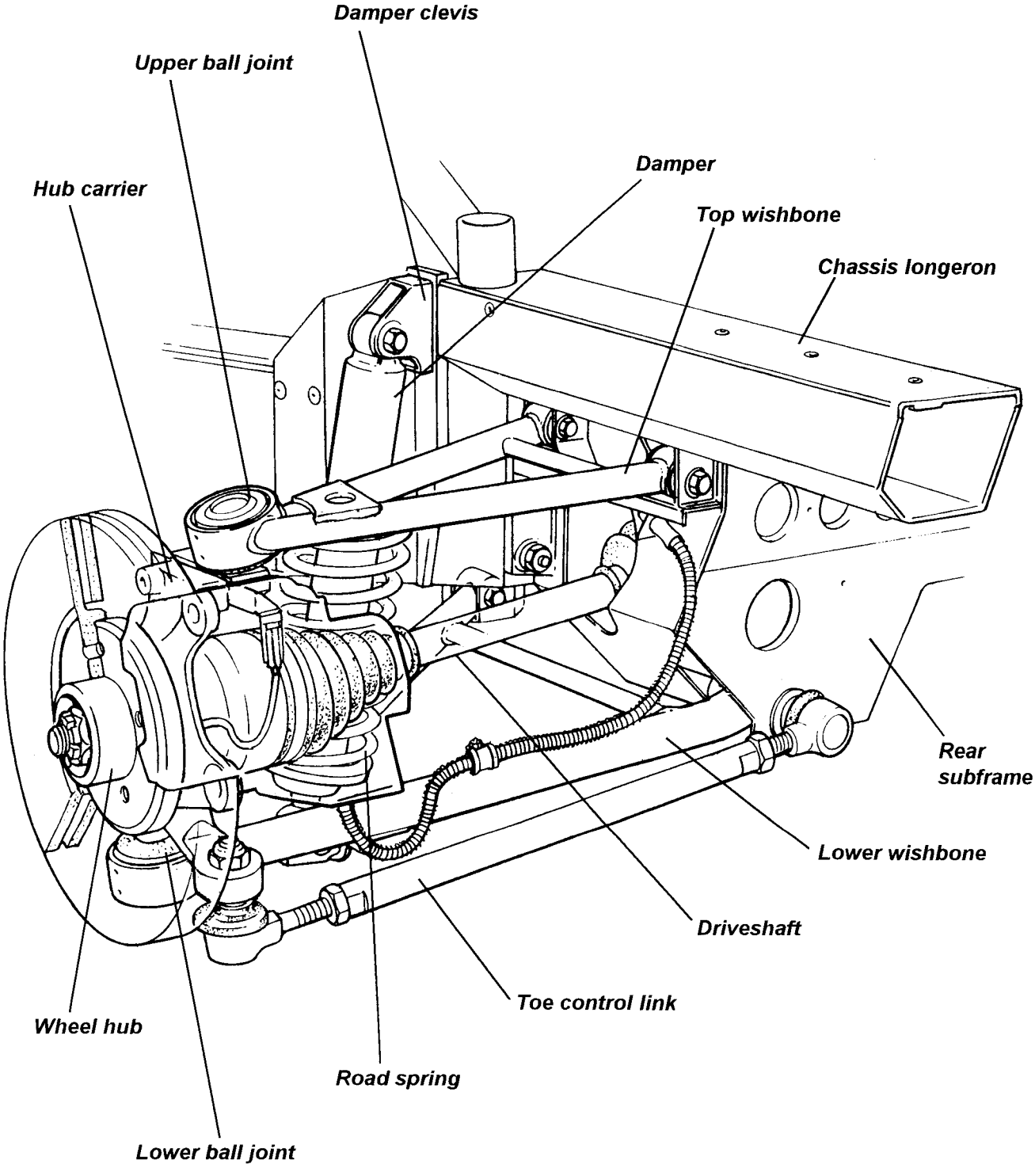
REAR SUSPENSION

SECTION DG - ELISE 2001 M.Y. Onwards


Damper clevis
Upper ball joint
Hub carrier
Damper
Top wishbone
Chassis longeron
Rear subframe
Lower wishbone
Driveshaft
Toe control link
Wheel hub
Road spring
Lower ball joint

