



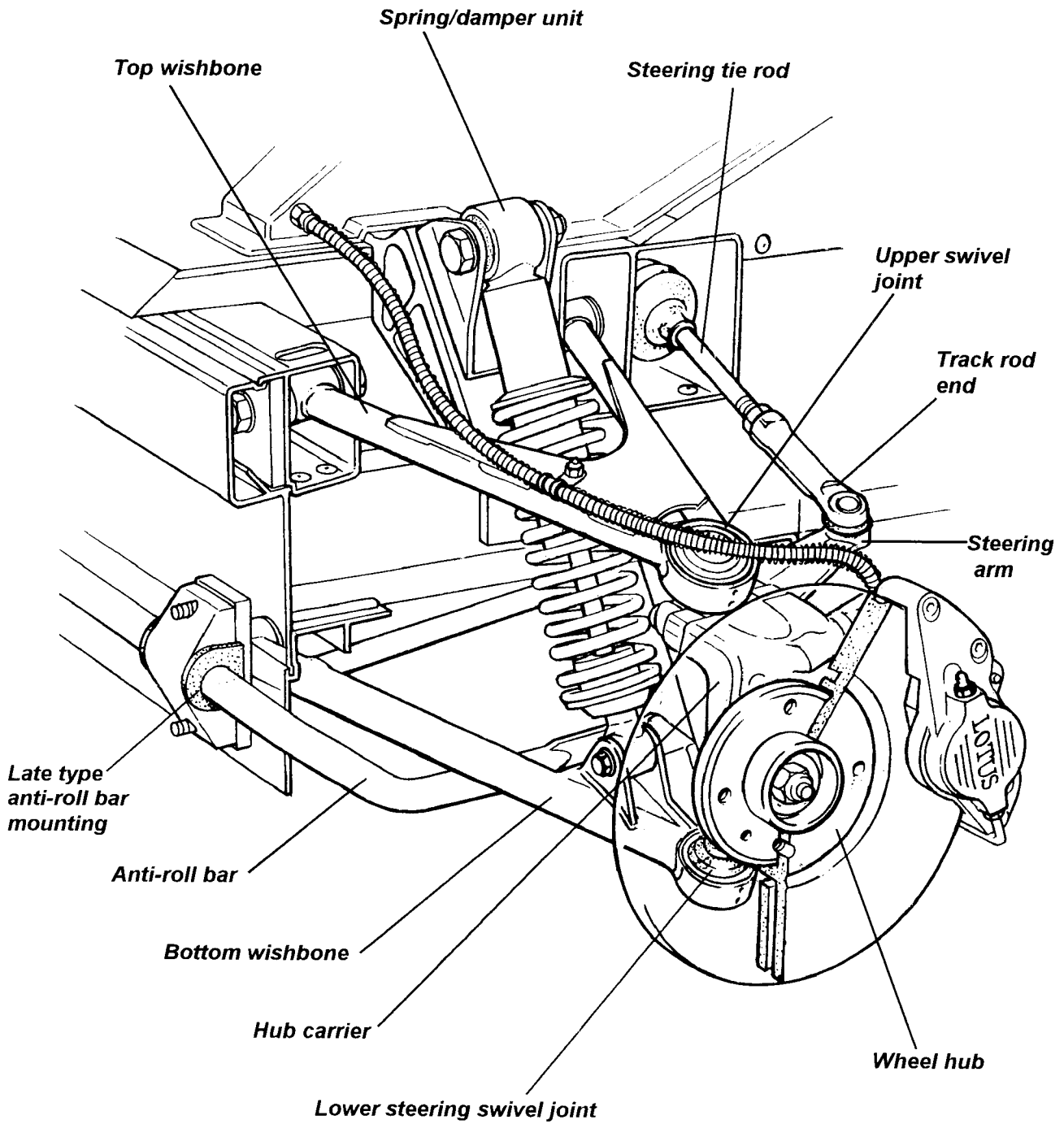
FRONT SUSPENSION

SECTION CH - ELISE 2001 M.Y. Onwards

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GENERAL LAYOUT



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CH.1 - GENERAL DESCRIPTION

The fully independent front suspension comprises, on each side of the car, upper and lower wishbones, a concentric coil spring/telescopic damper unit, and a tubular anti-roll bar. A forged steel hub carrier, provides a mounting for a the hub bearing unit to which the road wheel is attached via four spline socket bolts.

