

CHAPTER 8

PROPELLER SHAFT, REAR AXLE AND REAR SUSPENSION

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8:1 Description

The layout of the independent rear suspension, rear axle and drive shafts is shown in **FIG 8:1**. The main suspension crossmember and the differential carrier assembly are attached to the underbody by rubber cushioned mountings. The trailing arms are attached to the crossmember by means of rubber bushed pivots. The suspension struts which control vertical suspension travel consist of coil springs controlled by double acting hydraulic dampers. On some models, an anti-roll bar is fitted between the trailing arms (see **Section 8:7**).

Power is transmitted from the transmission output shaft to the differential unit pinion shaft by a two-piece propeller shaft provided with universal joints and an intermediate ballbearing attached to the underbody by a flexible rubber mounting. The front end of the propeller shaft is provided with a rubber coupling to cushion the drive.

Power is transmitted from the differential assembly to the rear wheels by drive shafts having flanged connections to the differential side gears and stub axles. On some models, a limited slip differential assembly is available as an optional extra.

The items of maintenance and overhaul which can be carried out by a reasonably competent owner/mechanic are given in this chapter, but it is not advised that any further operations be attempted. Special tools and equipment are essential to overhaul the differential components and set the necessary preloads, so, for this reason, the components should be dismantled and serviced only by a BMW service station having the necessary special equipment and trained personnel.

8:2 Routine maintenance

Checking of the oil level in the differential carrier and periodic changing of the oil should be carried out at the intervals specified in the manufacturer's service schedule. To check the oil level, make sure that the vehicle is standing on level ground, then remove the combined filler and level plug from the differential carrier. If necessary, add an approved grade of oil through the hole until the level is at the bottom of the hole. Allow excess oil to drain away fully, then refit the plug. To drain the oil, remove the filler and level plug and also the drain plug beneath the differential carrier. Allow the old oil to drain

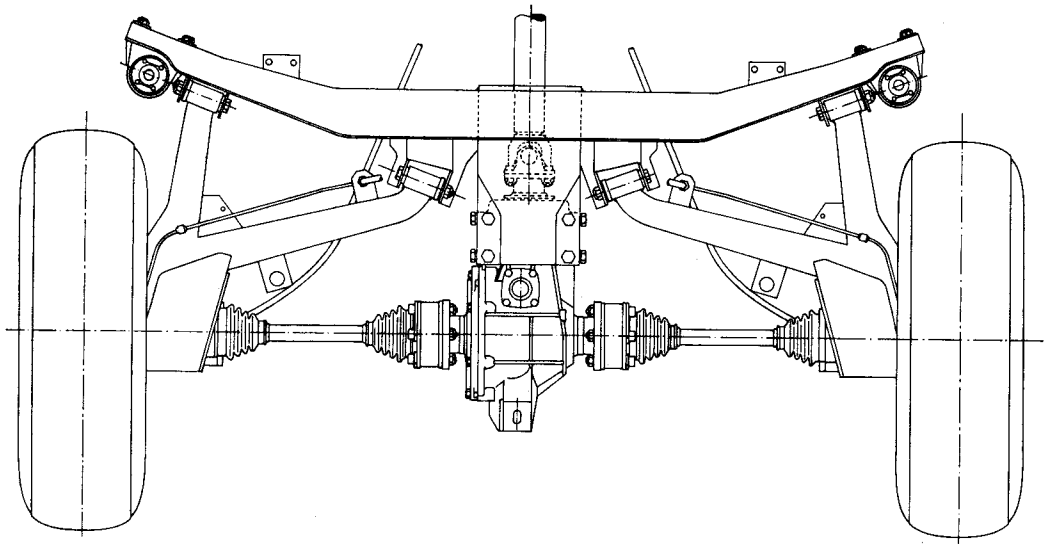


FIG 8:1 Layout of rear suspension, rear axle and drive shafts

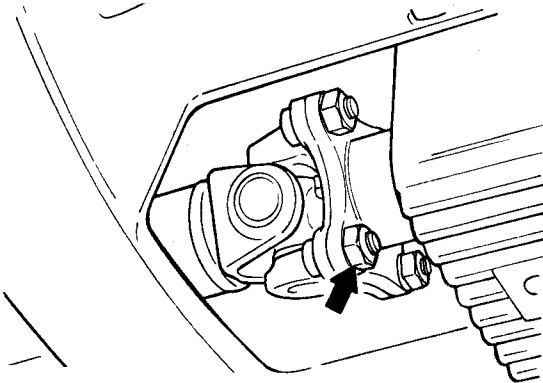


FIG 8:2 Propeller shaft to differential flange connection

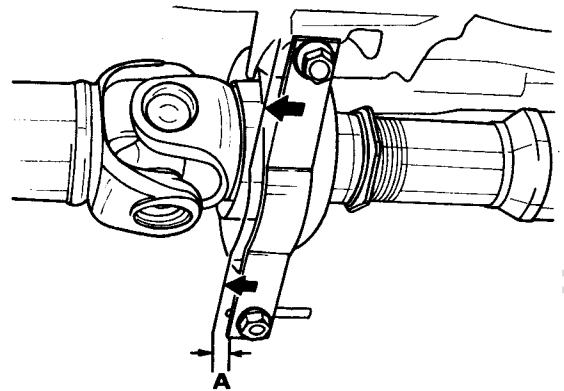


FIG 8:4 Centre bearing attachments

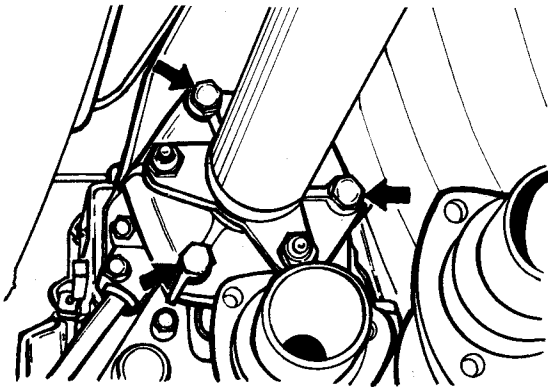


FIG 8:3 Disconnecting propeller shaft at rubber coupling

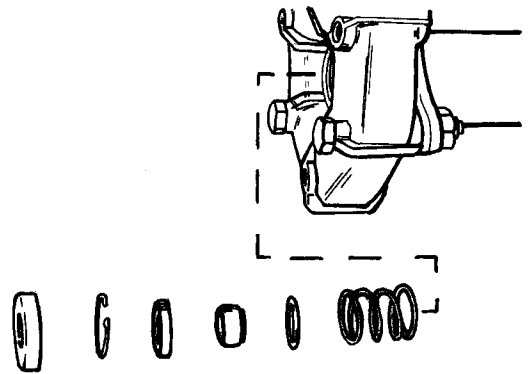


FIG 8:5 Locating ring assembly

fully into a suitable container, then refit the drain plug and add new oil to the correct level as described previously.

