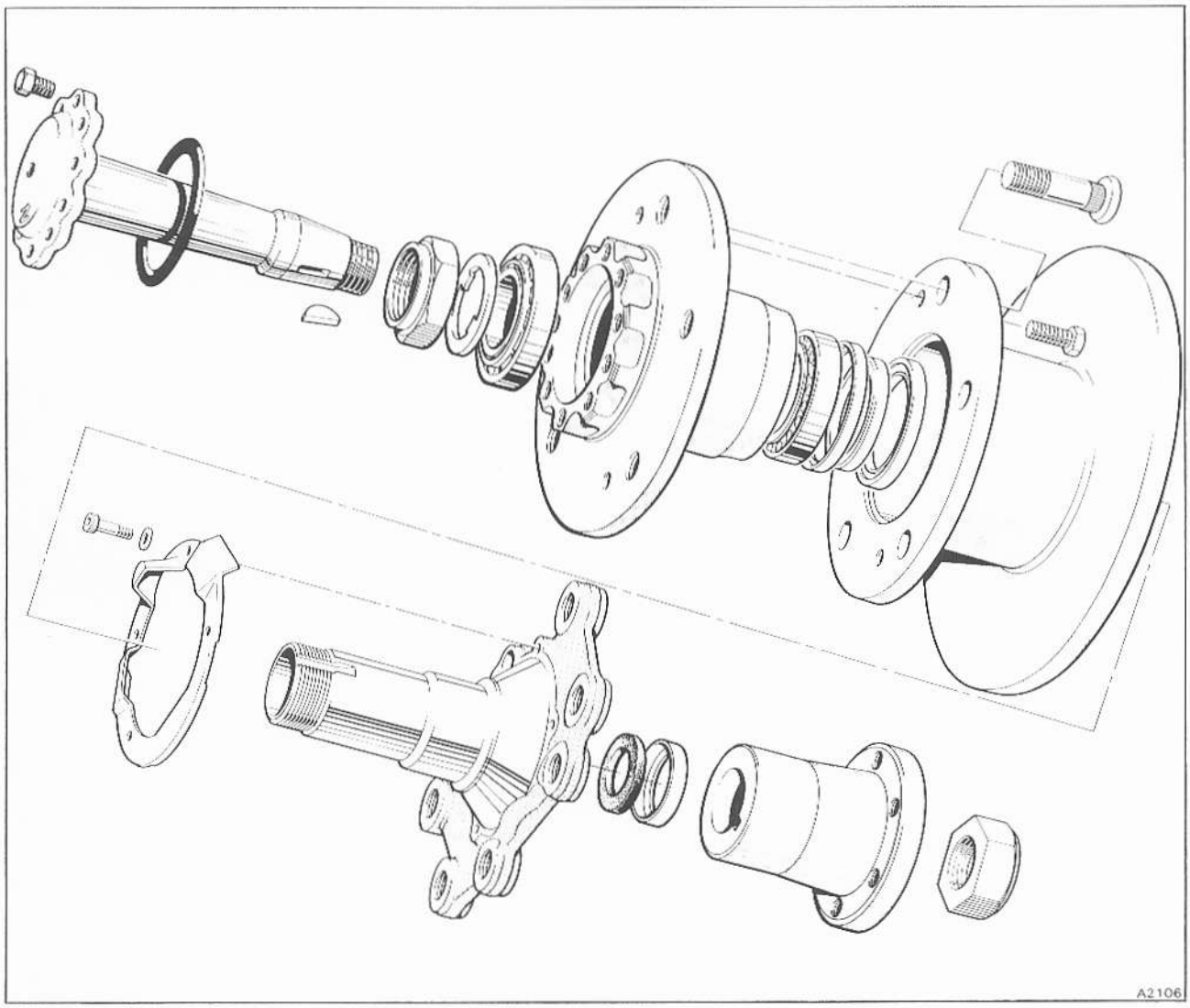


Fig. J5-1 Rear hub (cars other than Bentley Turbo R)

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

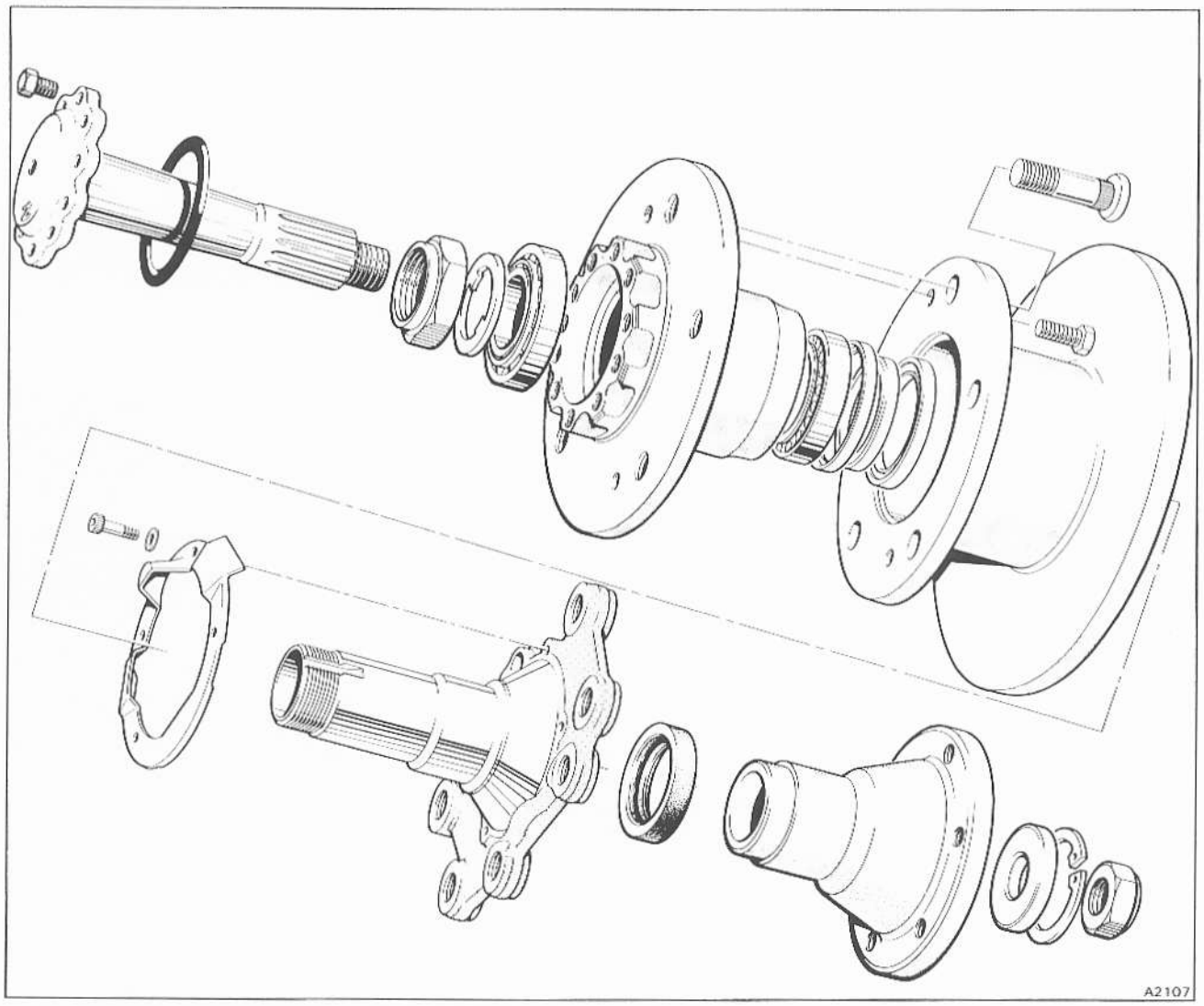


Fig. J5-2 Rear hub (Bentley Turbo R)

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, 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.

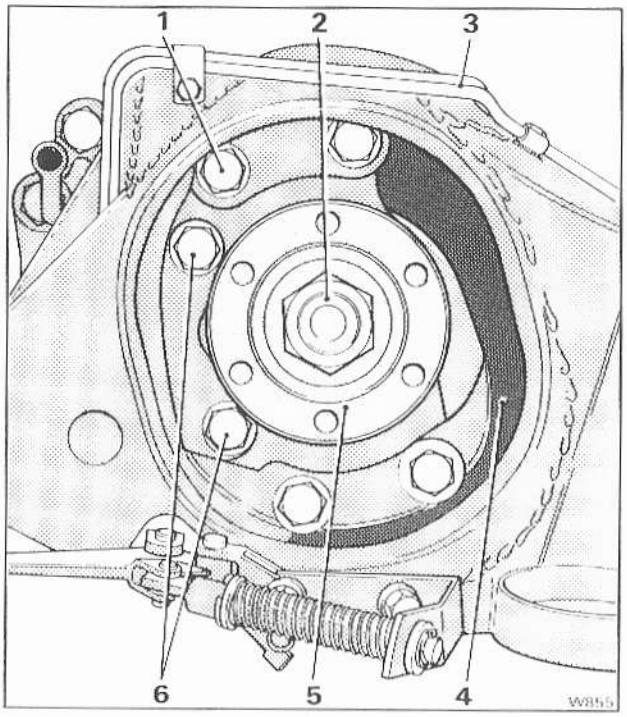


Fig. J5-3 Rear hub and brake caliper mounting
1 Hub mounting setscrew (4)
2 Hub drive-shaft retaining nut
3 Hydraulic brake pipes
4 Trailing arm
5 Hub coupling
6 Brake caliper mounting bolts

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

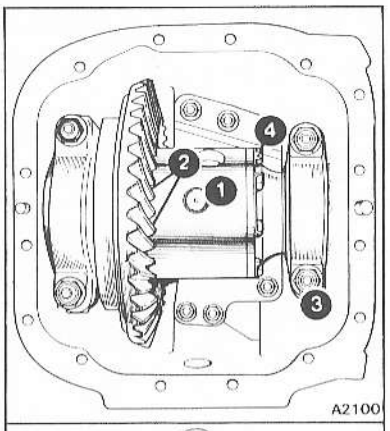
Special torque tightening figures

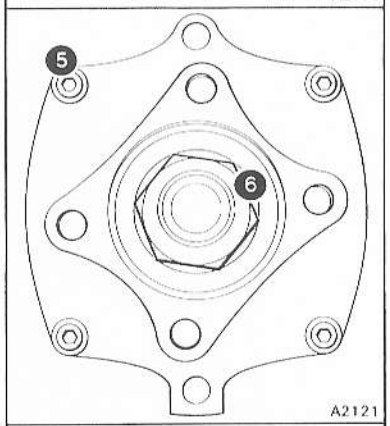
Introduction
This section contains the special torque tightening figures applicable to Chapter J.

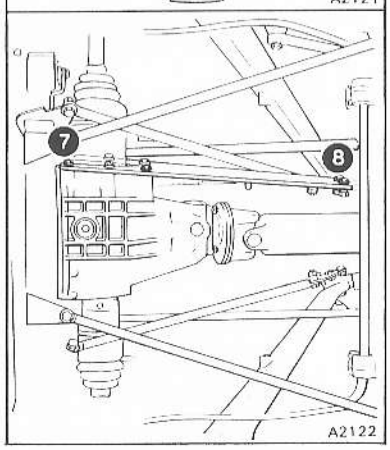
For standard torque tightening figures refer to Chapter P.

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

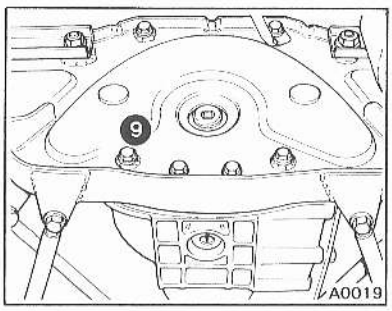






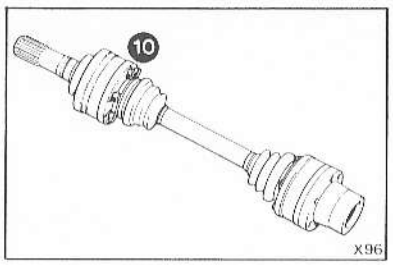
Ref.	Component	Nm	kgf m	lbf ft
1	Differential trunnion – bolt and lock-nut	16-19	1,63-1,94	12-14
2	Crownwheel to differential housing – capscrews	57-61	5,82-6,22	42-45
3	Nut-bearing cap final drive	81-88	8,3-8,9	60-65
4	Setscrew-end cover differential housing	11-13	1,10-1,38	8-10
5	Pinion housing to 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

Section J2



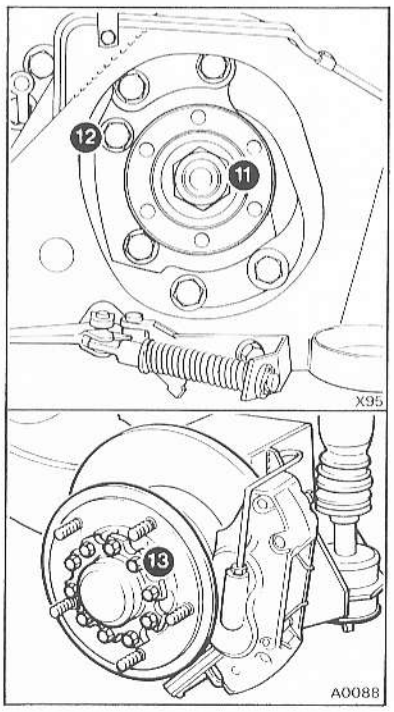
Ref.	Component	Nm	kgf m	lbf ft
9	Setscrew – final drive to crossmember	39-43	3,98-4,38	29-32

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

7/87
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
SCBZD00A2KCH29290
inclusive

Volume 2

TSD 4700

October 1989

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Engine cooling system

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Issue record sheet

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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.

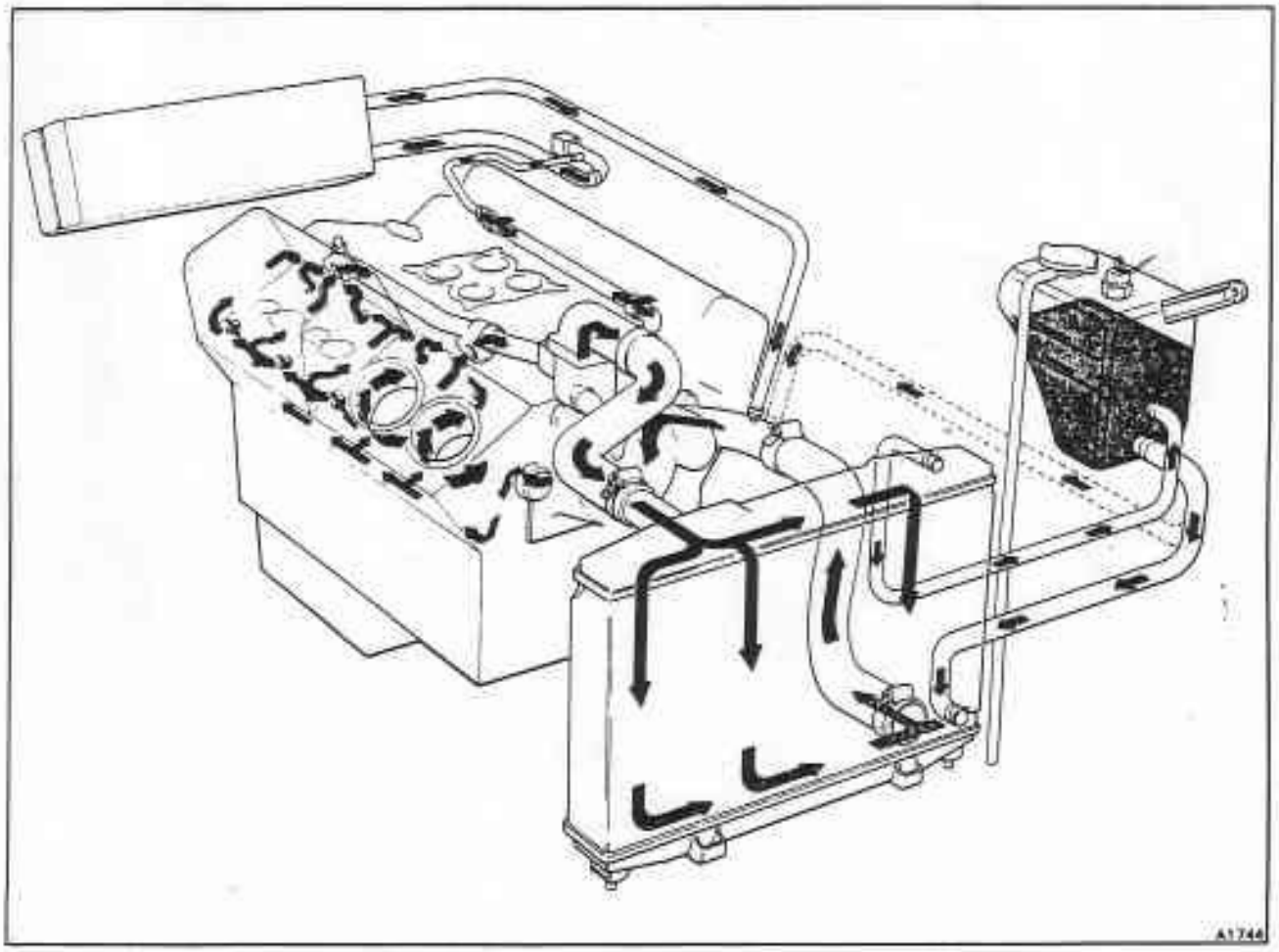


Fig. L2-1 Diagrammatic view of the cooling system Dotted line – 1989 model year cars

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.

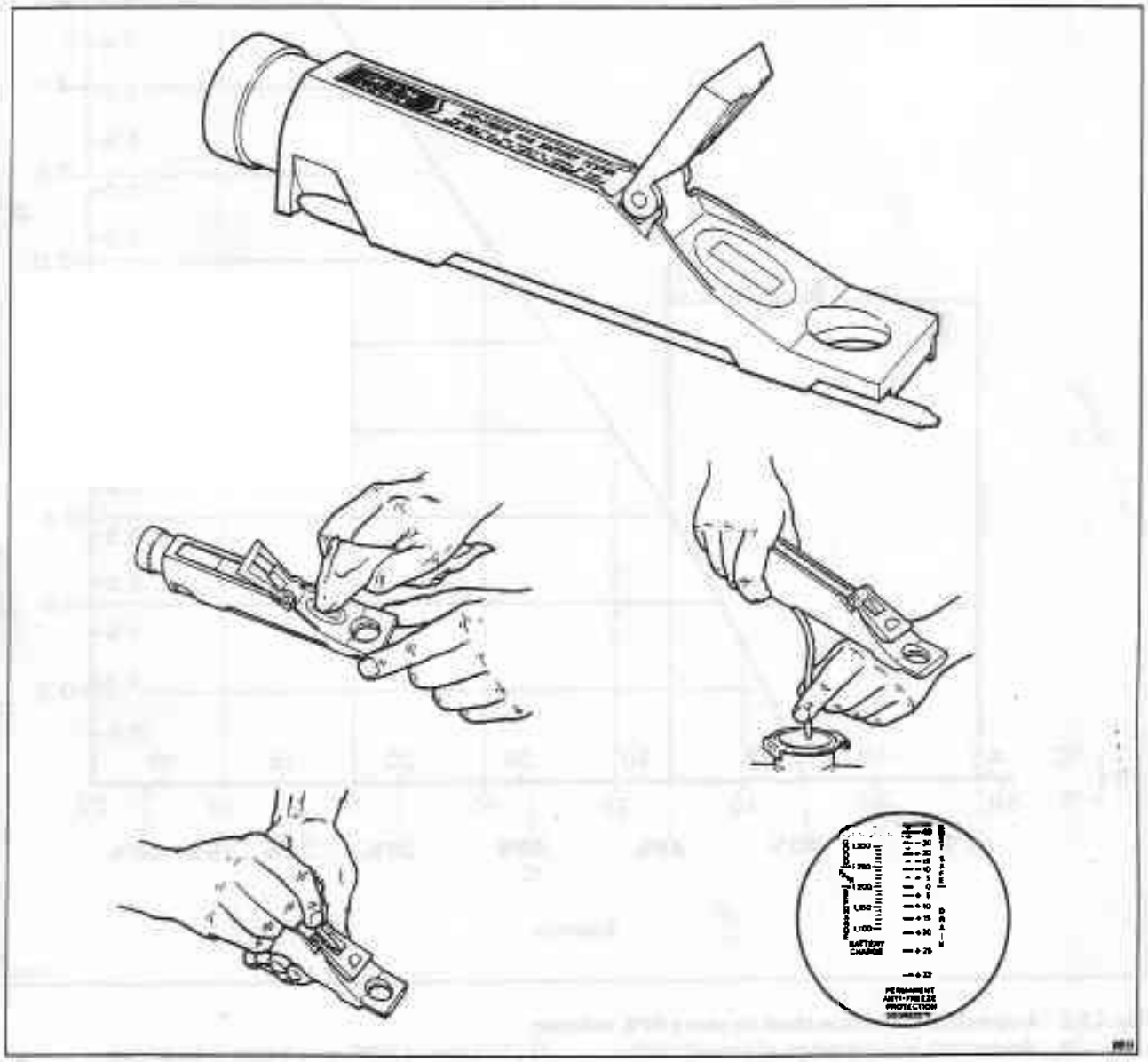


Fig. L3-1 Checking the anti-freeze concentration

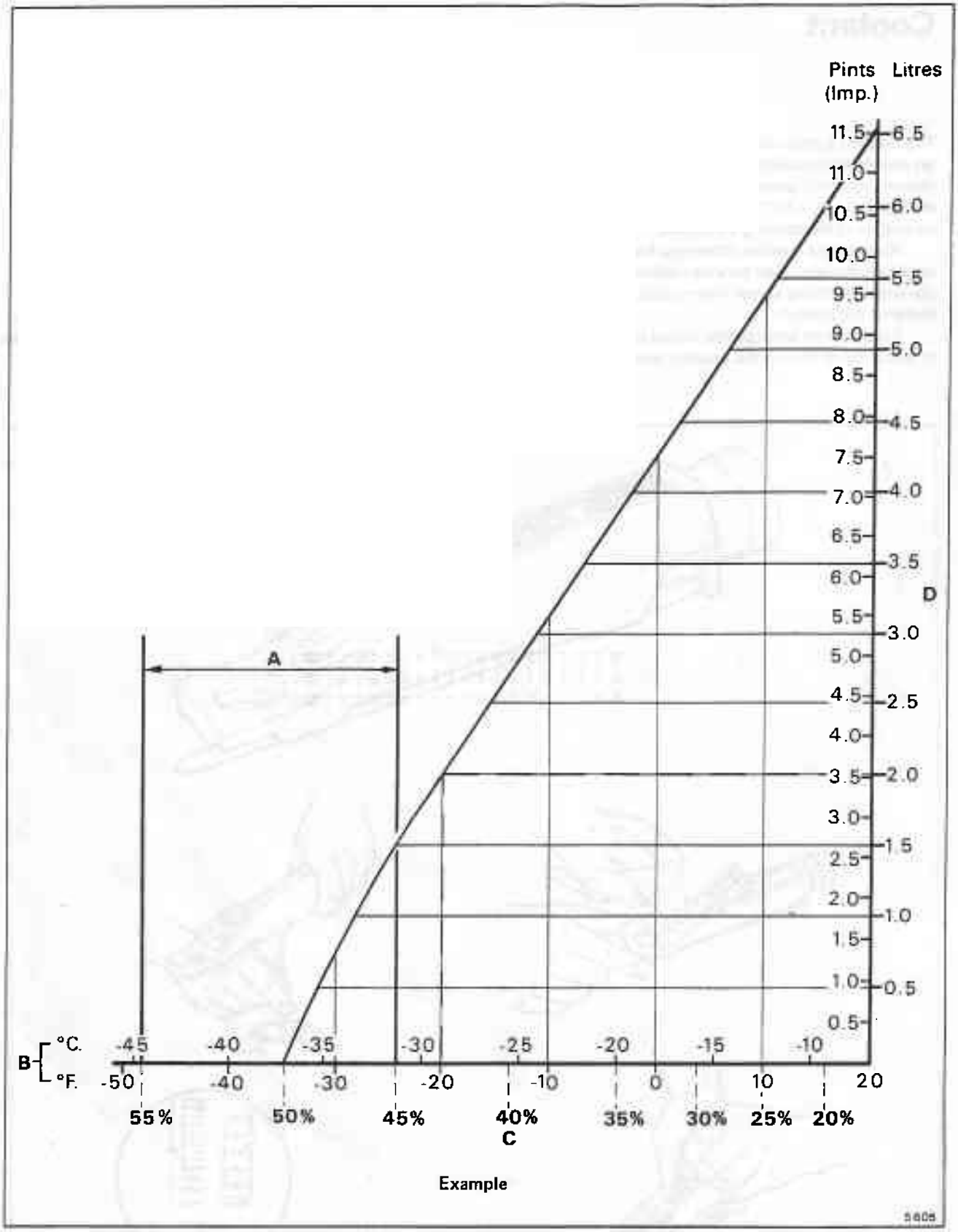


Fig. L3-2 Anti-freeze correction chart to give a 50% solution

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.