The upper and lower 'A' frame wishbones are fabricated from steel tube, the upper wishbone braced by sheet steel gussets at its apex, and the lower wishbone braced by a tubular strut at its base. The inboard ends of both wishbones use replaceable bonded rubber pivot bushes to provide maintenance free articulation, with a specification providing accurate and responsive dynamic characteristics. The outer ends of both wishbones incorporate housings into which the upper and lower steering swivel ball joints are pressed. The upper ball pin is secured to the forged steel, rearward facing steering arm, itself fixed to the hub carrier by two M10 bolts. The ball pin of the lower swivel joint is secured directly into a tapered hole in the bottom of the forged steel hub carrier. The Bilstein spring/damper unit acts between the outer end of the lower wishbone and the chassis, and is fitted with the damper rod lowermost in order to minimise unsprung weight.

A forward mounted tubular steel anti-roll bar, is supported in chassis mounted rubber pivot bushes and is operated via short ball jointed drop links from the lower wishbones.

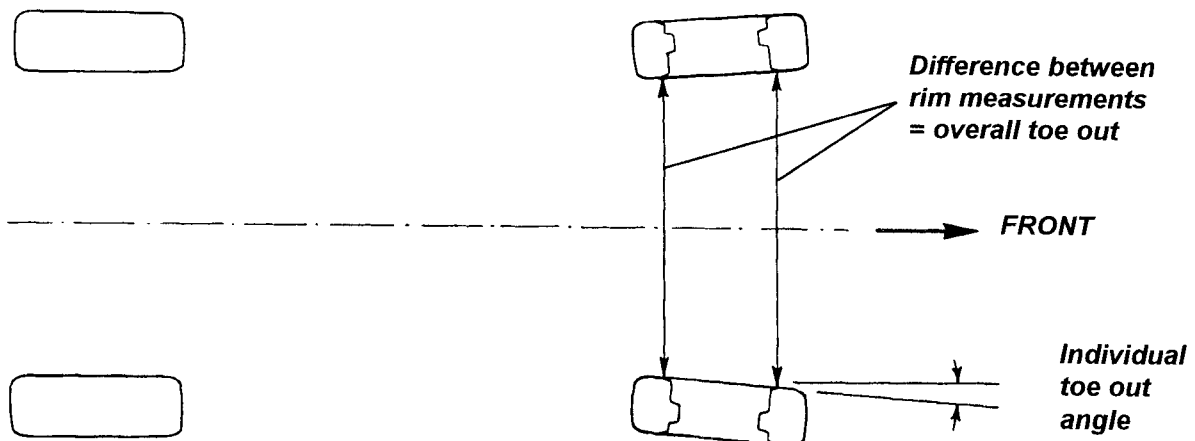
CH.2 - GEOMETRY & ADJUSTMENTS

Provision is made for the adjustment of wheel alignment, camber and castor. Under normal service conditions, no periodic scheduled check of the geometry is necessary, although a front wheel alignment check is recommended when the front tyres are replaced. A full geometry check is required only after front suspension repair, or if excessive tyre wear is evident, or if steering difficulties are encountered. Before any measurements or adjustments are made it is essential first to set the vehicle to its 'mid-laden' ride height, approximating to driver and passenger and a half tank of fuel. This will require the vehicle to be ballasted, or tied down:

Ride height (for geometry check)	- front	130 mm below front end of chassis siderail
	- rear	130 mm below rear end of chassis siderail
Alignment		0.2 mm toe-out overall; - 0, + 0.2 mm (0.03° toe-out overall; - 0, + 0.03°)
Camber		- 0.1°; + 0.1°, - 0.2°. Max side/side 0.2°
Castor		+ 3.8°; + 0.3°, - 0.2°. Max side/side 0.3°
Steering axis inclination		12° nominal

Alignment

Wheel alignment refers to the parallelism of the wheels when viewed from above and is crucial to vehicle stability, handling and tyre wear.