8:3 Propeller shaft

Removal:

Remove the rear exhaust pipes and silencers to gain the necessary access to the propeller shaft. Disconnect the rear end of the propeller shaft from the differential flange as shown in **FIG 8:2**. Disconnect the front end of the propeller shaft from the transmission output shaft by disconnecting the rubber coupling at the points arrowed in **FIG 8:3**. Do not remove the rubber coupling from the propeller shaft unless it is to be renewed, as it is pre-tensioned and therefore may be difficult to refit correctly. Refer to **FIG 8:4** and remove the two nuts to detach the centre bearing from the underbody. Bend the propeller shaft downwards at the centre and remove from beneath the car. If the propeller shaft is defective in any way it must be renewed complete, as the front and rear parts are matched and balanced as an assembly.

Locating ring and rubber coupling:

To remove the locating ring, refer to **FIG 8:5** and press off the sealing cap. Remove the circlip then extract ball cup, locating ring, washer and spring. Refitting is a reversal of the removal procedure, packing the locating unit with approximately 6g (0.212oz) of Molykote Longterm 2.

To renew the rubber coupling, remove the fixing bolts and discard the old unit. New rubber couplings are supplied complete with a tensioning strap to retain the unit suitably compressed for installation (see **FIG 8:6**). Install the unit and tighten the fixing bolts to the specified torque, then carefully cut free the strap and discard.

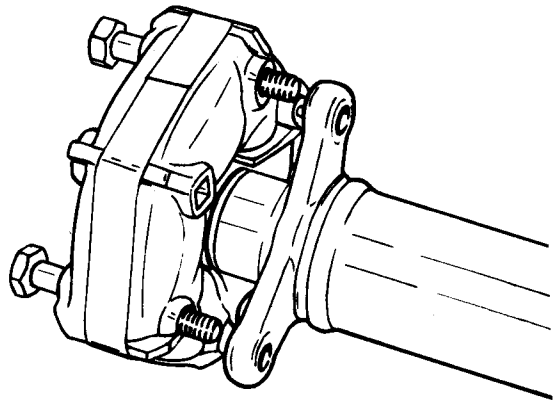


FIG 8:6 Renewing rubber coupling

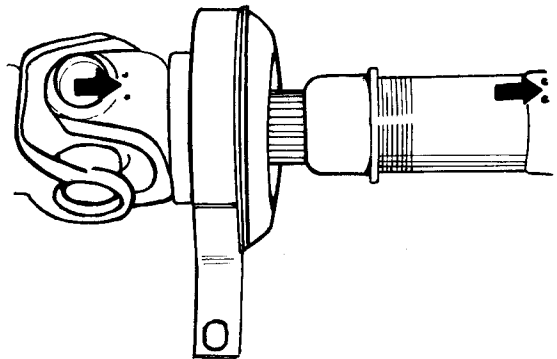


FIG 8:7 Marking propeller shaft for correct reassembly

Centre bearing assembly:

Before removing the centre bearing, mark the two parts of the propeller shaft as shown by the arrows in **FIG 8:7**, so that the original balance of the assembly can be retained when the parts are reassembled. Slacken the screw bush and pull the shaft from the splines.

Refer to **FIG 8:8** and remove the circlip and dust cap. Press the bearing support from the propeller shaft, then press the bearing from the support as shown in **FIG 8:9**. Check the bearing for wear or damage and renew if necessary. Reassemble in the reverse order of dismantling, smearing the mounting socket for the ballbearing with plain water before pressing the bearing into place.

Refitting:

This is a reversal of the removal procedure, tightening the component fixings to the specified torque figures. When installing the central bearing support bracket, refer to **FIG 8:4** and press the assembly 2mm (0.079in) in the direction of the arrows and hold in this position while firmly tightening the mounting nuts. To prevent strain on the rubber coupling, tighten the nuts only, holding the bolts against rotation with a second spanner.

8:4 Drive shafts

Note that drive shafts must not be deflected beyond an angle of 18° or damage to the universal joints may