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DG.1 - GENERAL DESCRIPTION

The fully independent rear suspension comprises, on each side of the car, upper and lower tubular steel wishbones, a toe control link, and a concentric coil spring/telescopic damper unit linked between the outboard end of the lower wishbone and the chassis. 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, with the inboard ends of both wishbones using replaceable bonded rubber pivot bushes to provide maintenance free articulation, with a specification providing accurate and responsive dynamic characteristics, with some suppression of noise and vibration. The two legs of the rearward biased top wishbone, pick up on the chassis rear subframe, and converge outboard to a ball joint housing into which is pressed a ball swivel joint. The ball pin of this joint locates in a forged steel plinth which is itself secured to the hub carrier using two horizontally disposed M10 bolts. The braced, wide based, forward biased lower wishbone, is anchored at its front inboard end to the chassis rear crossmember via a steel bracket, and at its rear inboard end to the chassis rear subframe. The outboard end of the wishbone houses another swivel ball joint, the ball pin of which is secured directly into a tapered hole in the forged steel hub carrier. The Bilstein telescopic damper with concentric coil spring, is fitted with the damper rod lowermost to minimise unsprung weight, and acts between the outer end of the lower wishbone and a steel clevis bracket bolted to the rear end of the chassis main side rail.

The adjustable length, double ball jointed, toe control link, shares a chassis anchorage with the rear pivot of the lower wishbone, and is secured directly into a rearward extension of the hub carrier.

The forged steel hub carrier, provides a mounting for a hub bearing unit which is secured by three 'Torx' head bolts, and incorporates a wheel speed sensor on the left hand side to supply engine management and speedometer data.

DG.2 - GEOMETRY & ADJUSTMENTS

Provision is made for the adjustment of wheel alignment and camber. Under normal service conditions, no periodic scheduled check of the geometry is necessary, with a full geometry check required only after suspension repair, or if excessive tyre wear is evident, or handling deficiencies 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. The following data refers to standard cars with non-adjustable spring/damper units. For cars fitted with Sport suspension, a lower ride height and revised geometry is used - refer to Section XA:

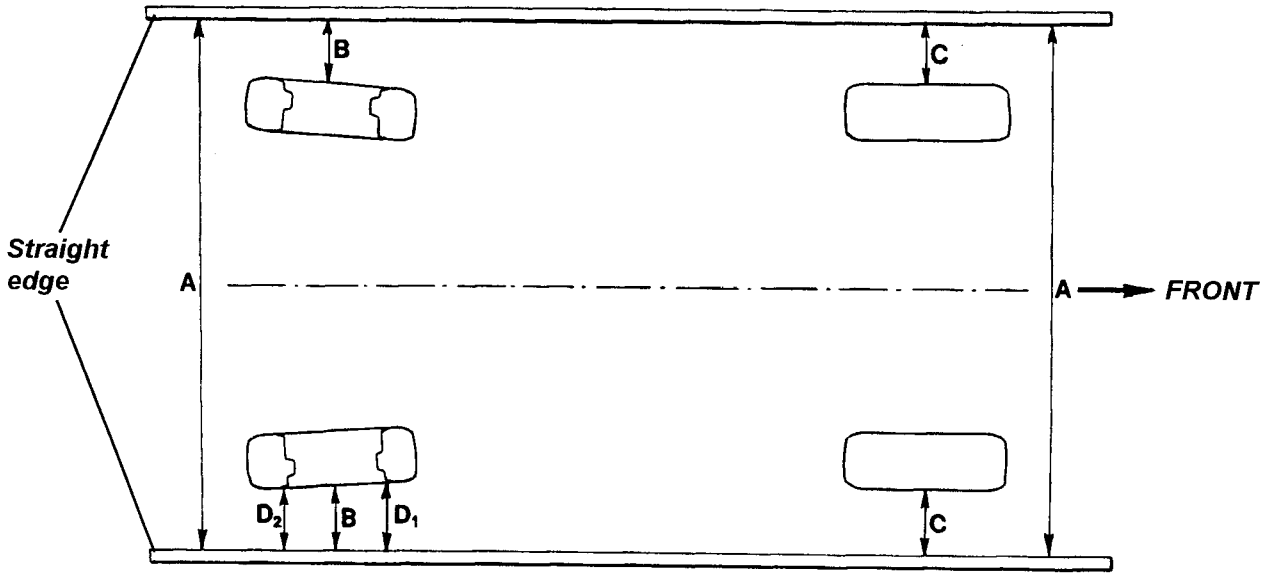
Ride height (for geometry check);	- front	130 mm below front end of chassis siderail
	- rear	130 mm below rear end of chassis siderail
Alignment;		1.2 mm toe-in each side; + 0.2 mm, - 0.
		(0.18° toe-in each side; + 0.03°, - 0)
		Max. difference side/side; 0.2 mm (0.03°)
Camber;		- 1.8°; ± 0.2°. Max. difference side/side; 0.2°

