


Chapter 10

Suspension and steering

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Degrees of difficulty

Easy , suitable for novice with little experience		Fairly easy , suitable for beginner with some experience		Fairly difficult , suitable for competent DIY mechanic		Difficult , suitable for experienced DIY mechanic		Very difficult , suitable for expert DIY or professional	
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Specifications

Front suspension

Type Independent, MacPherson strut, with anti-roll bar on most models

Rear suspension

Type:
 Astramax models Tubular axle with leaf springs and telescopic shock absorbers
 All other models Semi-independent, trailing link with coil springs and telescopic shock absorbers. Level control system optional; anti-roll bar on some models

Steering

Type Rack and pinion. Power assistance on some models

Wheel alignment and steering angles

Front wheels:	
Toe setting	1.0 mm ± 1.0 mm toe-out
Camber (non-adjustable):	
Standard*	-1° 15' + 0° 15'
Maximum difference between sides	1°
Castor (non-adjustable):	
Standard*	0° to 2°45'
Maximum difference between sides	1°
Rear wheels:	
Toe setting (non-adjustable):	
Standard*	0° 10' toe-out to 0° 40' toe-in
Maximum difference between sides	0° 15'
Camber (non-adjustable):	
Standard*:	
Rear drum brake models	0° to -1°
Rear disc brake models	-1°10' to -2°10'
Maximum difference between sides	0° 30'

*With 70 kg in each front seat, fuel tank half full and (where necessary) the level control system inflated to 1 bar

10•2 Suspension and steering

Roadwheels

Type	Pressed-steel or aluminium alloy (depending on model)
Size	4.5J x 13, 5J x 13, 5.5J x 13 or 5.5J x 14

Tyres

Size:	
4.5J x 13	145 R 13
5J x 13	155 R 13
5.5J x 13	155 R 13 or 175/70 R 13
5.5J x 14	175/65 R 14, 185/60 R 14 or 185/65 R 14

Pressures - refer to Chapter 1 Specifications

Torque wrench settings

	Nm	lbf ft
Front suspension		
Control arm pivot bolt	140	103
Control arm clamp bolts	70	52
Control arm balljoint pin nut	70	52
Control arm balljoint securing nuts	65	48
Suspension strut top mounting nuts	30	22
Suspension strut piston rod nut	55	41
Suspension strut ring nut	200	148
Steering tie-rod balljoint nut	60	44
Anti-roll bar brackets	40	30
Rear suspension		
Axle arm mountings to underbody	105	77
Rear anti-roll bar to rear axle	80	59
Rear auxiliary anti-roll bar - 2.0 litre 16-valve models	30	22
Shock absorber lower mountings:		
Hatchback, Saloon and Astramax	70	52
Estate and Van	10	7
Shock absorber top mountings:		
Hatchback and Saloon	See text	
Estate, Van and Astramax	70	52
Rear hub bearing nut:		
Stage 1	25	18
Stage 2	See text	
Leaf spring suspension components (Astramax):		
U-bolt nuts	45	33
Bump stop cup nut	20	15
Bump stop	50	37
Brake pressure regulating valve spring bracket	20	15
Steering		
Adjuster screw locknut	60	44
Flexible coupling clamp bolts	22	16
Steering wheel nut	25	18
Steering gear mountings	15	11
Pinion nut	40	30
Steering damper mounting (pinion end)	12	9
Steering damper mounting (moving end)	See text	
Tie-rod to rack	110	81
Tie-rod balljoint nut	60	44
Tie-rod and balljoint clamp bolts	20	15
Steering column support to bulkhead	22	16
Steering column bracket self - locking nut	15	11
Power steering fittings:		
Hydraulic unions on rack	37	27
Hydraulic unions on pump	28	21
Union nut - flexible hose to high pressure pipe	42	31
Pump support to block	40	30
Pump brackets to support	15	11
Tensioner strap to pump	40	30
Tensioner strap to support	15	11
Tensioner locknuts	40	30
Roadwheels		
Wheel bolts	90	66

1 General information

The front suspension is fully independent. It consists of MacPherson struts; the coil springs surrounding the shock absorbers. An anti-roll bar is fitted to most models (see illustration).

Rear suspension is by axle tube and twin trailing arms. Coil springs and telescopic

shock absorbers are used, mounted independently of each other. Again, an anti-roll bar is fitted to most models (see illustration). On 2.0 litre 16-valve models and auxiliary anti-roll bar is also fitted.

A driver-operated level control system is available as an option on some models. The system enables the vehicle ride height and attitude to be maintained regardless of loading.

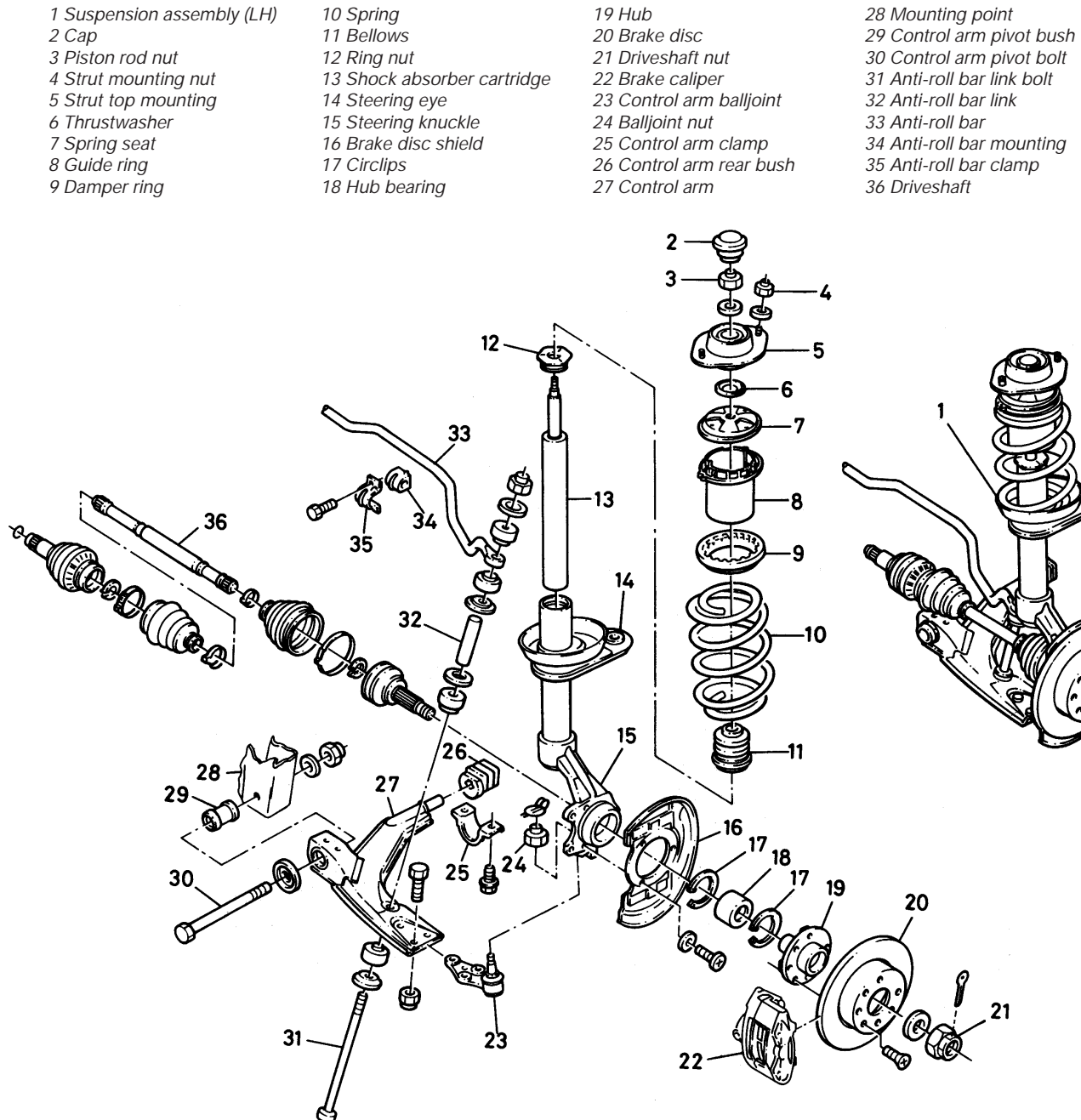
The steering gear is of rack and pinion type.

A collapsible steering column is fitted; on some models the top part of the column is adjustable to provide different steering wheel positions.

A steering damper is fitted to certain models without power assistance to reduce the feedback of shocks to the steering wheel.

Power assistance is available as an option on the larger-engined models. Assistance is by hydraulic pressure, generated in a pump driven from the crankshaft pulley.

