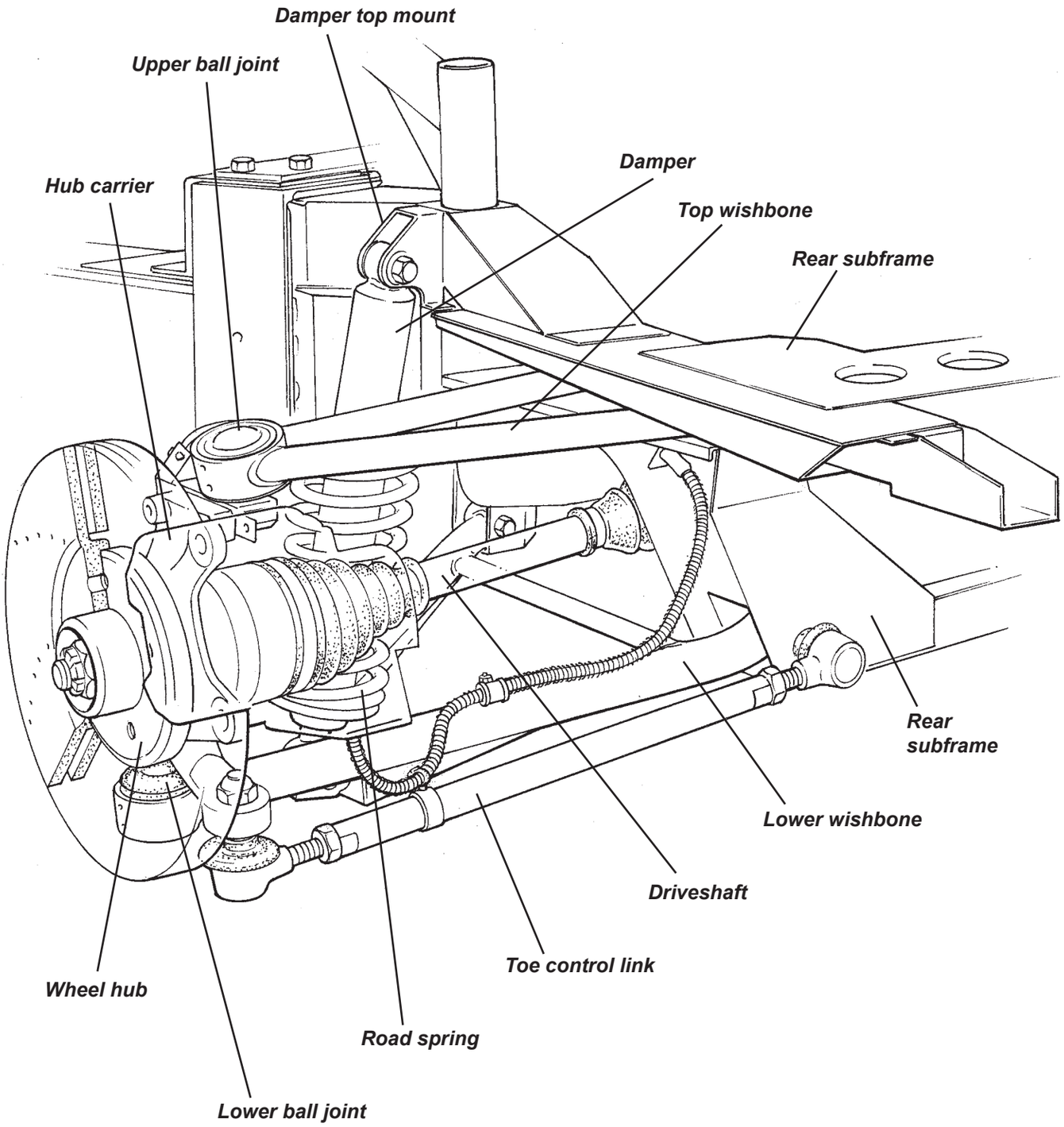
REAR SUSPENSION

SECTION DH

Rear Suspension Layout



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DH.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 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 top wishbone pick up on the chassis rear subframe, and converge outboard and forwards 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, 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 two legs converge outboard and rearwards to a ball joint housing which accommodates 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 an anchorage on the steel subframe.