Alignment

Wheel alignment refers to the parallelism of the wheels when viewed from above and is crucial to vehicle stability, handling and tyre wear. It 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. Rear wheel alignment should be measured only using equipment which measures **individual** rear wheel alignment reletive to the car centreline. Wheel alignment is designed to vary with suspension travel ('bump steer') and the base setting should be measured only at the specified mid laden ride height.

It is possible to accurately measure individual wheel alignment using a pair of long straight bars or round section elastic in conjunction with 4 axle stands or similar. Any bars used must be longer than the length of the car, and be suitably stiff and straight.

Set up the bars or elastic on each side of the car at wheel centre height as shown an the diagram, so that A = A, B = B and C = C.



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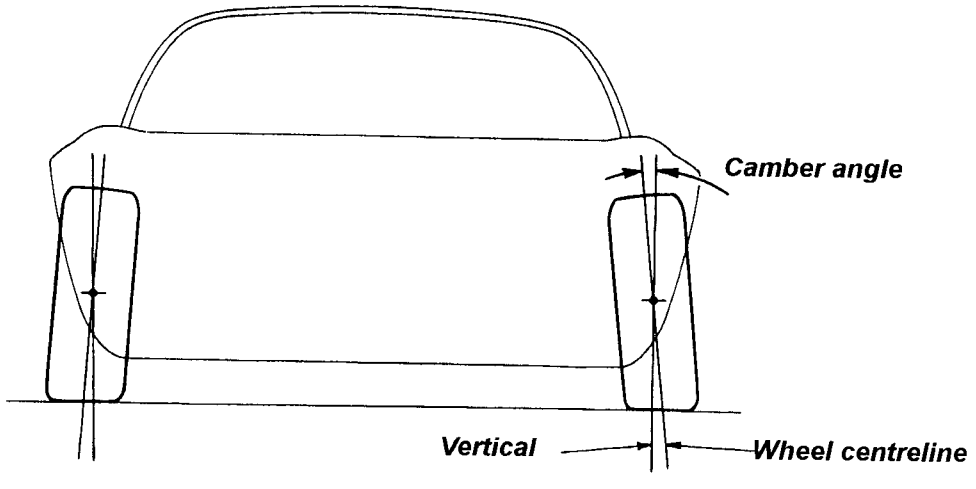
Measure the distance from the bar to the rim of the wheel concerned at the front and rear of the centre line of the wheel (D_1, D_2). If the front dimension, D_1, is greater than the rear dimension, D_2, the wheel has TOE-IN. If the rear dimension is greater than the front dimension, the wheel has TOE-OUT. The difference between the two measurements is the amount the wheel has toe-in or toe-out.

Wheel alignment is adjusted via the toe control link which is equipped with a left hand threaded ball joint at the inboard end, and a right hand threaded ball joint at the outboard end. Slacken both ball joint locknuts, and turn the link rod as necessary to increase or decrease the effective length of the link. As a guide, lengthening the link rod by a turn of one 'flat' (60°) will increase toe-in by just less than 1mm.

After adjustment, tighten the two locknuts to 55 Nm taking care to ensure that the ball joint sockets are aligned at 90° to each other.

Camber Adjustment

Camber is the angle from vertical of the wheel when viewed from the rear, and is said to be negative when the wheel leans inwards at the top (positive when leaning outwards).