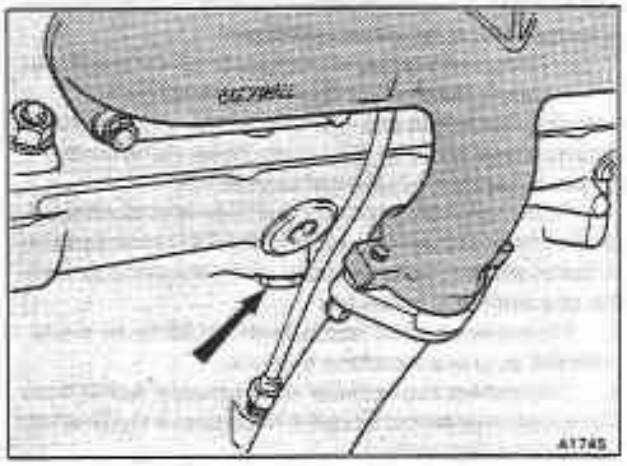


Fig. L3-3 Crankcase coolant drain plug

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.

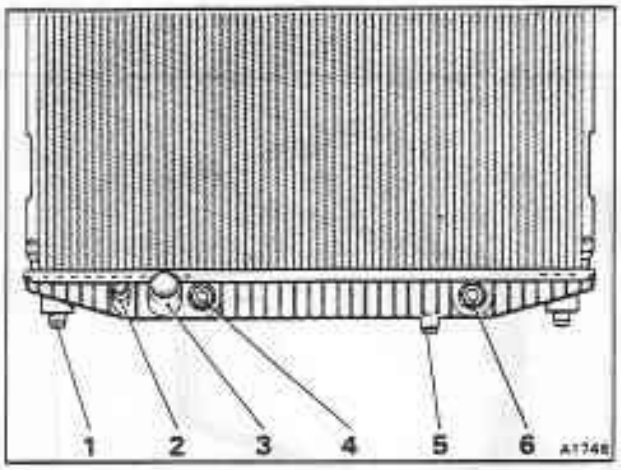


Fig. L4-1 Bottom of radiator assembly

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.

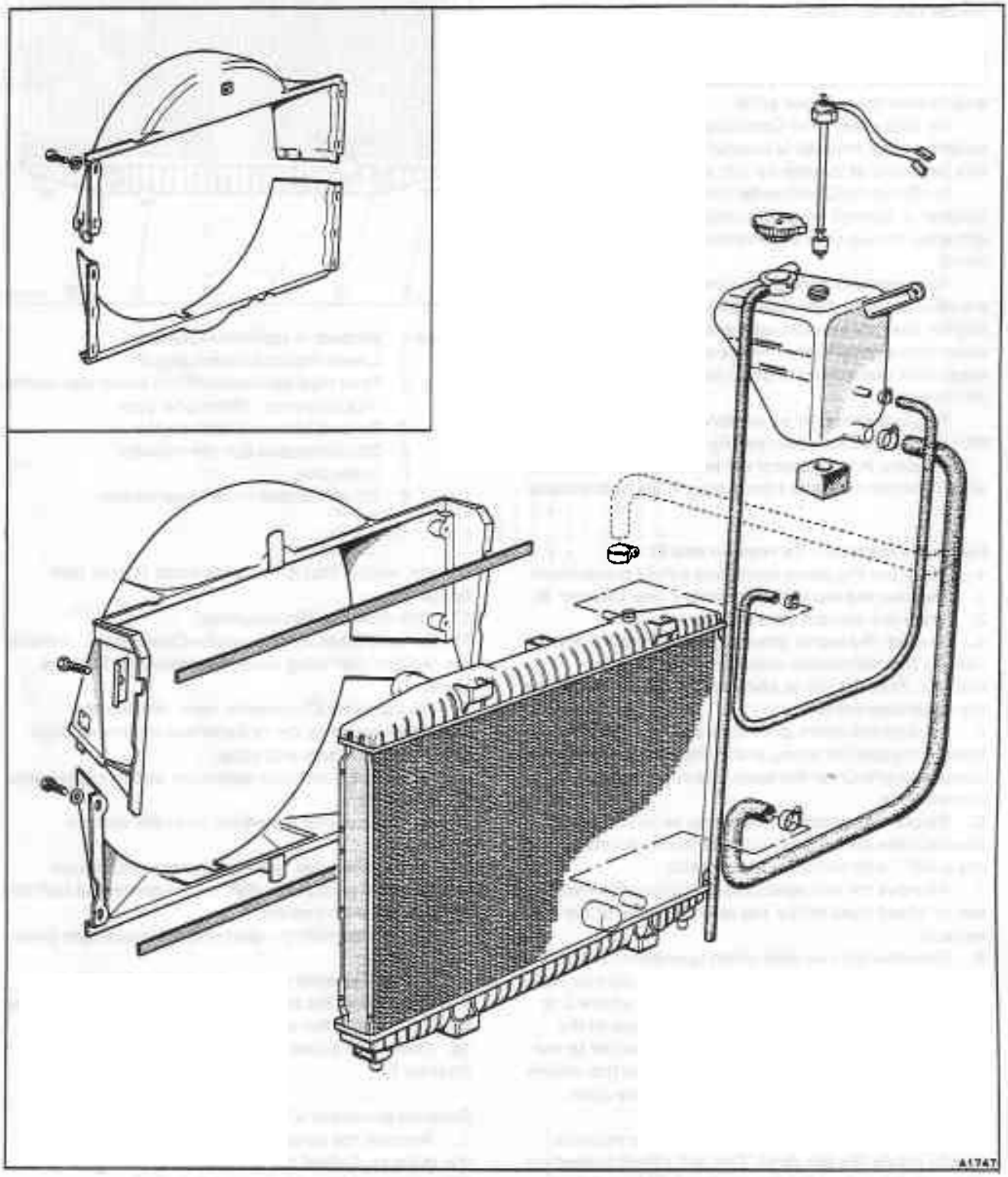


Fig. L4-2 Radiator and expansion bottle Inset – Fan cowl (Two door cars) Dotted line – 1989 model year cars

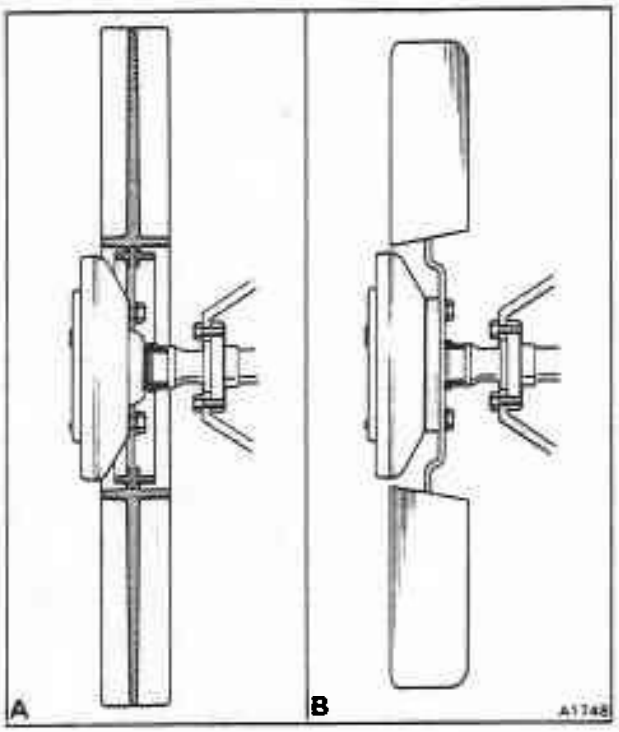


Fig. L4-3 Fan assembly retention
A Four door cars
B Two door cars

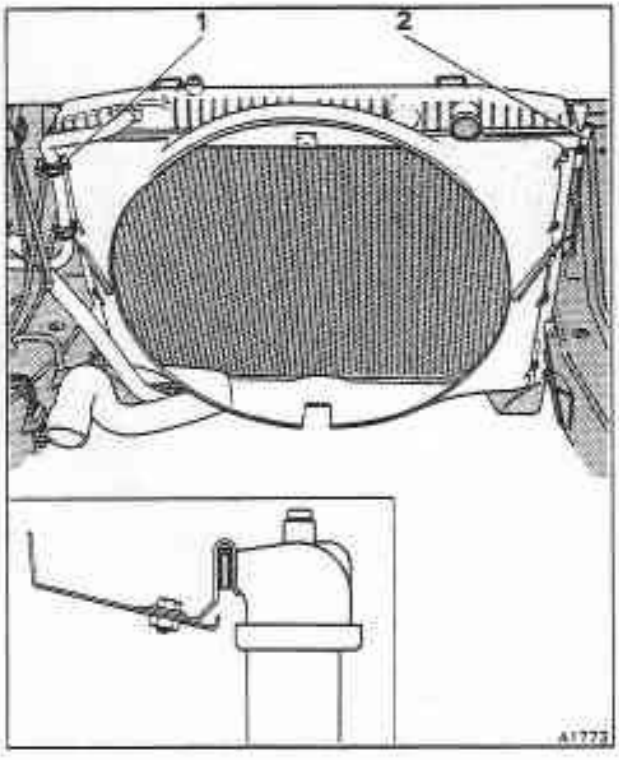


Fig. L4-4 Mounting points for radiator and fan cowl
1 Fan cowl retaining setscrews
2 Radiator top mount
Inset – Radiator top mounts (Two door cars)

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).

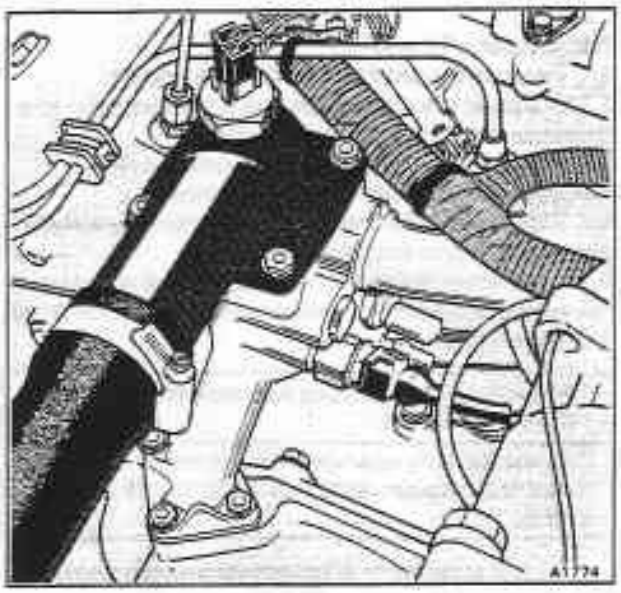


Fig. L5-1 Thermostat housing assembly

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.

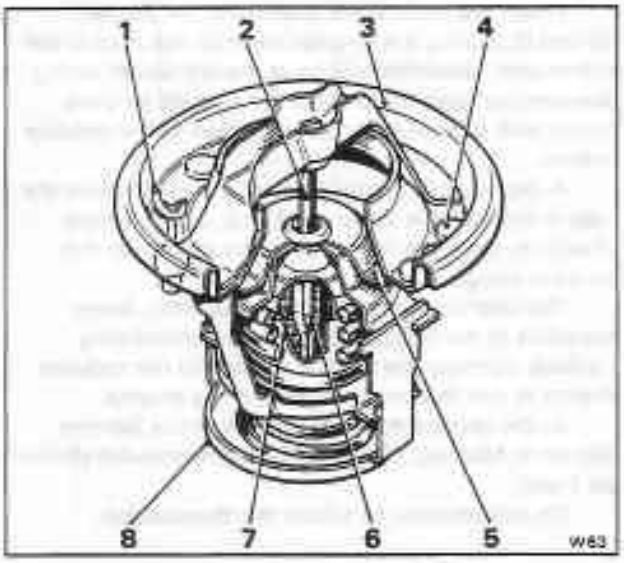


Fig. L5-2 Thermostat

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.

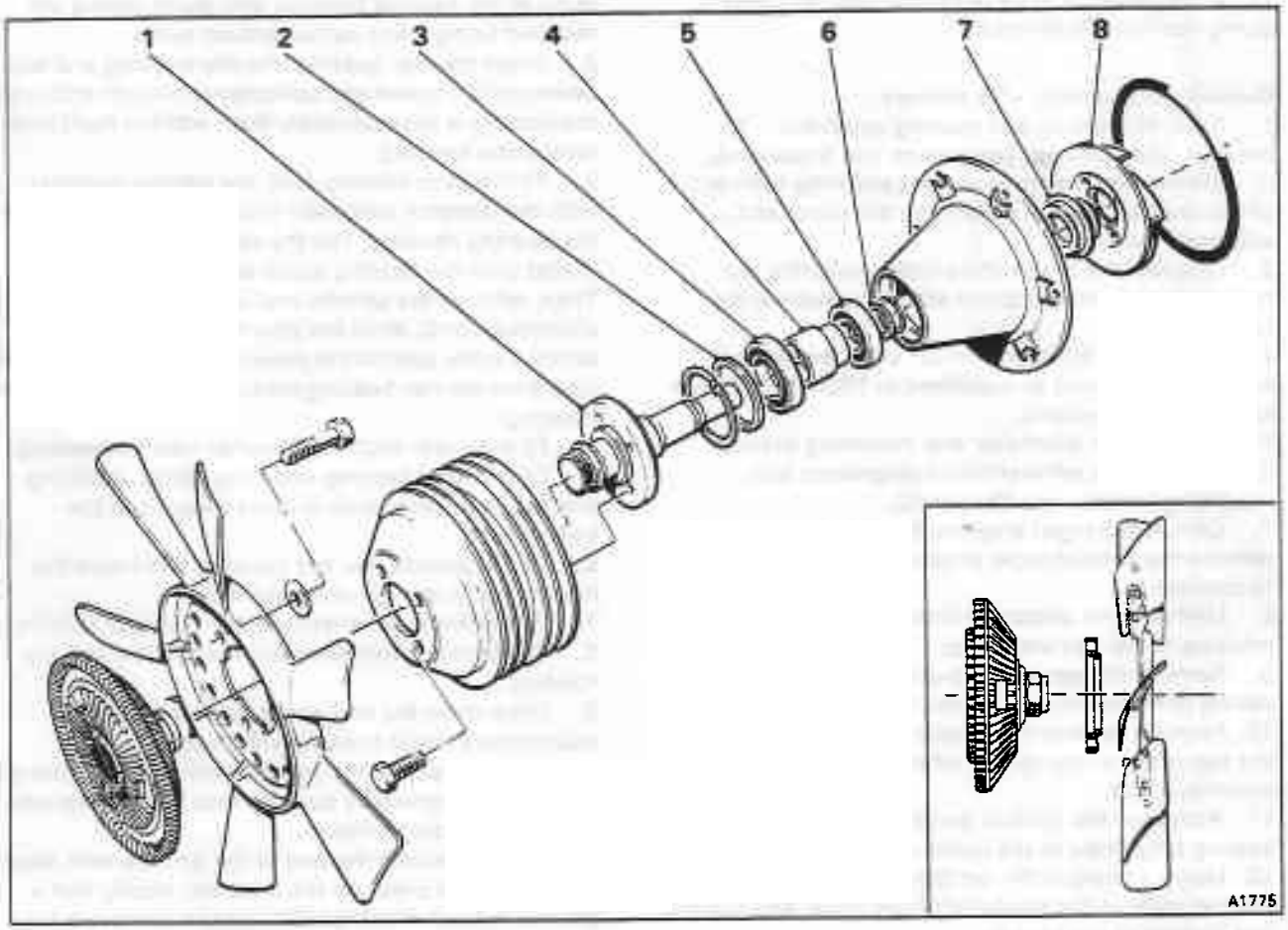


Fig. L6-1 Coolant pump

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.

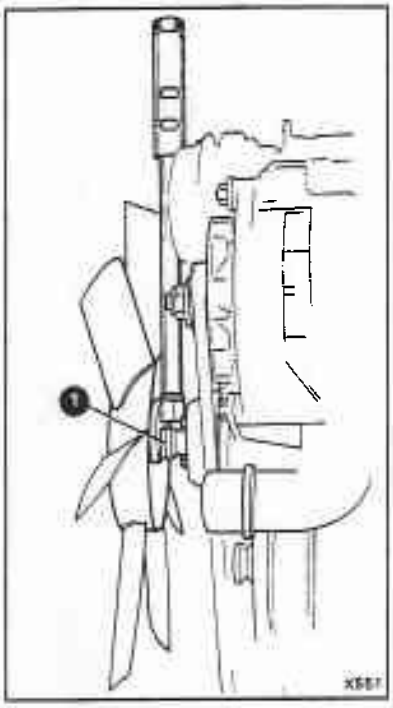
1. If the casing has been removed from the crankcase, ensure that the joint faces are free from burrs. Any burrs should be removed using a fine carborundum stone.
2. Obtain a new gasket and modify it to suit the crankcase to coolant pump joint faces.
3. Tighten all bolts to the standard torque figures 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

Anti-freeze and summer coolant

Applicable to

All Rolls-Royce and Bentley motor cars prior to vehicle identification number (VIN) SCBZSOTO3HCX20001

Introduction

This Product Support Information Sheet has been issued to outline the correct procedure when refilling/replenishing the cooling system with ICI 007/400F anti-freeze and summer coolant. The original issue of Product Support Information Sheet L1 should be destroyed.

Description

ICI 007/400F anti-freeze and summer coolant has been introduced on all cars from and including vehicle identification number (VIN) SCBZS0T03HCX20001 and will be supplied for all replacement purposes.

Prestone UT 184 coolant which was previously used has been replaced by ICI 007/400F coolant.

Prestone UT 184 can be identified by its green colour whilst the new ICI coolant is coloured blue.

Although it is generally accepted that coolants should not be mixed, the new ICI coolant can be mixed with Preston UT 184, if the need arises.

Warning:
Mixing with any other types of coolant is not recommended. If there is any doubt as to what type of coolant is present, it will be necessary to flush the system completely (see Chapter L of the relevant Workshop Manual) before refilling with ICI 007/400F.

Whenever a system is refilled with ICI 007/400F, a coolant warning label (part number UE 70988) must be fitted to the radiator or expansion tank in a prominent position.

Parts affected

Displaced part number	Description	Quantity	New part number
UB 33058L5	ICI 007/400F anti-freeze	5 litres	UE 70936L5
UB 33058L205	ICI 007/400F anti-freeze	205 litres	UE 70936L210
	Coolant warning label	1	UE 70988

Hil/MT

Steering system

Contents

Sections

Issue record sheet

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

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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.

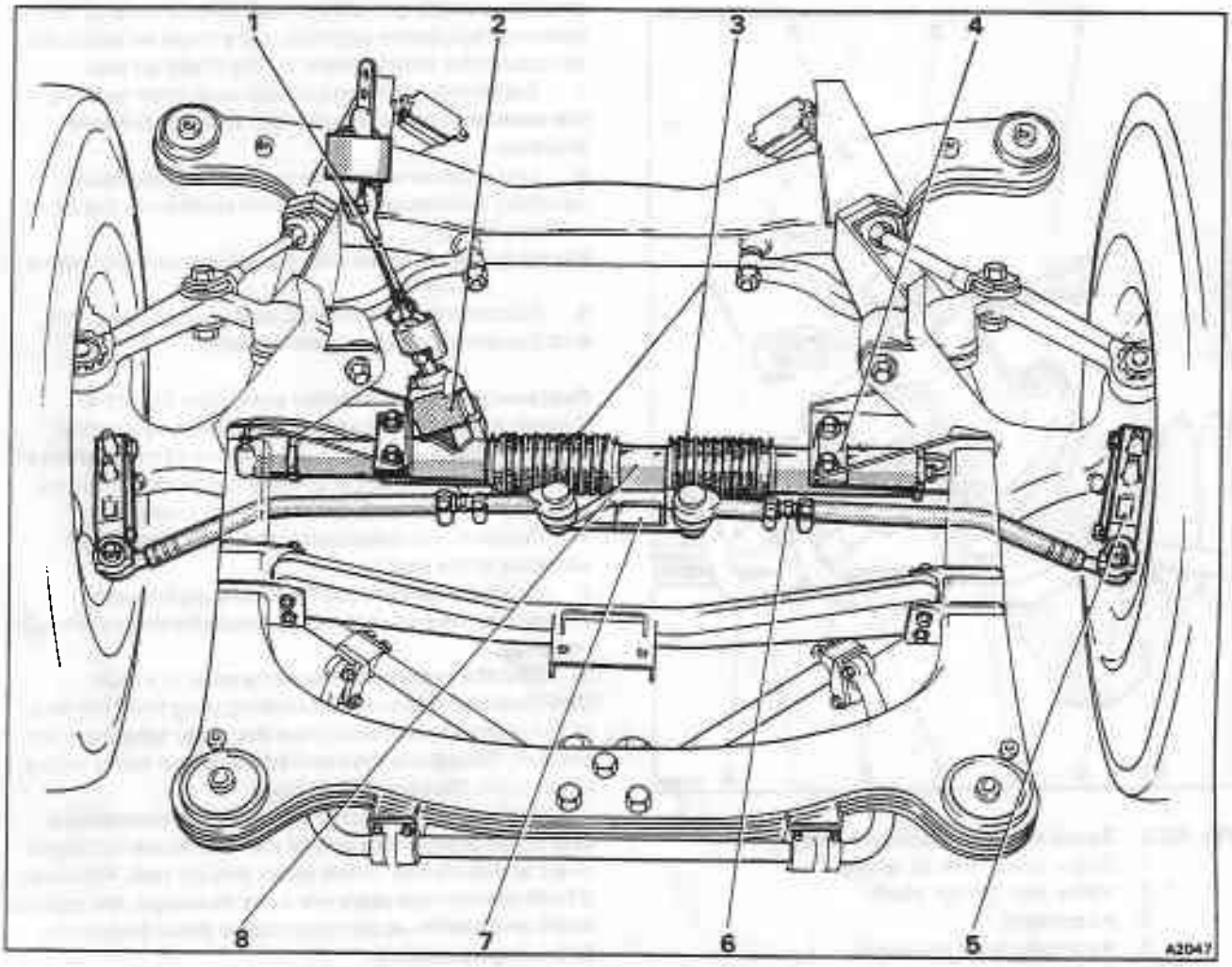


Fig. N2-1 Steering unit mounted in sub-frame

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.

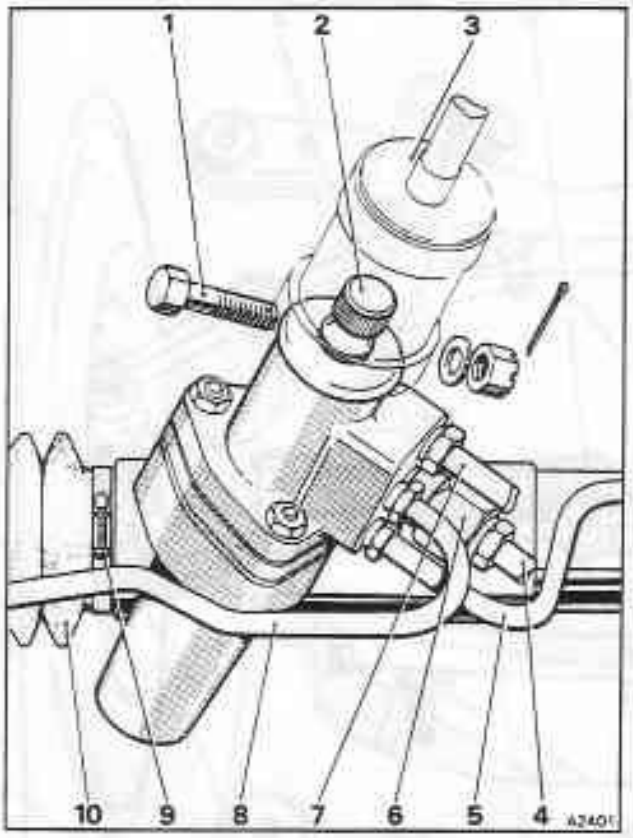


Fig. N2-2 Spool valve and pinion housing

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,

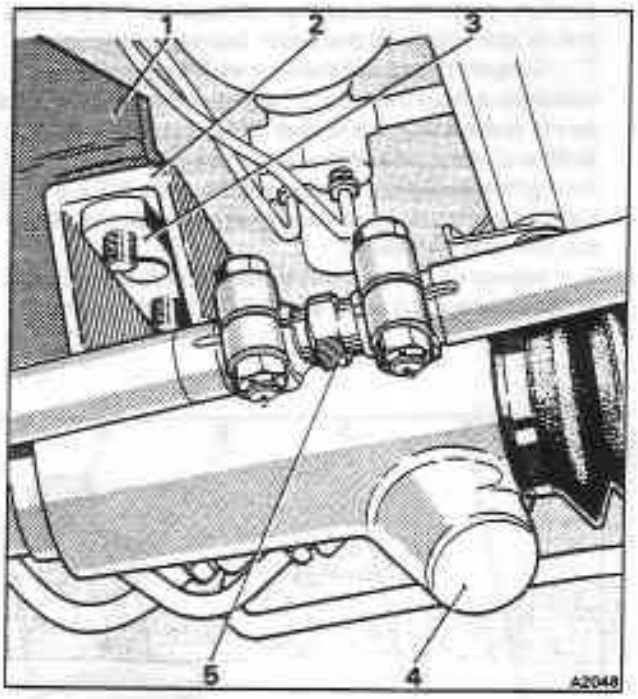


Fig. N2-3 Steering to sub-frame mounting
1 Sub-frame bracket
2 Steering unit mounting foot
3 Tapping block
4 Pinion housing
5 Track rod adjuster

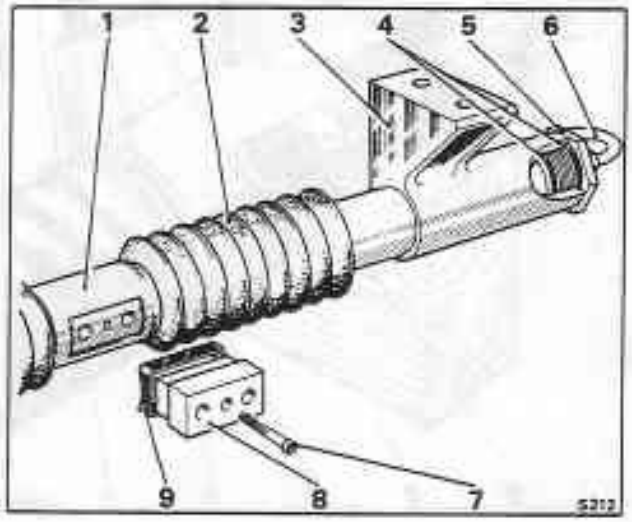


Fig. N2-4 Removal of convoluted seals
1 Centre tube
2 Seal
3 Mounting foot
4 'O' rings
5 Blanking plug
6 Fluid feed pipework
7 Cap head socket screw
8 Centre block
9 Shaped seal

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.