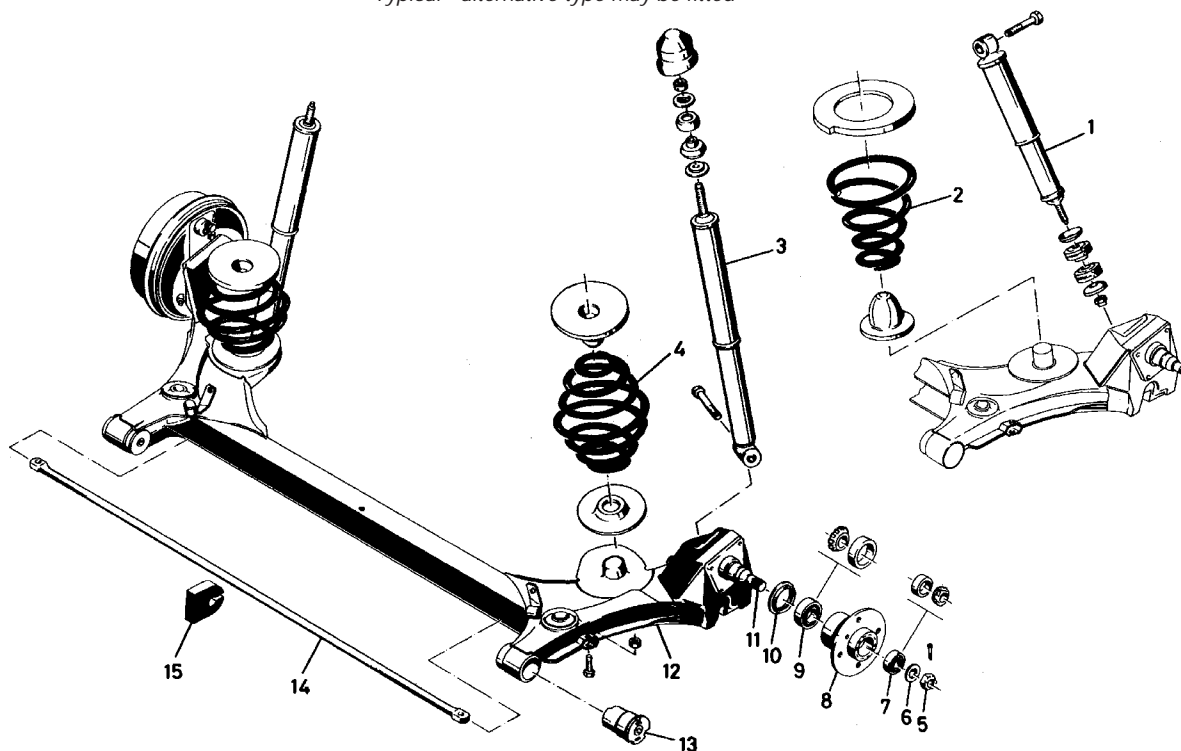
1.1 Exploded view of the front suspension components



1.2 Exploded view of rear suspension components

- | | | | |
|------------------------------|-----------------|-----------------|------------------|
| 1 Shock absorber (Estate) | 5 Hub nut | 9 Inner bearing | 13 Axle arm bush |
| 2 Spring* | 6 Thrustwasher | 10 Oil seal | 14 Anti-roll bar |
| 3 Shock absorber (Hatchback) | 7 Outer bearing | 11 Stub axle | 15 Rubber damper |
| 4 Spring* | 8 Hub | 12 Axle arm | |

*Typical - alternative type may be fitted



2 Front suspension strut - removal and refitting

Removal

- 1 Slacken the front wheel bolts, raise and support the vehicle (see "Jacking and Vehicle Support") and remove the front wheel.
- 2 Remove the split pin and undo the driveshaft retaining nut (see Chapter 8 for details). Remove the nut and washer.
- 3 Unbolt the brake caliper and tie it up out of the way so that the hydraulic hose is not strained (See Chapter 9 for details).
- 4 Disconnect the tie-rod and control arm balljoints using a balljoint separator.
- 5 Push the driveshaft out of the hub and tie it up out of the way (see Chapter 8). Remember that the vehicle must not be moved on its wheels without the hub bearing being clamped.
- 6 Undo the two securing nuts from the suspension turret and remove the strut downwards.

Refitting

- 7 Commence refitting by offering the strut to the turret. Secure it with new self-locking nuts, tightened to the specified torque.
- 8 Lubricate the driveshaft splines and pass

the driveshaft into the hub. Fit a new washer and castellated nut, but only tighten the nut finger tight at this stage.

- 9 Reconnect the control arm balljoint. Tighten the pin nut to the specified torque and secure it with a new split pin.
- 10 Reconnect the tie-rod balljoint. Fit a new self-locking nut and tighten it to the specified torque.
- 11 Clean out the brake caliper mounting bolt holes, then refit the caliper and secure with new bolts coated with thread locking compound. Tighten the bolts to the specified torque (see Chapter 9 Specifications).
- 12 Tighten the driveshaft nut (see Chapter 8).

- 13 Refit the roadwheel, lower the vehicle and tighten the wheel bolts.

3 Front hub bearings - renewal

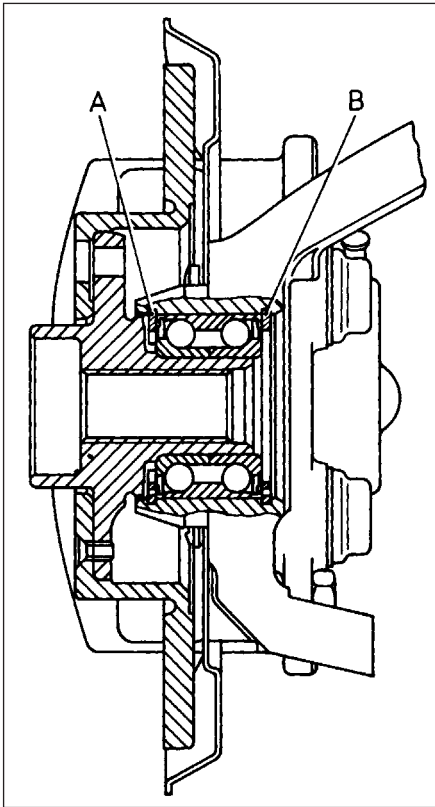
- 1 Remove the suspension strut (Section 2).
- 2 Remove the securing screw and take off the brake disc.
- 3 Support the steering knuckle and press or drive out the hub. Alternatively, draw off the hub by screwing two wheel bolts onto progressively thicker packing pieces (see illustrations).



3.3a Removing the hub from the carrier



3.3b Hub removed from the carrier



3.5a Sectional view of front hub

A Outboard circlip B Inboard circlip

- 4 Remove the brake disc shield.
- 5 Remove the two circlips (see illustrations) and press or drive the bearing outer races out of the steering knuckle.
- 6 If the bearing inner race stayed on the hub, press or pull it off.
- 7 Fit the outboard circlip to its groove in the steering knuckle so that the ends of the circlip will point downwards when the strut is installed.
- 8 Press the new bearing into position, acting only on the outer race, until it contacts the outboard circlip.
- 9 Fit the inboard circlip, again with the ends pointing downwards.



4.6b Removing the strut ring nut



3.5b Removing a hub bearing circlip

- 10 Refit the brake disc shield.
- 11 Support the bearing inner race with a tube and press the hub into position.
- 12 Refit and secure the brake disc.
- 13 Refit the suspension strut as described in Section 2.

4 Front suspension strut - overhaul



Warning: Before attempting to dismantle the front/rear suspension strut a suitable tool to hold the coil spring in compression must be obtained Adjustable coil spring compressors are readily available and are recommended for this operation. Any attempt to dismantle the strut without such a tool is likely to result in damage or personal injury.

- 1 Remove the suspension strut (Section 2).
- 2 Clamp the strut in a vice. Fit the spring compressor and tighten it to unload the pressure on the upper seat.
- 3 Hold the flats on the piston rod to stop it rotating and unscrew the piston rod nut. A 19 mm ring spanner with a deep offset will be needed.
- 4 Remove the top mounting and ball-bearing.
- 5 Carefully release the spring compressor. Remove the spring seat, guide ring, damper ring and bellows, followed by the spring itself. On later models also remove the rubber damping ring.