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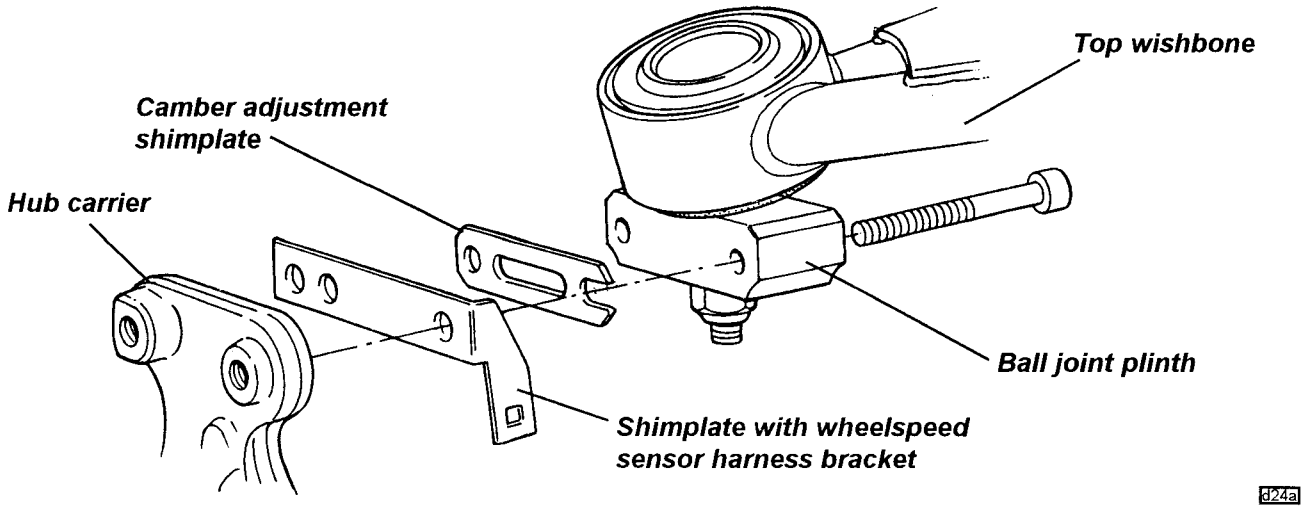
The primary purpose of camber is to achieve the maximum efficiency of the tyre under cornering loads and body roll, with the specification closely allied to a particular wheel/tyre combination. The camber angle changes with suspension travel, becoming more negative on bump, and should be measured only at the specified ride height. Incorrect camber can result in handling deficiencies and excessive tyre wear.



- Camber adjustment shim plates are fitted between the top wishbone ball joint plinth and the hub carrier.
- Shims are available in 1 mm thickness. Note that on the left hand side, the shimplate fitted against the hub carrier must always incorporate the mounting bracket for the wheel speed sensor harness connector.
- Reducing the shim pack thickness will increase negative camber. Adding shims will reduce negative camber.
- A 1mm shim plate will alter camber by approximately 0.3°.
- Apply Permabond A130 (A912E7033) to the threads of the two ball joint plinth fixing bolts, and torque tighten to 45 Nm.

DG.3 - 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. If the hub carrier is to be removed, necessitating withdrawal of the driveshaft, it is recommended first to release the driveshaft nut before dismantling the brakes.

With the car on a wheel free lift and with the rear wheels removed:

1. Remove the engine bay undertray to provide access to the lower wishbone front pivot.

2. Disconnect the parking brake cable from the caliper. Release the 'P' clip securing the brake hose to the top wishbone and remove the two bolts securing the brake caliper to the hub carrier. Support the caliper aside without straining the brake hose. Release the single retaining screw, and remove the brake disc from the hub.

3. On the left hand suspension, disconnect the wheel speed sensor cable, and release from routing clips.

4. Release the bolt securing the outer end of the toe link to the hub carrier, noting the identification of the spacers fitted above and below the hub carrier leg.

5. Remove the nut securing the ball pin of the lower ball joint to the hub carrier, and use a suitable splitter tool to separate the joint.

6. Remove the split pin and driveshaft nut, and use a suitable puller tool to extract the driveshaft from the hub.

7. Remove the two bolts securing the top swivel joint plinth to the hub carrier, noting and retaining the camber adjustment shim pack.