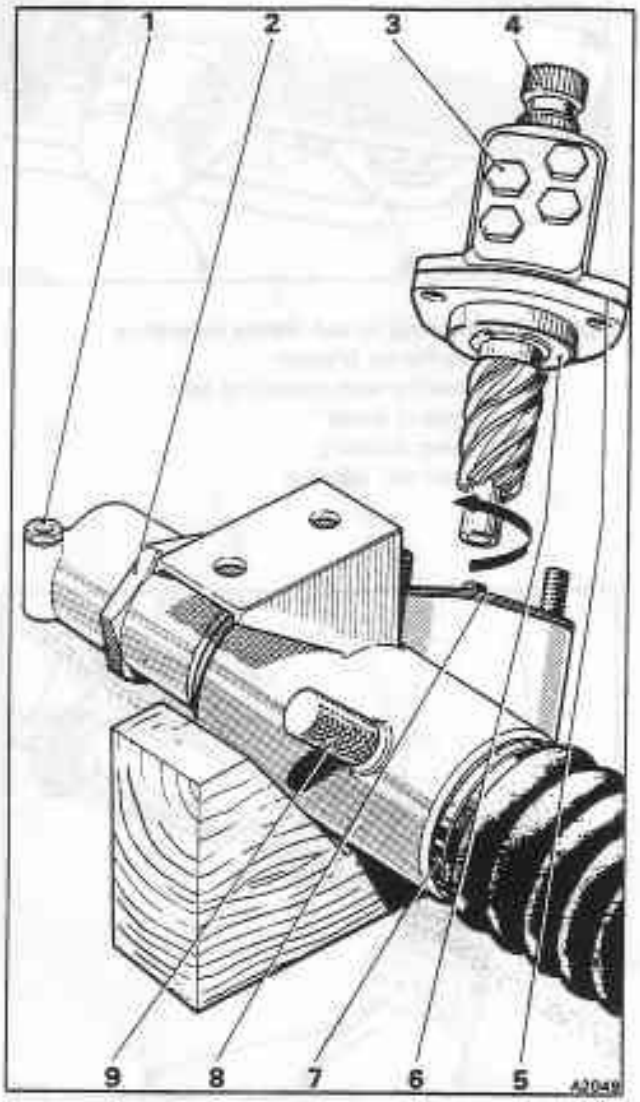


Fig. N2-5 Pinion and spool valve removal
1 Plastic dust cap
2 End cap lock-nut
3 Plastic dust caps
4 Pinion boss splines
5 Bearing pre-load shim
6 Bearing carrier
7 Seal clip
8 Pinion pre-load shims
9 Rack centring plug

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.

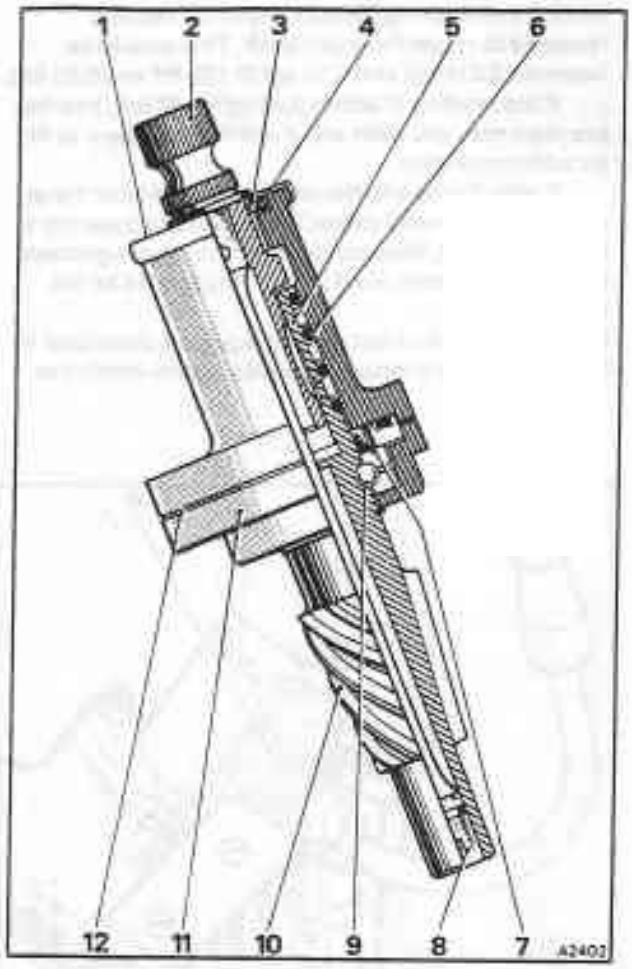


Fig. N2-6 Pinion and spool valve unit
1 Spool valve housing
2 Spline
3 Lip-type oil seal
4 'O' ring
5 Spool valve
6 P T F E rings (4)
7 Lower oil seal
8 Torque arm
9 Thrust ball race
10 Pinion
11 Ball race carrier
12 Pre-load shim(s)

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).

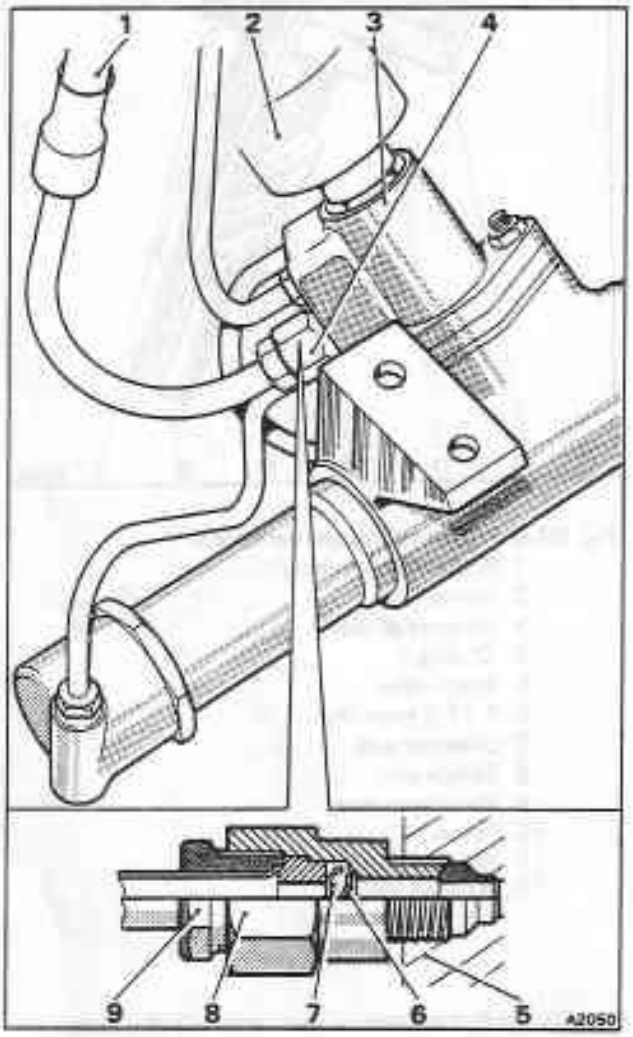


Fig. N2-7 Anti-joggle valve

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

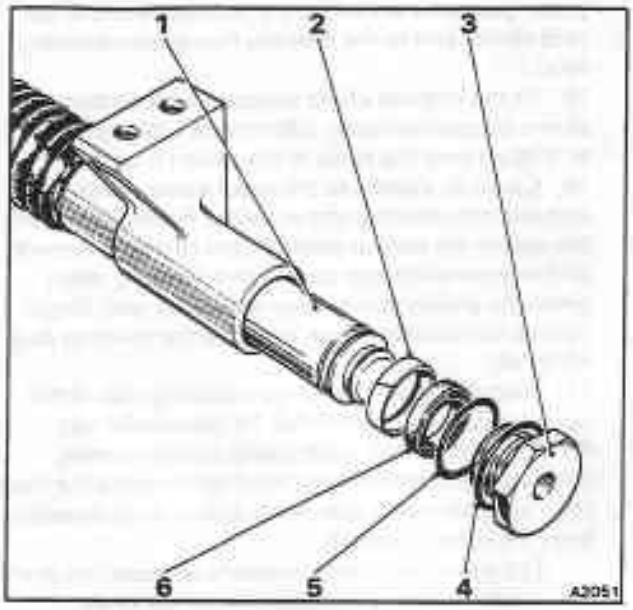


Fig. N2-8 Assembly of free end components

1 Rack spindle
2 P T F E seal
3 Blanking plug
4 End plug 'O' ring
5 Tube 'O' ring
6 Oil seal

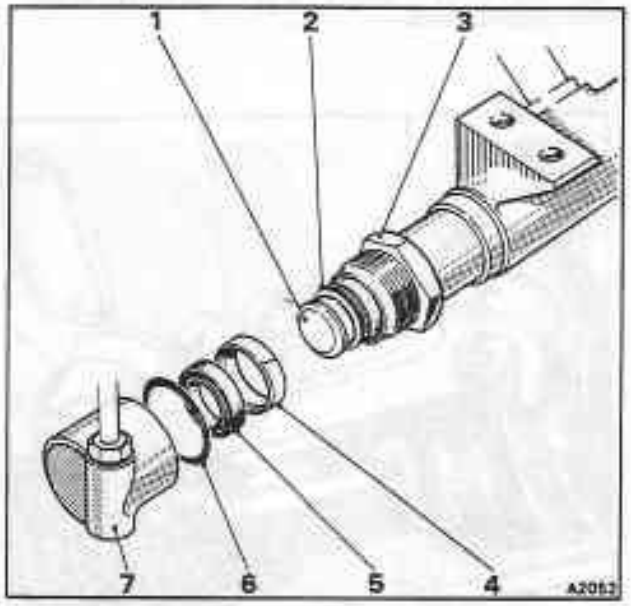


Fig. N2-9 Assembly of pinion box end components

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.

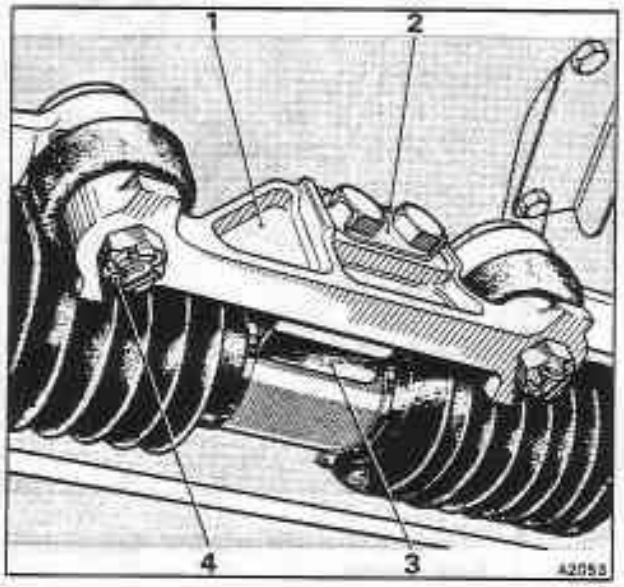


Fig. N2-10 Inner ball joint bracket in position
1 Bracket
2 Tab-washer
3 Centre block seal
4 Castellated nut and split-pin

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,

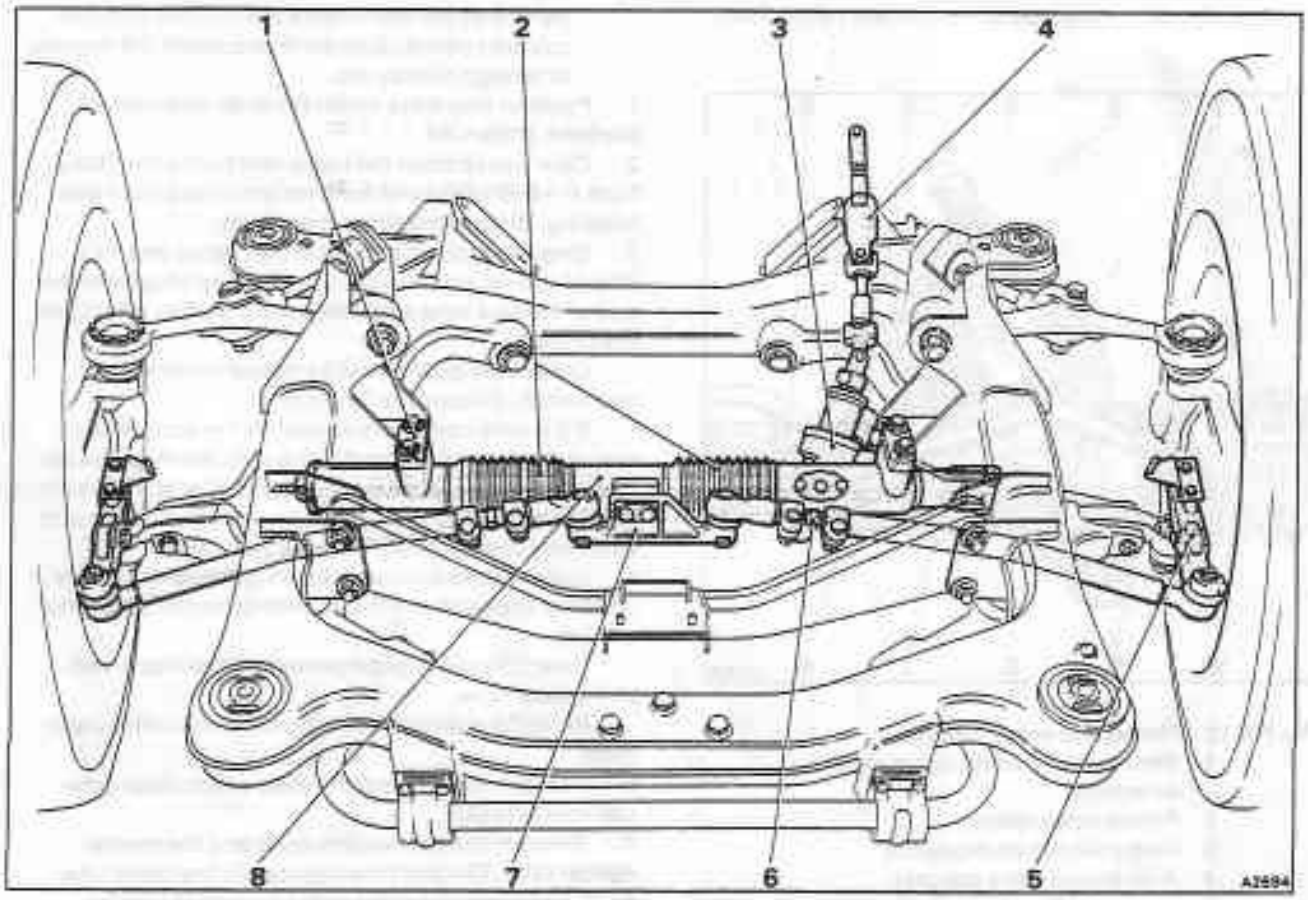


Fig. N2-11 Steering unit mounted in sub-frame

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.

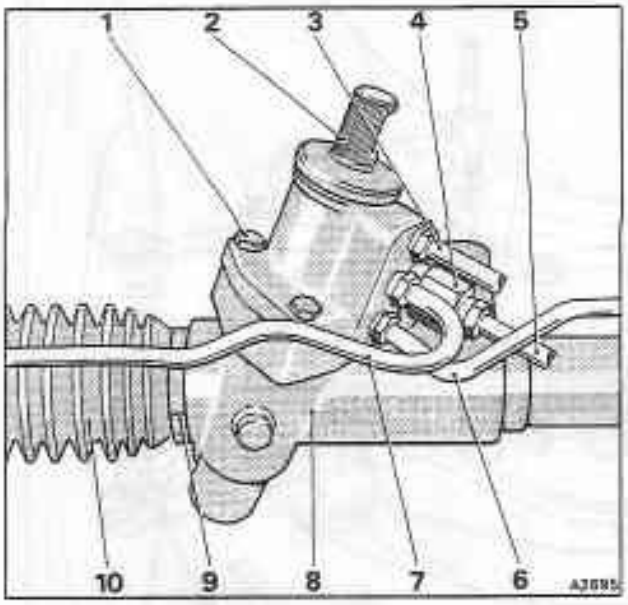


Fig. N2-12 Pinion and valve housing

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.

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.

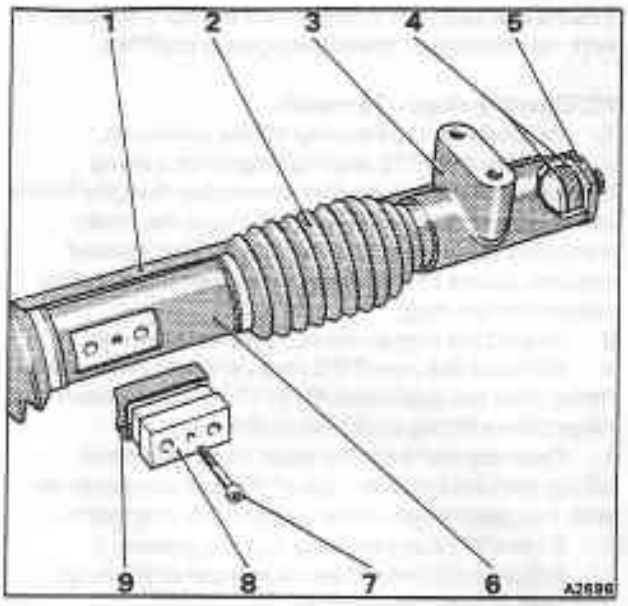


Fig. N2-13 Removal of convoluted seals

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

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.

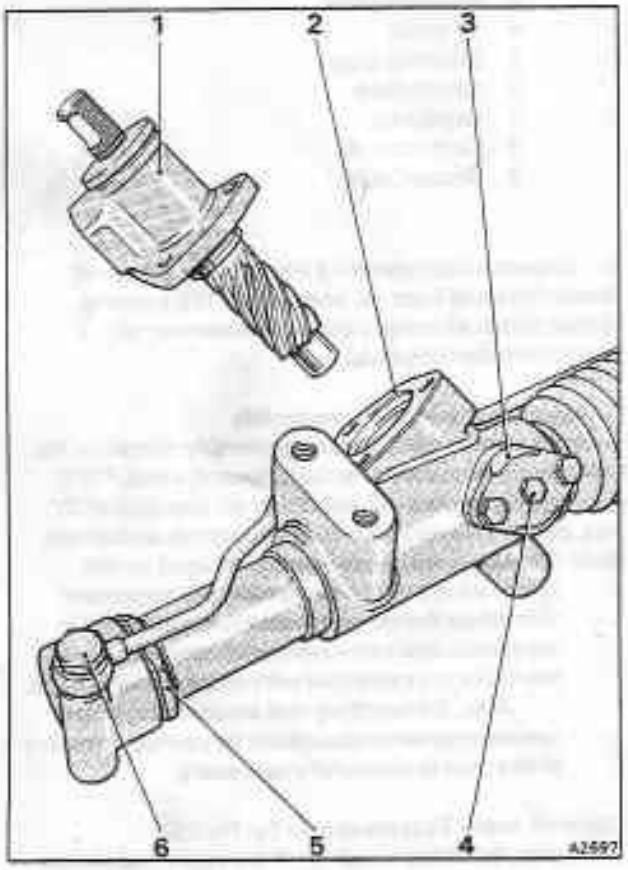


Fig. N2-14 Pinion and valve housing removal

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.

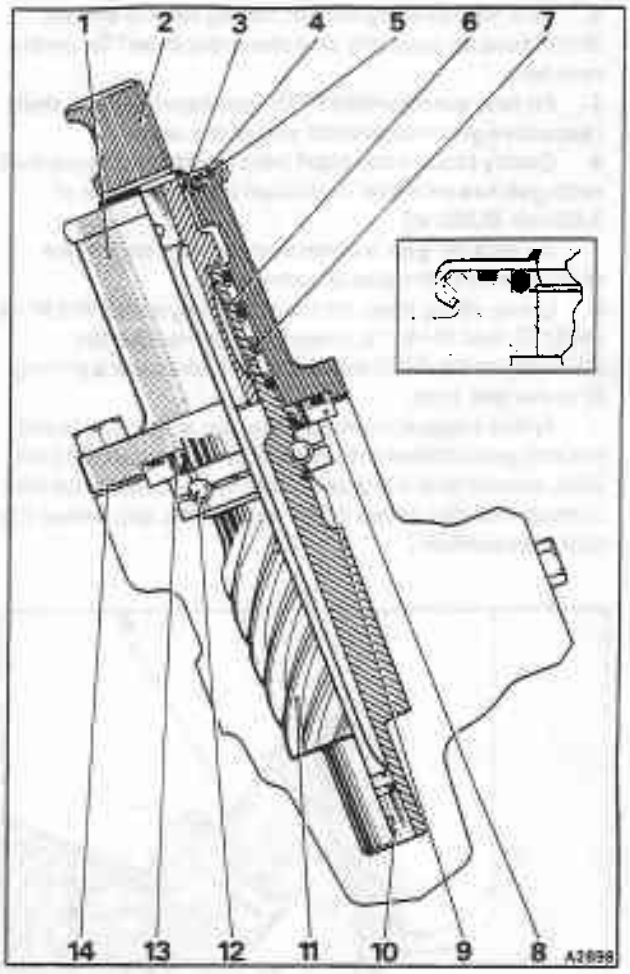


Fig. N2-15 Pinion and valve unit

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.

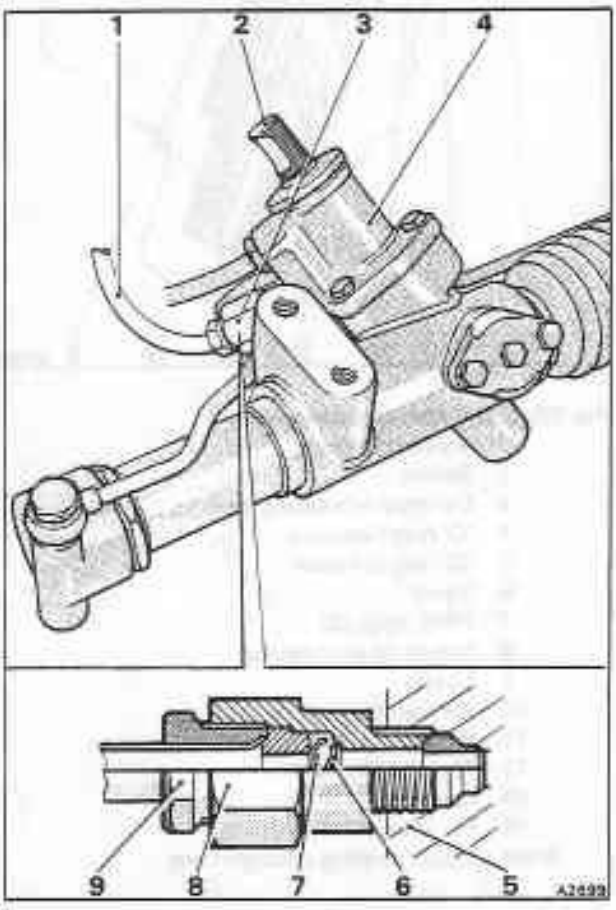


Fig. N2-16 Anti-joggle valve
1 High pressure fluid
2 Spline
3 Anti-joggle valve
4 Pinion valve housing
5 Valve housing casting
6 Spring
7 Flap valve
8 Adapter
9 Pipe union

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).