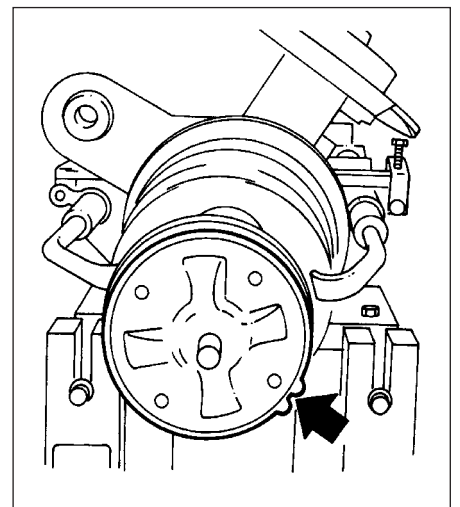


4.7 Removing the shock absorber cartridge

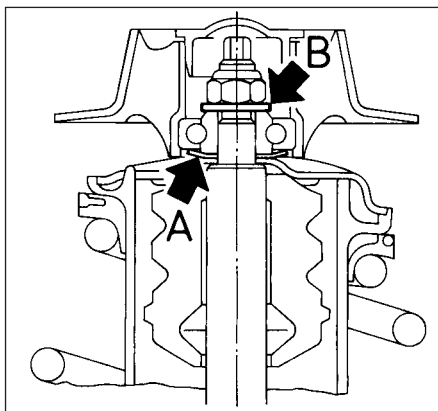


4.6a One method of unscrewing the strut ring nut

- 6 To remove the shock absorber cartridge, unscrew the ring nut from the top of the strut tube. This nut is very tight: one way of undoing it is to invert the strut so that the nut is clamped in the vice, then levering the strut round using a long bar and a bolt passed through the steering eye (see illustrations).
- 7 With the ring nut removed, the cartridge can be withdrawn and the new one fitted (see illustration). Secure it with a new ring nut, tightened to the specified torque. Do not clean the wax off the new nut.
- 8 Refit the rubber damping ring (where fitted) then compress the spring and refit it. (Strictly speaking it can be left in place when renewing the cartridge, but unless special tools are available for dealing with the ring nut, it will be too much in the way.)
- 9 Lubricate the top mounting ball-bearing with grease to GM spec 19 41 574. (The bearing cannot be renewed independently of the mounting) (see illustration).
- 10 Fit the top mounting to the strut piston rod, making sure that the lower thrustwasher is fitted with the raised edge upwards (see illustration). Hold the piston rod still and fit a new self-locking nut; tighten the nut to the specified torque.



4.9 Lug on spring seat (arrowed) points forwards on LH strut, rearwards on RH strut



4.10 Sectional view of strut top mounting

A Lower thrustwasher B Upper thrustwasher

11 Release the spring compressor. Make sure that the ends of the springs are correctly seated.

12 Release the strut from the vice and refit it to the vehicle, as described in Section 2.

13 If new springs or shock absorbers are being fitted, it is good practice to fit new components to both sides. A great variety of springs is available: consult your GM dealer to be sure of obtaining the correct ones.

5 Front suspension control arm - removal and refitting

Removal

1 Slacken the front wheel bolts, raise and support the vehicle (see "Jacking and Vehicle Support") and remove the front wheel.

2 When fitted, unbolt the anti-roll bar from the control arm.

3 Remove the split pin and slacken the control arm balljoint nut (see illustration). Separate the balljoint with a proprietary separator and remove the nut.

4 Unscrew the clamp bolts and the pivot bolts from the inboard end of the arm (see illustration). Withdraw the arm.

Refitting

5 Before refitting, clean out the clamp bolt holes with a tap or a bolt with a slot cut in it.

6 Commence refitting by bolting the arm loosely into position. Fit the pivot bolt with its head facing towards the front of the vehicle and use a new self-locking nut.

7 Use new clamp bolts and coat their threads with locking compound.

8 Jack up under the control arm so that it is more or less horizontal, then tighten the pivot bolt to the specified torque.

9 Tighten the clamp bolts to the specified torque. Lower the jack under the control arm.

10 Tighten the balljoint pin nut to the specified torque and secure with a new split pin.



5.3 Control arm balljoint nut (arrowed)

11 Reconnect the anti-roll bar (if applicable). Refer to Section 8 for tightening procedure.

12 Refit the roadwheel, lower the vehicle and tighten the wheel bolts.

6 Control arm bushes - renewal

1 Remove the control arm, as described in Section 5.

2 Press out the front bush using suitable pieces of tube and a vice or a long bolt and washers. The bush should be removed from front to rear.

3 Fit the new front bush in the same direction (front to rear), using liquid detergent as a lubricant. The inner sleeve collar faces rearwards. When correctly fitted, the bush should overhang equally on both sides.

4 Support the front of the rear bush. Note which way round it is fitted, then press the arm out of it.

5 Lubricate the rear spigot with liquid detergent, then press on the new rear bush, making sure it is the right way round (flattened surface towards balljoint pin).

6 Refit the control arm, as described in Section 5.

7 Control arm balljoint - renewal

1 Remove the control arm (Section 5).

2 Drill out the rivets which secure the old balljoint. Use a pillar drill with a 12 mm bit,



8.2 Front anti-roll bar end link



5.4 Control arm clamp bolts (arrowed)

and drill accurately into a centre punch mark on each rivet head. Have this work done professionally if need be: sloppy drilling will render the arm scrap.

3 Fit the new balljoint and secure it with the bolts and self-locking nuts provided. The nuts should be fitted on the underside of the arm. Tighten the nuts to the specified torque.

4 Refit the control arm, as described in Section 5.

8 Front anti-roll bar - removal and refitting

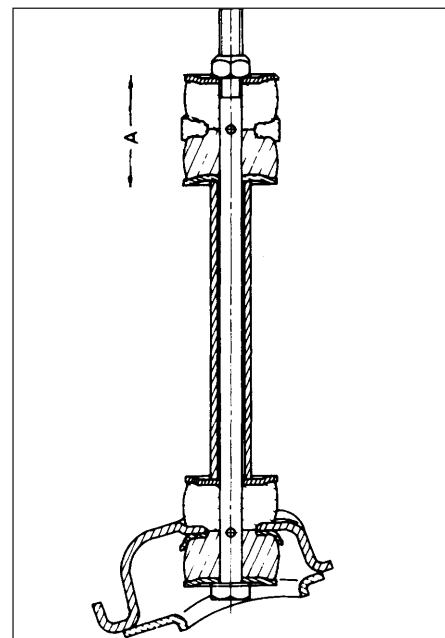
Removal

1 Raise and support the front of the vehicle (see "Jacking and Vehicle Support").

2 Unbolt both ends of the anti-roll bar from the control arms (see illustration).

3 Unbolt the two brackets from the bulkhead.

4 Remove the anti-roll bar through one of the wheel arches, turning the steering wheel as necessary to obtain sufficient clearance.



8.7 Anti-roll bar cushion link setting
A = 38mm

5 Renew the rubber mountings as necessary. Use a silicone-based lubricant on the bulkhead bracket bushes.

Refitting

6 When refitting, fasten the two brackets first; tightening their bolts to the specified torque.

7 Tighten the end mountings to achieve a dimension A, as shown using new self-locking nuts (see illustration).

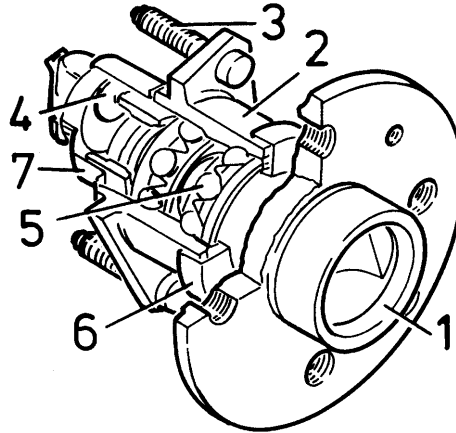
8 Lower the vehicle when the anti-roll bar is secured.

9 Rear hub bearings - adjustment



9.10 Rear wheel hub assembly - later (1992 onwards) models

- 1 Hub
- 2 Bearing housing
- 3 Stud
- 4 End cap (with integral wheel speed sensor - models with ABS)
- 5 Bearings
- 6 Sealing ring
- 7 Pulse gear (ABS vehicles only)



Early (pre 1992) models

1 Chock the front wheels. engage a gear (or P) and release the handbrake.

2 Remove the wheel trim. If the roadwheels have no central hole, slacken the wheel bolts.

3 Raise and support the rear of the vehicle (see "Jacking and Vehicle Support") so that the wheel is free to turn. If it has no central hole, remove it.

4 Prise off the hub grease cap using a stout screwdriver.

5 Remove the split pin from the hub nut. Tighten the nut to 25 Nm, at the same time turning the wheel or brake drum in order to settle the bearings.

6 Slacken the hub nut until the thrustwasher behind the nut can just be moved by poking it with a screwdriver. Do not lever or twist against the hub nut or brake drum when testing the washer for freedom of movement

7 Insert a new split pin to secure the hub nut. If the split pin holes are not aligned, tighten the nut to align the nearest holes, temporarily insert the split pin and check to see if the washer can still be moved. If it cannot, remove the split pin and back off the nut to the next set of holes.

8 When adjustment is correct, spread the legs of the split pin around the nut. Refit the grease cap, and the roadwheel is removed, and lower the vehicle. Tighten the wheel bolts if they were disturbed and refit the wheel trim.

9 If adjustment fails to cure noise or roughness, the bearings should be renewed, as described in the next Section.

Later (1992 onwards) models

10 On later models, adjustment of the rear hub bearings is not possible. The taper roller bearings fitted to earlier models are replaced with double-row roller type bearings which are sealed and are intended to last the vehicle's entire service life (see illustration). **Note:** Never overtighten the hub nut beyond the specified torque setting in an attempt to "adjust" the bearing. If there is excess play in the hub bearing, the bearings must be renewed.

10 Rear hub - removal and refitting



Removal

Early (pre 1992) models

1 Remove the brake drum/disc, as described in Chapter 9.

2 Prise off the hub grease cap, remove the split pin and undo the hub nut (see illustration).

3 Pull the hub off the stub axle. Catch the thrustwasher and the outer bearing race, which will be displaced.

Later (1992) models

4 Remove the brake drum/disc as described in Chapter 9.

5 Disconnect the ABS wheel speed sensor wiring connector (where necessary) then undo the four retaining nuts and remove the hub assembly from the vehicle.