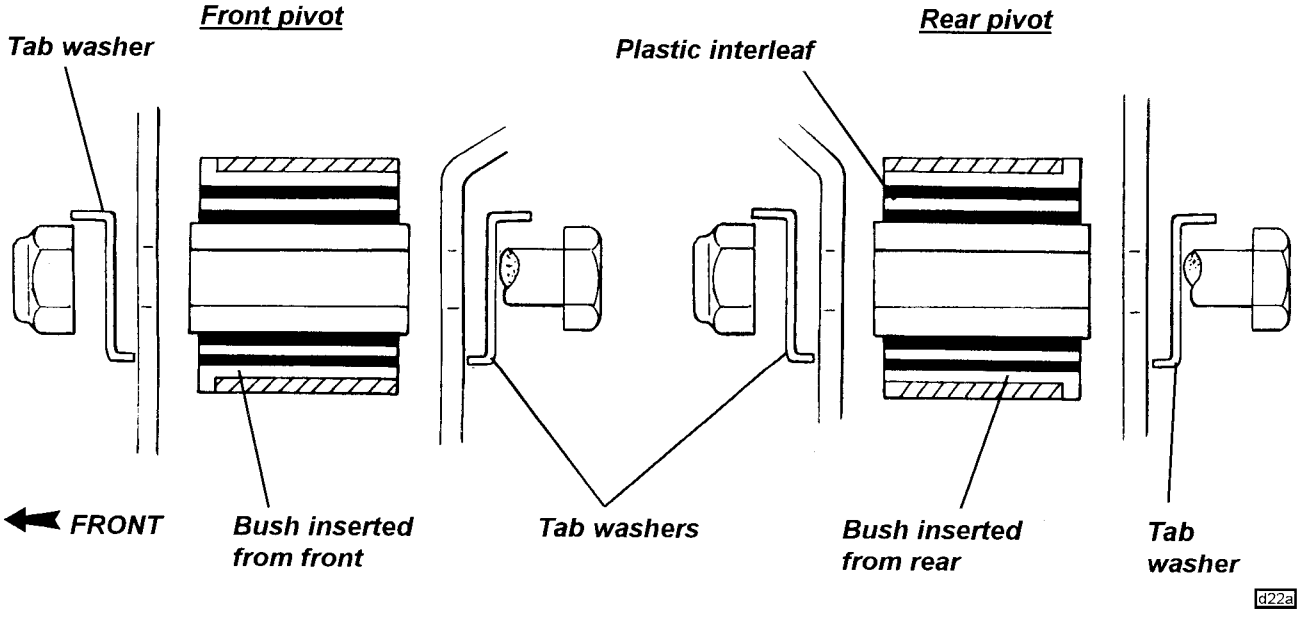
8. Remove the top wishbone pivot bolts, and withdraw the wishbone from the rear subframe.

9. Remove the top and bottom mounting bolts for the spring/damper unit, and withdraw.

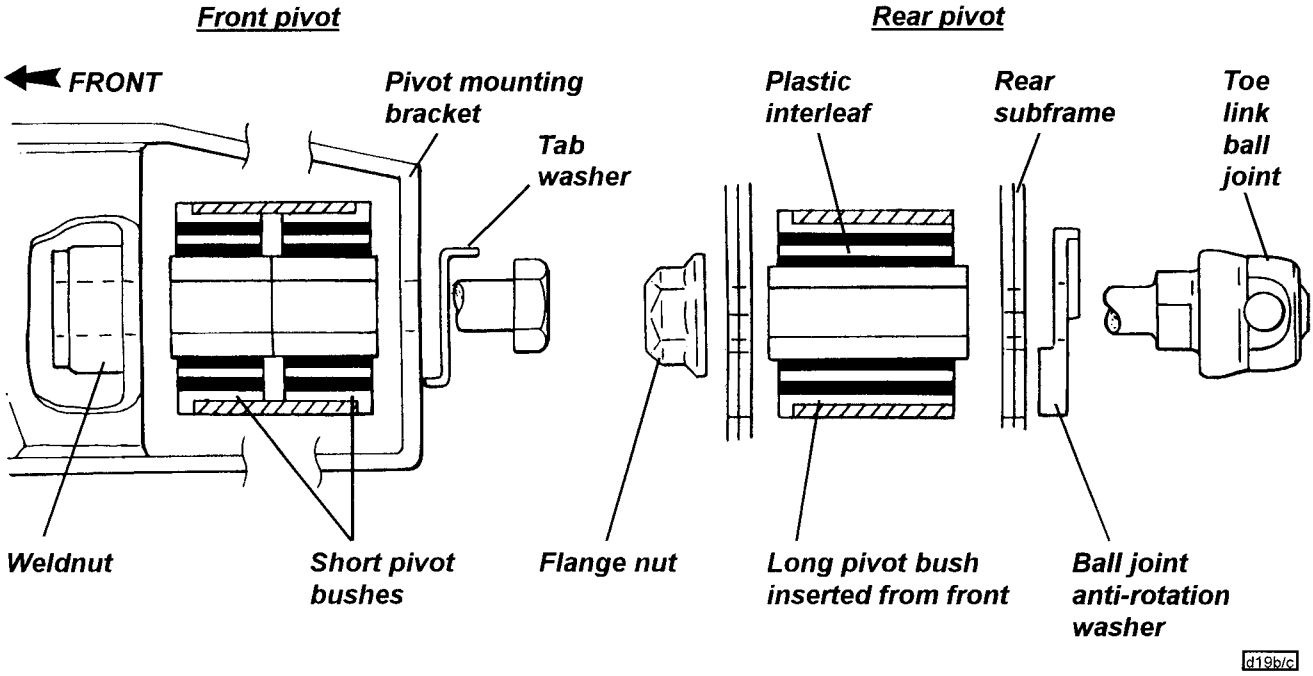
10. Remove the heatshield over the toe-link ball joint, release the toe-link stud, remove the lower wishbone front pivot bolt and withdraw the lower wishbone and toe link.