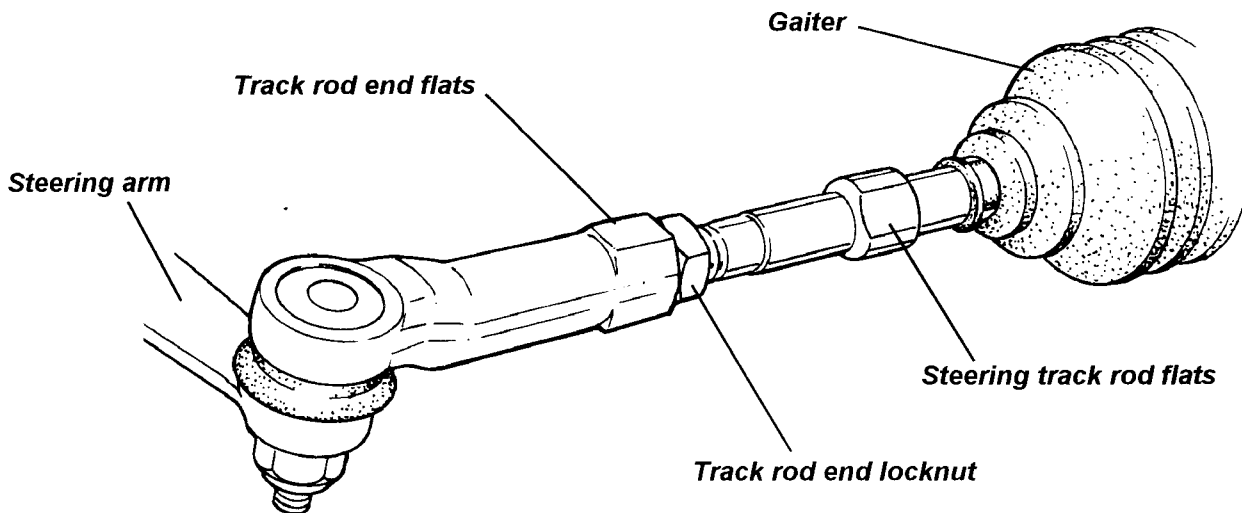


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Alignment is measured either by the angle a wheel makes with the vehicle centre line, or the difference in dimension between the wheel rim to wheel rim measurement at the front and rear of the wheel at hub centre height. The wheels are said to 'toe-in' when the wheel paths converge ahead of the vehicle, and 'toe-out' when they diverge. Wheel alignment is designed to vary with both steering angle (Ackerman) and suspension travel (bump steer) and should be measured only 'straight ahead' at the specified ride height.

Front wheel alignment is adjusted by screwing the track rods into or out of the track rod outer end ball joints. In order to preserve the required bump steer characteristic and steering symmetry, the effective length of each track rod must remain equal - adjust each track rod by a similar amount.



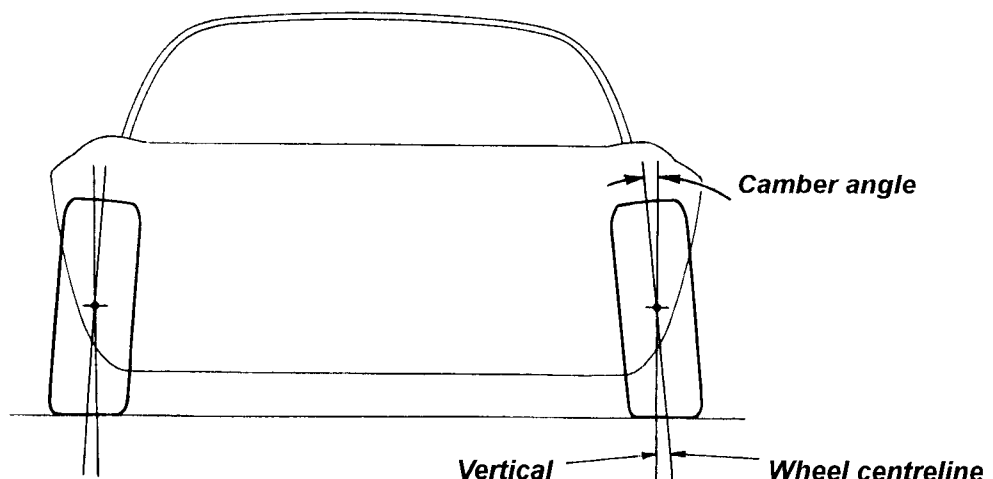
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- Hold the track rod end using the flats provided, and slacken the locknut. Repeat for the opposite side.
- Turn each track rod a similar amount. As a guide, turning both track rods by one quarter of a turn will alter overall toe-out by approx. 2.0 mm.
- When adjustment is correct, hold each track rod end and tighten the locknuts to 80 - 82 Nm (58 - 60 lbf.ft).

When slackening or tightening the track rod end locknuts, it is important that the torque reaction is resisted using the track rod end flats, and that the ball joint itself is not allowed to be stressed.