Refitting

Early (pre 1992) models

6 Fit the hub to the stub axle, being careful not to damage the oil seal. Fit the outer bearing race, the thrustwasher and the castellated nut (see illustrations).

7 Tighten the nut finger tight, then refit the brake drum/disc, as described in Chapter 9.

8 Adjust the bearings, as described in Section 9.

Later (1992 onwards) models

9 Ensure that the hub and carrier mating surfaces are clean and dry then fit the hub assembly. Refit the retaining nuts and tighten them securely

10 Reconnect the ABS sensor wiring connector (where necessary) and refit the drum/disc as described in Chapter 9.

11 Rear hub bearings - renewal



Early (pre 1992) models

1 Remove the hub assembly as described in Section 10.



10.2 Rear hub nut split pin



10.6a Fit the outer bearing race . . .



10.6b . . . the washer and the castellated nut

2 Prise the oil seal out of the inboard side of the hub.

3 Extract the inner bearing race, then press or drive the bearing outer tracks from the hub.

4 Clean out the old grease from the hub cavity. Make sure the bearing seats are undamaged, then press or drive the new tracks squarely into the hub.

5 Generously grease the bearing races, the new oil seal and the bearing tracks. Half fill the space between the tracks with grease.

6 Fit the inner race and then the oil seal; lips inwards. Tap the seal into place with a tube or a piece of wood.

7 Refit the hub as described in Section 10.

Later (1992 onwards) models

8 On later models if the bearings are worn the complete hub assembly must be renewed; it is not possible to renew the bearings separately.

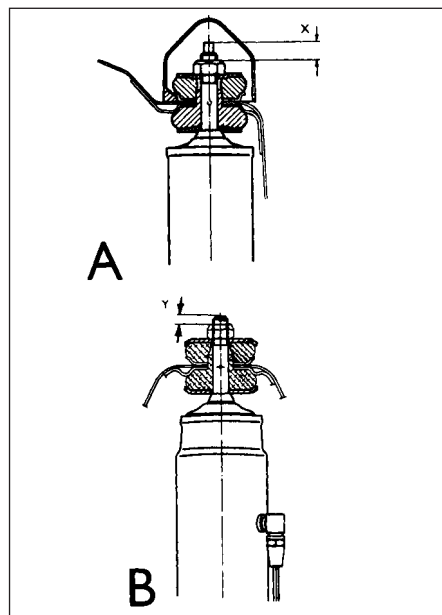
12 Rear shock absorbers - removal and refitting

Note: Refer to Section 17 for information on the Astramax

1 Shock absorbers should be renewed in pairs, but they should only be removed from one side at a time. Proceed as described under the relevant sub-heading

Hatchback and Saloon

2 Inside the vehicle, remove the cap from the shock absorber top mounting. Grip the flats on the piston rod with pliers or a small



12.9 Rear shock absorber top mounting setting

A Without level control

B With level control or two locknuts

X = 9 mm

Y = 6 mm



12.2 Rear shock absorber upper mounting - Hatchback

spanner and unscrew the top mounting nut. Remove the nut, washer and rubber buffer (see illustration).

3 Raise and support the rear of the vehicle (see "Jacking and Vehicle Support").

4 On vehicles with the level control system disconnect the pressure line from the shock absorber by undoing the union nut.

5 Unbolt the shock absorber lower mounting (see illustration). Free the shock absorber from the bracket and remove it from the vehicle.

6 Commence refitting by introducing the shock absorber to the lower mounting bracket. Use a plastic or wooden mallet if need be.

7 Wedge the shock absorber so that the lower mounting hole is aligned. Fit the lower mounting bolt, tapping it gently through the shock absorber eye, and tighten it to the specified torque.

8 Partly lower the vehicle, guiding the top of the shock absorber into position. Make sure that the washer and rubber buffer for the underside of the top mounting are in position.

9 Lower the vehicle to the ground. Fit the top mounting rubber buffer and washer. Tighten the mounting nut or nuts to achieve an exposed piston rod length as shown (see illustration). Refit the cap.

10 Repeat the operations on the other side of the vehicle. Where necessary, on completion, reconnect the pressure line unions and inflate the system to 0.8 bar.

Estate and Van

11 Raise and support the rear of the vehicle (see "Jacking and Vehicle Support").



12.13 Rear shock absorber lower mounting - Estate



12.5 Rear shock absorber lower mounting bolt (arrowed) - Hatchback

12 On vehicles with the level control system, disconnect the pressure line from the shock absorber by undoing the union nut.

13 Unload the shock absorber mounting by jacking up under the axle arm. Remove the lower mounting nut, washer and rubber buffer (see illustration). Lower the jack.

14 Remove the top mounting bolt (see illustration) and extract the shock absorber from its mountings.

15 Commence refitting by securing the top end of the shock absorber, but only tighten the bolt loosely at first.

16 Secure the bottom mounting, making sure that the rubber buffers and washers are in position, and tighten the cap nut to the specified torque.

17 Tighten the top mounting to the specified torque.

18 Repeat the operations on the other side of the vehicle, then lower it to the ground. Where necessary, on completion, reconnect the pressure line unions and inflate the system to 0.8 bar.

13 Rear anti-roll bar - removal and refitting

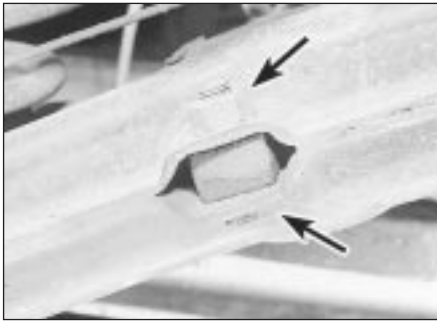
Main roll bar

Removal

1 Slacken the rear wheel bolts on one side only. Raise and support the rear of the vehicle (see "Jacking and Vehicle Support") and remove the roadwheel.



12.14 Rear shock absorber top mounting bolt (arrowed) - Estate



13.2 Rear anti-roll bar mounting nut and bolt (arrowed)

2 Remove the mounting nut and bolt from both ends of the anti-roll bar (see illustration).

3 Remove the rubber damper from the centre of the axle.

4 Remove the anti-roll bar from the side on which the wheel was removed. If it is reluctant to move, drive it from the other side.

Refitting

5 Refit in the reverse order to removal. Use liquid detergent as a lubricant when fitting the rubber damper. Tighten the anti-roll bar mountings to the specified torque.

Auxiliary anti-roll bar - 2.0 litre 16-valve models

Removal

6 Raise and support the rear of the car (see "Jacking and Vehicle Support").

7 Remove the two nuts and bolts from each end of the anti-roll bar (see illustration).

Refitting

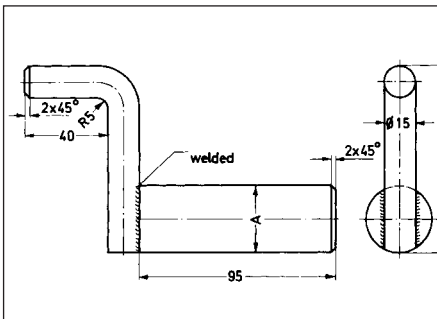
8 Refitting is the reverse of the removal procedure. Tighten the fastenings to the specified torque.

14 Rear springs - removal and refitting

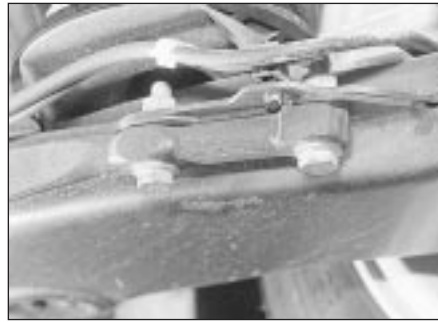
Note: Refer to Section 17 for information on the Astramax

1 Rear springs should be renewed in pairs.

2 On vehicles with a level control system, depressurise it at the filling valve.



14.4 Rear axle arm jacking adapter. All dimensions in mm; diameter A to suit jack



13.7 Auxiliary anti-roll bar mounting - 2.0 litre 16-valve models

3 Raise and support the rear of the vehicle (see "Jacking and Vehicle Support").

Hatchback and Saloon

4 Unload the shock absorber mounting on one side by jacking up under the axle arm. A tool made up to the dimensions shown is useful for this (see illustration).

5 Unbolt the shock absorber lower mounting. Free the lower end of the shock absorber from its bracket.

6 Lower the jack and remove the spring and rubber dampers. Lever the axle arm downwards slightly if necessary to remove the spring.

7 If the spring is to be renewed, it is sound policy to renew the rubber dampers also.

8 Insert the new spring and dampers, raise the axle arm and make fast the shock absorber lower mounting. Where conical type springs are fitted, ensure that the upper ends are correctly located in the spring seat (see illustration).