11. If necessary, remove the top swivel joint ball pin nut, and use a ball joint splitter tool to separate the joint from its plinth. Either swivel joint may be replaced using suitable press tool dollies.

12. 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 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 a single 30mm long bush into each pivot eye from the outside end (front of front eye, and rear of rear eye).



Lower wishbone rear pivot - insert a single 30mm long bush from the front end of the eye.
Lower wishbone front pivot - insert a 16mm long bush into each end of the front eye.



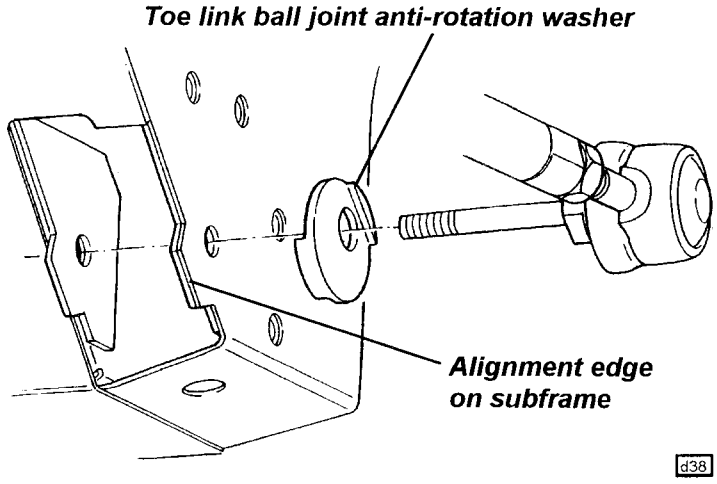
13. The road spring may be removed from the damper using a suitable spring compressor to allow the spring lower slotted seat to be withdrawn. Note that the spring upper seat is retained by a circlip located in the lowermost of three available damper body grooves.

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.
- Apply Permabond 130 (A912E7033V) to the threads of the top ball joint plinth fixing bolts.
- Lubricate the ends of the damper top eye bush with rubber grease.
- Tab washers are used on the top wishbone pivots, and for the bolt head of the lower wishbone forward pivot. In each case, ensure that one end of the tab washer is folded around the chassis edge, and after torque tightening the nut, form the other end of the washer against the flats of the nut.
- The inboard toe-link fixing incorporates a special ball pin anti-rotation washer, machined with two flats, one of which locates against a flat on the ball pin, and the other against the edge of the subframe. Check that the inboard joint has a LH toe-link thread, and that the batch code stamped on the joint is 43275 or later.



- Ensure that the heatshield is refitted over the toe-link inboard ball joint.
- Take care correctly to assemble the toe-link outboard ball joint (RH toe-link thread) to the hub carrier. The 8mm spacer should be fitted onto the ball joint stud noting that an internal chamfer is provided at both ends to accommodate the root radius of the stud. On top of the hub carrier lug should be fitted the 10mm spacer and Nyloc nut. Check that the batch number stamped on the joint is 43273 or later. For competition optimisation of the bump steer characteristic, refer to DG.4.
- Press the brake pedal to reposition the pads before driving the car.