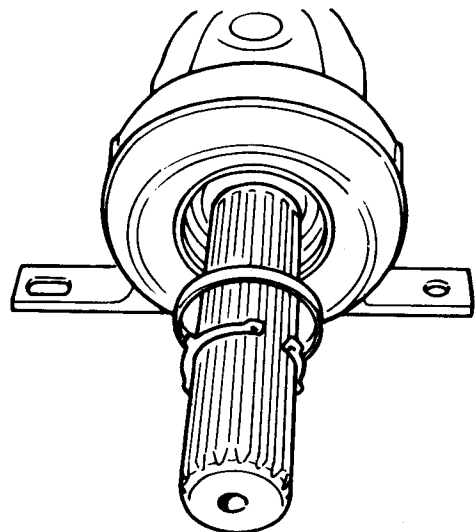


FIG 8:8 Removing circlip and dust cap

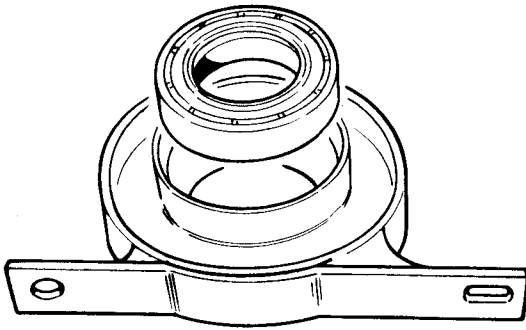


FIG 8:9 Centre bearing removal

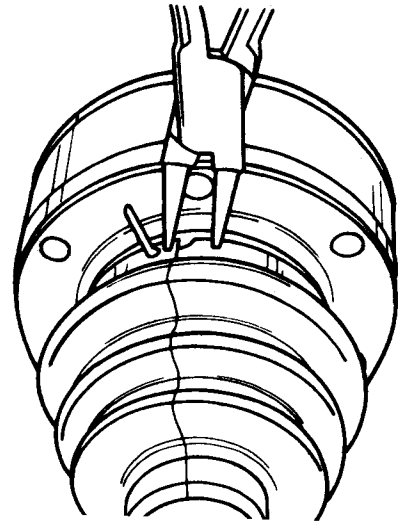


FIG 8:12 Tightening retaining clip

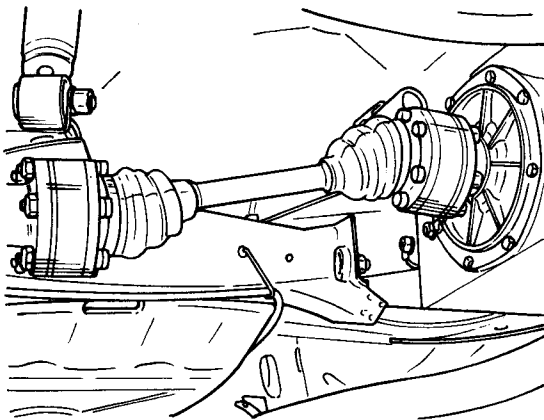


FIG 8:10 Drive shaft installation

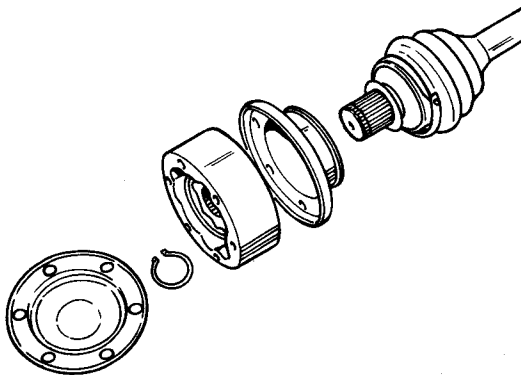


FIG 8:11 Drive shaft components

occur. To prevent this, always make sure that the drive shaft is properly supported when disconnected at either end.

Removal:

Raise and safely support the rear of the car on floor stands. Refer to FIG 8:10 and remove the bolts securing the drive shaft flanges to the differential and stub axle flanges. Carefully remove the drive shaft from beneath the car.

Examine the drive shaft for wear or damage. If the rubber gaiter is damaged in any way, it must be renewed without delay otherwise the ingress of dirt and grit will cause rapid wear of the universal joint. If the shaft or either of the universal joints are faulty in any way, components must be renewed as necessary.

Renewing rubber gaiter:

Refer to FIG 8:11. Tap off the sealing cover then remove the circlip. Remove the gaiter securing clip then press off the universal joint and pull off the gaiter. Note that the axial clamp ring which fits over the drive shaft splines is installed with the internal dishing towards the universal joint.

Discard the old gaiter and retaining clips and thoroughly degrease the remaining parts. Pack the universal joint and inside of gaiter with 120g (4.2oz) of approved grease. Clean all traces of grease from the gaiter sealing surface and the universal joint flange. Smear the gaiter sealing surface with sealing compound EC750M-2G51 or similar. To facilitate tightening of the new retaining clips, drill two holes 2mm (0.078in) in diameter so that the ends of the clip can be squeezed together with circlip pliers as shown in FIG 8:12. Bend the tab to secure the clip.

Refitting:

Refit the drive shaft in the reverse order of removal, tightening the fixing bolts alternately and evenly to the specified torque.

8:5 Stub axles and wheel bearings

Removal:

Raise the rear of the car and support safely on floor stands. Remove the road wheel. Refer to **Section 8:4** and detach the outer end of the drive shaft from the stub axle flange. Tie the end of the drive shaft away from the work area so that the universal joint is not strained. Refer to **FIG 8:13** and lift out the locking plate, remove the flanged nut and pull off the drive flange.

On models fitted with disc rear brakes, detach the caliper without disconnecting the fluid pipe and support safely by wiring to the suspension. On models fitted with drum brakes, remove the brake drum. Detailed instructions concerning brake system components are given in **Chapter 11**.

To remove the stub axle, refer to **FIG 8:14**. Screw the flanged nut back on to the axle until it is flush with the end to protect the threads, then drive out the stub axle using a soft-faced hammer. Remove the nut and detach the stub axle completely. Check the stub axle spacer ring shown arrowed in **FIG 8:15** for wear or damage and renew if necessary.

If the wheel bearings are to be removed, take great care to avoid dirt or oil contamination of brake system components. **FIG 8:16** shows a section through the wheel hub and bearings. Use a suitable drift to drive out the outer bearing and seal, working evenly around the circumference to prevent jamming. Remove the spacer sleeve, then drive out the inner bearing and seal in a similar manner. Remove the spacer ring indicated by measurement **C**. Carefully degrease hub, bearings and spacer components. Discard the seals. Both wheel bearings must be renewed if either is found worn or damaged, but note the recommendation that bearings are renewed regardless of apparent condition at approximately 60,000 mile (100,000km) intervals. Only use replacement bearings which are marked C3 on the outer race.

Refitting:

When installing wheel bearings, the required thickness **C** for the inner bearing spacer must be determined, and a spacer of the correct thickness installed (see **FIG 8:16**). Drive the outer bearing fully into place first, then determine distance between bearing and hub shoulder, as shown at **B** in **FIG 8:17**. The length of the spacer sleeve must now be measured to determine length **A**, as shown in **FIG 8:18**. The difference between the two measurements must now be calculated and a standard figure **D** of 0.1mm (0.004in) deducted from the result to give required thickness **C**. Measurement **D** is deducted to give the required hub end float of 0.05 to 0.10mm (0.002 to 0.004in).