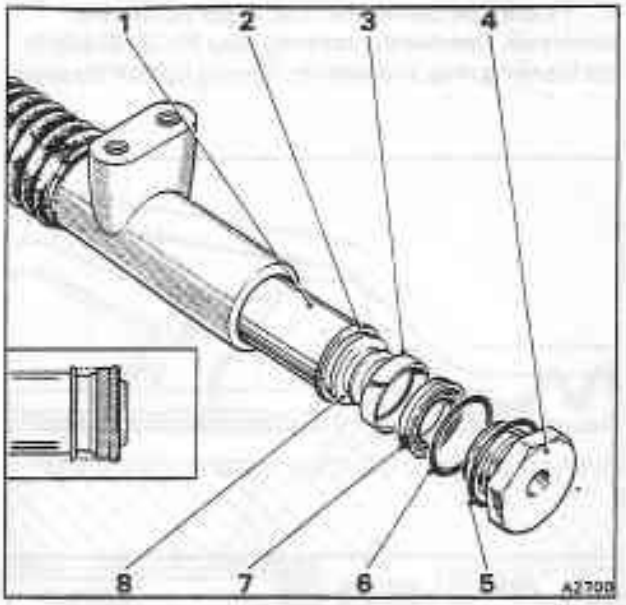


Fig. N2-17 Assembly of free end components

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

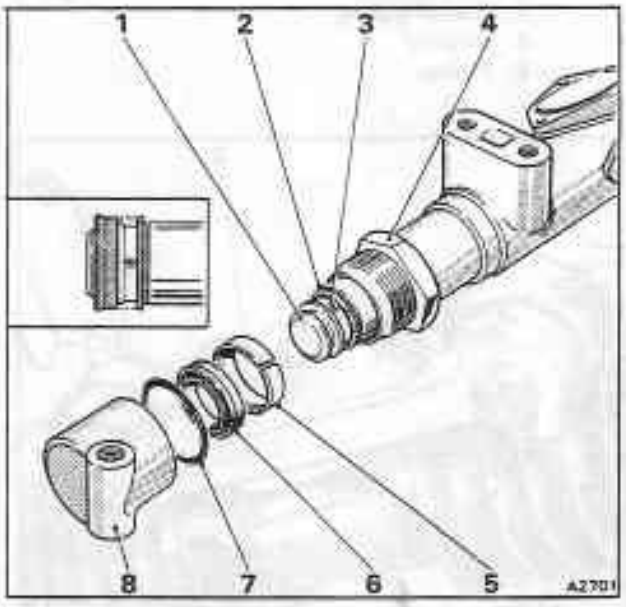


Fig. N2-18 Assembly of pinion box end components

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).

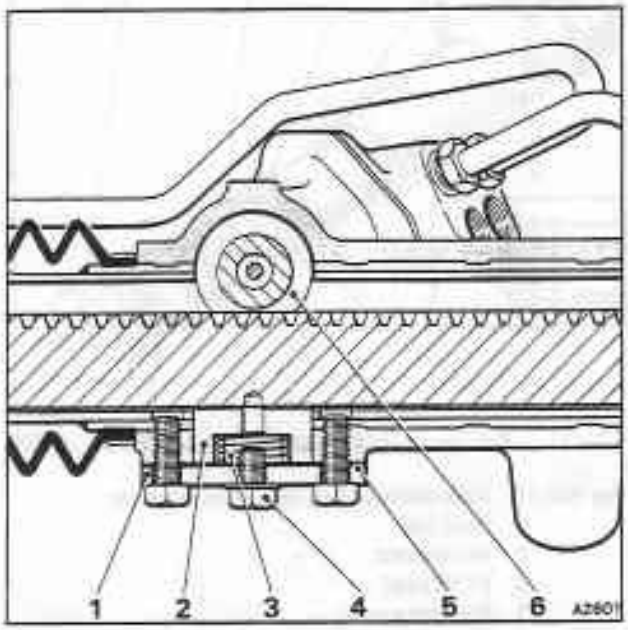


Fig. N2-19 Pinion mesh adjustment
1 Cover plate
2 Rack slipper
3 Spring
4 Blanking plug
5 Shim(s)
6 Pinion

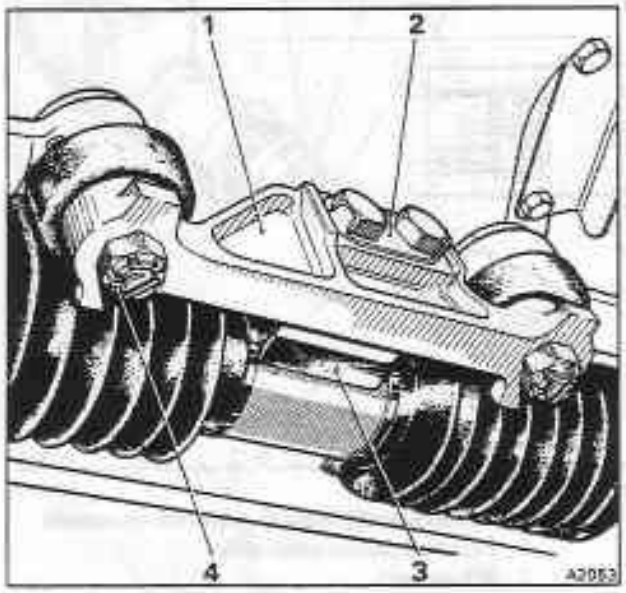


Fig. N2-20 Inner ball joint bracket in position
1 Bracket
2 Tab-washer
3 Centre block seal
4 Castellated nut and split pin

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.

Rack and pinion unit - To assemble (unit incorporating an external adjuster) (see fig. N2-2)

N2-2 Pinion mesh adjustment (rack and pinion unit incorporating an external adjuster)

- 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.) Smear 35 g (1.25 oz) of Rocol Sapphire grease onto the meshing gear of the rack bar, pinion, and pinion thrust ball race.
- 3.) From the pinion box end (smooth bore end) of the tube, push the rack bar into its central position. Ensure that the centralizing hose is in the middle of the rack slipper hole.
- 4.) 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.

- 5.) Fit the three setscrews and 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 sizing tools (in the following order) RH 9114, RH 9113, and RH 9112, progressively reduce the diameter of the PTFE bearings.

- 6.) 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.
- 7.) Fit the rack bar piston seals to each end of the rack using fitting 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.

- 8.) Fit the rack slipper, spring, spring seat, gasket, and coverplate. Torque tighten the setscrews to between 20 Nm and 25 Nm (2,0 kgf m and 2,5 kgf m; 15 lbf ft and 18 lbf ft). Then, fit the centre block to the rack.
- 9.) With the rack in the central position, adjust the rack mesh pre-load as follows.

Slacken the lock-nut and unscrew it at least one full turn. Then, screw in the adjuster screw (against spring pressure) until the pressure needed to rotate the screw begins to increase.

The torque required to rotate the valve should 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.

If this torque figure is too high, screw out the adjuster screw in small steps (i.e. 20° at a time) until the correct torque figure is obtained, tighten the lock-nut. Then, check the centre block radial free play in the rack tube. This should be no more than 0,76 mm (0.030 in). Readjust if necessary.

- 10. Fit the centring plug RH 12465.
- 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. Then, clean and prime the threads 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. 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 spanner 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).

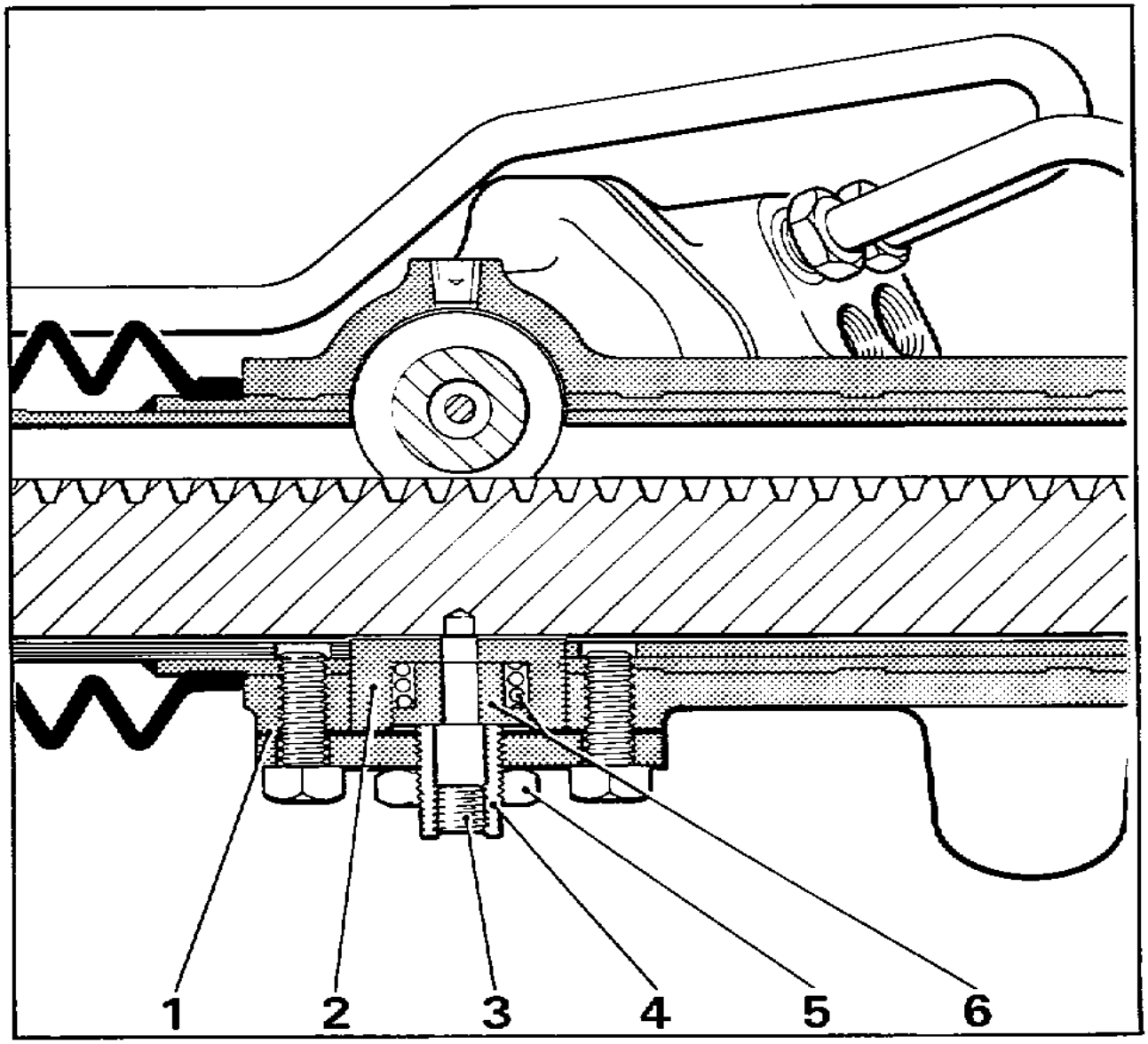
Fit the banjo bolt hydraulic fitting, ensuring new sealing washers are fitted.

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.

Fig N2-2 Steering Rack Mesh Adjustment

Racks fitted with External Adjuster



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.

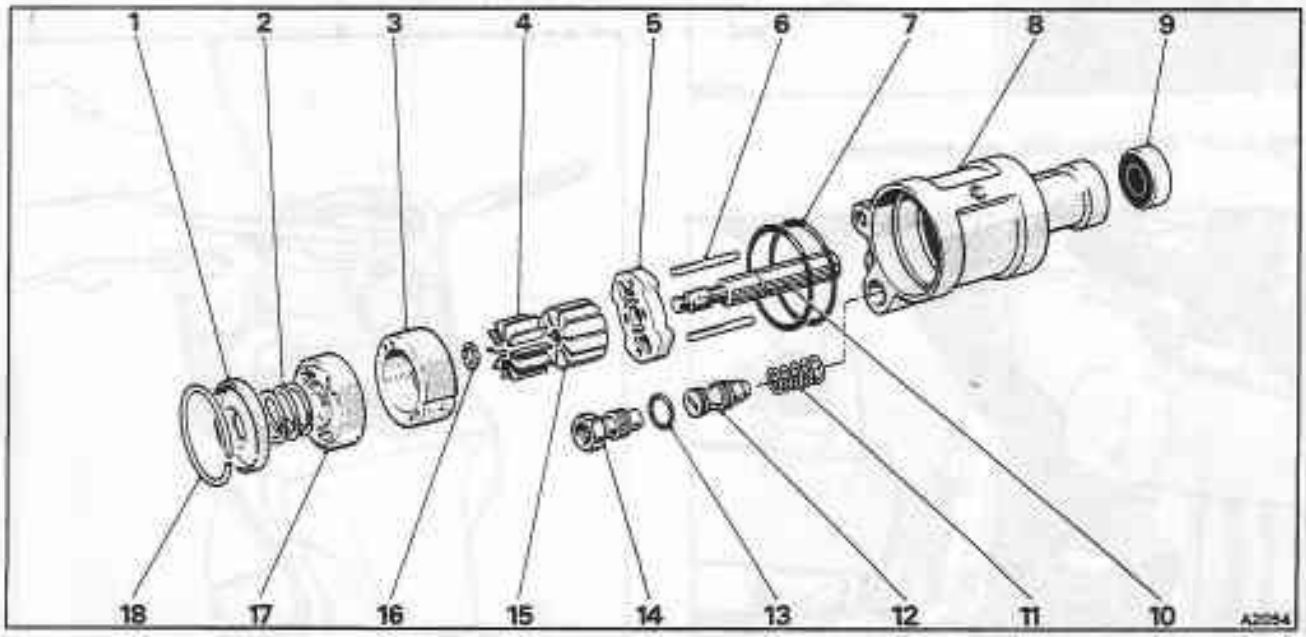


Fig. N3-1 Steering pump

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.

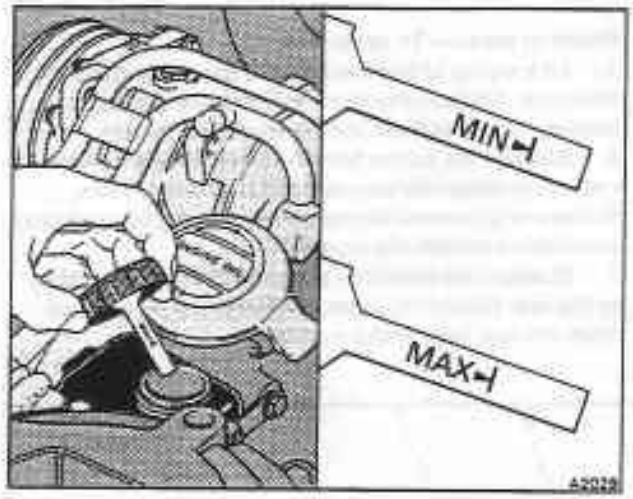


Fig. N3-2 Reservoir filler cap markings

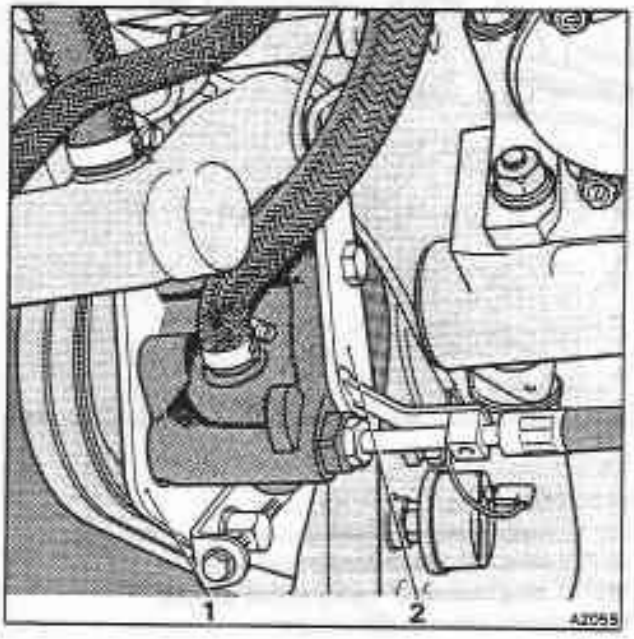


Fig. N3-3 Pump mountings
1 Front pivot plate
2 Rear mounting plate

Fig. N3-4 End plate removal
1 Retaining ring
2 End plate

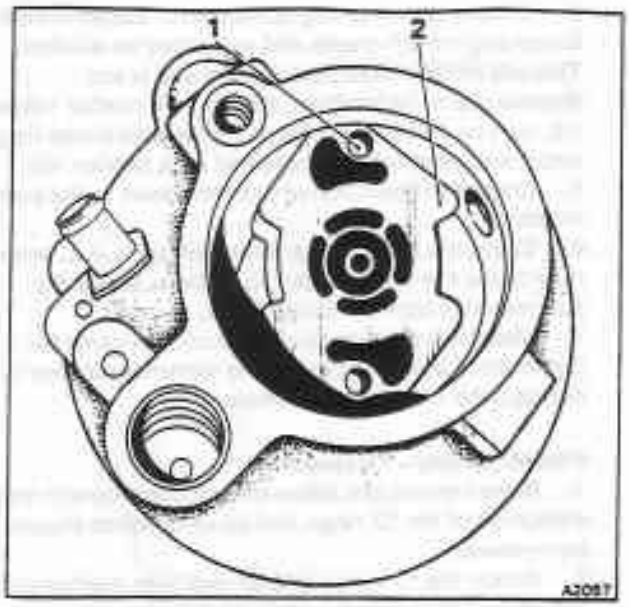


Fig. N3-5 Positioning of thrust plate
1 Dowel pin (2)
2 Thrust plate

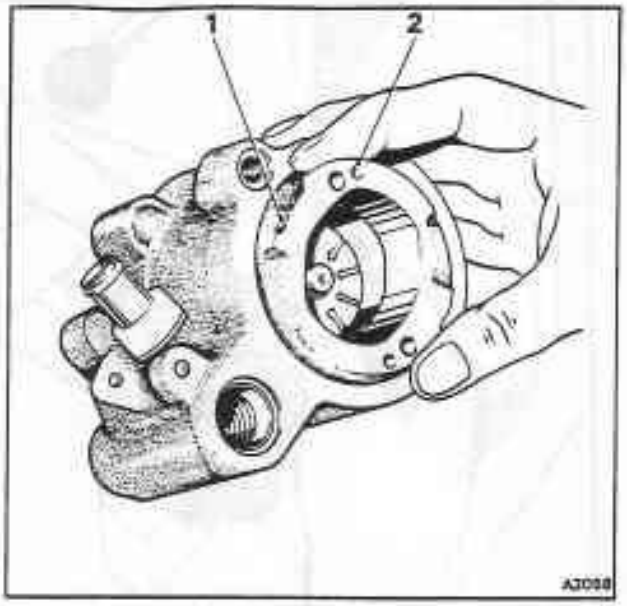


Fig. N3-7 Correct positioning of pump ring
1 Direction of rotation arrow
2 Dowel hole (2)

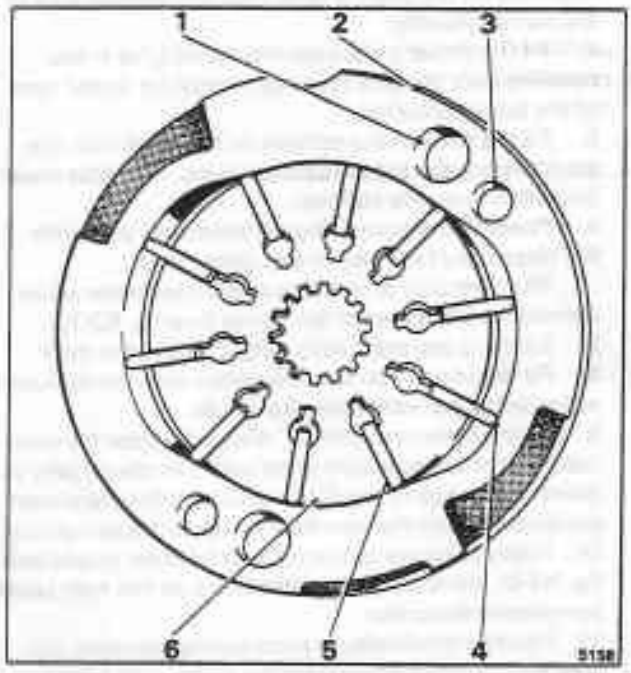


Fig. N3-6 Pump rotor and vanes
1 Oil transfer hole (2)
2 Pump ring
3 Dowel hole
4 Radiused edge of vane
5 Vane (10)
6 Rotor

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.

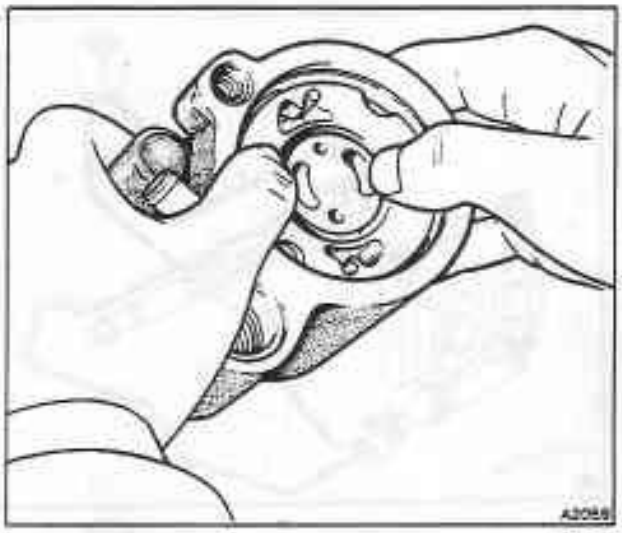


Fig. N3-8 Fitting the pressure plate

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.

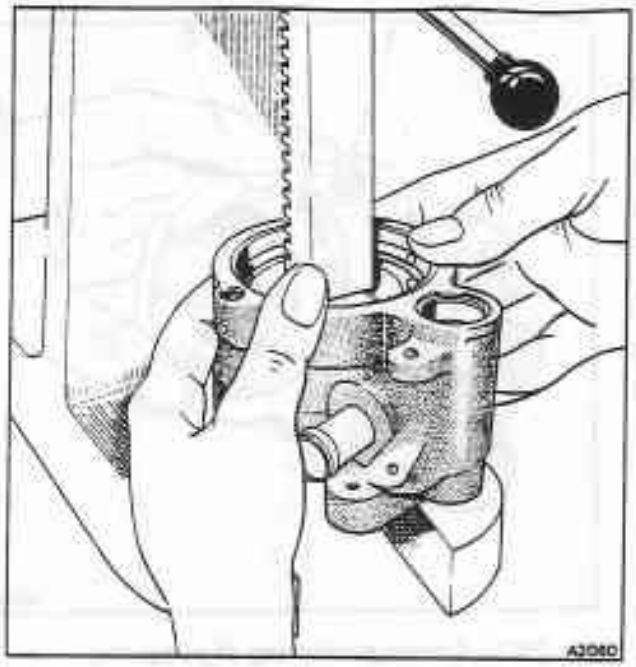


Fig. N3-9 Method of replacing end plate

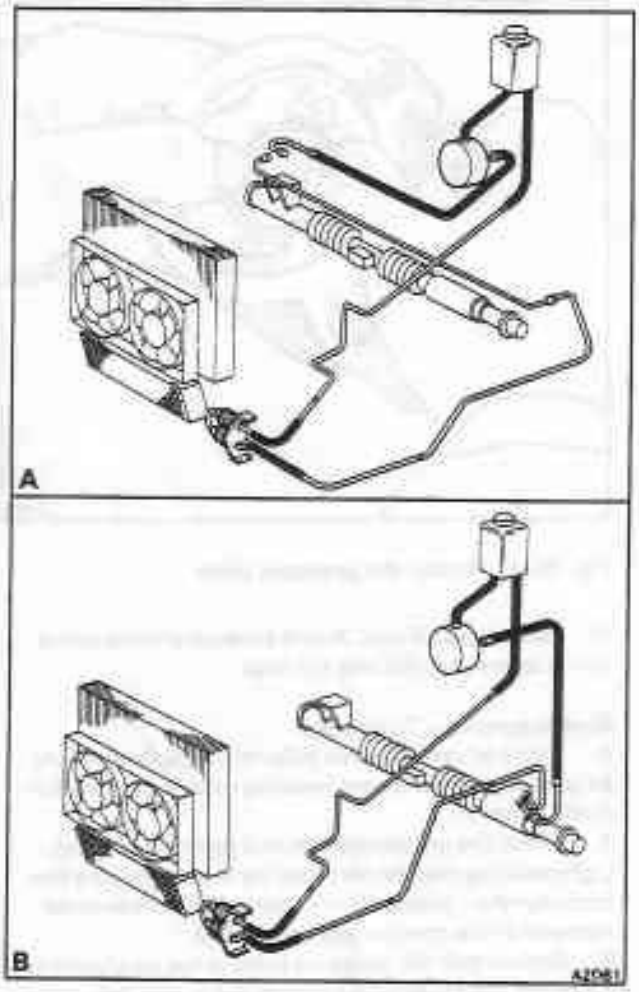


Fig. N3-10 Hydraulic pipe layouts
A Right-hand drive
B Left-hand drive

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.