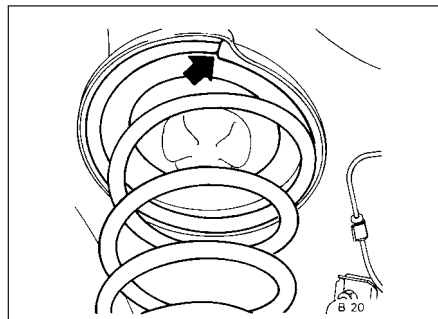
9 Repeat the operations on the other side of the vehicle. On completion, inflate the level control system (where fitted) to 0.8 bar.

Estate and Van

10 Jack up under one axle arm and unbolt the shock absorber lower mounting. Lower the jack and repeat the operation on the other side, leaving the jack in place.

11 Remove the springs and lower dampers, lowering the jack as necessary.

12 If renewing the sprung upper dampers, glue them in position with impact adhesive to aid fitting.



14.8 Correct location of upper end of spring (arrowed) - conical type shown

13 Fit the new spring and dampers. Where conical type springs are fitted, ensure that the upper ends are correctly located in the spring seat (see illustration 14.8).

14 Raise the jack and reconnect the shock absorber lower mounting on that side, then transfer the jack to the other side and secure the other shock absorber.

15 Tighten the shock absorber lower mountings to the specified torque. On completion, inflate the level control system (where fitted) to 0.8 bar.

15 Rear axle assembly - removal and refitting

Note: Refer to Section 17 for information on the Astramax

Removal

1 Slacken the rear wheel bolts, raise and support the rear of the vehicle (see "Jacking and Vehicle Support") and remove the rear wheels.

2 On vehicles with a level control system, depressurise it at the filling valve.

3 Disconnect the handbrake cable at the equaliser yoke and free it from the underbody guides.

4 Unhook the rear part of the exhaust system from its rubber mountings.

5 Disconnect the brake flexible hose at the rear axle brackets. Plug or cap the hoses to reduce fluid spillage.

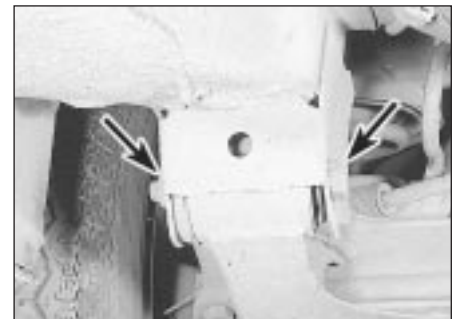
6 On Estate and Van models, unbolt the brake pressure regulating valve spring bracket.

7 Remove the rear springs, as described in Section 14.

8 Support the centre of the rear axle with a jack and a block of wood or a cradle. Unhook the axle arm mountings from the underbody (see illustration) and lower the jack. An assistant should steady the assembly whilst it is being unbolted and lowered.

9 Pass the handbrake cable over the exhaust system and remove the axle assembly.

10 Strip the axle of brake components, hubs, anti-roll bar etc, if needed for transfer to a new axle. Refer to the appropriate Chapters and Sections for details.



15.8 Axle arm mounting nut and bolt (arrowed)

Refitting

11 With the aid of an assistant, offer the new axle to the vehicle, remembering to pass the handbrake cable over the exhaust system. Insert the axle arm mounting bolts, but do not tighten them yet.

12 Fit the springs and secure the shock absorbers, as described in Section 14.

13 Reconnect the brake flexible hoses, then bleed the hydraulic system (Chapter 9).

14 On Estate and Van models, secure the brake pressure regulating valve spring bracket, as described in Chapter 9.

15 Secure the exhaust system to its mountings.

16 Secure the handbrake cable to its guides and to the yoke.

17 Adjust the rear wheel bearings, as described in Section 9.

18 Adjust the brakes by making at least 10 applications of the brake pedal, then adjust the handbrake, as described in Chapter 1.

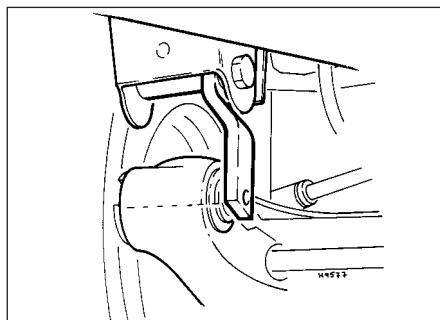
19 Fit the roadwheels, lower the vehicle and tighten the wheel bolts.

20 Load the vehicle by having two assistants sit in the front seats, then tighten the axle arm mounting bolts to the specified torque.

21 When a level control system is fitted, inflate it to 0.8 bar.

16 Rear axle mounting bushes - renewal

1 The mounting bushes must always be renewed in pairs. Without doubt the opportunity should be taken to renew them if the axle is removed for some other reason. They can be renewed with the axle in situ as follows.



16.8 Cranked link used to support axle arm

2 Depressurise the level control system, when fitted.

3 Remove the rear springs, as described in Section 14, then reattach the shock absorber lower mountings.

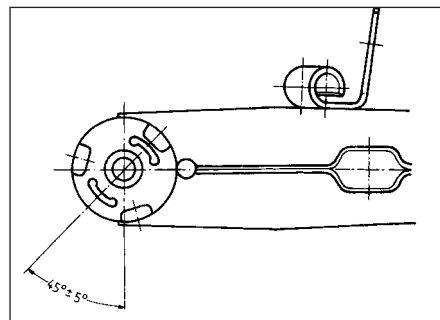
4 On Estate and Van models, unbolt the brake pressure regulating valve spring bracket.

5 Unclip the brake flexible hose from the brackets on the underbody. If care is taken there is no need to disconnect the hoses.

6 Support the axle centrally with a hydraulic jack and a block of wood or a cradle.

7 Remove the axle arm mounting bolts and carefully lower the axle until the bushes are accessible. Bend the brake pipes slightly if necessary to avoid straining the flexible hoses.

8 Cut or chisel the flange from the outboard face of one bush. In order to restrain the axle from moving during this operation, the makers specify the use of a cranked link, one end of which bolts to the axle arm mounting, the other end carrying a pin which locates in the inner side of the bush (see illustration). Be



16.10 Correct orientation of rear axle arm bush

careful not to knock the axle off the jack: provide additional supports if possible.

9 Draw the old bush out from the inboard side to the outboard, using suitable tubes, bolts and washers. (The maker's special tool set for this job, consisting of the tubes etc plus the cranked link, is numbered KM-452-A). Removal of the bush will be easier if the axle arm around it is heated to 50° to 70°C using hot air, steam or a soldering iron.

Do not use a naked flame: the fuel tank is not far away.

10 Coat the new bush with liquid detergent and draw it into place, observing the correct orientation, until the flange rests against the edge of the axle arm (see illustration).

11 Repeat the operations on the other side of the vehicle.

12 Raise and secure the axle, but do not tighten the axle arm bolts yet.

13 Secure the brake flexible hose to their brackets.

14 Refit the springs (Section 14).

15 On Estate and Van models, refit the pressure regulating valve spring bracket, as described in Chapter 9, Section 15.

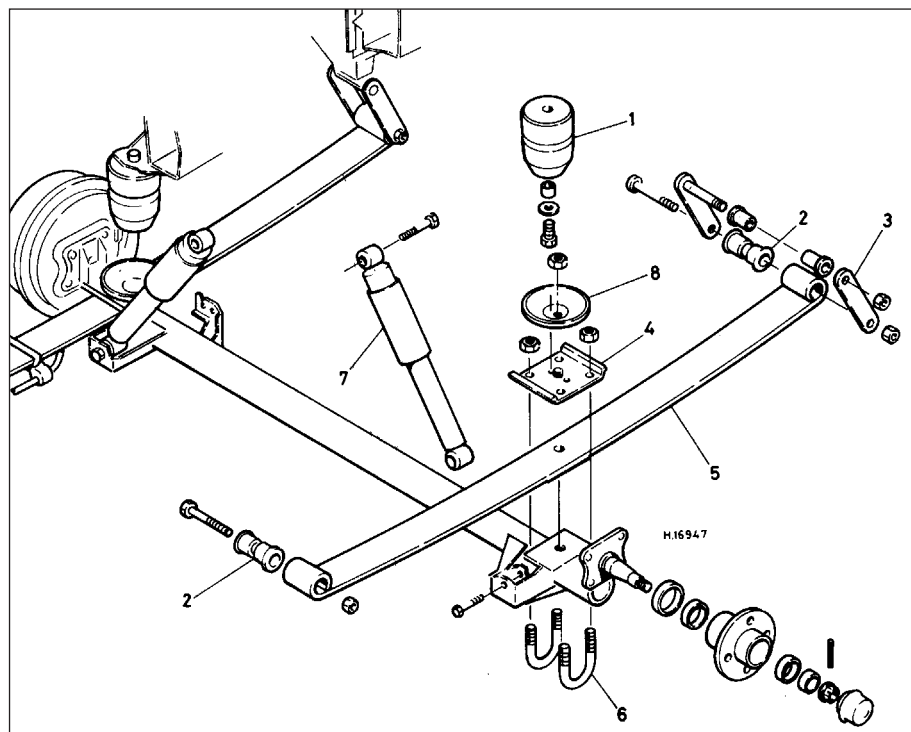
16 Lower the vehicle onto its wheels, have two assistants sit in the front seats and tighten the axle arm mounting bolts to the specified torque.