For example, if **A** equals 63.5mm (2.5in) and **B** equals 58.6mm (2.307in), the difference of 4.9mm (0.192in) less measurement **D** of 0.1mm (0.004in) will give a required spacer thickness **C** of 4.8mm (0.188in).

Remove the outer wheel bearing again. Pack each wheel bearing with 35g (1.2oz) of approved grease, then install outer bearing, spacer sleeve, spacer ring of correct thickness and inner bearing. Note that the space between each wheel bearing and grease seal must be free of grease, but that the space between the lips of each

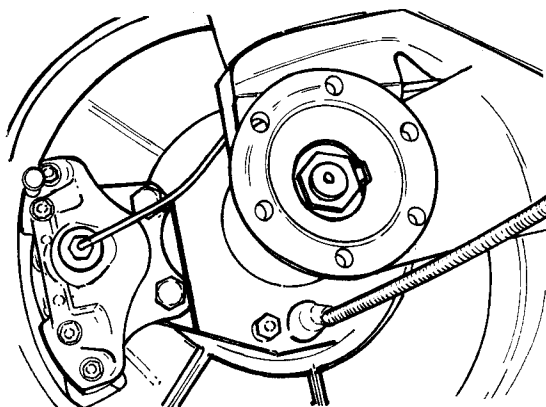


FIG 8:13 Drive flange retaining nut and locking plate

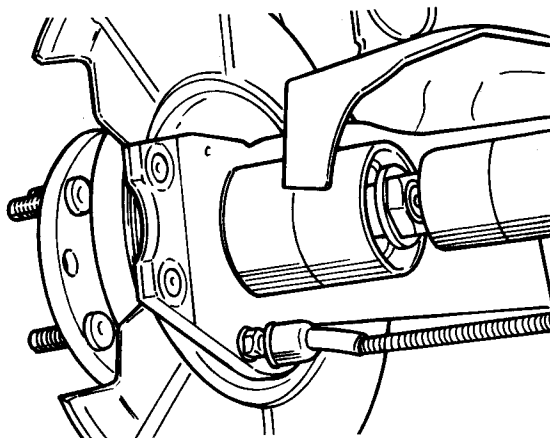


FIG 8:14 Stub axle removal

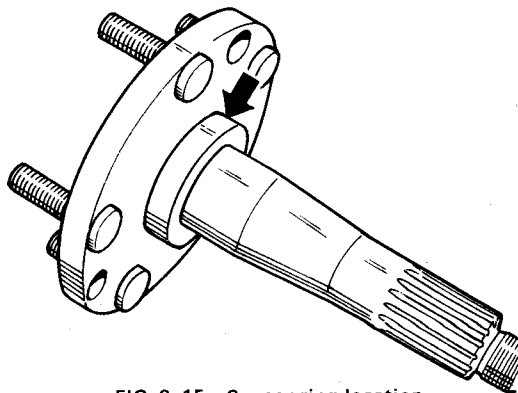


FIG 8:15 Spacer ring location

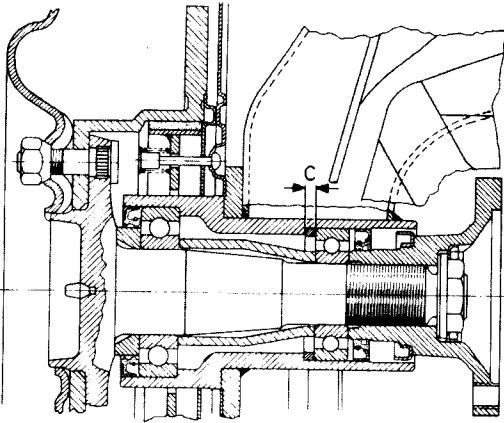


FIG 8:16 Section through wheel hub and bearings

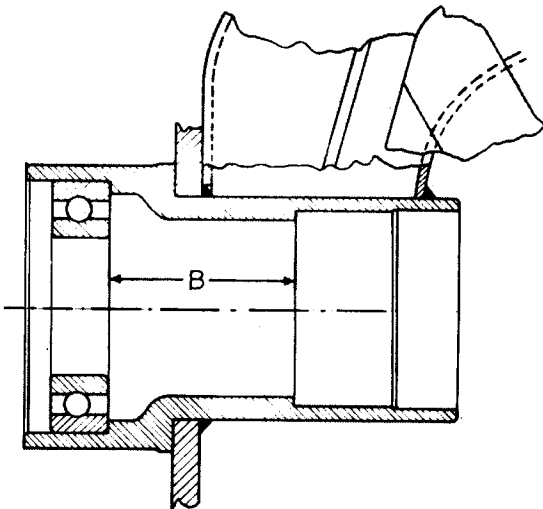


FIG 8:17 Distance between outer bearing and hub shoulder

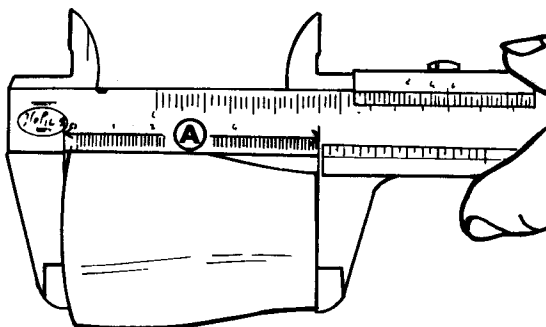


FIG 8:18 Measuring length of spacer sleeve

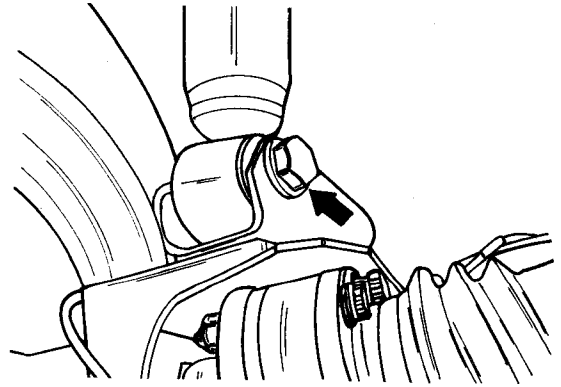


FIG 8:19 Suspension strut lower mounting bolt

seal should be packed with approved grease. Install the new seals, driving them fully and squarely home. Take care to avoid grease contamination of braking system components.