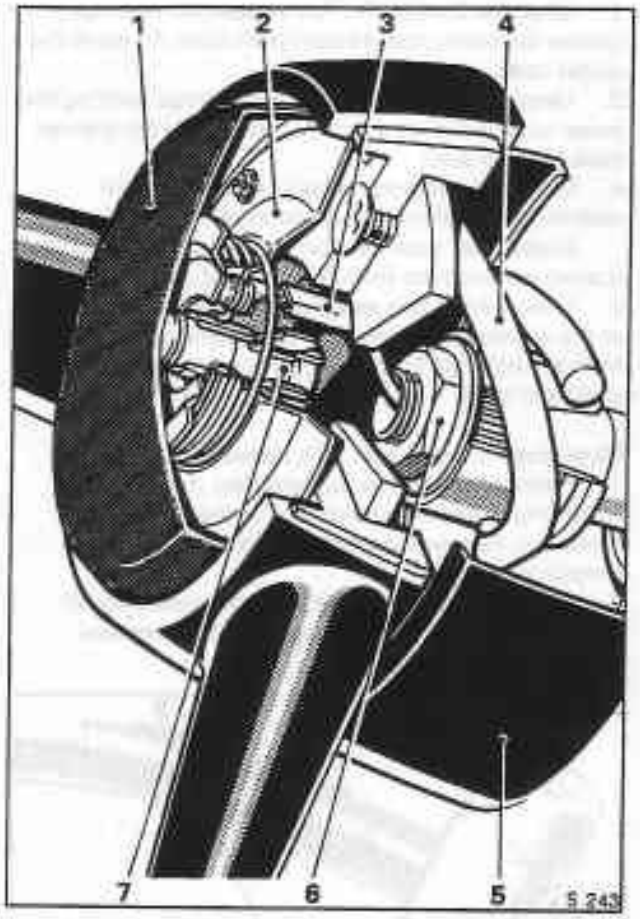


Fig. N4-1 Steering wheel components

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 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.

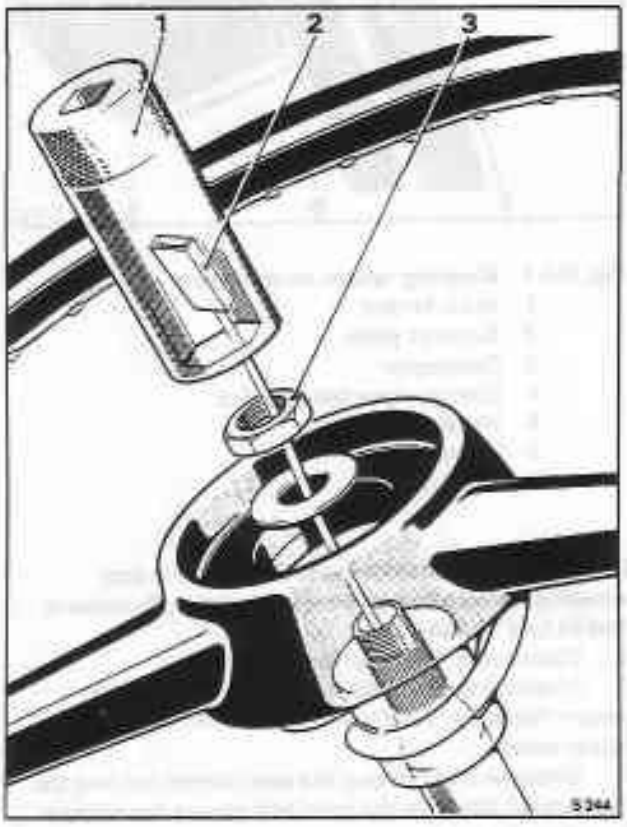


Fig. N4-2 Steering wheel fitting

1 Deep bodied hexagon socket
2 Electrical horn connector
3 Steering wheel nut

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

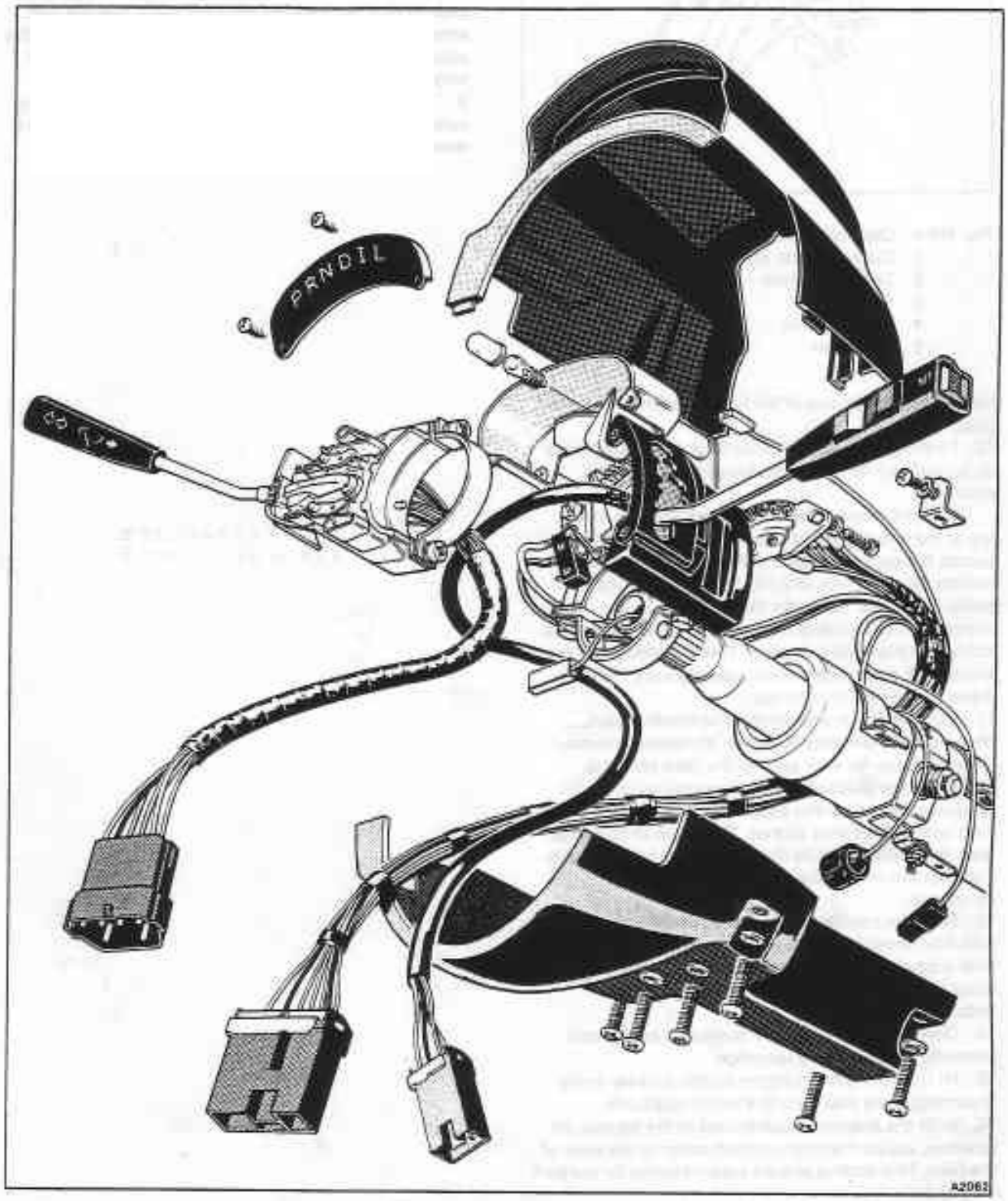


Fig. N4-3 Gear range selector, direction indicator, wash/wipe units, upper and lower cowlings

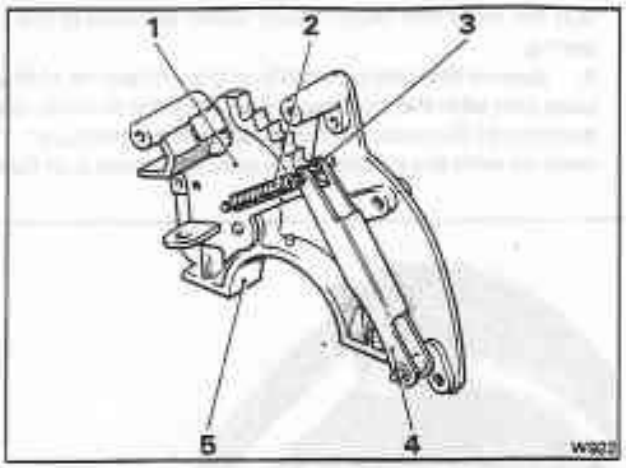


Fig. N4-4 Quadrant to rocking arm assembly
1 Gear selector quadrant
2 Tension spring – rocking arm (2)
3 Roller
4 Rocking arm
5 Base unit

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.

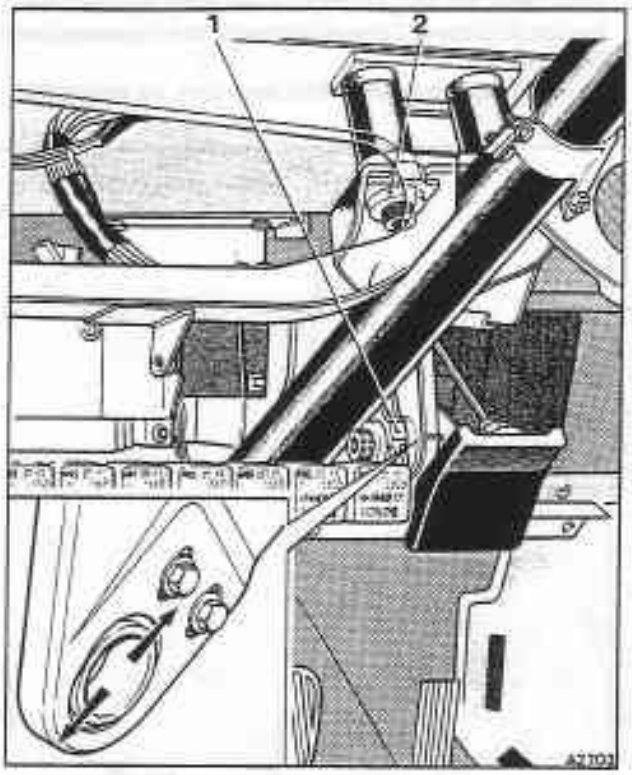


Fig. N5-2 Steering column in position
1 Lower mounting point
2 Upper mounting point

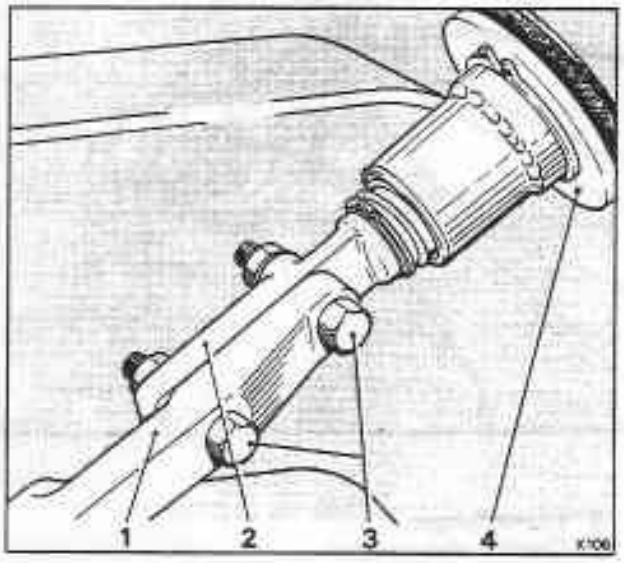


Fig. N5-1 Steering column link to linkage arm
1 Linkage arm
2 Steering column link
3 Securing nuts and bolts
4 Washer – toeboard

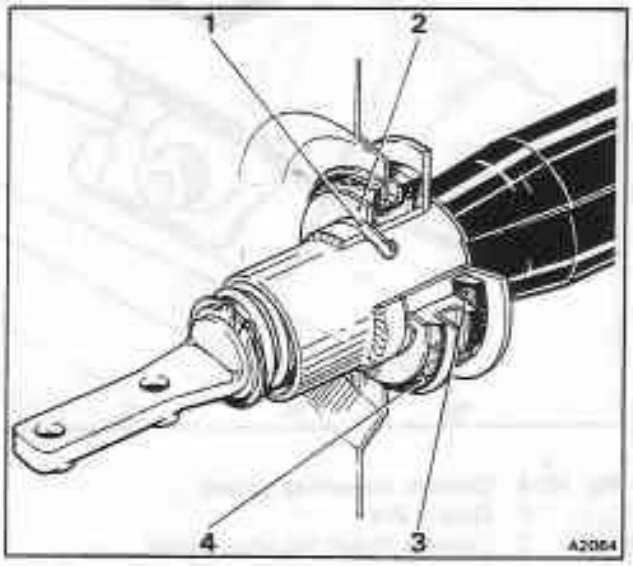


Fig. N5-3 Toeboard fixing
1 Circlip
2 Washer
3 Soft rubber washer
4 Bulkhead grommet

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

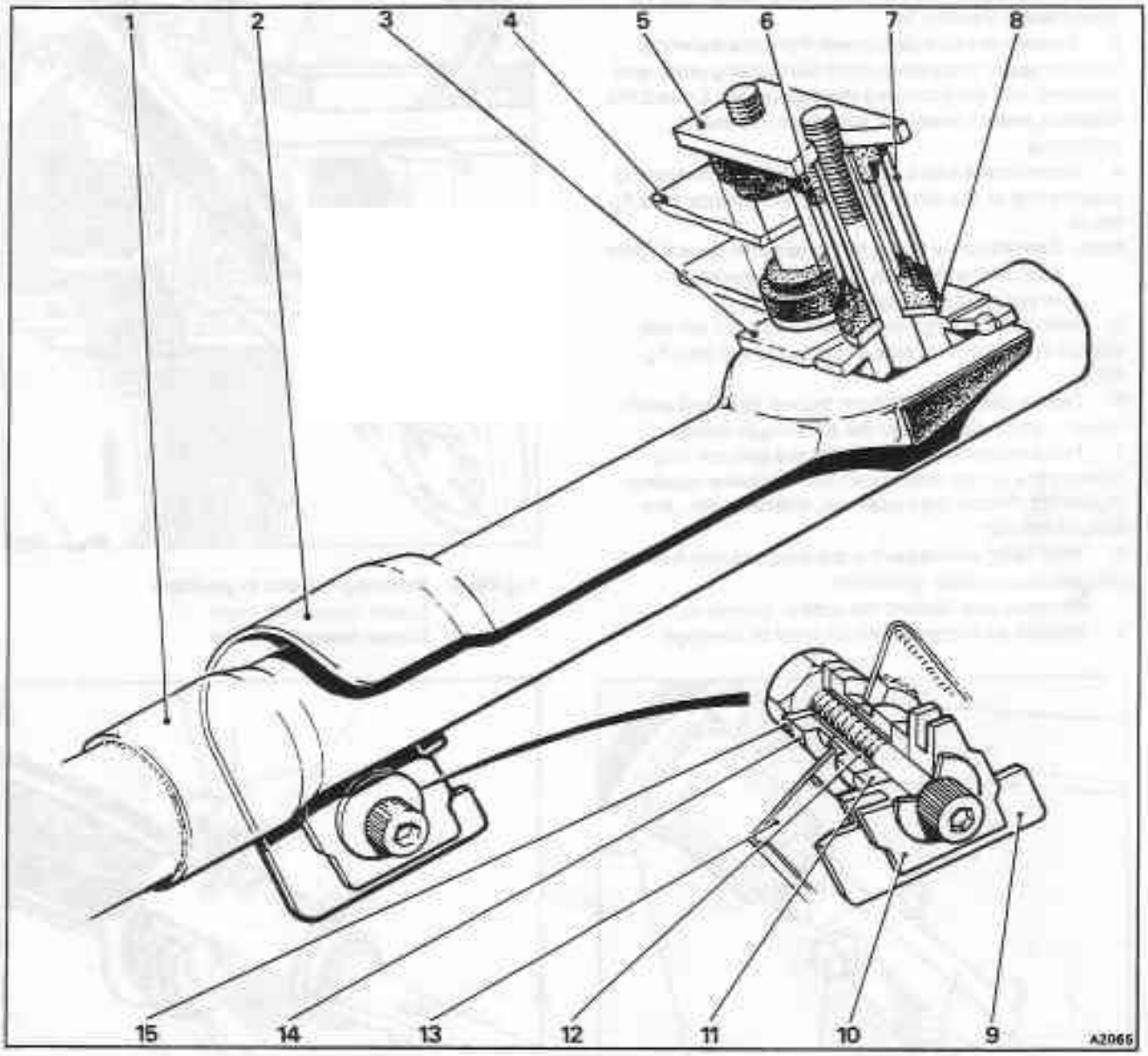


Fig. N5-4 Column mounting points

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).

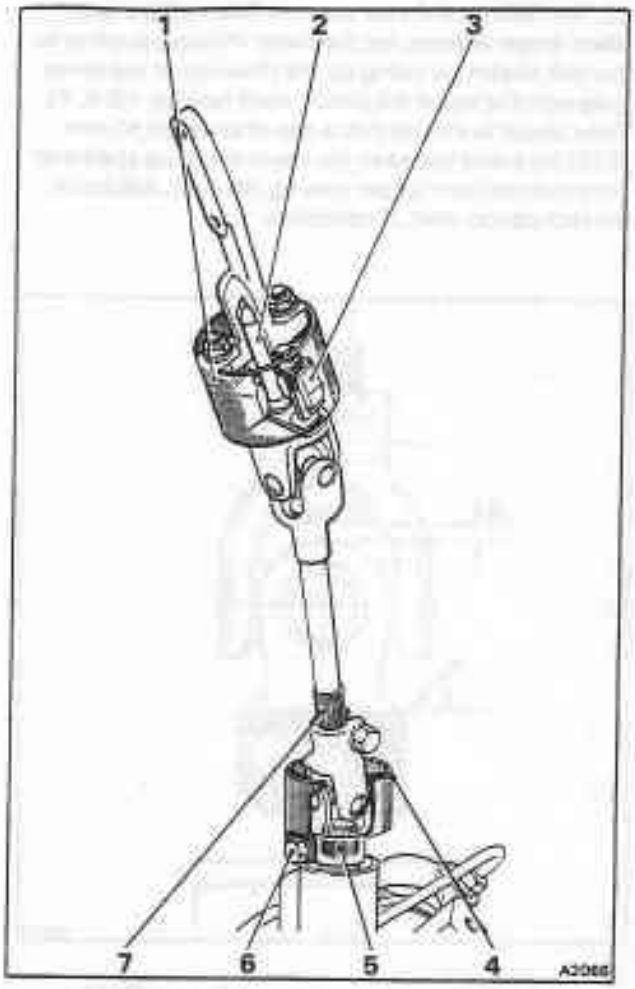


Fig. N5-5 Column to steering unit linkage

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.

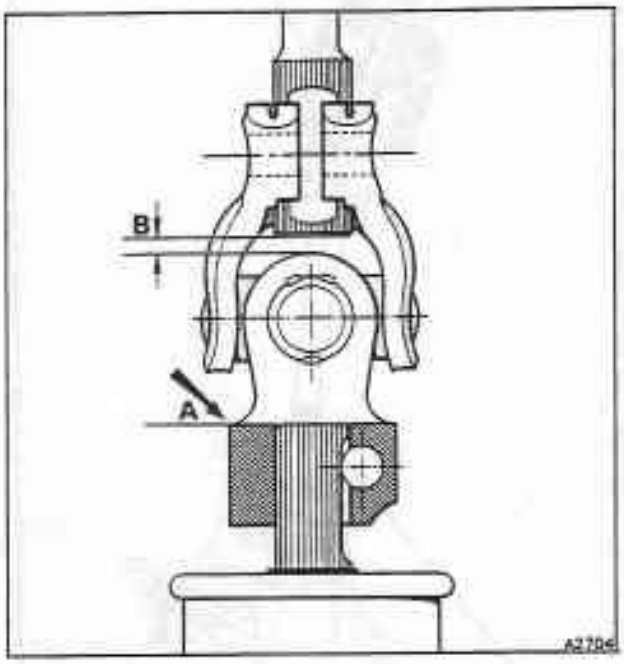


Fig. N5-6 Column to steering unit linkage (1989 model year cars not fitted with 'one-piece' lower linkage)

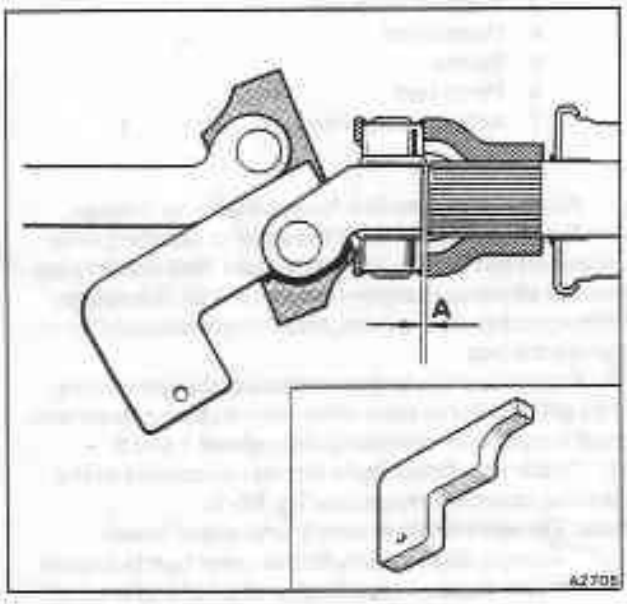


Fig. N5-7 Column to steering unit linkage (1989 model year cars fitted with 'one-piece' lower linkage)

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.

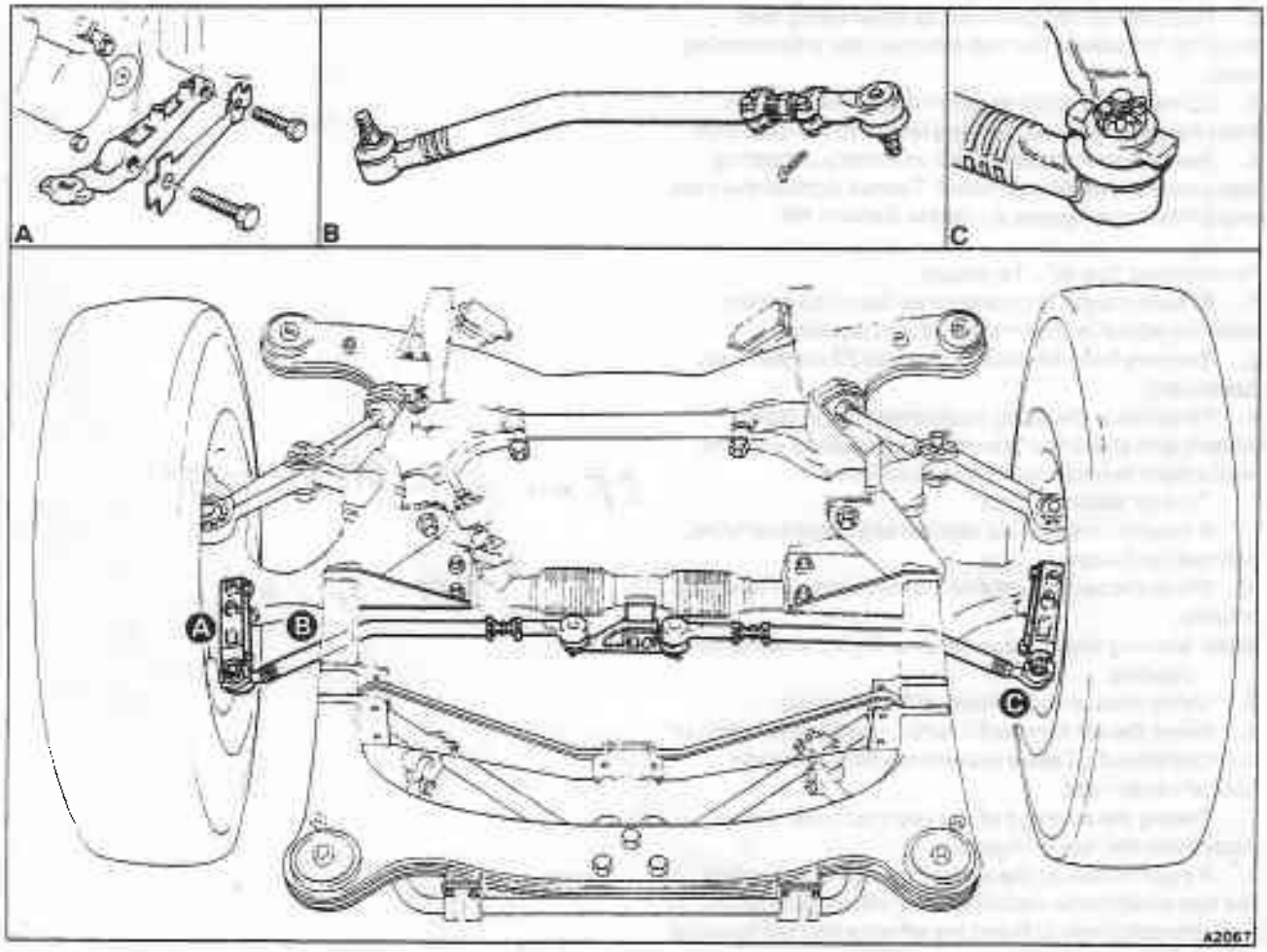


Fig. N6-1 Steering linkage

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.