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.
- At every service interval, the toe-link should be checked for free articulation by using a spanner on the flats of the link and twisting in both directions. The torque required to articulate the joints should be little more than may be applied by hand. If any joint is found to be seized or tight (or if any free play is evident), the joint should be renewed.

Torque Settings:		**Nm**
- Upper and lower wishbone pivot bolts		45
- Upper and lower swivel joint ball pins		55
- Upper swivel joint plinth to hub carrier		45
- Toe-link outer ball joint to hub carrier*		74
- Toe-link inner ball joint/wishbone to subframe**		74***
- Toe-link ball joint lock nuts		55
- Damper to lower wishbone		45
- Damper to chassis		45
- Brake caliper to hub carrier	- upper M10	45 - 50
	- lower M8	26 - 30
- Hub bearing unit to hub carrier		90
- Rear hub nut		220

* Check batch number of ball joint is 43273 or later
** Check batch number of ball joint is 43275 or later
*** On 2001 M.Y. cars with VIN serial nos. 0001 to 0041, plus 0056 & 0057, use 45Nm

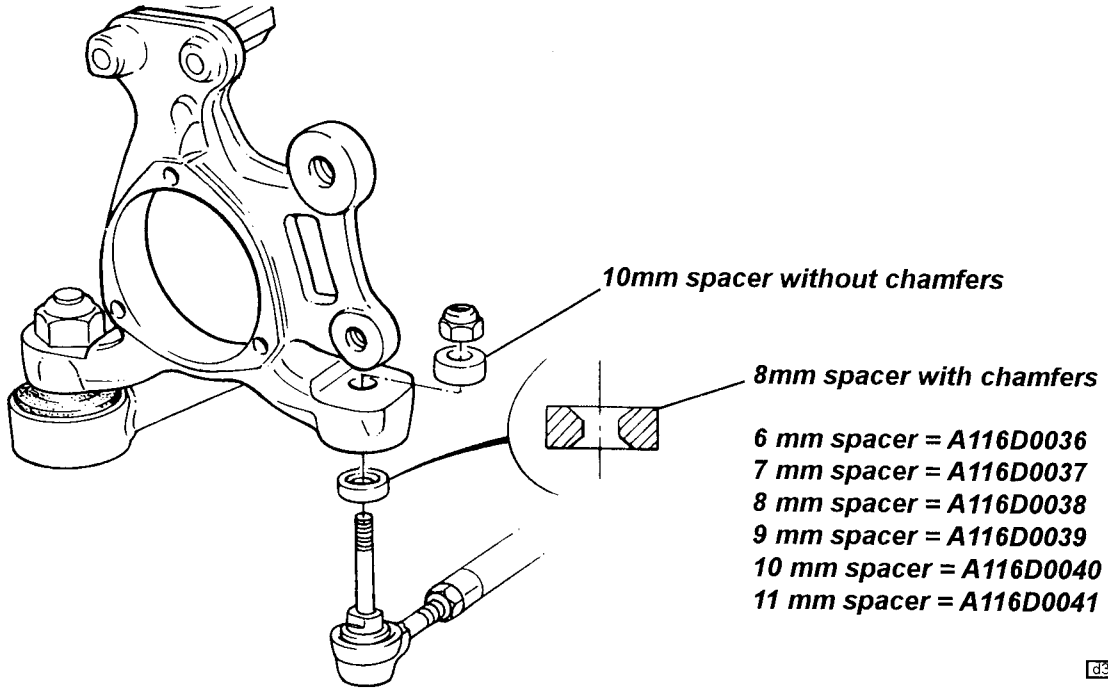
DG.4 - REAR BUMP STEER ADJUSTMENT

The rear suspension toe-link geometry is designed to apply a small amount of toe variation with suspension travel (roll resultant from cornering forces) in order to produce the desired handling characteristics. The general requirement is for the outside wheel to adopt a small increase in toe-in as the suspension is compressed.

A spacer is fitted between the outboard toe-link and the hub carrier in order to set the joint height in relation to the wishbone outboard pivot. The standard spacer length of 8mm will provide a basically correct geometry, but in order to optimise the characteristic, a dedicated bump steer gauge must be used to measure the toe change for each rear wheel.