Refit the stub axle, taking care not to displace the bearings and seals. Correct locations of bearings are finalised when the drive flange is secured to the stub axle. Fit the drive flange, taking care not to damage the seal, then tighten the flanged nut to the specified torque. Tighten the nut a fraction further if necessary to ensure correct alignment of locking plate, then fit locking plate over nut and into drive flange groove (see FIG 8:13). Refit braking system components as described in Chapter 11, then reconnect the drive shaft and install the road wheel.

8:6 Suspension struts

Either Nivomat self-levelling units or conventional coil spring and damper units may be fitted, it being possible to convert the former type to the latter specification if desired as described later in this section. Other modifications also described are the installation of additional damper rings and rubber discs to the suspension strut assemblies on older models to improve ride comfort.

Note that suspension strut assemblies must be renewed in pairs, never on one side of the car only. As several modifications have been introduced over the period of production, particularly to the suspension strut lower mounting, it is advisable to take the old units to the spares department so that they can be properly matched with the replacements.

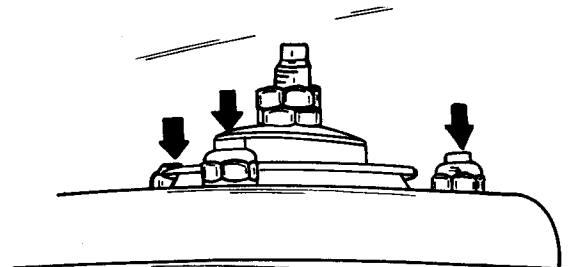


FIG 8:20 Suspension strut upper mounting nuts

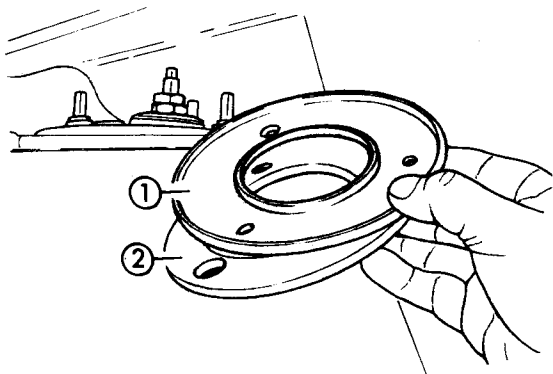


FIG 8:21 Cover ring 1 and damper plate 2

If faulty operation of Nivomat units is suspected, the car should be taken to a BMW service station so that their operation can be checked using special equipment.

Removal:

Raise the rear of the car and support the body safely on floor stands so that the suspension hangs free, then raise a suitable jack beneath the trailing arm to take the weight of the unit from the suspension strut assembly. The strut controls downward movement of the suspension, so if the strut is disconnected without support beneath the trailing arm, the resultant drive shaft deflection may be sufficient to damage the universal joints (see also **Section 8:4**).

Remove the nut from the bolt arrowed in **FIG 8:19**, then lower the trailing arm until the bolt can be released to disconnect the suspension strut from the bracket. Do not lower the trailing arm any further than necessary. From inside the luggage compartment, remove the three nuts arrowed in **FIG 8:20** to release the suspension strut upper centring bush from the wheelarch. On later versions, remove cover ring 1 and damper plate 2 as shown in **FIG 8:21**. Manoeuvre the lower end of the suspension strut from the trailing arm bracket and detach the unit from beneath the car.

Refitting:

This is a reversal of the removal procedure, making sure that the spacer rings, where fitted, are properly installed as shown by the arrows in **FIG 8:22**. The suspension strut must be installed so that the rubber protrusions on damper plate 3 face to the front and rear of the car respectively.

Dismantling:

Remove the suspension strut assembly as described previously. Note that it is essential to use compressor tool 6035 or similar when dismantling the unit. Never attempt to remove damper upper components without the use of such a tool.

Compress the coil spring with the special tool until it is clear of the upper damper plate (see **FIG 8:23**), then hold the lower nut on the damper rod with one spanner while slackening the locknut with a second spanner. Remove the nuts then detach the plate, damper plate