17 When fitted, pressurise the level control system to 0.8 bar.

17 Leaf spring rear suspension components (Astramax) - removal and refitting

Rear shock absorber

1 Raise and support the rear of the vehicle (see "Jacking and Vehicle Support") (see illustration).



17.1 Exploded view of Astramax rear suspension

- | | |
|------------------|------------------|
| 1 Bump stop | 5 Leaf spring |
| 2 Bushes | 6 U-bolt |
| 3 Shackle | 7 Shock absorber |
| 4 Tensioning pin | 8 Bump stop cup |

- 2 Unload the shock absorber mounting by jacking up under the axle arm.
- 3 Slacken and remove the upper and lower mounting bolts and remove the shock absorber from the vehicle.
- 4 Refitting is the reverse of removal, tightening the shock absorber bolts to the specified torque.
- 5 Repeat the operations on the other side of the vehicle, then lower it to the ground.

Rear leaf spring

- 6 Raise the rear of the vehicle and support it securely. Support the rear axle with another jack.
- 7 Remove the handbrake cable bracket from the spring.
- 8 Disconnect the brake pressure regulating valve spring from the leaf spring.
- 9 Unbolt the front leaf spring-to-body attachment and remove the bolt.
- 10 Unbolt the rear spring-to-shackle attachment and remove the bolt.
- 11 Remove the bump stop nut and washer, and the cup itself.
- 12 Unscrew the U-bolt nuts. Remove the tensioning plate and the U-bolts.
- 13 Remove the leaf spring from the vehicle.
- 14 If the spring is being renewed, transfer the brake pressure regulating valve spring bracket to the new spring.
- 15 To renew the spring bushes, press or drive out the old bushes and press in the new ones using a long bolt, some tubing and washers. Coat the new bushes with liquid detergent as an assembly lubricant.
- 16 Refitting is the reverse of the removal procedure, noting the following points:
 - a) *The shorter section of the spring faces the front of the vehicle.*
 - b) *The hole in the tensioning plate for the bump stop cup locating lug must be towards the centre of the vehicle.*
 - c) *The exposed lengths of thread on the U-bolts must not differ by more than 3 mm.*
 - d) *Adjust the position of the brake pressure regulating valve spring bracket so that the spring is neither tight nor slack.*

Bump stop

- 17 Raise and support the rear of the vehicle (see "Jacking and Vehicle Support").
- 18 Unscrew the bump stop bolt and remove the bump stop.
- 19 Refitting is the reverse of the removal procedure.

Rear axle

- 20 Slacken the rear wheel bolts, raise and support the rear of the vehicle and remove the rear wheels.
- 21 Remove the brake drums/discs and disconnect the handbrake cable (Chapter 9).
- 22 Disconnect the brake flexible hoses at the bracket on the axle. Plug or cap the open unions.
- 23 Support the centre of the rear axle with a

jack and a block of wood or a cradle.

- 24 Remove the shock absorber lower mounting bolts on both sides.
 - 25 Remove the bump stop cups from both sides. They are each secured by a single nut and washer.
 - 26 Unscrew the U-bolt nuts on one side of the axle. Remove the tensioning plate and the U-bolts.
 - 27 Repeat the procedure on the other side.
- Note:** *The axle may tip to one side or the other if it is not centrally supported.*
- 28 Lower the jack and remove the axle from the vehicle.
 - 29 Strip off the hubs, brake components etc if needed for transfer to another axle.
 - 30 Refitting is the reverse of the removal procedure, noting the following points:
 - a) *The hole in the tensioning plate for the bump stop cup locating lug must be towards the centre of the vehicle.*
 - b) *The exposed lengths of thread on the U-bolts must not differ by more than 3 mm.*
 - c) *Tighten all fastenings to the specified torque.*
 - d) *Bleed the brake hydraulic system and adjust the handbrake on completion.*

18 Level control system - description and maintenance

- 1 On vehicles equipped with this system ride height can be controlled by pressurising the rear shock absorbers with air. The shock absorbers are connected to each other, and to the filling valve, by a high pressure pipeline. The filling valve is similar to a tyre inflation valve; it is located on the right-hand side of the load area.
- 2 For normal (unladen) running, the system should be pressurised to 0.8 bar. Before loading the vehicle, measure the ride height between the rear bumper and the ground. After loading, restore the ride height by increasing the system pressure using tyre inflation equipment. Do not exceed 5 bar.
- 3 Do not drive the vehicle unladen with a high pressure in the system, nor inflate the system to the maximum pressure before loading.



19.2 Removing the steering wheel central cap

- 4 Maintenance consists of checking the pressure lines and unions for security and good condition.

19 Steering wheel - removal and refitting



Removal

- 1 Disconnect the battery earth lead.
- 2 Prise off the central cap from the steering wheel. Disconnect the horn contact wires and remove the cap (see illustration).
- 3 Set the steering in the straight-ahead position.
- 4 Relieve the locktabs and undo the central retaining nut (see illustration).
- 5 Depending on the work to be done, it may ease refitting to mark the relationship of the wheel centre to the shaft splines.
- 6 Pull the wheel off the shaft splines. If pulling by hand, be careful not to injure yourself if the wheel suddenly comes free. Use a puller if it is tight. **Do not** use a hammer: damage to the column may result.
- 7 If wished, the horn contact ring can now be unclipped. Note that the direction indicator return segment on the ring points to the left.

Refitting

- 8 Before refitting, make sure that the washer and spring are in place on the shaft. Fit the steering wheel onto the splines, making sure it is correctly aligned.
- 9 Fit a new lockwasher and refit the nut. Tighten the nut to the specified torque and bend up the lockwasher tabs.
- 10 Reconnect the horn contact wires and press the central cap into place.
- 11 Reconnect the battery earth lead.

20 Steering column - removal and refitting



Removal

- 1 Disconnect the battery earth lead.
- 2 Although not strictly necessary, access will be improved if the steering wheel is removed. See Section 19.



19.4 Steering wheel retaining nut and locktabs (arrowed)



20.3a Removing an upper shroud securing screw

3 Remove the upper and lower switch shrouds. These are secured by eight screws with the fixed steering wheel, or five screws with the adjustable wheel (see illustrations).

4 Remove the steering lock cylinder, as described in Section 23.

5 Disconnect the ignition switch multi-plug.

6 Remove the multi-function switches by depressing their retaining clips. With the adjustable wheel it may be necessary to undo the switch housing screws and draw the housing away from the dashboard to provide sufficient clearance.

7 Make sure that the steering is in the straight-ahead position, then remove the flexible coupling clamp bolt from the base of the column. Unbolt the column support from the bulkhead and recover the washer.

8 Remove the column upper mounting bracket nut and bolt. The bolt is of the shear-head type: drill it and extract it with a proprietary stud extractor, or it may be possible to unscrew the bolt by driving its head round with a chisel or punch. The nut is a self-locking type and should be renewed.

9 Withdraw the column slightly to free it from the flexible coupling, then remove it from the vehicle. Avoid knocking or dropping it as this could damage the collapsible section.

10 If a new column assembly is to be fitted, a large plastic washer will be found at the base of the column tube. This is to centre the shaft in the tube and should be removed when fitting is complete.

Refitting

11 Commence refitting by making sure that the roadwheels are still in the straight-ahead position, and that the flexible coupling is positioned so that the column clamp bolt will be horizontal and on top.

12 Offer the column assembly to its mountings, inserting the base of the shaft into the coupling. Insert the mounting nuts and bolts, but only tighten them finger tight at this stage. Do not try to force the column into position or damage may result.

13 Tighten the column bulkhead support bolt to the specified torque. Make sure the washer is in place.

14 Tighten the upper mounting bracket fastenings: the shear-head bolt should be



20.3b Removing a lower shroud securing screw adjustable wheel

tightened until its head breaks off. The new self-locking nut should be tightened to the specified torque.

15 Pull the shaft upwards as far as it will go and tighten the flexible coupling clamp bolt to the specified torque.

16 Prise out the plastic washer from the base of the column tube. It can stay on the shaft.

17 Reconnect the ignition switch and refit the multi-function switches.

18 Refit the remaining components in the reverse order to removal.

21 Steering column - overhaul

The steering column incorporates a telescopic safety feature. In the event of a front end crash, the shaft housing collapses and prevents the steering wheel injuring the driver. Before refitting the steering column examine the column and mountings for signs of damage and deformation and check the steering shaft for signs of free play in the column bushes. If there are signs of damage or play, the column must be renewed. Overhaul of the column is possible but this is a fiddly task and should be entrusted to a Vauxhall/Opel dealer. Consult your Vauxhall/Opel dealer for further information.

22 Steering column flexible coupling - removal and refitting

Removal

1 Position the steering in the straight-ahead position

2 Slacken the steering rack mountings on the bulkhead.

3 Remove both clamp bolts from the coupling.

4 Push the coupling upwards, remove it from the pinion shaft, tilt it and withdraw it from the column shaft.

Refitting

5 Before refitting, make sure that the roadwheels are still in the straight-ahead position and that the steering wheel spokes are centred and pointing downwards.