Camber Adjustment

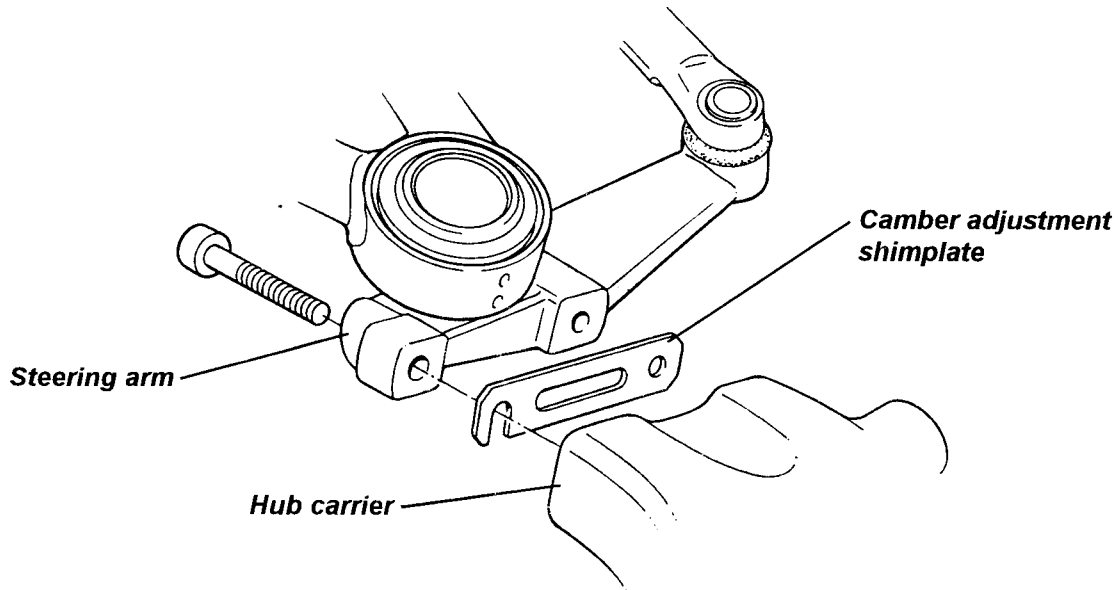
Camber is the angle from vertical of the wheel when viewed from the front, and is said to be negative when the wheel leans inwards at the top (positive when leaning outwards). The primary purpose of camber is to achieve the maximum efficiency of the tyre under cornering loads and body roll, with the specification closely allied to a particular wheel/tyre combination. The camber angle changes with suspension travel, becoming more negative on bump, and should be measured only at the specified ride height. Incorrect camber can result in handling deficiencies and excessive tyre wear.



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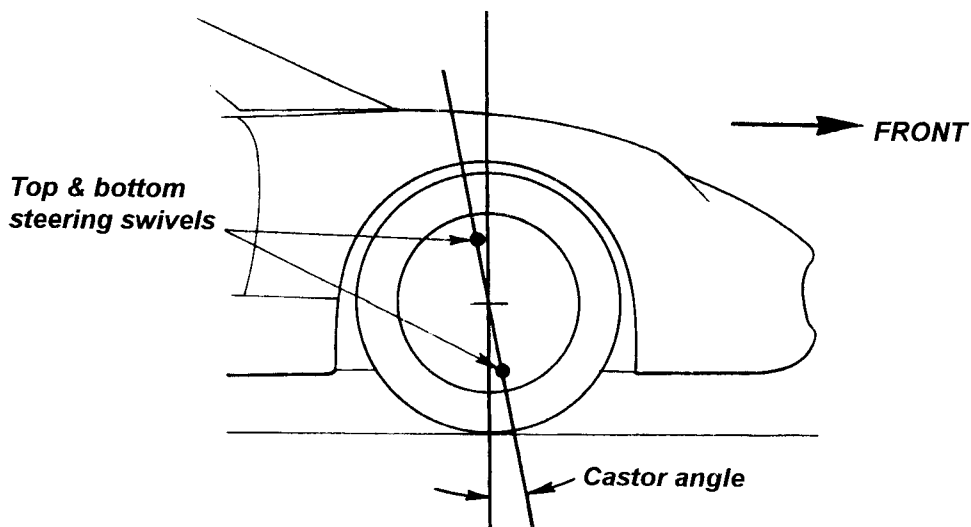
Camber adjustment is effected by adding or deleting shim plates between the steering arm (to which the upper steering swivel joint is fixed) and the hub carrier.



- Shimplates are available in 1mm and 3mm thicknesses.
- Reducing the shim pack thickness will increase negative camber. Adding shims will reduce negative camber.
- A 1mm shim plate will alter camber by approximately 0.25°.
- Apply Permabond A130 (A912E7033) to the two steering arm fixing bolts, and tighten to 45 Nm

Castor Adjustment

Castor is the angle from vertical of the steering axis of the wheel when viewed from the side. Its primary purpose is to provide a natural straight running tendency of the steered wheels with forward vehicle motion. Castor angles have a complex interaction with other steering geometries and if unbalanced or outside of specification, can result in various stability and handling deficiencies.