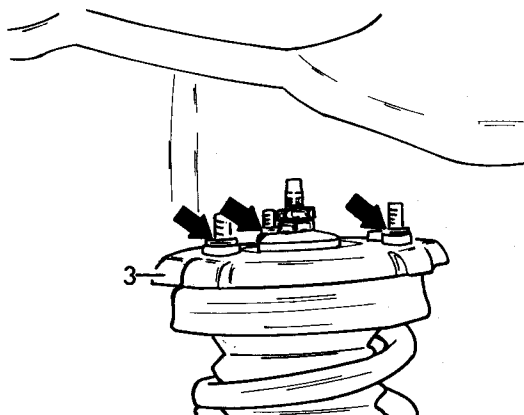


FIG 8:22 Spacer ring locations

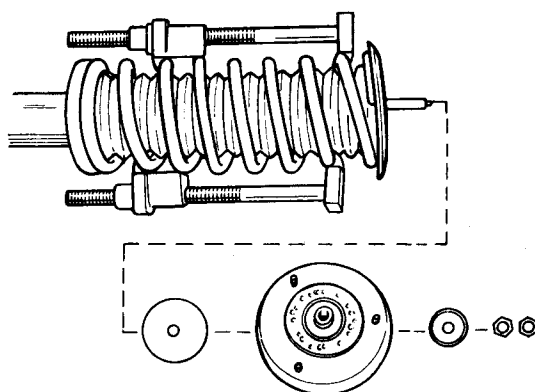


FIG 8:23 Compressing spring and removing damper upper components

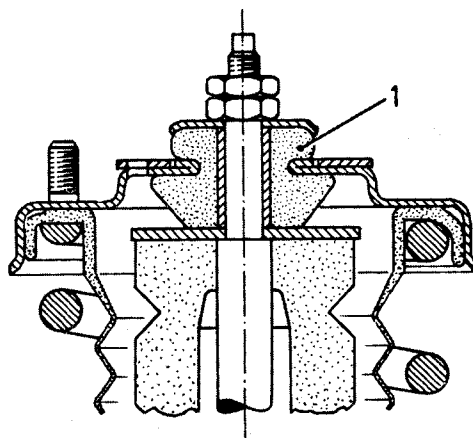


FIG 8:24 Rubber bush 1 on early models

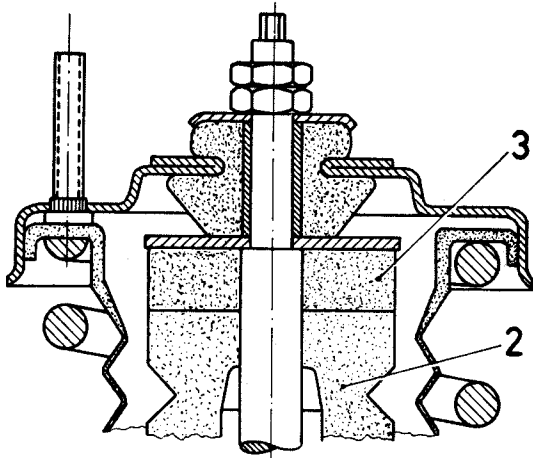


FIG 8:25 Additional rubber ring 3 above auxiliary spring 2 on later models

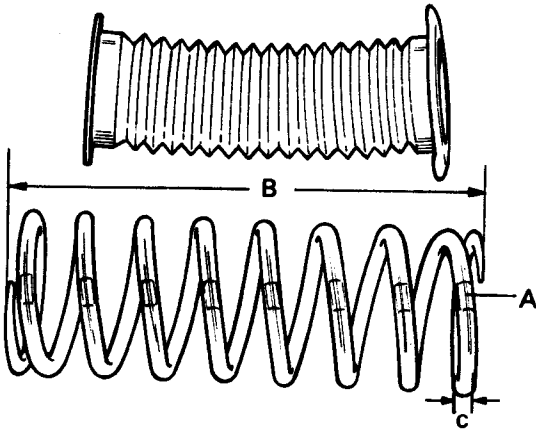


FIG 8:26 Checking coil spring specifications

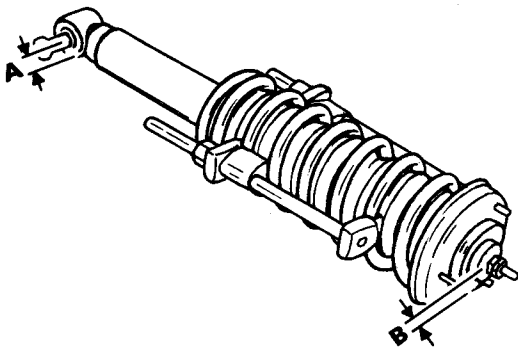


FIG 8:27 Suspension strut alignment

and supporting ring. Check the rubber bush in the damper plate and renew if damaged or perished. Rubber bush installation on early models is shown at 1 in FIG 8:24. Later models are fitted with an additional rubber disc 15mm (0.6in) thick, as shown at 3 in FIG 8:25, the disc being placed on top of auxiliary spring 2. The purpose of this additional disc is to provide additional stiffening of the suspension when the car is heavily laden. This disc can be subsequently fitted to earlier models not so equipped, if desired, without modifying any of the remaining parts.

Slacken the spring compressor until all spring pressure is released, then remove the coil spring and detach the inner rubber components. Replace any rubber component which is worn, perished or split. If a coil spring is to be renewed, the new spring must comply with the original in respect of identification mark **A**, overall length **B** and thickness **C** as shown in FIG 8:26. It is recommended that the rubber gaiter also shown in the illustration is renewed at the same time as the coil spring, regardless of its apparent condition.

Reassembly:

This is a reversal of the dismantling procedure. Before finally releasing the spring compressor, make sure that the suspension strut assembly is correctly aligned as shown in FIG 8:27. Dimension **A** must be the same on both sides and dimension **B** must be 43mm (1.6929in). Make sure that the locknut is firmly tightened against the upper securing nut. Remove the spring compressor tool, then refit the assembly to the vehicle as described previously.

Installation of later type damper rings:

The later type damper rings may be fitted to earlier models not so equipped, if desired. To do this, remove each strut assembly in turn, compress the coil spring and remove the upper damper plate and rubber gaiter all as described previously. Carefully tap the upper mounting studs from the damper plate and discard them. In their place, install longer (8 × 35mm) knurled head studs of the correct type (see FIG 8:25). Discard the original rubber gaiter and install a replacement of the correct type having the appropriate recesses for the knurled head studs.

Enlarge the strut upper mounting holes in the car bodywork from the original 9mm (0.3543in) diameter to 16mm (0.6299in), using a special Turatol type drill as shown in FIG 8:28. Drill shaft length should be 110mm (4.3307in).

Fit three spacer rings of the correct type to the studs, as shown by the arrows in FIG 8:22, then install the suspension strut assembly to the vehicle as described previously.

Modifying Nivomat units to spring strut type:

If desired, the Nivomat self-levelling suspension strut assemblies can be modified to convert them to the spring strut type. Note that, if this work is carried out, the anti-roll bar, if fitted, should be removed completely as it is not used with the modified type of suspension strut (see Section 8:7).

Remove and dismantle the suspension strut assemblies as described previously. The original components and those components required to carry out the modifications are shown in **FIG 8:29**. The new parts required are damper assembly 1, rubber ring 2, support ring 3, coil spring 4, spacer tube 5, upper plate 6 and upper nut and locknut 7. Original parts from the Nivomat units for fitting to the modified units are rubber gaiter 8, auxiliary spring 9, damping ring 10 and upper damper plate 11. The remaining original parts must be discarded. Reassemble and install the modified unit as described previously.

8:7 Anti-roll bar

Some models may be fitted with an anti-roll bar which is mounted to the rear suspension crossmember by means of rubber bushes and to the trailing arms on each side by means of rubber bushed links (see **FIG 8:30**). Removal and installation of the anti-roll bar are straightforward operations. Renew the rubber bushes if worn or perished. Make sure that the rubber bushes are installed free of dirt and grease.