The adjustable length, double ball jointed, toe control link, shares a subframe anchorage with the rear pivot of the lower wishbone, and at its outboard end, is secured directly into a tapered hole in a rearward integral 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 for the anti-lock brake system, engine management and speedometer data.

DH.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/full tank of fuel. This will require the vehicle to be ballasted or tied down:

Standard Elise

Mid laden ride height (reference height for geometry check);		
	- front	130 mm below front end of chassis siderail
	- rear	130 mm below rear end of chassis siderail
Camber;	- optimum	- 1.8°
	- tolerance	- 1.6° to - 2.0°; max. side/side: 0.2°
Alignment;	- optimum	1.2 mm (0.16°) toe-in each side
	- tolerance	1.2 to 1.8 mm toe-in each side
	(0.16° to 0.24° toe-in each side)	
	Max. difference side/side: 0.3 mm (0.04°)	

Roadsport Elise, Exige

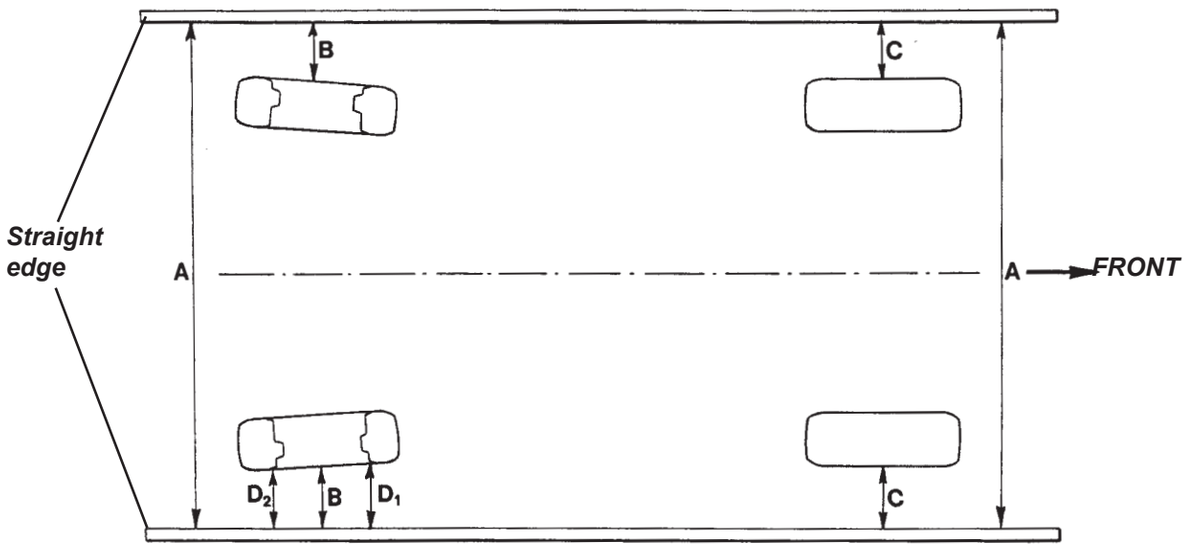
Mid laden ride height (reference height for geometry check);		
	- front	130 mm below front end of chassis siderail
	- rear	130 mm below rear end of chassis siderail
Camber;	- optimum	- 1.8°
	- tolerance	- 1.6° to - 2.0°; max. side/side: 0.2°
Alignment;	- optimum	1.5 mm (0.20°) toe-in each side
	- tolerance	1.2 to 1.8 mm toe-in each side
	(0.16° to 0.24° toe-in each side)	
	Max. difference side/side: 0.3 mm (0.04°)	