2,5 mm with 712 MM tyres

712 5,in (7')

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.

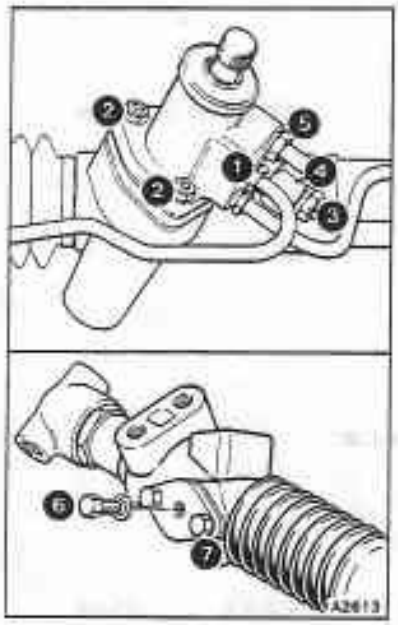
Symptoms	Possible cause	Action
Steering		
Car pulls to one side	1. Front end geometry incorrect.	1. Check steering geometry.
	2. Pump drive belts slipping.	2. Adjust drive belts. Renew belts if necessary.
	3. Flow control valve sticking.	3. Examine flow control valve. Renew valve if necessary.
Heavy 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

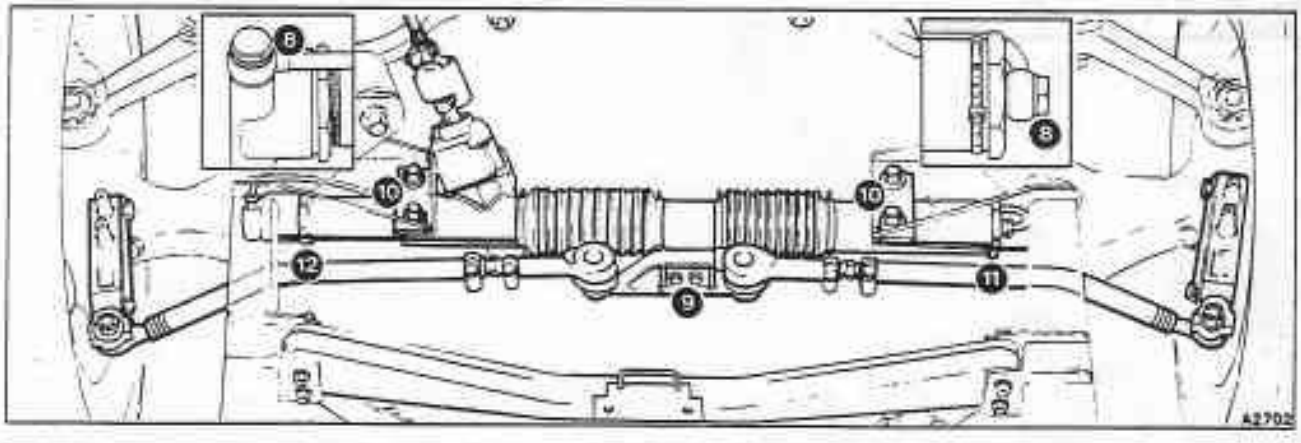
Introduction
This chapter contains the special torque tightening figures applicable to Chapter N.

For standard torque tightening figures refer to Chapter P.

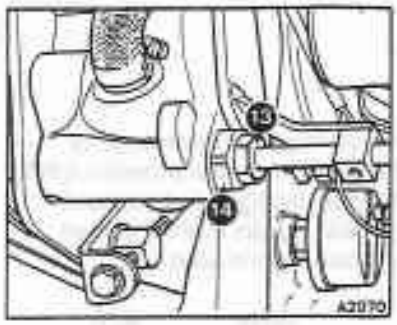
Components used during manufacture of the vehicle have different thread formations (metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews, it is important to ensure that the correct type and size of thread formation is used.



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

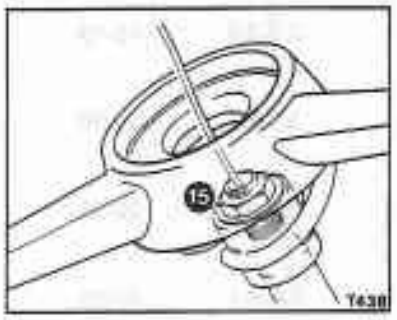


Section N3



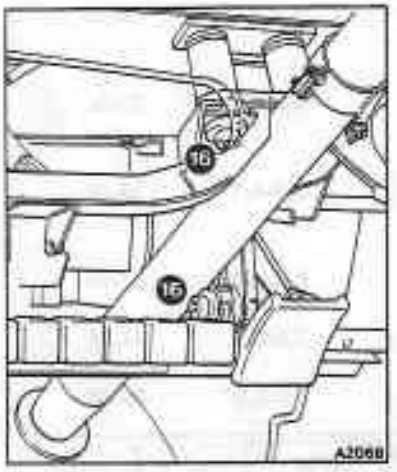
Ref.	Component	Nm	kgf m	lbf ft
13	Steering pump pressure pipe – union	28-40	2,8-4,1	20-30
14	Control valve outlet adapter	50-75	5,1-7,6	37-55

Section N4



Ref.	Component	Nm	kgf m	lbf ft
15	Steering wheel – nut	34-38	3,5-3,8	25-28

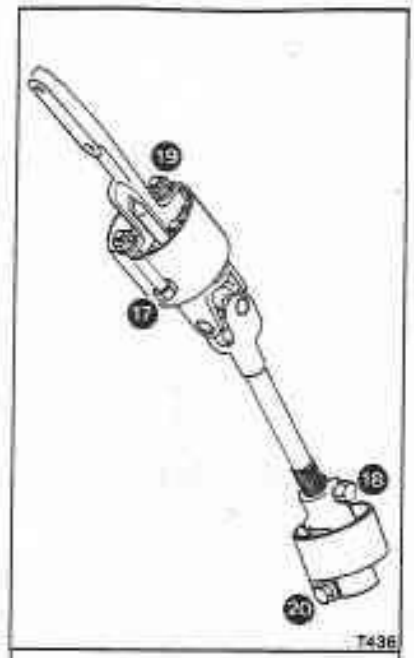
Section N5

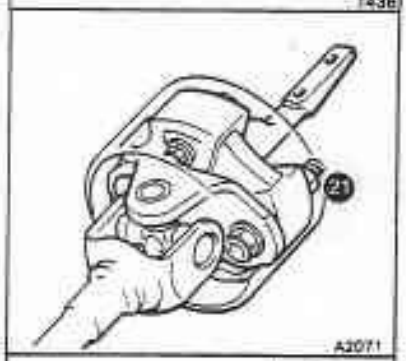


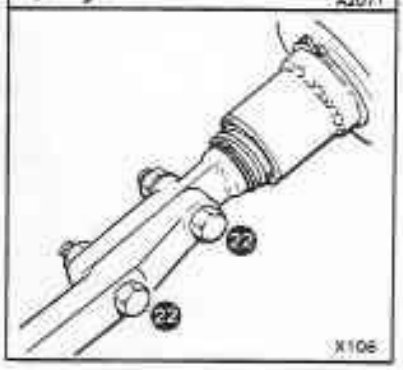
Ref.	Component	Nm	kgf m	lbf ft
16	Steering column mounting – Allen capscrew	29-32	2,9-3,3	21-24

Section N5 (continued)

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
21	Input shaft to bonded coupling – nut	22-24	2,2-2,4	16-18
22	Steering column linkage – fitted bolts	22-24	2,2-2,4	16-18

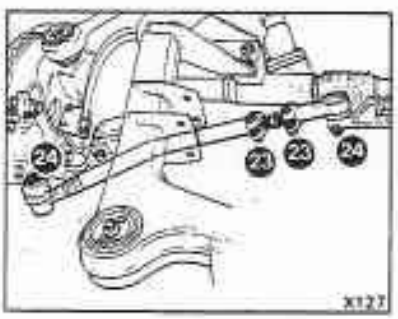






Section N6

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.

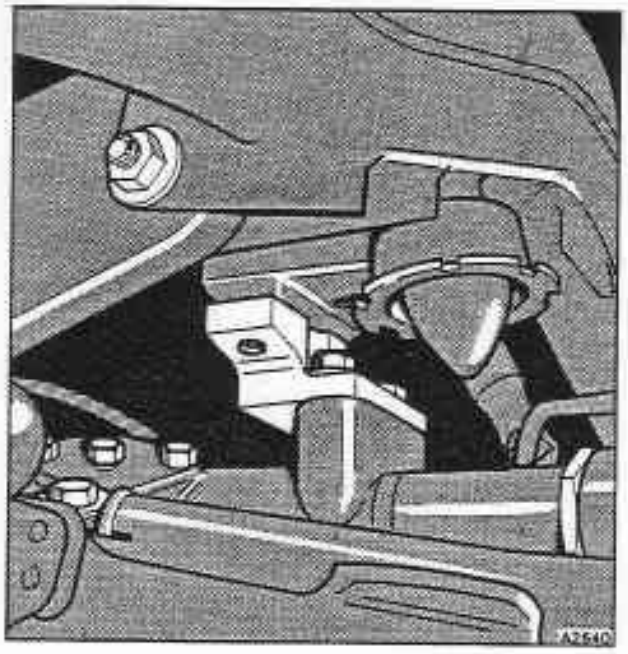


Fig. N9-1 Modified arrangement – adapter blocks to sub-frame

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

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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.

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
3/8 in dia UNF 9/16 in A/F	30-33	3,0-3,4	22-25
7/16 in dia UNF 5/8 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
5/8 in dia UNF 7/8 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

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
3/8 in dia UNF 9/16 in A/F	39-43	4,0-4,4	29-32
7/16 in dia UNF 5/8 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
5/8 in dia UNF 7/8 in A/F	116-122	11,6-12,4	85-90

Exhaust systems

Contents

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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.

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.

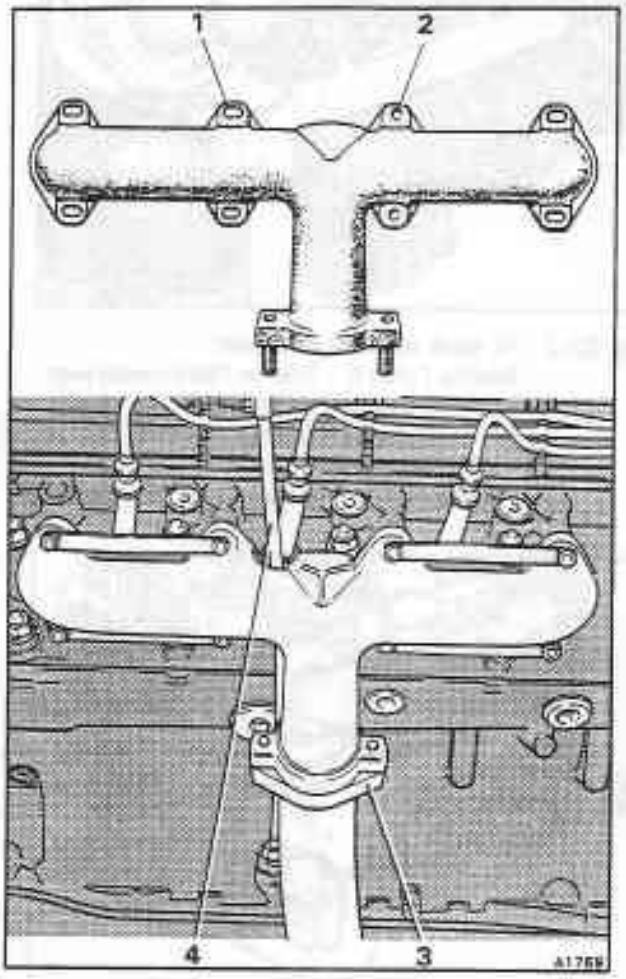


Fig. Q3-1 'B' bank exhaust manifold
Cars other than Bentley Turbo R
1 Elongated hole
2 Location hole
3 Exhaust clamp
4 Engine oil dipstick

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.

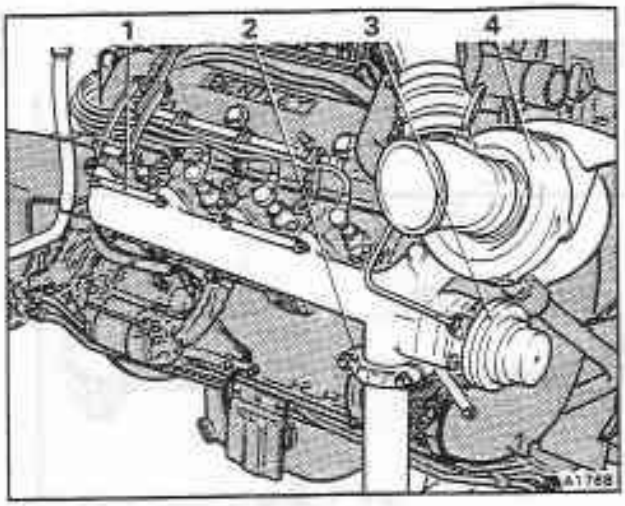


Fig. Q3-2 'A' bank exhaust manifold
Bentley Turbo R – Prior to 1989 model year
1 Manifold setscrew lock-plate
2 Connecting pipe clamp
3 Wastegate assembly
4 Turbocharger assembly

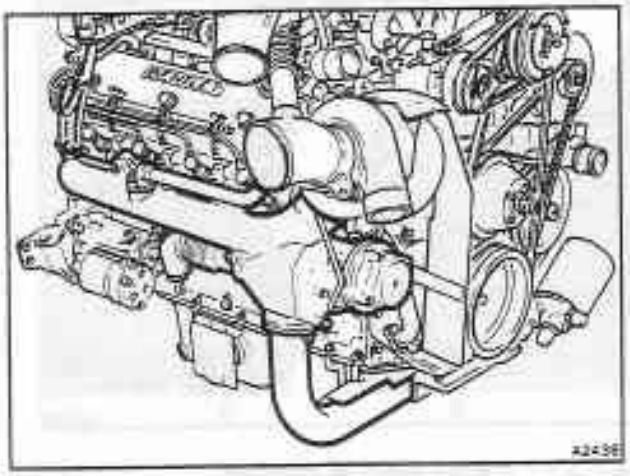


Fig. Q3-3 One piece exhaust manifold – 'A' bank
Bentley Turbo R – 1989 model year

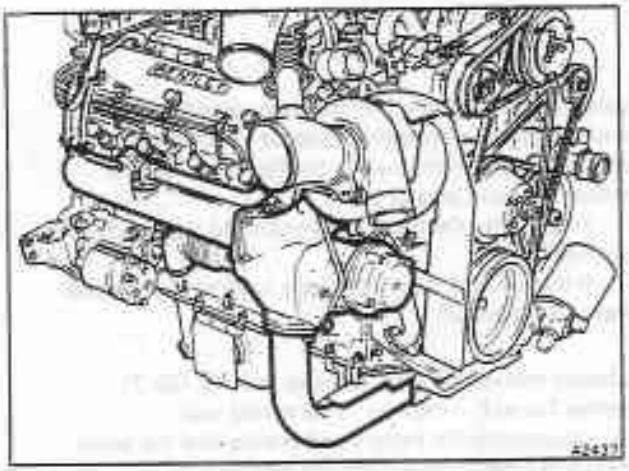


Fig. Q3-4 Split type exhaust manifold – 'A' bank
Bentley Turbo R – 1989 model year

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.

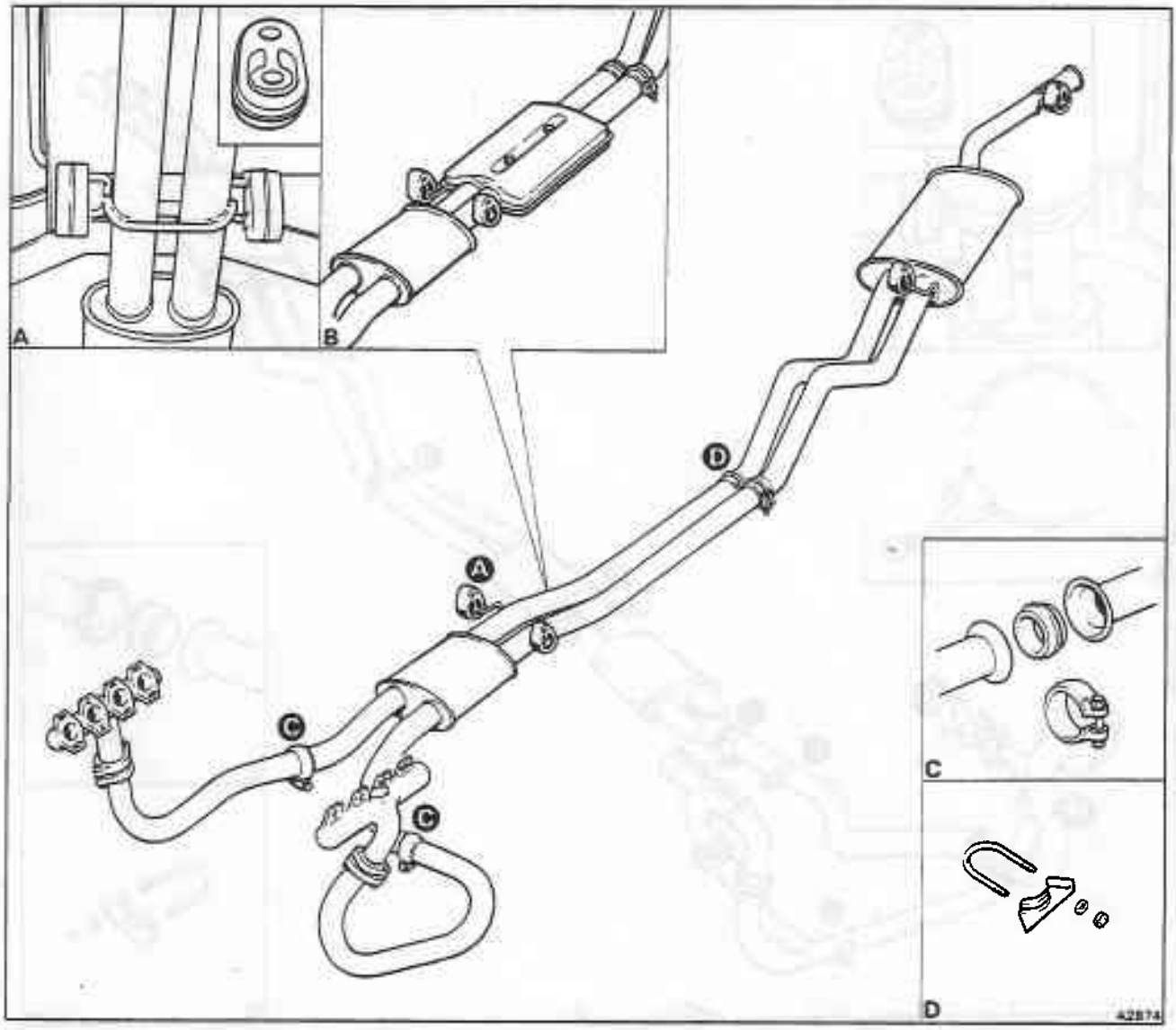


Fig. Q4-1 Exhaust system Cars other than Bentley Turbo R Inset B 1989 model year running change

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.

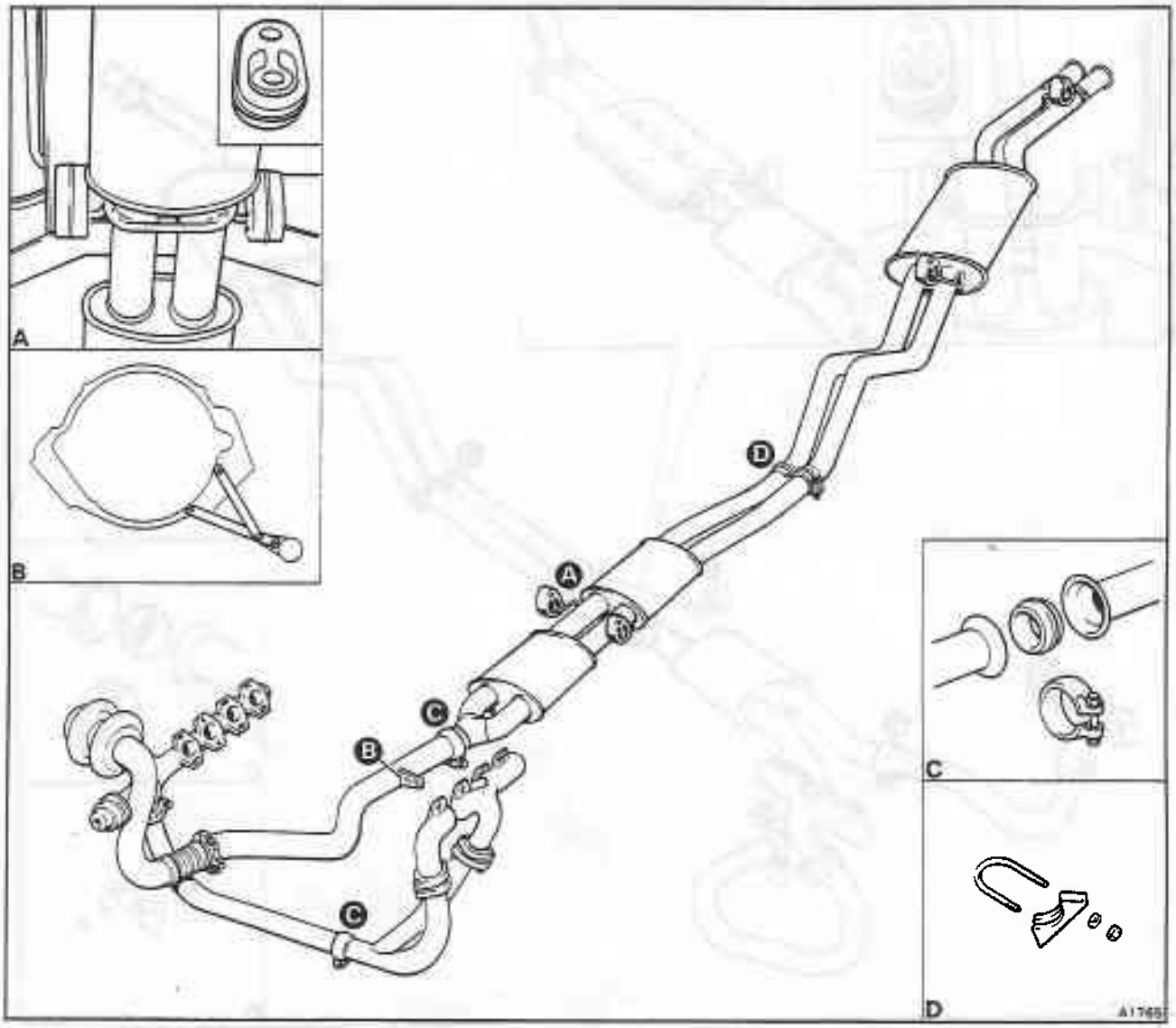


Fig. Q4-2 Exhaust system Bentley Turbo R – Prior to 1989 model year

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.