8:8 Trailing arms and thrust stays

Trailing arm removal:

Refer to **Chapter 11** and disconnect the handbrake cables from the handbrake lever, then plug the fluid outlets from the master cylinder reservoir with pointed wooden sticks.

Raise and safely support the rear of the car so that the rear suspension hangs free, then remove the road wheel. Disconnect the anti-roll bar, if fitted. Pull the handbrake cable from the protective tube and disconnect the brake hoses. Refer to **Section 8:4** and remove the drive shaft completely, then disconnect the lower end of the suspension strut from the trailing arm as described in **Section 8:6**. Refer to **FIG 8:31** and disconnect the trailing arm from the mountings on the crossmember.

If the rubber mounting bushes in the trailing arm bores are worn, damaged or perished, they should be renewed. Press the old bushes out with a suitable drift and coat the new bushes with poly-glycol before forcing them into position. Always make sure that the collar end of the bush is towards the outer side of the trailing arm. If it is suspected that the trailing arm assembly is distorted, it should be taken to a BMW service station so that it can be checked using special equipment.

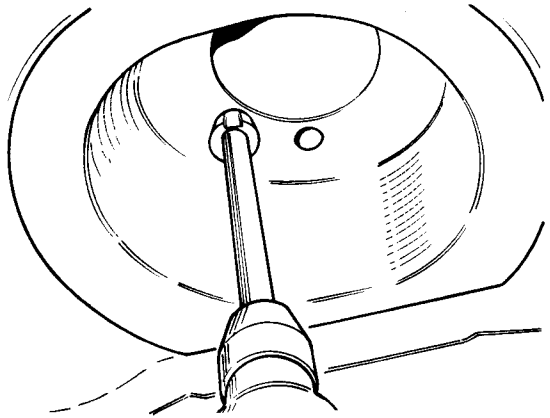


FIG 8:28 Drilling out mounting holes to accept modified suspension strut

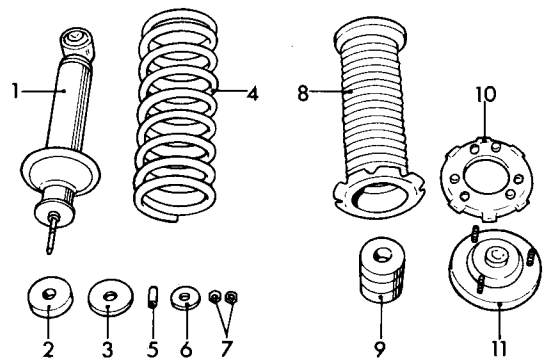


FIG 8:29 Parts required to modify suspension struts to later type

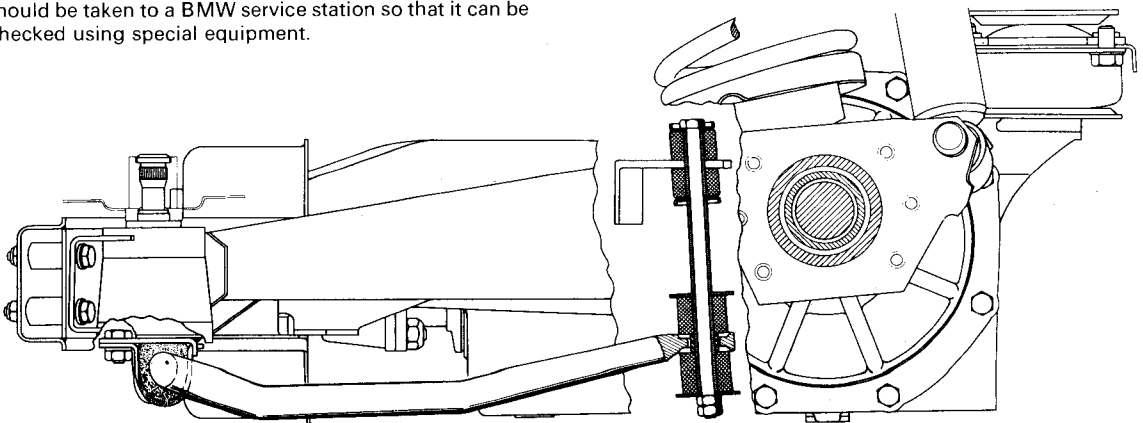


FIG 8:30 Anti-roll bar installation

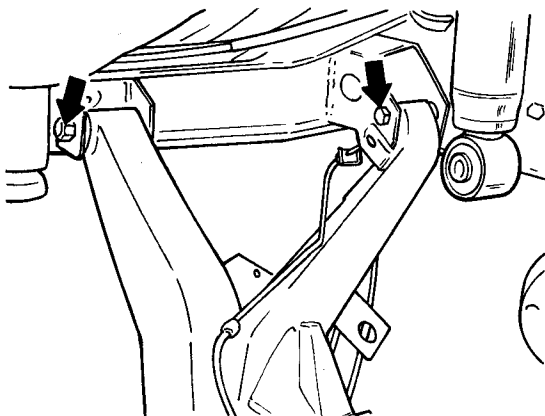


FIG 8:31 Trailing arm to crossmember mountings

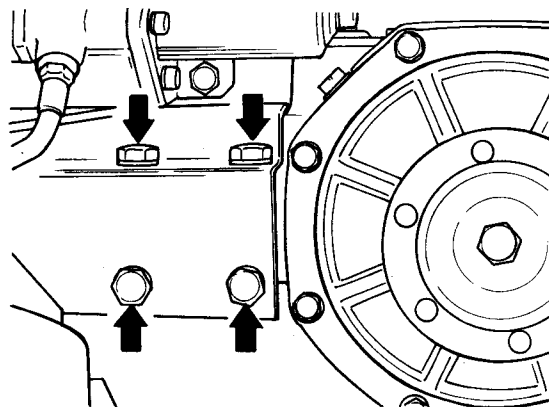


FIG 8:34 Differential carrier to crossmember attachments

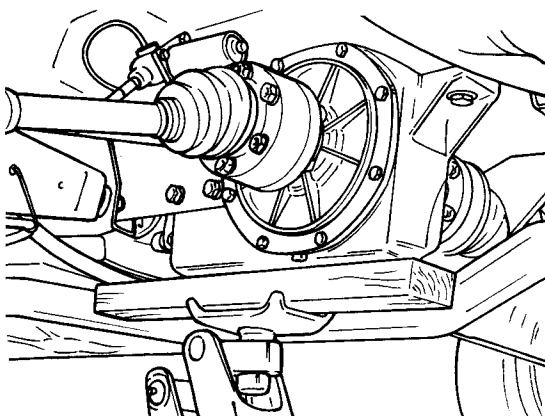


FIG 8:32 Supporting differential carrier

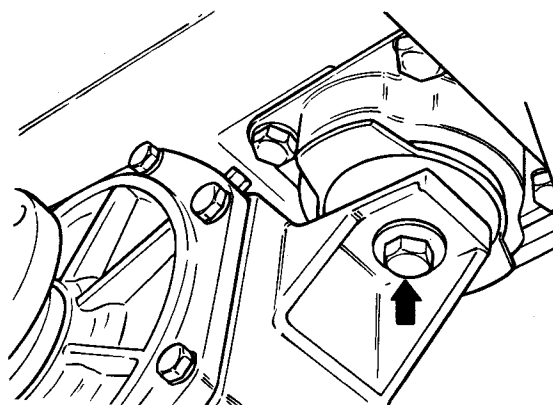


FIG 8:35 Bolt securing carrier to rubber mounting

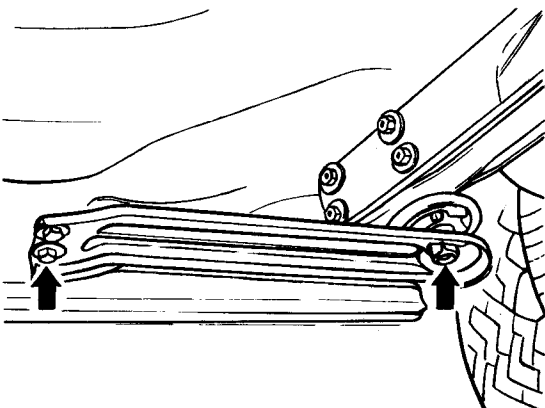


FIG 8:33 Thrust stay attachment points

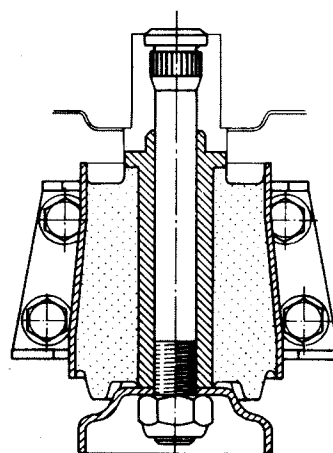


FIG 8:36 Section through crossmember rubber mounting

Refitting:

This is a reversal of the removal procedure, but note that the trailing arm to crossmember attachments must not be fully tightened during assembly. Reconnect the brake hoses and bleed the braking system, then reconnect the handbrake cables and adjust, referring to **Chapter 11** for full instructions. When all other work is complete, the trailing arm to crossmember fixings must be tightened to the specified torque with the car correctly loaded, the appropriate details being given in **Chapter 9, Section 9:4**.

Thrust stay removal:

Raise and safely support the rear of the car on floor stands. Raise a jack beneath the differential carrier to support the weight of the unit, fitting a piece of wood between the carrier and jack to prevent damage as shown in **FIG 8:32**. Remove the nut and bolts arrowed in **FIG 8:33** and detach the thrust stay from beneath the car.