Bump Steer Measurement Procedure

i) Remove the spring and damper assembly.
ii) Remove the brake caliper.
iii) Fit the flat datum plate of the bump steer gauge against the roadwheel mounting face of the brake disc, and retain with two wheel bolts.
iv) Lock the brake disc to prevent the plate from turning.
v) Use a jack to set the suspension height to 323mm between damper mounting holes (mid-laden ride height).
vi) Set the two dial gauges against the plate on a horizontal axis, 16 inches apart. Zero both gauges.
vii) Jack the the suspension towards bump by 10mm as measured on the datum plate, and record the difference between dial gauge readings - representing the change in toe-in.
viii) Raise the suspension to 20, 30 and 40mm from the baseline, recording in each case the dial gauge differential.
iv) Compare readings with the graph below. If readings fall outside of the tolerance band, the 8mm spacer fitted between the toe-link outboard ball joint and the underside of the hub carrier leg must be replaced by one of a different length. Lowering the joint height by 1mm will increase the toe-in at 40mm bump travel by approx. 0.2mm. **Ensure that the spacer fitted first onto the ball joint stud has an internal chamfer to provide clearance for the toe-link stud root radius.**



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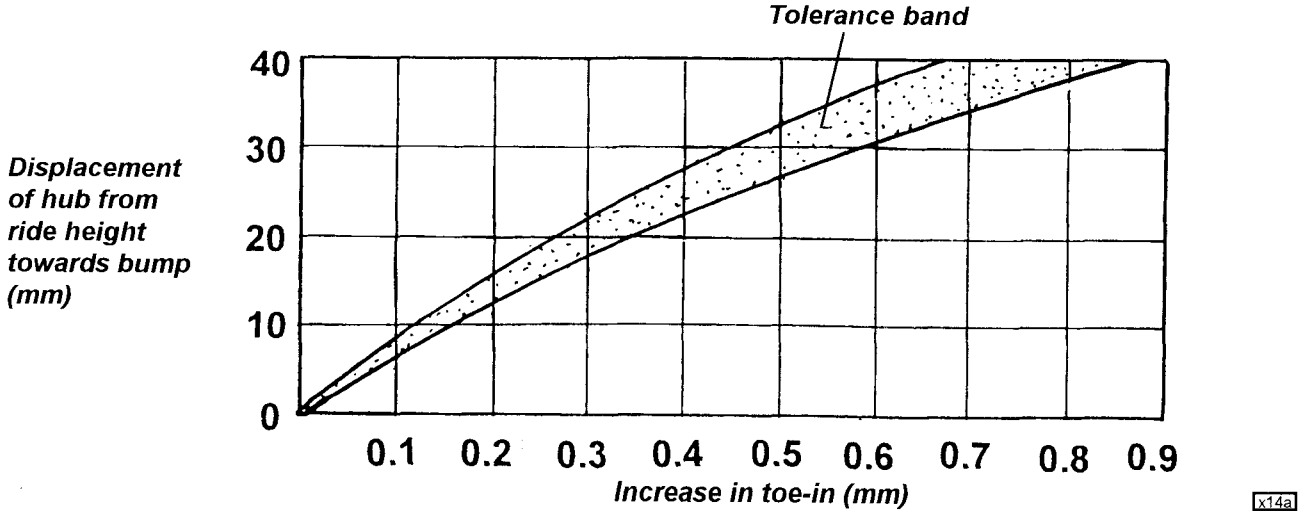

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DG.5 - REAR WHEEL BEARINGS

The sealed rear 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. The left hand hub unit incorporates a wheel speed sensor used to supply the engine management ECM and speedometer.

To Replace Hub Bearing Assembly

1. With the wheel removed, apply the parking brake, remove the split pin from the nut retaining the driveshaft in the hub, and release the nut.

2. 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.

3. Disconnect the wheel speed sensor harness from the LH hub unit.

4. Using a Torx socket, release the three bolts securing the hub bearing unit to the hub carrier, and withdraw the unit from the hub carrier and driveshaft.

5. Fit the new hub bearing unit in reverse order to disassembly, with the following notes:
   - Torque tighten the three Torx bolts securing the hub bearing assembly to the hub carrier to 90 Nm.
   - Torque tighten the driveshaft nut to 220 Nm and retain using a new split pin.
   - Pump the brake pedal to reposition the pads before driving the car.