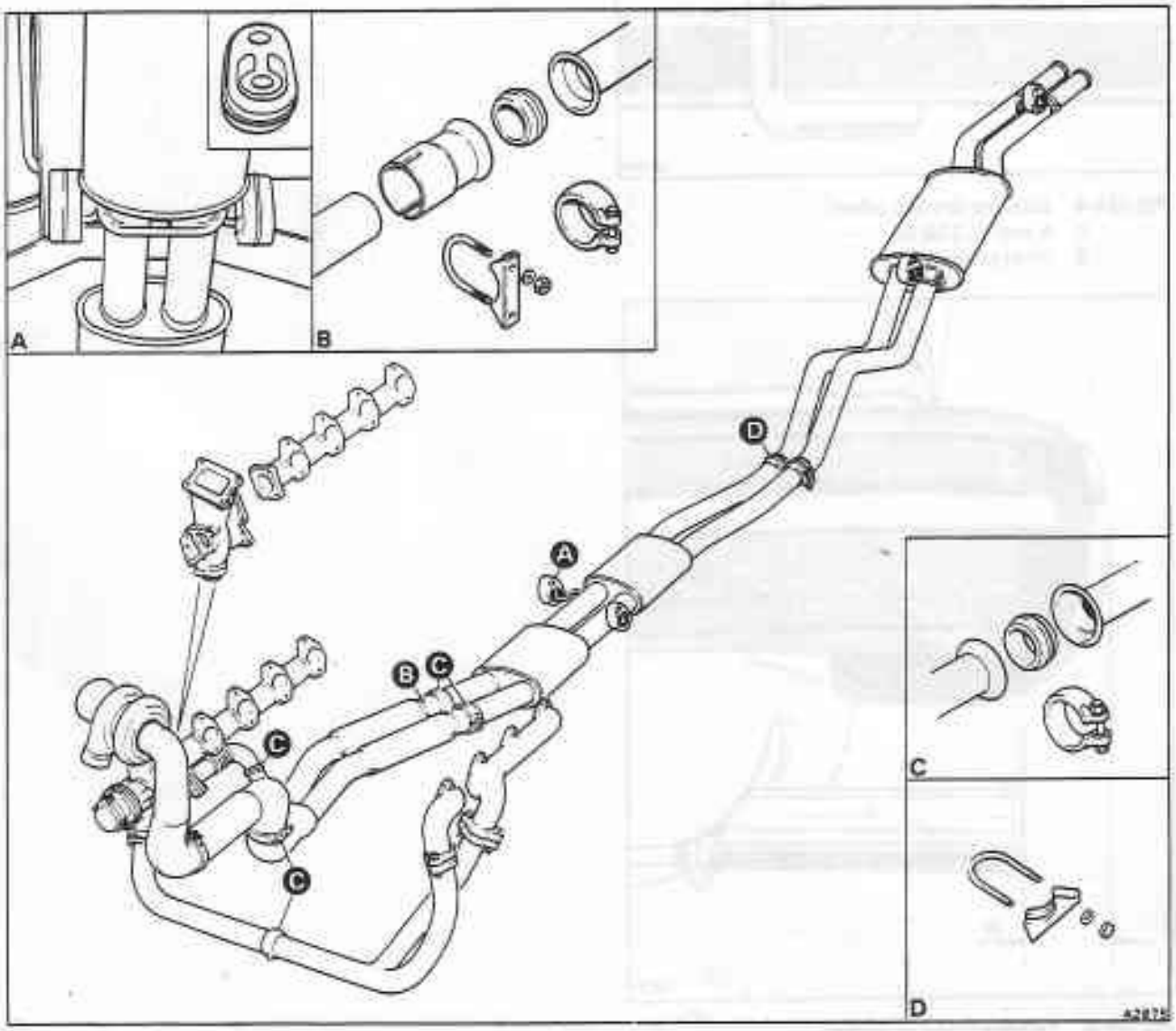


Fig. Q4-3 Exhaust system Bentley Turbo R – 1989 model year Inset B Running change

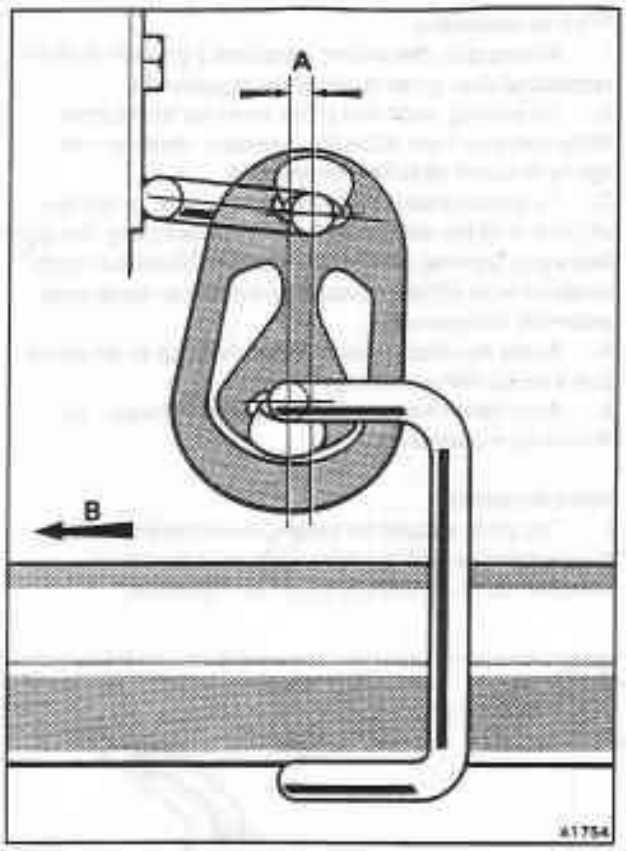


Fig. Q4-4 Exhaust mount offset
A 6 mm (0.236 in)
B Front of car

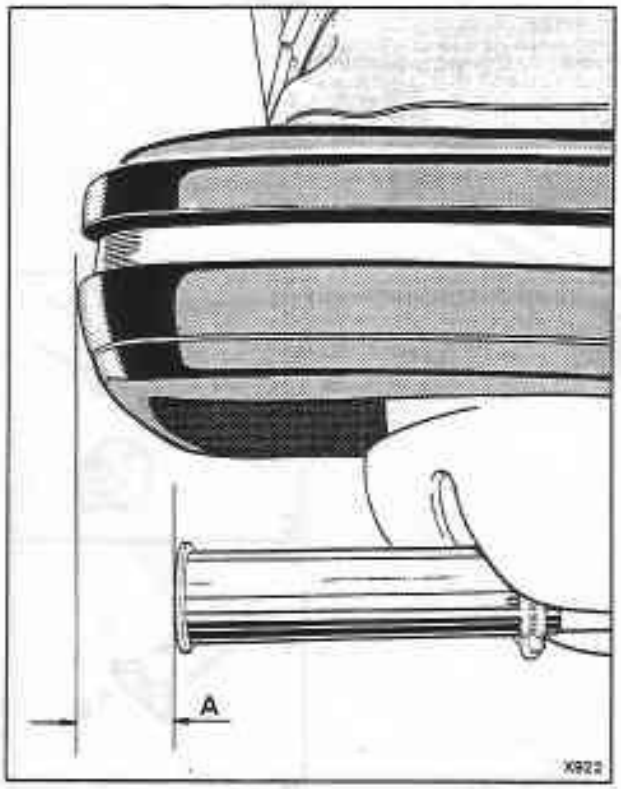


Fig. Q4-5 Tailpipe finisher setting
A 60 mm (2.364 in)

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.

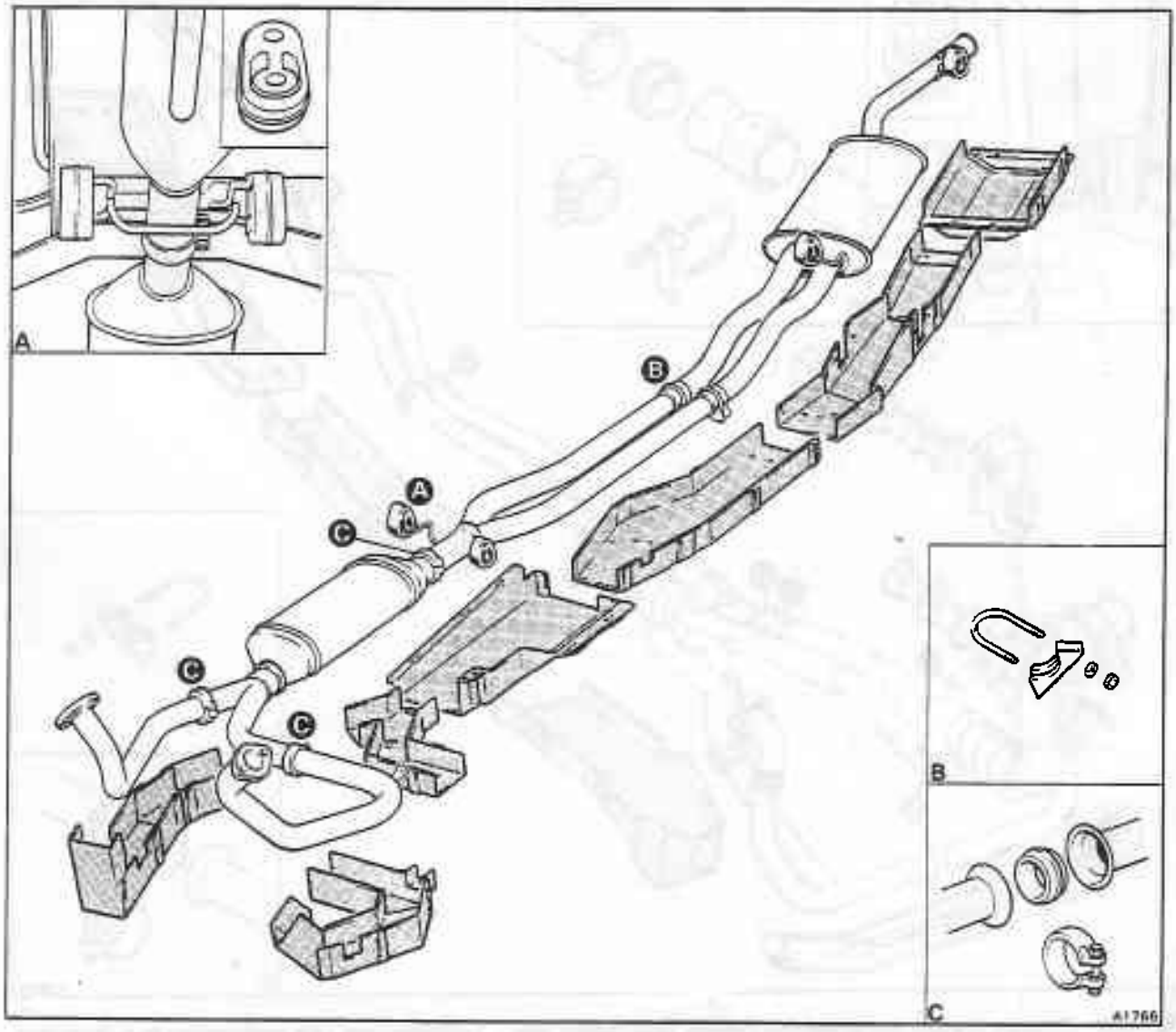


Fig. Q5-1 Exhaust system and grass-fire shields Naturally aspirated cars conforming to a Japanese specification

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

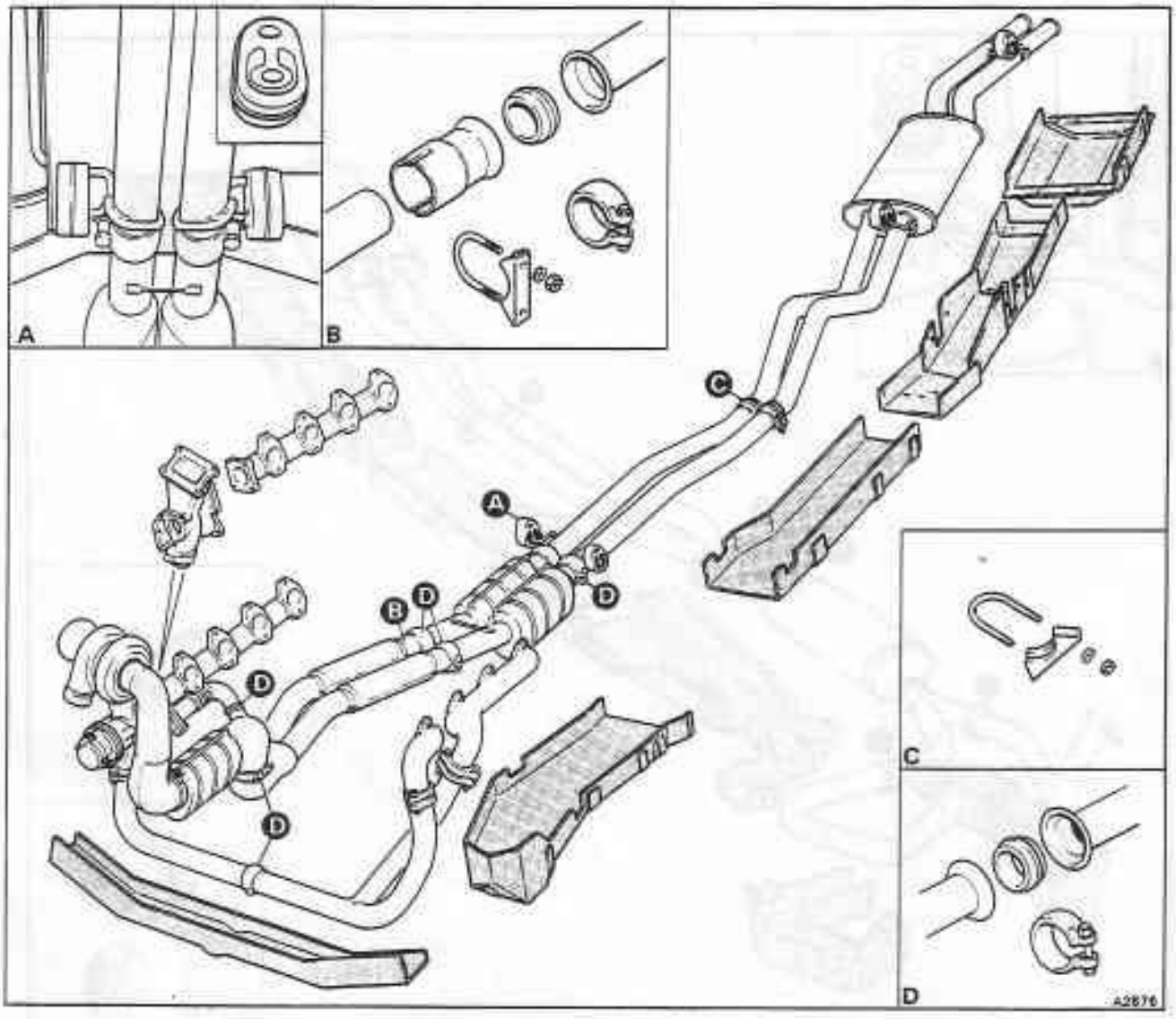


Fig. Q5-2 Exhaust system and grass-fire shields 1989 model year – Turbocharged cars conforming to a Japanese specification Inset B Running change

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.

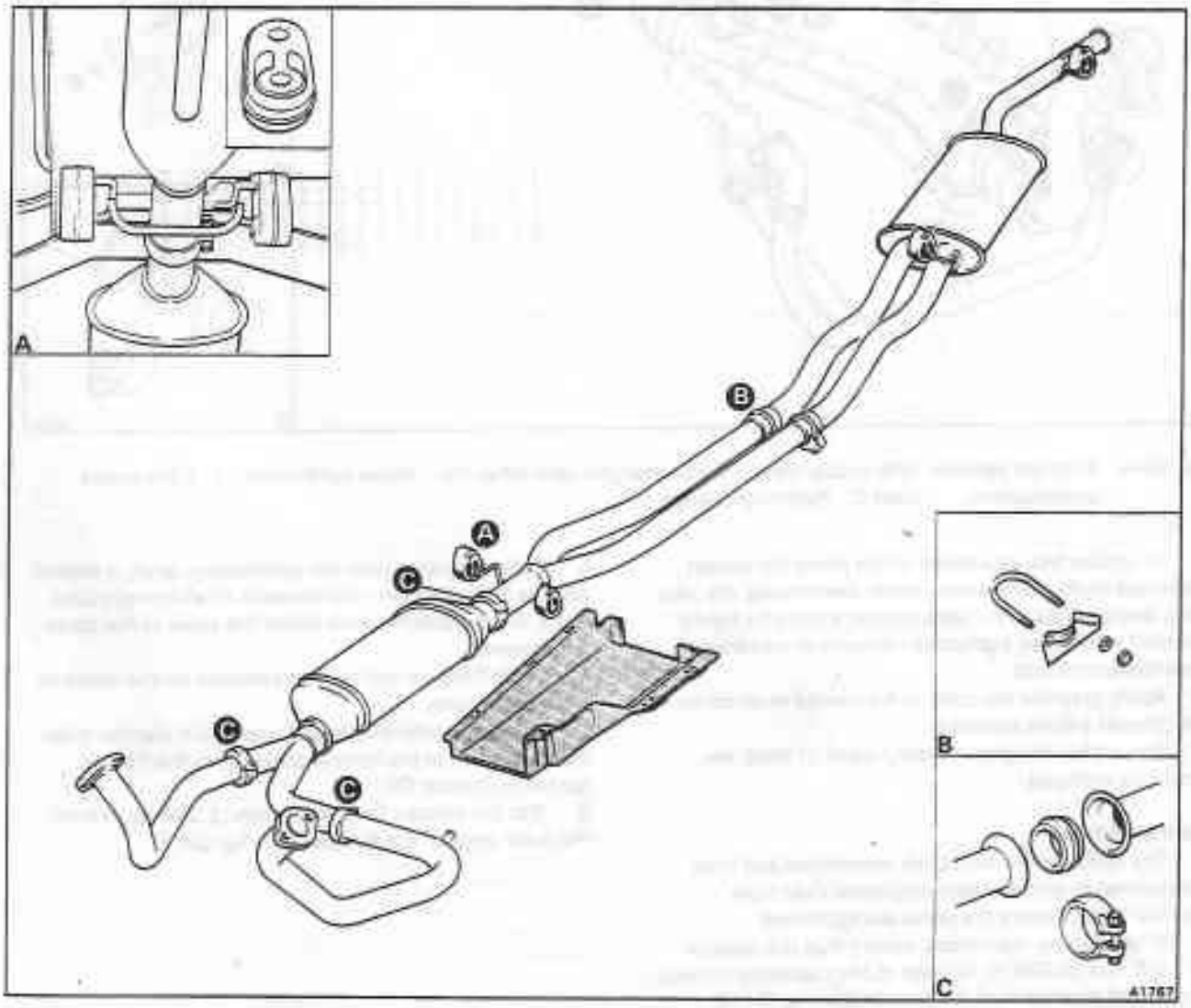


Fig. Q5-3 Exhaust system and grass-fire shield Naturally aspirated cars other than those conforming to a Japanese specification

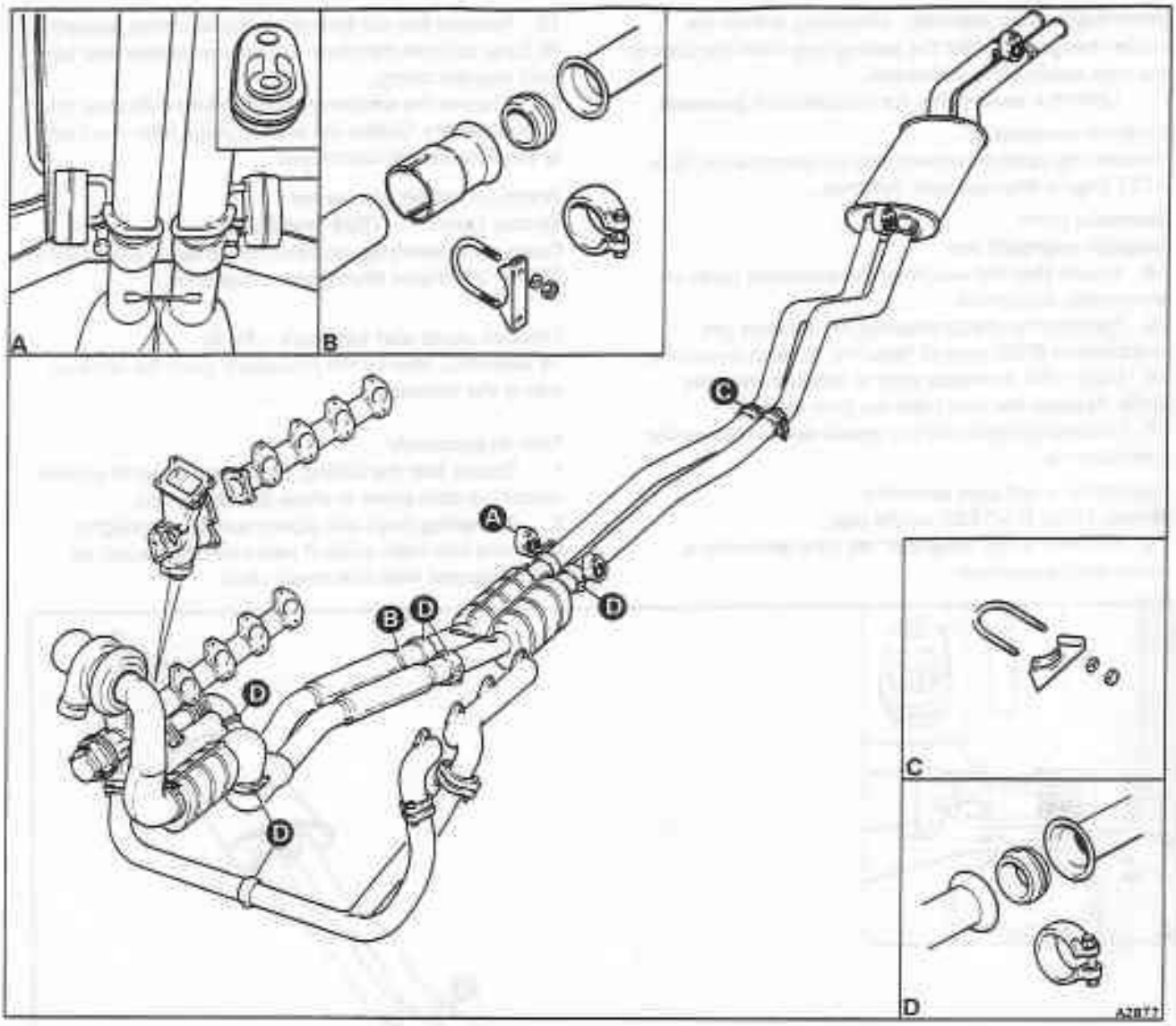


Fig. Q5-4 Exhaust system 1989 model year – Turbocharged cars other than those conforming to a Japanese specification Inset B Running change

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.

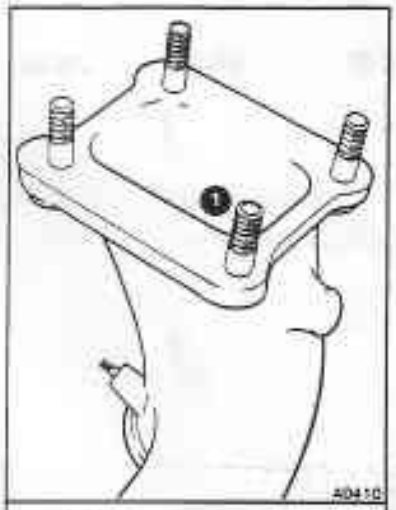
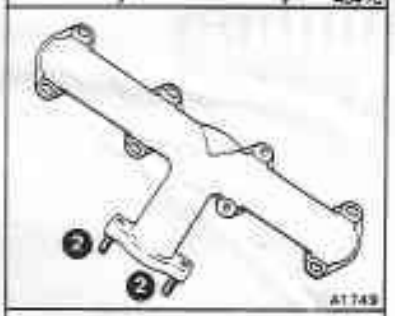
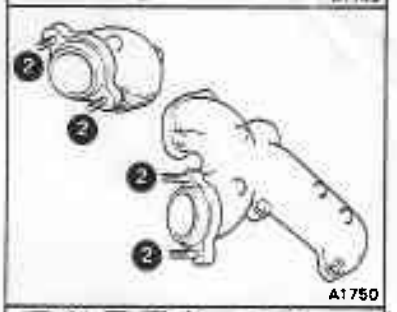
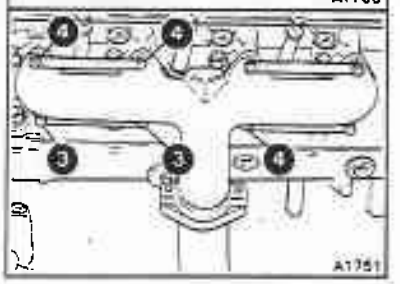
5. Torque tighten the Hymatic spherical clamps (with the clamp bolt in the vertical position) to the figures quoted in Section Q6.
6. Set the tailpipe finisher 60 mm (2.364 in) in from the outer edge of the bumper (see fig. Q4-5).

Special torque tightening figures

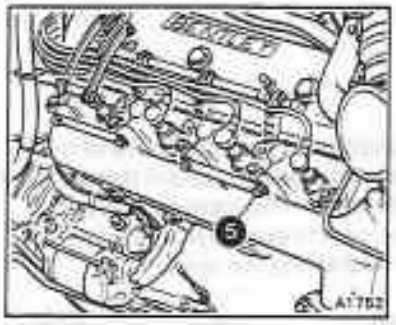
Introduction
This section contains the special torque tightening figures applicable to Chapter Q.

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.

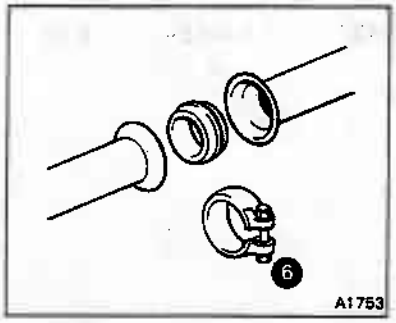
Section Q3	Ref.	Component	Nm	kgf m	lbf ft
	1	Turbocharger assembly to exhaust manifold — stud 4 off	11-13	1,2-1,3	8-10
	2	Downtake pipe to exhaust manifold — studs Naturally aspirated engines	11-13	1,2-1,3	8-10
		Turbocharged engines			
	3	Exhaust manifold — setscrews 2 off (A3 and A4 lower) Naturally 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



Ref.	Component	Nm	kgf m	lbf ft
6	Hymatic clamp — nut	25-27	2,5-2,7	18-20

Wheels and Tyres

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Issue record sheet

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

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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).