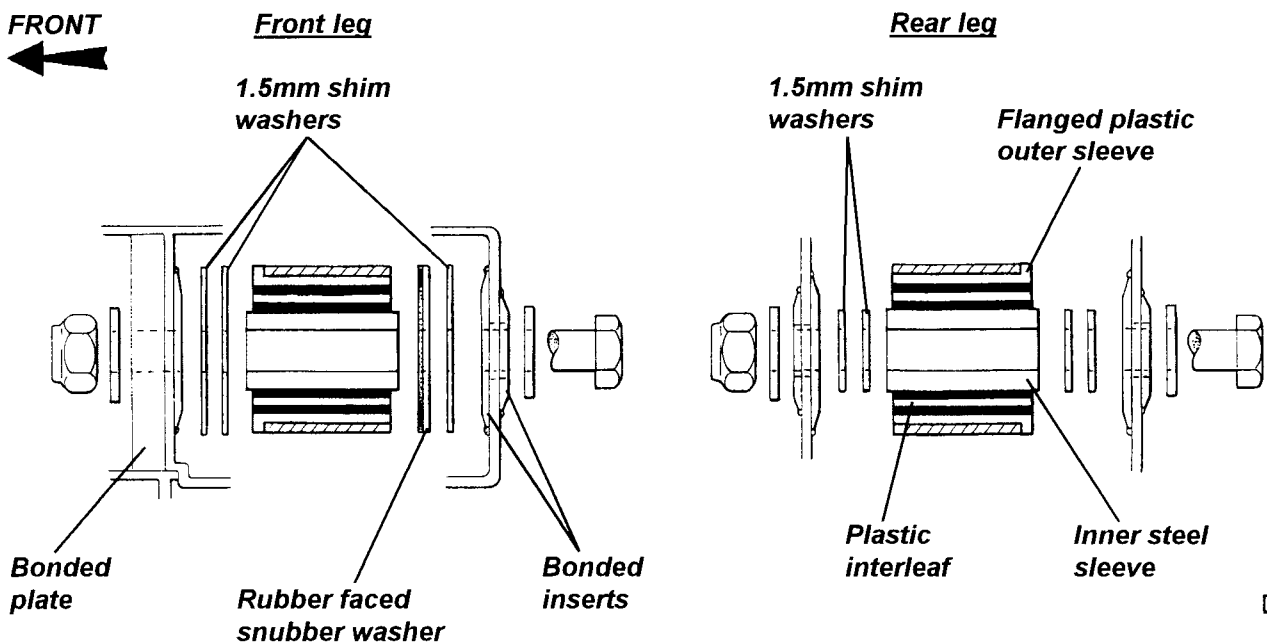




The wishbone pivot bushes are bonded rubber type with a plastic flanged outer sleeve, a plain steel inner sleeve, and a plastic interleaf sleeve within the rubber bush to control the flexing characteristic. The top wishbone rear bush, identified by a blue paint mark, has no interleaf sleeve.

The top wishbone pivots are sandwiched between the walls of transverse chassis box sections, the pick up points in which are reinforced either with machined inserts, or in the case of the foremost position, a thick alloy plate, each being bonded to the chassis with epoxy adhesive. Spacer washers are fitted ahead of and behind each of the top wishbone pivot bushes to allow the wishbone to be displaced forwards or backwards, with an associated change of castor angle. A rubber faced snubber washer fitted against the rear face of the top wishbone front bush prevents metal to metal contact under extreme braking forces. The spacer washers may be re-distributed between the front and rear of each pivot bush but the snubber washer position, and the total shim pack thickness of 4 x 1.5mm at each pivot (inc. the 1.5mm snubber washer) must remain unchanged.

Top Wishbone Inboard Fixing



Notes

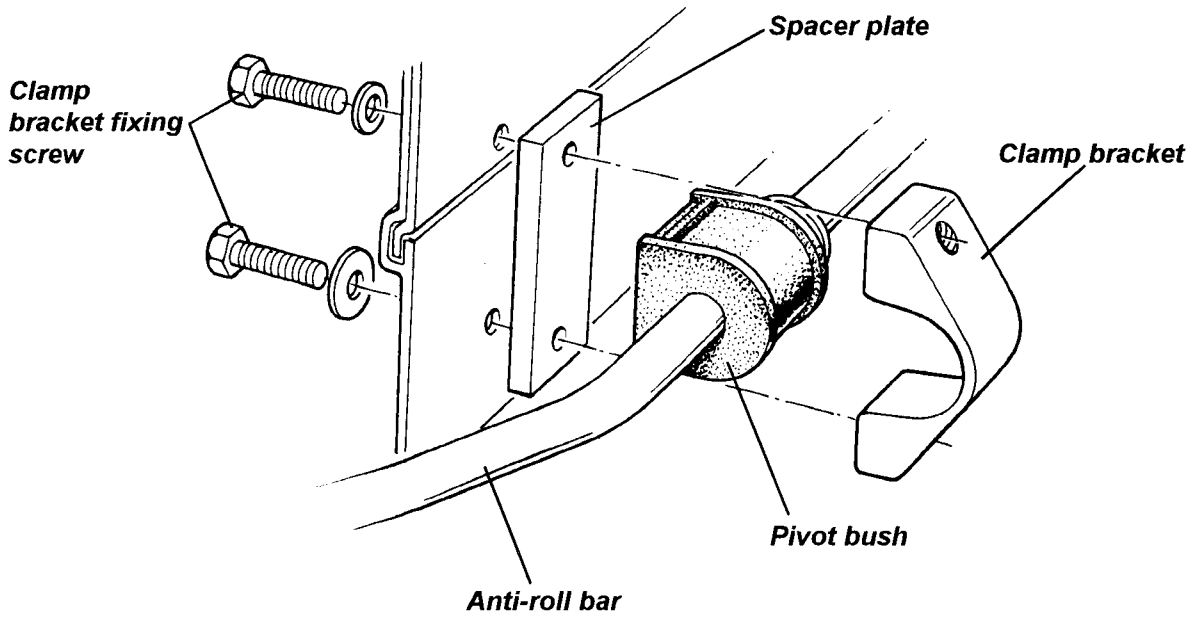
- Shim distribution at the front bush of either wishbone must be copied at the rear bush of that wishbone.
- Transferring a 1.5mm shim washer from ahead of, to behind the pivot bushes, will **reduce** castor by approximately 0.4°.
- Transferring a 1.5mm shim washer from behind, to ahead of the pivot bushes, will **increase** castor by approximately 0.4°.
- Ensure that the load spreading washers are correctly located beneath the bolt heads and nuts as shown in the drawings.
- Ensure that the pivot bolts are tightened only with the vehicle at ride height. Torque to 45 Nm.