6 Fit the coupling in such a position that the column clamp bolt will be horizontal and on top.

7 Push downwards on the coupling and tighten the pinion side clamp bolt to the specified torque.

8 Tighten the steering gear mountings to the specified torque.

9 Pull the steering shaft upwards as far as it will go and tighten the clamp bolt to the specified torque.

10 Make sure that the roadwheels and the steering wheel are still in the straight-ahead position.

23 Steering lock cylinder and ignition switch wiring block - removal and refitting

1 To renew either the ignition switch or the steering lock cylinder, first remove the lower half of the steering column shroud by undoing and removing the securing screws. Disconnect the battery negative terminal and proceed as described under the relevant sub-heading.

Ignition switch wiring block

2 Disconnect the wiring block from the ignition switch.

3 Slacken the two small retaining screws and withdraw the wiring block from the end of the lock housing.

4 Refitting is the reverse of removal, ensuring that the switch centre is correctly engaged with the lock cylinder rod flats.

Steering lock cylinder

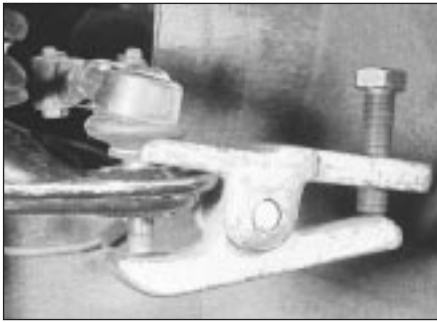
5 Disconnect the battery earth lead and, after removing the lower half of the steering column shroud, insert the ignition key and turn it to the "II" position.

6 Using a piece of wire or a drill shank (3 mm dia), depress the lock spring retaining the cylinder and carefully withdraw the cylinder from its housing (see illustration). It is important that the ignition switch is not removed or disturbed while the lock cylinder is not fitted.

7 Before fitting a new lock cylinder insert the ignition key and turn it to the "II" position. Insert the assembly into the steering lock



23.6 Releasing the steering lock detent spring with an Allen key (arrowed)



24.2 Tie-rod balljoint separator in use It is better practice to leave the balljoint nut loosely fitted

housing and press it down until the retaining spring engages before removing the key.
8 Reconnect the battery earth lead and test the operation of the ignition switch before fitting the lower half shroud.

24 Tie-rod balljoints - removal and refitting

Removal

- 1 Remove the roadwheel on the side concerned.
- 2 Slacken the balljoint nut, release the ball-pin using a balljoint separator and remove the nut. Extract the balljoint from the steering arm (see illustration).
- 3 Slacken the clamp bolt which secures the balljoint to the threaded adjustment pin. Mark the position of the balljoint on the adjustment pin with paint or tape, then unscrew the balljoint from the pin.
- 4 Note that the balljoints are handed. The right-hand balljoint is marked R; the left-hand balljoint has no marking.

Refitting

- 5 Screw in the new balljoint onto the adjustment pin to approximately the same position as was occupied by the old one. Secure it with the clamp bolt.
- 6 Connect the balljoint to the steering arm. Secure it with a new self-locking nut, tightened to the specified torque.



26.2 Steering damper securing nut (arrowed)

- 7 Refit the roadwheel, lower the vehicle and tighten the wheel bolts.
- 8 Check the front wheel alignment and adjust if necessary. No harm will result from driving the vehicle a short distance to have the alignment checked.

25 Steering rack bellows - removal and refitting

Removal

- 1 Remove the steering gear, as described in Section 27.
- 2 Remove the mounting bracket and rubber insulator from the end of the rack furthest from the pinion.
- 3 On power-assisted racks, disconnect the hydraulic pipe union adjacent to the end of the bellows.
- 4 Remove the clamping wires and slide both bellows and the connecting tube off the rack. Separate the bellows from the tube.

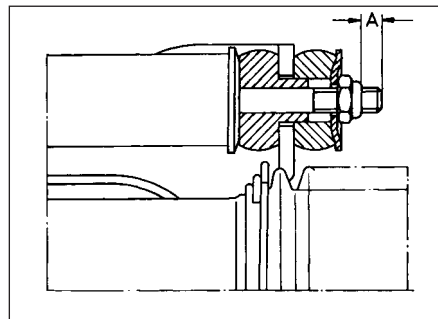
Refitting

- 5 Fit the new bellows and the tube to the rack. Secure the bellows with new wire clips, positioned so that when the rack is in the car the ends of the clips will point upwards. Make sure that the bellows are not twisted.
- 6 On power-assisted only, reconnect the hydraulic pipe union using new sealing rings. Tighten the union to the specified torque.
- 7 Refit the rubber insulator and mounting bracket. The concave end of the mounting bracket flange must point downwards when the rack is fitted.
- 8 If the pinion sealing cap has been disturbed, make sure it is refitted with its notch engaged with the rib on the pinion housing.
- 9 Refit the steering gear (Section 27).

26 Steering damper - removal and refitting

Removal

- 1 When fitted, the steering damper is removed as follows.



26.5 Steering damper securing nut setting
 $A = 6 \text{ mm}$

- 2 Remove the securing nut at the moving end of the damper (see illustration). Recover the washer.
- 3 Unbolt the damper from the bracket at the pinion end and remove it.

Refitting

- 4 When refitting, secure the pinion end of the damper first and tighten its mounting bolt to the specified torque.
- 5 Tighten the securing nut at the moving end of the damper to obtain a dimension A as shown (see illustration).

27 Steering gear - removal and refitting

Manual steering

Removal

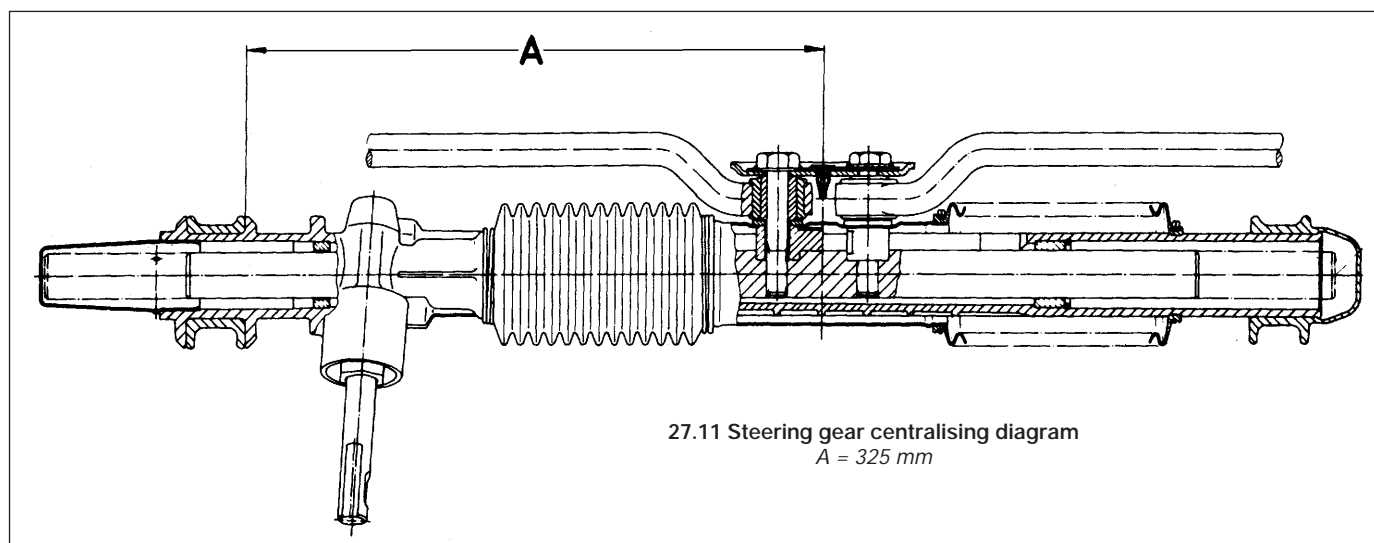
- 1 Disconnect the battery earth lead.
- 2 On carburettor models only, remove the air cleaner, as described in Chapter 3.
- 3 On models with a headlamp washer system, release the fluid reservoir and move it to one side.
- 4 Remove both tie-rod bolts from the centre of the rack (see illustration). Recover the bolt locks, the spacer plate and the washers.
- 5 If a steering damper is fitted, unbolt it at the pinion end and remove it, complete with the moving end tube and bracket.
- 6 Set the steering in the straight-ahead position.
- 7 Slacken both clamp bolts on the flexible coupling. Push the coupling upwards as far as it will go.
- 8 Remove the front right-hand wheel.
- 9 Unbolt the steering gear mounting brackets from the bulkhead. Make sure that the pinion is free of the coupling, then withdraw the steering gear through the wheel arch.

Refitting

- 10 Commence refitting by fastening the steering gear to the bulkhead. Tighten the mounting bracket bolts to the specified torque. Use new self-locking nuts on the mounting studs.