Refitting is a reversal of the removal procedure.

8:9 Differential carrier

Removal:

Raise and safely support the rear of the car on floor stands, then disconnect the rear end of the propeller shaft from the differential flange as described in **Section 8:3** and remove both drive shafts as described in **Section 8:4**. Support the weight of the differential carrier with a suitable jack acting against a wooden insulator, as shown in **FIG 8:32**. Refer to **FIG 8:34** and remove the four bolts on each side securing the differential carrier to the rear axle crossmember. Remove the fixing bolt arrowed in **FIG 8:35** securing the rear of the carrier to the rubber mounting.

Refitting:

This is a reversal of the removal procedure. On completion, check oil level in differential carrier as described in **Section 8:2**.

8:10 Differential and crossmember mountings

Differential mounting removal:

Raise and safely support the rear of the car on floor stands, then use a suitable jack and wooden insulator to support the differential carrier as shown in **FIG 8:32**. Remove the carrier to mounting attachment bolt arrowed in **FIG 8:35**, then remove the four attachment bolts and remove the rubber mounting assembly from the car body.

Refitting is a reversal of the removal procedure.

Crossmember mounting removal:

Raise and safely support the rear of the car on floor stands, then use a suitable jack and wooden insulator to support the weight of the differential carrier as shown in **FIG 8:32**. Remove the rear seat squab from inside the car. Refer to **Section 8:8** and remove the thrust stay for access to the crossmember mounting. A section through the mounting is shown in **FIG 8:36**. Use a soft-faced hammer to drive out the knurled head bolt, then remove the rubber bush from the crossmember.

Refitting is a reversal of the removal procedure.

8:11 Rear wheel alignment

Due to the need for accurate results, the checking of rear wheel toe-in and camber angles should be carried out with optical measuring equipment. If rear wheel alignment is incorrect the rear suspension system must be examined for faulty, damaged or distorted components, including the wheel rims. Checks should also be made for correct location of the rear suspension crossmember on the underbody, and for possible distortion of the underbody itself. All checks should be carried out by a BMW service station having the necessary special equipment.

8:12 Fault diagnosis

(a) Noisy axle

- 1 Insufficient or incorrect lubricant
- 2 Worn bearings or gears

(b) Excessive backlash

- 1 Worn gears or bearings
- 2 Worn propeller shaft joints
- 3 Worn drive shaft joints

(c) Oil leakage

- 1 Defective seals
- 2 Damaged gaskets or joint faces

(d) Vibration

- 1 Propeller shaft out of balance
- 2 Worn universal joints

(e) Rattles

- 1 Worn universal joints
- 2 Worn suspension component bushes
- 3 Worn or damaged rubber mountings
- 4 Worn suspension strut mountings

NOTES