CH.3 - ANTI-ROLL BAR

A tubular steel anti-roll bar is mounted in pivot bushes onto the front face of the chassis, and is linked to the outboard ends of each lower front wishbone via short ball jointed links. The anti-roll bar is secured to the front face of the chassis by rubber pivot bushes and alloy clamp brackets. Washers welded to the bar bear against the inner sides of the bushes to provide lateral location. Castrol LMX rubber grease, or equivalent, should be used when fitting the rubber bushes onto the anti-roll bar.

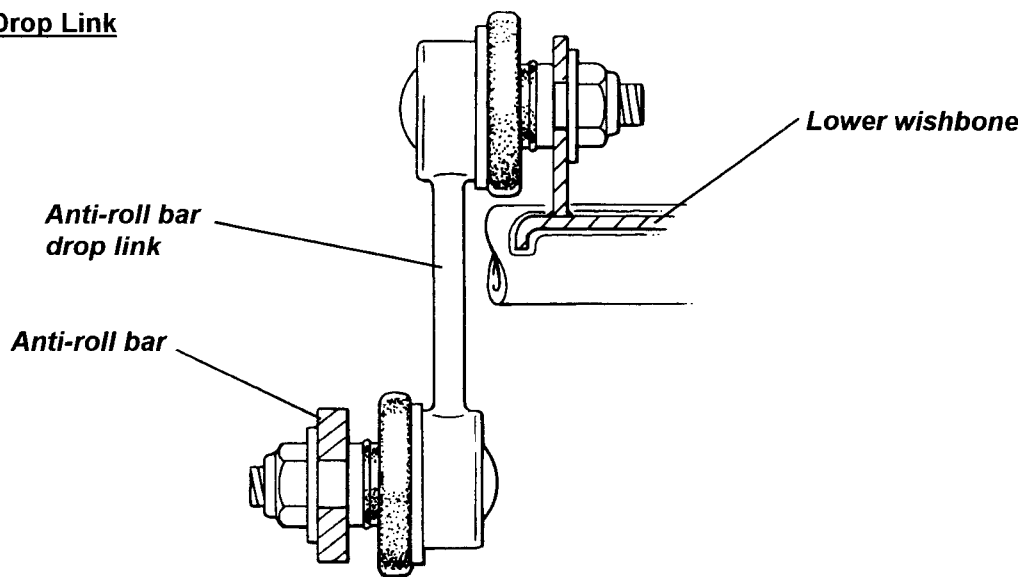


Anti-Roll Bar Mounting



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Anti-Roll Bar Drop Link



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**CH.4 - SUSPENSION DISASSEMBLY/ASSEMBLY**

The suspension may be disassembled without the use of any special tools other than a 'Torx' socket for the hub bearing carrier bolts, and a spring compressor, required only if the spring is to be removed from the damper unit. With the car on a wheel free lift and with the front wheels removed:

1. Remove the wheelarch liner(s) as appropriate.
2. Remove the two bolts securing the brake caliper to the hub carrier, release the flexible hose from the top wishbone, and support the caliper aside without straining the brake hose. Release the single countersunk screw, and remove the brake disc.
3. Remove the nut securing the track rod end into the steering arm, and use a ball joint splitter to separate the rod end from the arm.
4. Remove the nut securing the top swivel joint to the steering arm, and use a ball joint splitter to separate the joint from the arm. Remove the two M10 fixing bolts and remove the steering arm from the hub carrier, taking care not to misplace the camber adjustment shim plates.
5. Remove the nut securing the lower swivel joint to the hub carrier, and use a ball joint splitter to separate the ball pin from the carrier.
6. Remove the bolts securing the spring/damper unit to the lower wishbone and chassis anchor bracket, and withdraw the unit, noting the spacer washers fitted at the top end.
7. Disconnect the anti-roll bar drop link from the lower wishbone, and remove the lower wishbone front pivot bolt.
8. Remove the lower wishbone rear pivot bolt from within the cabin footwell, and withdraw the wishbone.
9. Before removing the two pivot bolts for the top wishbone, take careful note of the distribution of castor adjustment washers. Move the steering rack to full lock to provide clearance for the withdrawal of the wishbone rear pivot bolt. Withdraw the wishbone.
10. The wishbone pivot bushes comprise a rubber bush bonded to a steel inner sleeve and a flanged plastic outer sleeve. The bushes may be pressed out of the wishbone eyes, and new bushes fitted using suitable press tool dollies. Smear the outer surface of the new bush with IPC 'P-80' rubber lubricant emulsion (A082C6042V) to ease fitment, and assemble as follows:
Top wishbone - insert from the outside of both pivot eyes (from front of front eye, and rear of rear eye).
Lower wishbone - insert from the inside of both pivot eyes (from rear of front eye, and front of rear eye).
Note that all top wishbone pivot bushes are common with the exception of the top wishbone rear pivot, which contains no interleaf sleeve and is identified by a blue paint mark.
11. Top and bottom swivel joints are identical, and may be replaced if necessary using a suitable press.
12. If the anti-roll bar is to be removed; remove the front alloy undertray, and, by drilling out the rivets, the small alloy closing panel at each side of the crash structure below the anti-roll bar. Release the a.r. bar clamps and drop links, and withdraw the bar.
13. The road spring may be removed from the damper using a suitable spring compressor to allow the spring lower slotted seat to be withdrawn. Note that the spring upper seat is retained by a circlip located in the centre of three available damper body grooves.
14. To remove the hub bearing unit from the hub carrier, release the three Torx head bolts and withdraw the complete unit. The hub unit is not serviceable, and is replaced complete if faulty.



Reassembly

Re-assemble the suspension in reverse order to disassembly with the following notes:

- Take care to assemble each pivot bolt with the correct washers/snubbers/spacers as shown in the diagrams.
- Smear the shank of each pivot bolt with PBC grease, but do not allow contamination of the threads.
- Take care to refit the original camber adjustment shimpack, and distribute the castor shims as noted on removal.
- After re-fitting the anti-roll bar, ensure that the crash structure closing panels are re-riveted.
- Apply Permabond A130 (A912E7033V) to the threads of the steering arm bolts.
- Lubricate the ends of the damper top eye bush with rubber grease.
- Press the brake pedal to reposition the pads before driving the car.

15. The Service Schedule specifies that the security of the front and rear suspension is checked at each service. This operation requires that all the principal suspension pivot bolts are torque checked, noting the following points:

Where a bolt is tapped into a housing or weldnut, and relies on a thread locking compound for security, it is important to appreciate that if the bolt is disturbed, the locking compound must be re-applied. The following procedure should be adopted for all such fixings:

- Check the torque of the fixing.
- If the specified torque is attained without the fixing being disturbed (moving), take no further action.
- If the bolt moves, the locking action of the thread adhesive will have been compromised. Remove the bolt completely, clean off all old adhesive using a wire brush and acetone, and apply new adhesive as specified.
- Refit the bolt and tighten to the specified torque.
- If for any reason a bolt is found to have become loose, and the car has been operated for any period in this condition, the bolt should be renewed as a standard precaution and related components carefully inspected for hole ovality or wear.

Torque Settings:

	<u>Nm</u>
- Upper and lower wishbone pivot bolts	45
- Upper swivel joint to steering arm	55
- Lower swivel joint to plinth	55
- Steering arm to hub carrier	45
- Track rod end to steering arm	30
- Damper to lower wishbone	45
- Damper to top anchor bracket	45
- Damper anchor bracket to chassis	25
- Hub bearing unit to hub carrier	90
- Brake caliper to hub carrier	45
- Anti-roll bar rubber bush mounting clamps	25
- Anti-roll bar drop links	45

CH.5 - FRONT WHEEL BEARINGS

The sealed front wheel bearings are contained in a steel housing secured to the hub carrier with three 'Torx' bolts. The double row, angular contact, ball bearing is retained in the outer housing and also onto the hub spigot by a shoulder and a peening operation, and is inseperable for service.