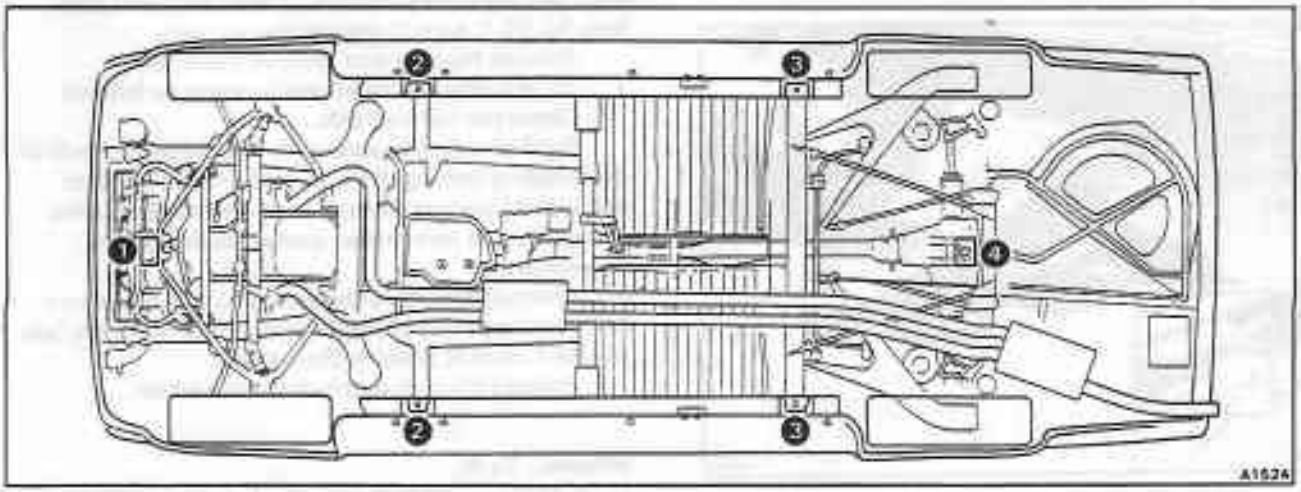


Fig. R2-1 Car jacking positions
1 Front jacking point using a trolley jack
2 Front jacking points using the car jack
3 Rear jacking points using the car jack
4 Rear jacking point using a trolley jack

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.

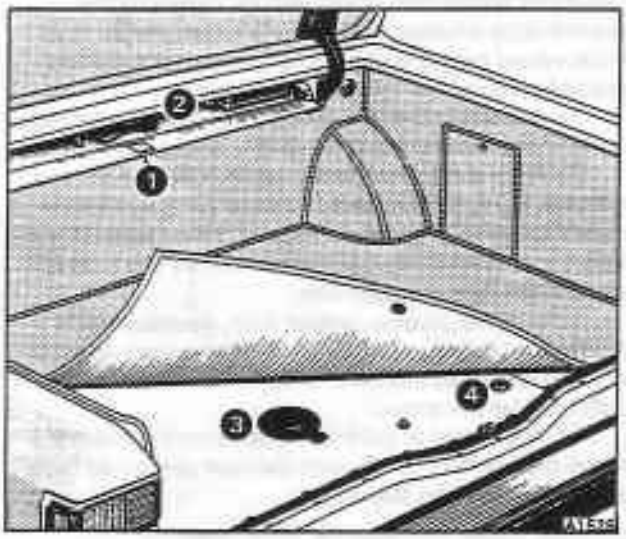


Fig. R2-2 Luggage compartment

1 Location of key and wheel trim removal tool
2 Tools stowage area
3 Rubber plug
4 Lowering bolt for spare wheel carrier

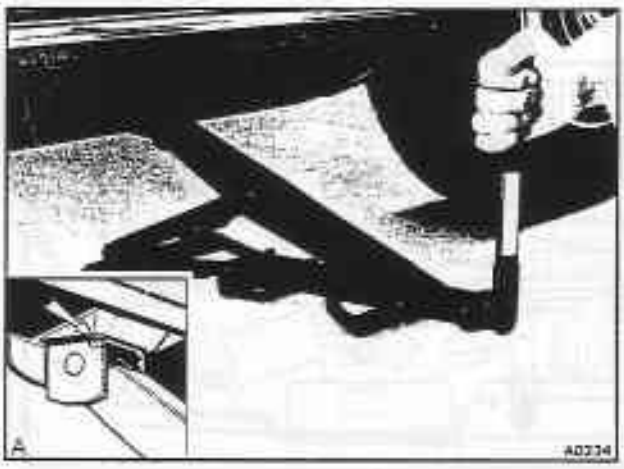


Fig. R2-3 Car jack correctly positioned

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.

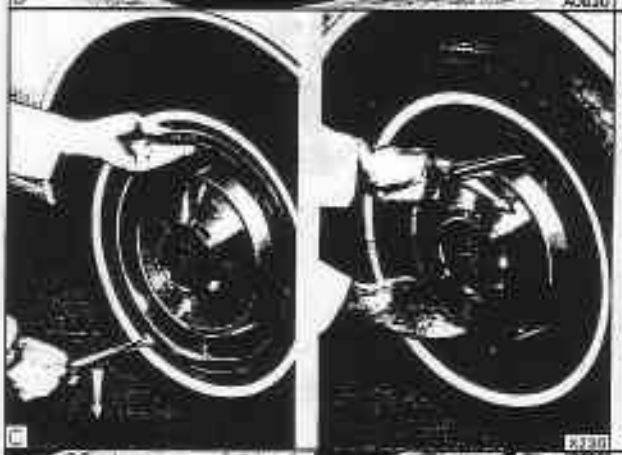
One-piece wheel trim

Prior to 1989 model year
Rolls-Royce Silver Spirit
Bentley Eight

1989 model year
Rolls-Royce Silver Spirit

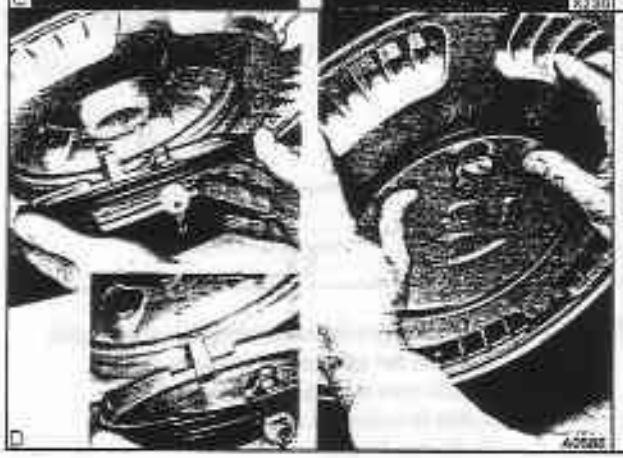
One-piece wheel trim

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

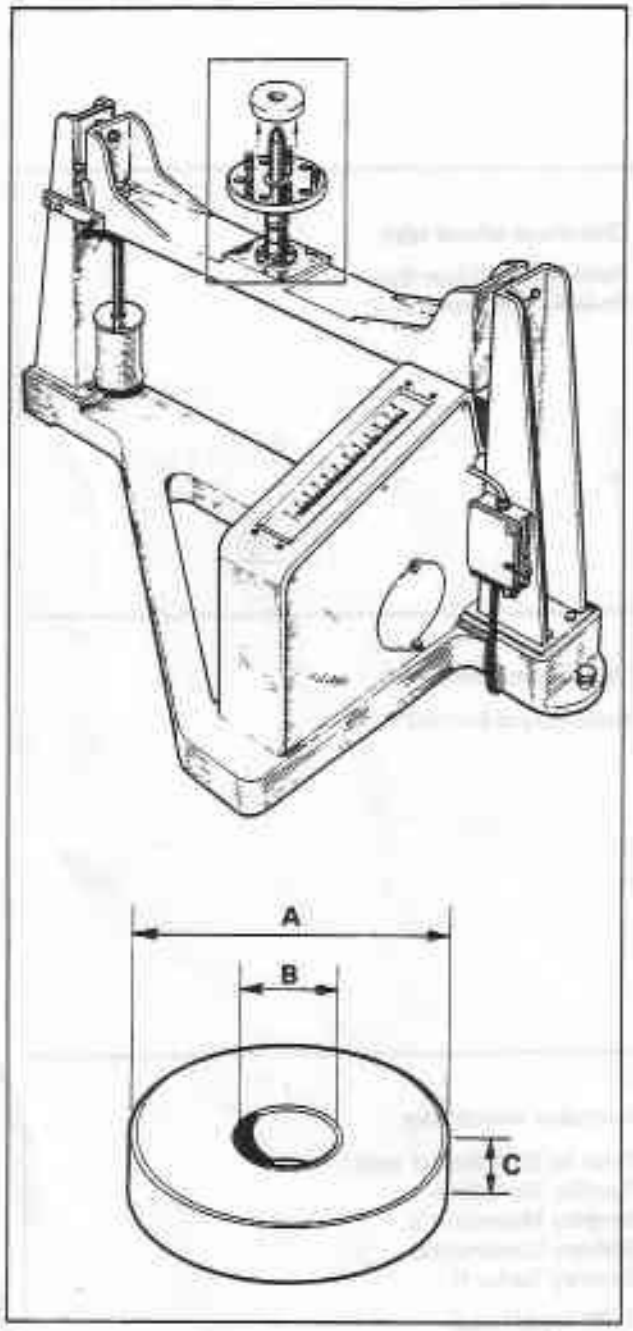


Fig. R2-5 Horizontal type of balancing machine with adapter for spigotted wheels

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)

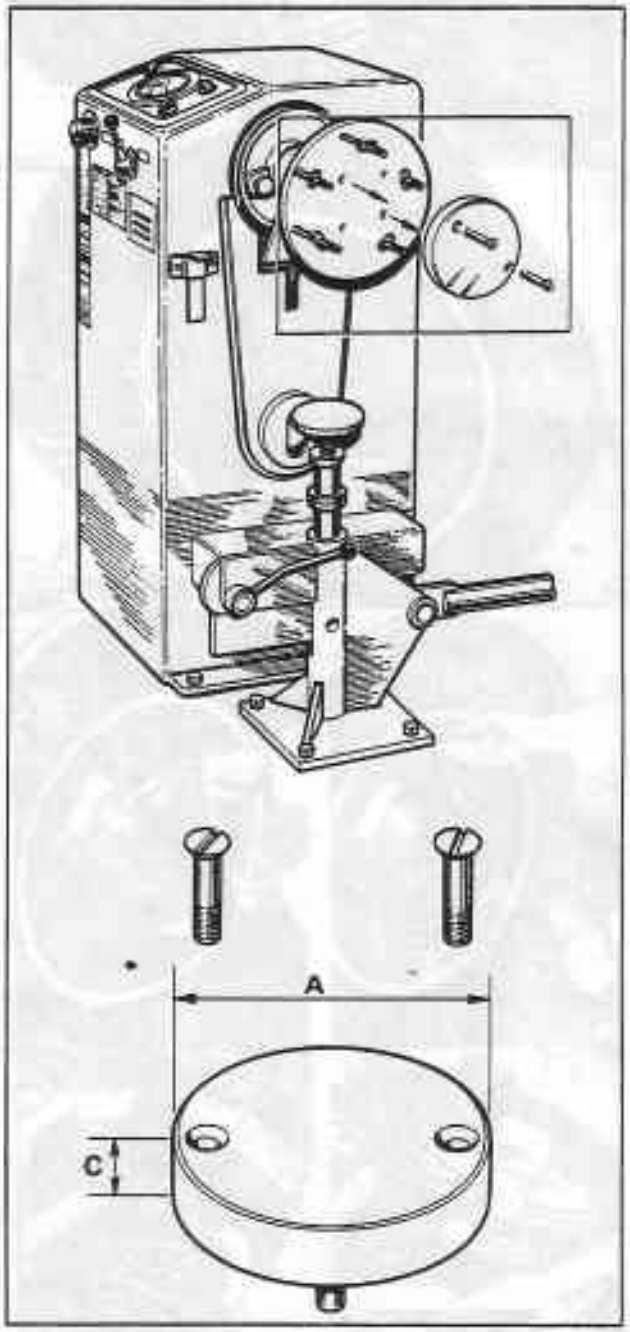


Fig. R2-6 Vertical type of balancing machine with adapter for spigotted wheels

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

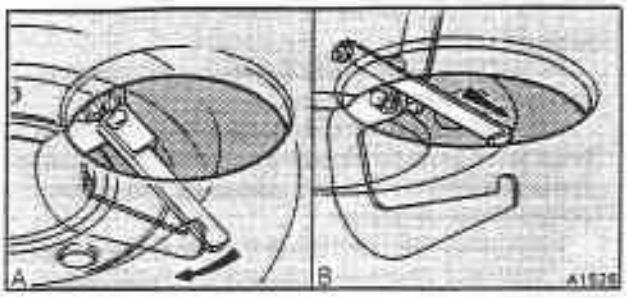


Fig. R2-7 Spare wheel retainers

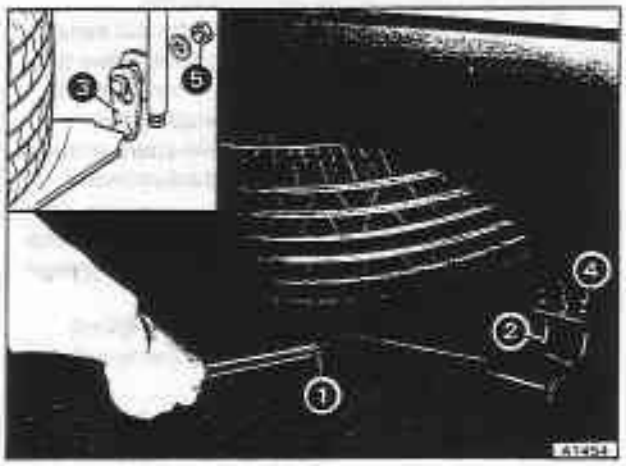


Fig. R2-8 Lowering the spare wheel and carrier adjustment

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.

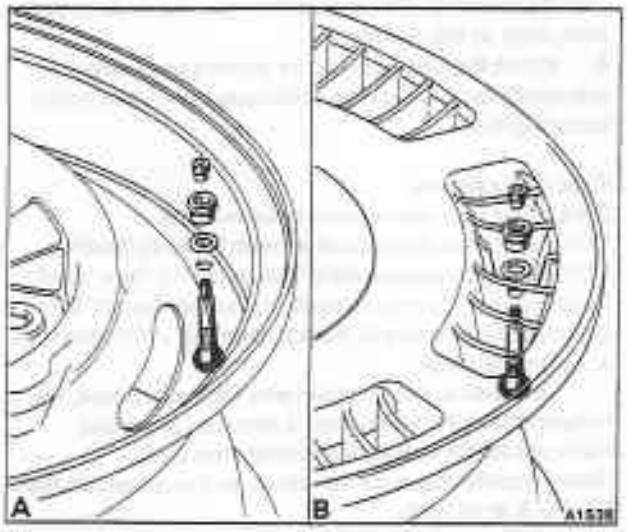


Fig. R3-1 Clamp-in tyre valves

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,

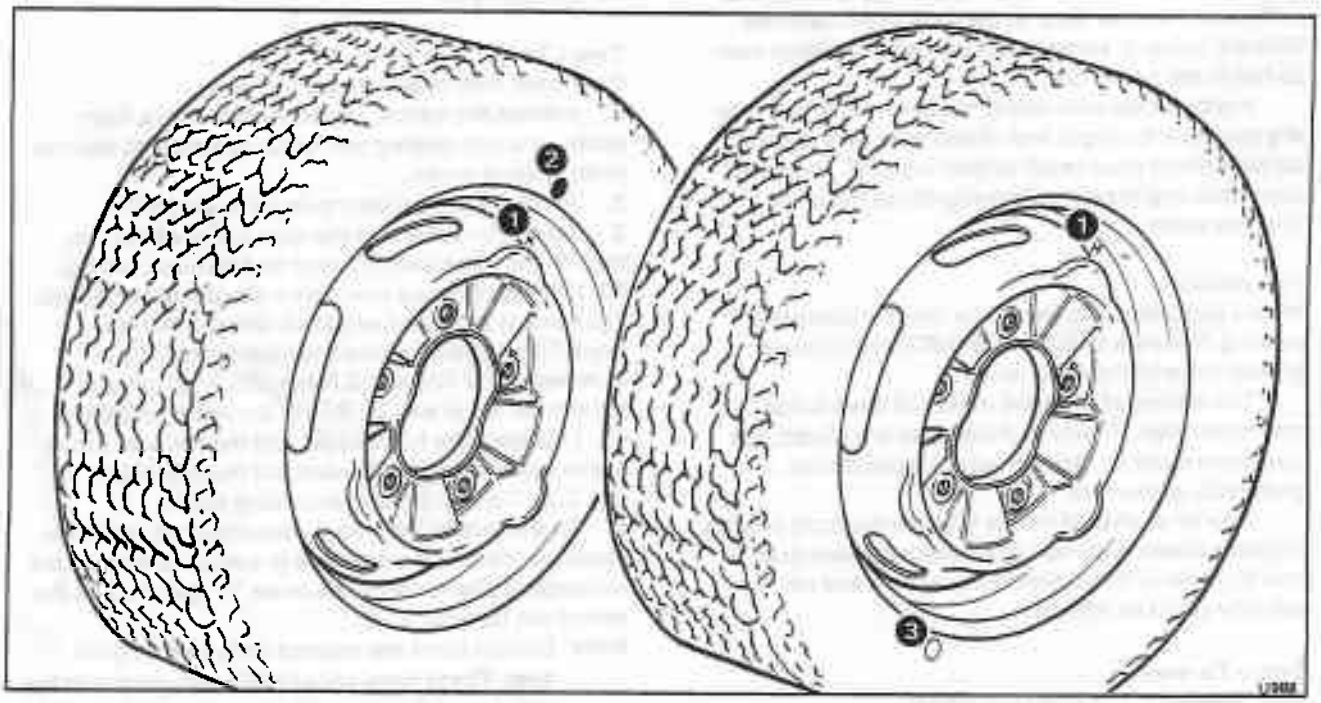


Fig. R3-2 Wheel and tyre alignment markings
1 'H' marking
2 Green spot marking
3 White spot marking

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/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.

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.

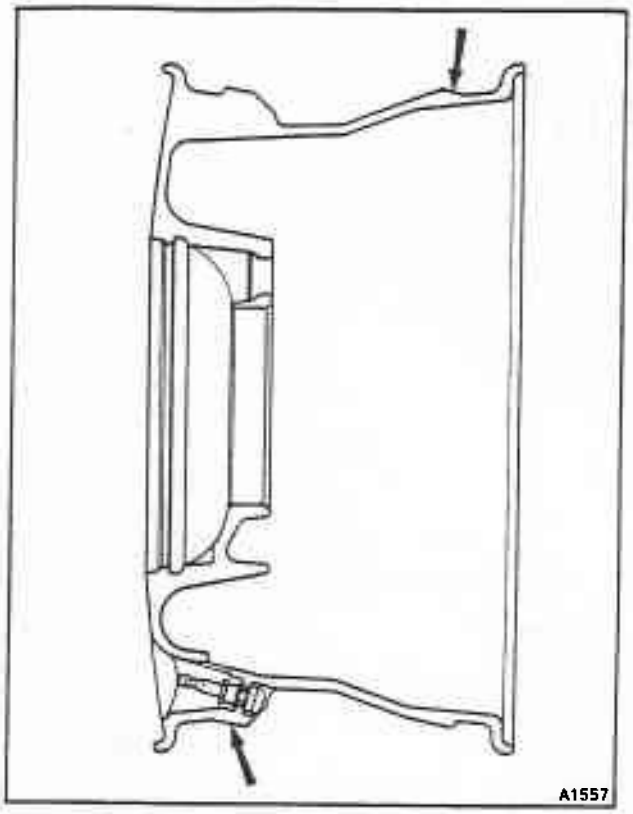


Fig. R3-3 Sectional view of Bentley Turbo R wheel

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/in²) Rear 2,0 bar (28 lbf/in²) Sustained speeds in excess of 180 km/h (110 mile/h) Front 2,1 bar (30 lbf/in²) Rear 2,4 bar (34 lbf/in²)
	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/in²) Rear 1,9 bar (190 kPa, 27 lbf/in²) Sustained speeds in excess of 140 km/h (87 mile/h) Front 2,2 bar (220 kPa, 32 lbf/in²) Rear 2,4 bar (240 kPa, 34 lbf/in²)
	Cars conforming to a North American specification	Up to four occupants and 46 kg (100 lb) of luggage	Front 1,7 bar (24 lbf/in²) Rear 2,0 bar (28 lbf/in²)
		Up to five occupants and 135 kg (300 lb) of luggage	Front 1,8 bar (26 lbf/in²) Rear 2,2 bar (32 lbf/in²)

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/in²) Rear 2,0 bar (28 lbf/in²) Sustained speeds in excess of 180 km/h (110 mile/h) Front 2,1 bar (30 lbf/in²) Rear 2,4 bar (34 lbf/in²)
	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/in²) Rear 2,0 bar (28 lbf/in²)
		Up to four occupants and 115 kg (250 lb) of luggage	Front 1,8 bar (26 lbf/in²) Rear 2,2 bar (32 lbf/in²)

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/in²) Rear 2,1 bar (30 lbf/in²) Sustained speeds in excess of 180 km/h (110 mile/h) Front 2,1 bar (30 lbf/in²) Rear 2,5 bar (36 lbf/in²)
	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/in²) Rear 1,9 bar (190 kPa, 27 lbf/in²) Sustained speeds in excess of 140 km/h (87 mile/h) Front 2,2 bar (220 kPa, 32 lbf/in²) Rear 2,4 bar (240 kPa, 34 lbf/in²)
	Cars conforming to a North American specification	Up to four occupants and 46 kg (100 lb) of luggage	Front 1,7 bar (24 lbf/in²) Rear 2,0 bar (28 lbf/in²)
		Up to five occupants and 135 kg (300 lb) of luggage	Front 1,8 bar (26 lbf/in²) Rear 2,2 bar (32 lbf/in²)

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/in²) Rear 2,1 bar (30 lbf/in²) Sustained speeds in excess of 180 km/h (110 mile/h) Front 2,1 bar (30 lbf/in²) Rear 2,5 bar (36 lbf/in²)
	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/in²) Rear 2,0 bar (28 lbf/in²)
		Up to four occupants and 115 kg (250 lb) of luggage	Front 1,8 bar (26 lbf/in²) Rear 2,2 bar (32 lbf/in²)

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/in²) Rear 2,6 bar (260 kPa, 37 lbf/in²) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,1 bar (210 kPa, 30 lbf/in²) Rear 2,6 bar (260 kPa, 37 lbf/in²)
		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/in²) Rear 2,6 bar (260 kPa, 37 lbf/in²) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,3 bar (230 kPa, 33 lbf/in²) Rear 3,1 bar (310 kPa, 44 lbf/in²)
	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/in²) Rear 2,6 bar (37 lbf/in²) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,1 bar (30 lbf/in²) Rear 2,6 bar (37 lbf/in²)
		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/in²) Rear 2,6 bar (37 lbf/in²) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,5 bar (36 lbf/in²) Rear 3,3 bar (48 lbf/in²)
	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/in²) Rear 2,6 bar (37 lbf/in²) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,1 bar (30 lbf/in²) Rear 2,6 bar (37 lbf/in²)
		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/in²) Rear 2,6 bar (37 lbf/in²) Sustained speeds in excess of 210 km/h (130 mile/h) Front 2,3 bar (33 lbf/in²) Rear 3,1 bar (44 lbf/in²)

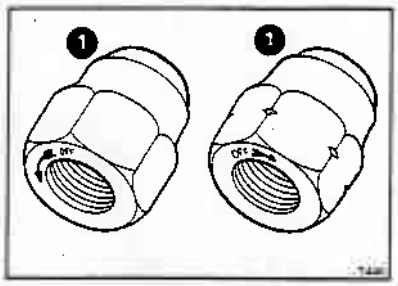
Special torque tightening figures

Introduction
This section contains the special torque tightening figures applicable to Chapter R.

For standard torque tightening figures refer to Chapter P.

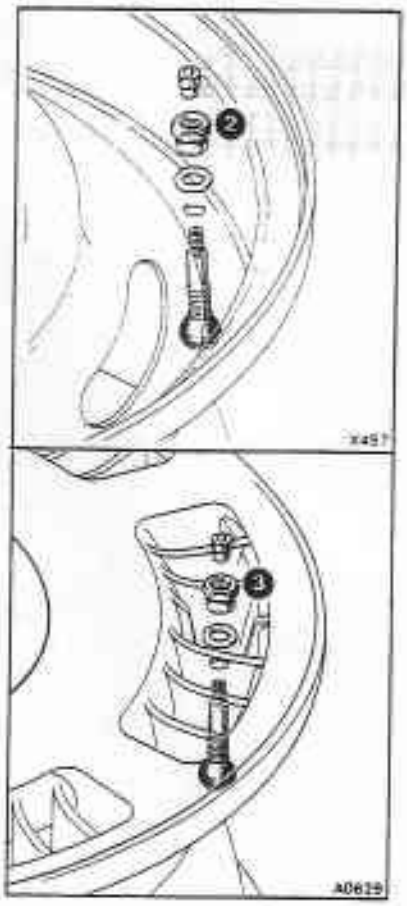
Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

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