27.4 Tie-rod connection to steering rack



27.11 Steering gear centralising diagram

A = 325 mm

11 Before connecting the flexible coupling make sure the steering gear is in the straight-ahead position (see illustration).

12 Reconnect the flexible coupling as described in Section 6.

13 Reconnect the tie-rods to the rack, remembering to fit the washers under the rod ends. (Note that the tie-rods are handed: they are fitted correctly when their clamp bolts are fitted from below). Fit the spacer plate or damper bracket and tighten the bolts to the specified torque, using new lockplates.

14 Refit the remaining components in the reverse order to removal.

Power steering

Removal

15 Refer to paragraphs 1 to 9, but additionally the flow and return pipes must be disconnected from the pinion housing. Allow the fluid to drain from the open unions, then plug the holes to keep dirt out. Introduction of dirt may seriously damage the hydraulic system.

Refitting

16 Refer to paragraphs 10 to 14. Top-up and bleed the system on completion, as described in Section 29.

28 Steering gear - overhaul

1 Examine the steering gear assembly for signs of wear or damage and check that the rack moves freely throughout the full length of its travel with no signs of roughness or excessive free play between the steering gear pinion and rack. It is possible to overhaul the steering gear assembly housing components but this task should be entrusted to a Vauxhall dealer. The only components which can be renewed easily by the home mechanic are the steering gear bellows and the tie-rod ends which are covered elsewhere in this Chapter.

2 On models equipped with power-assisted steering inspect all the steering gear fluid unions for signs of leakage and check that all union nuts are securely tightened.

3 Inspect the rubber mountings and pinion gear cover renew them if the rubbers shown signs of wear or deterioration.

29 Power-assisted steering - bleeding

1 After any of the hydraulic unions has been disturbed, or if the fluid level has been allowed to fall so low that air has been introduced into the system, bleeding should be carried out as follows.

2 Top-up the reservoir with fresh clean fluid of the specified type. Fluid drained from the system must not be re-used.

3 If the pump is dry, start the engine momentarily and then switch it off. Top-up the reservoir to the lower mark on the dipstick, run the engine briefly again and repeat the process

until the fluid level stabilises. It is important that the pump is not allowed to run dry.

4 With the engine running at idle speed, turn the steering wheel approximately 45° to left and right of centre, then from lock to lock. Do not hold the wheel on either lock, as this improves some strain on the hydraulic system.

5 Switch off the engine and correct the fluid level.

30 Power steering pump - removal and refitting

Removal

1 Remove the pump drivebelt, as described in Chapter 1.

2 Disconnect the fluid feed and return hoses from the pump. Be prepared for fluid spillage. Plug the openings; being careful not to introduce dirt.

3 Unbolt and remove the pump (see illustration).

4 A defective pump must be renewed: no spares are available.

Refitting

5 Refit in the reverse order to removal. Tension the drivebelt, as described in Chapter 1, before tightening the pump mountings.

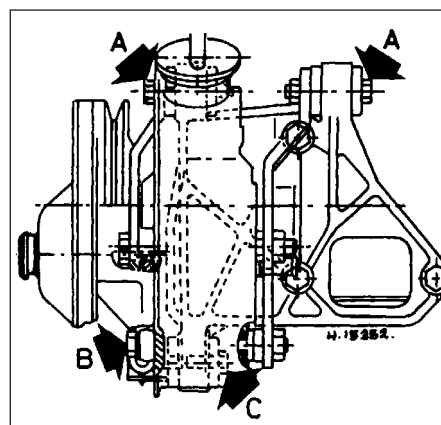
6 Bleed the system, as described in Section 29. Pay particular attention to the procedure required to prime the pump if a new pump has been fitted.

31 Power steering fluid reservoir - removal and refitting

Removal

1 Slacken the reservoir clamp bolt.

2 Disconnect both hoses from the reservoir. Be prepared for fluid spillage. Remove the reservoir.



30.3 Steering pump mountings

A Pump pivot bolts

B Tensioner strap pivot bolt

C Tensioner strap mounting bolt

Refitting

3 Refit in the reverse order to removal. Bleed the system on completion, as described in Section 29.

32 Wheel alignment and steering angles - general information

Accurate front wheel alignment is essential for precise steering and handling, and for even tyre wear. Before carrying out any checking or adjusting operations, make sure that the tyres are correctly inflated, that all steering and suspension joints and linkages are in sound condition and that the wheels are not buckled or distorted, particularly around the rims. It will also be necessary to have the car positioned on flat level ground with enough space to push the car backwards and forwards through about half its length.

Front wheel alignment consists of four factors:

Camber is the angle at which the roadwheels are set from the vertical when viewed from the front or rear of the vehicle. Positive camber is the angle (in degrees) that the wheels are tilted outwards at the top from the vertical.

Castor is the angle between the steering axis and a vertical line when viewed from each side of the vehicle. Positive castor is indicated when the steering axis is inclined towards the

rear of the vehicle at its upper end.

Steering axis inclination is the angle, when viewed from the front or rear of the vehicle, between the vertical and an imaginary line drawn between the upper and lower front suspension strut mountings.

Toe setting is the amount by which the distance between the front inside edges of the roadwheel differs from that between the rear inside edges, when measured at hub height. If the distance between the front edges is less than that at the rear, the wheels are said to toe-in. If it is greater than at the rear, the wheels toe-out.

Camber, castor and steering axis inclination are set during manufacture and are not adjustable. Unless the vehicle has suffered accident damage, or there is gross wear in the suspension mountings or joints, it can be assumed that these settings are correct. If for any reason it is believed that they are not correct, the task of checking them should be left to a GM dealer who will have the necessary special equipment needed to measure the small angles involved.

It is, however, within the scope of the home mechanic to check and adjust the front wheel toe setting. To do this a tracking gauge must first be obtained. Two types of gauges are available and can be obtained from motor accessory shops. The first type measures the distance between the front and rear inside edges of the roadwheels, as previously

described, with the car stationary. The second type, known as a scuff plate, measures the actual position of the contact surface of the tyre, in relation to the road surface, with the vehicle in motion. This is done by pushing or driving the front tyre over a plate which then moves slightly according to the scuff of the tyre and shows this movement on a scale. Both types have their advantages and disadvantages, but either can give satisfactory results if used correctly and carefully.

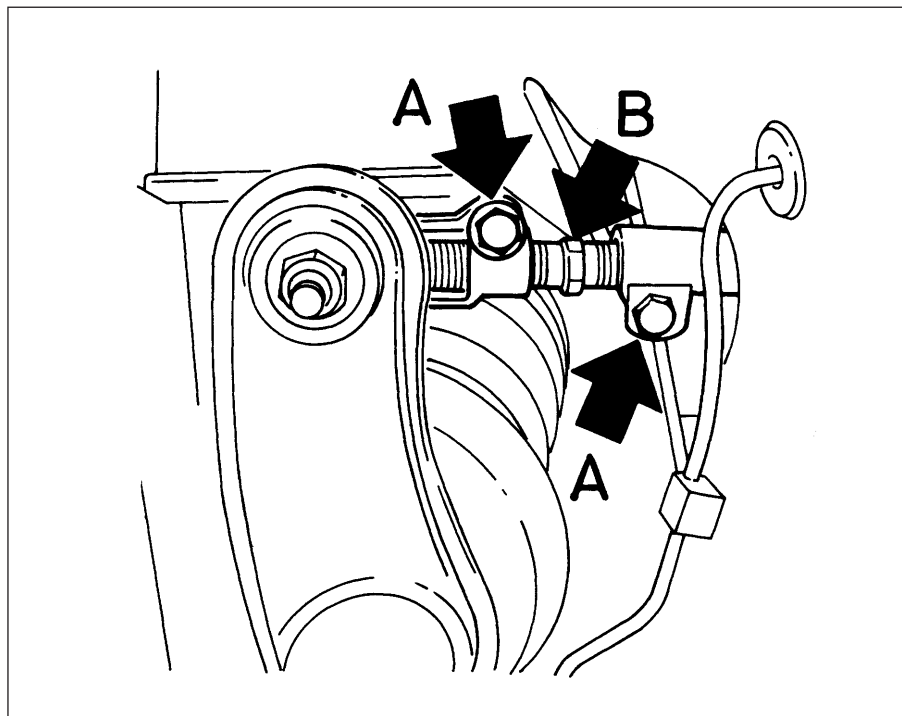
Many tyre specialists will also check toe settings free or for a nominal charge.

Make sure that the steering is in the straight-ahead position when making measurements.

If adjustment is found to be necessary, clean the ends of the tie-rods in the area of the adjustment pin and clamp bolts.

Slacken the clamp bolts (one on each tie-rod balljoint and one on each tie-rod) and turn the adjustment pin on each tie-rod by the same amount in the same direction (**see illustration**). Only turn each pin by a quarter turn at a time before rechecking.

When adjustment is correct, tighten the clamp bolts to the specified torque. Check that the tie-rod lengths are equal to within 5 mm and that the steering wheel spokes are in the correct straight-ahead position.



32.8 Toe adjustment points (only one side shown)

A Clamp bolts

B Adjustment pin