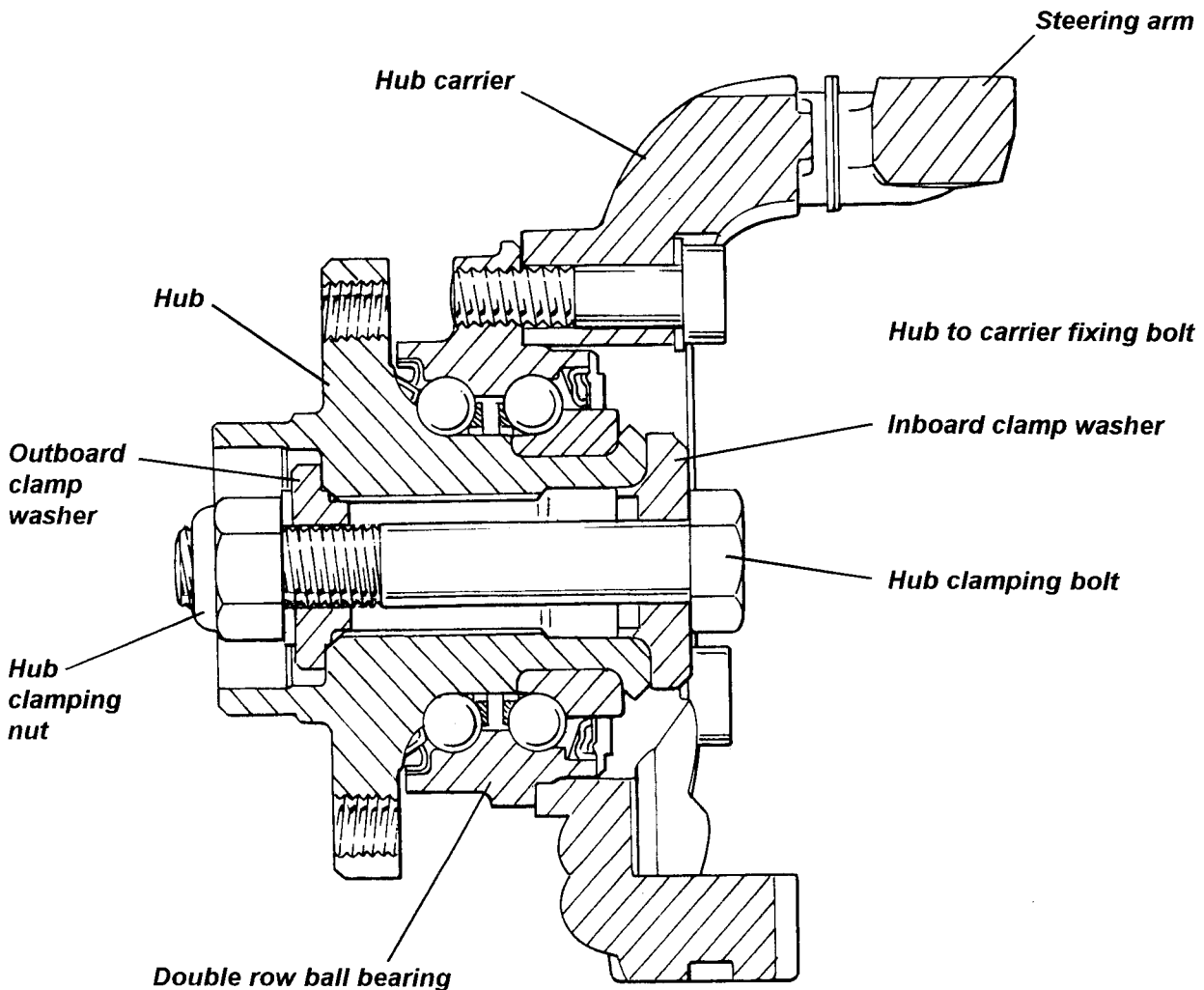
If there is found to be any discernible free play in the hub bearing, or any roughness or tight spots can be felt, or any signs of lubricant expulsion are evident, the hub assembly should be replaced - there is no provision for adjustment.

To Replace Hub Bearing Assembly

1. With the wheel removed, release the two fixing bolts, and remove the brake caliper from the hub carrier. Support clear of the brake disc without straining the flexible hose. Release the single countersunk screw and withdraw the brake disc from the hub.



- Using a Torx socket, release the three bolts securing the hub bearing unit to the hub carrier.
- Transfer to the new hub bearing unit**, the M16 bolt and stepped washers clamping the hub into the inner races of the hub bearings, with the nut on the outboard side. Torque tighten to 210 Nm
- Fit the new hub bearing unit to the hub carrier and retain with the three Torx bolts. Torque tighten to 90 Nm.
- Refit the brake disc and caliper, using PermaBond A130 (A912E7033) to the threads of the caliper fixing bolts and torque tightening to 45 Nm. Pump the brake pedal to reposition the pads before driving the car.



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