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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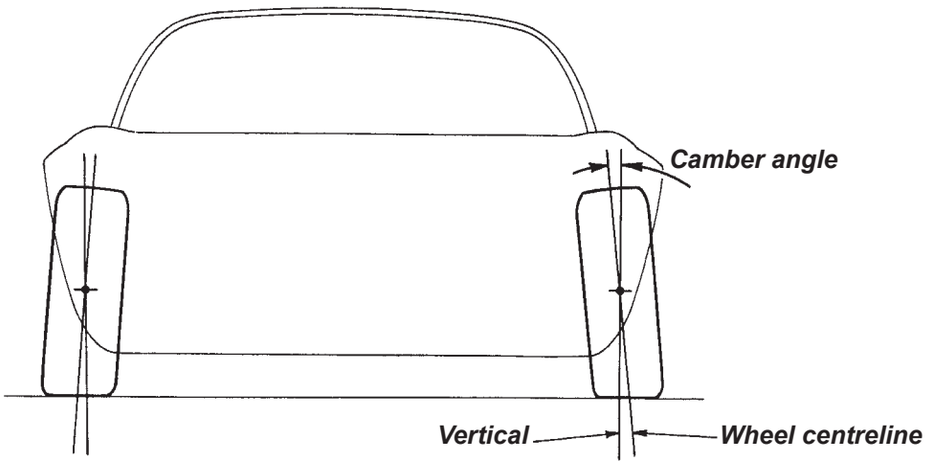
Measure the distance from the bar to the rim of the wheel concerned at the front and rear of the centre line of the wheel (D_1, D_2). If the front dimension, D_1, is greater than the rear dimension, D_2, the wheel has TOE-IN. If the rear dimension is greater than the front dimension, the wheel has TOE-OUT. 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' (one sixth of a turn) will increase toe-in by approximately 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 to allow some free articulation.

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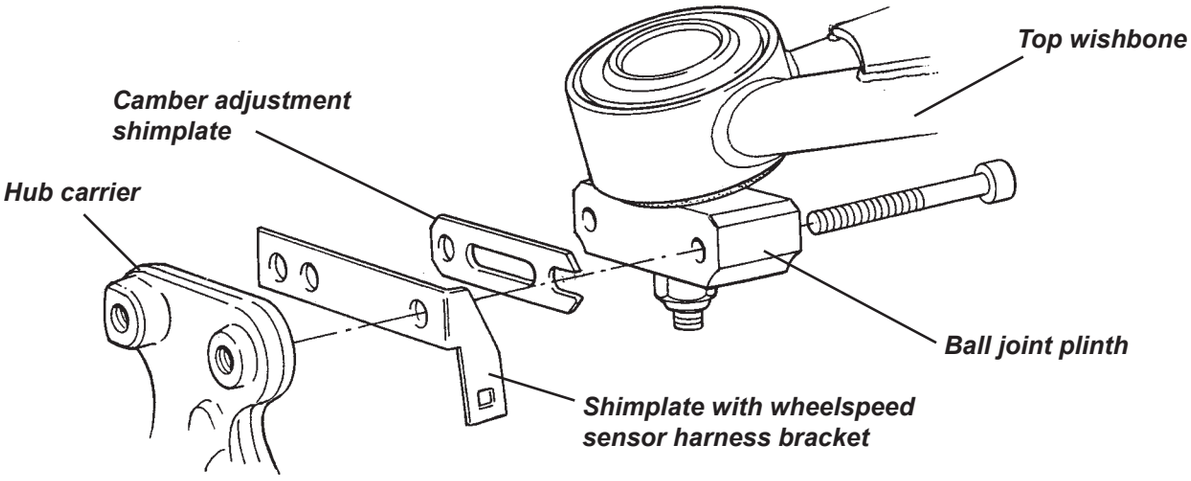
The primary purpose of camber is to achieve the maximum efficiency of the tyre under cornering loads and body roll, with the specification closely allied to a particular wheel/tyre combination. The camber angle changes with suspension travel, becoming more negative on bump, and should be measured only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



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- 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.

DH.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, a spring compressor required only if the spring is to be removed from the damper unit, and a ball joint splitter. 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 split pin securing the driveshaft nut, and with the brakes firmly applied, remove the driveshaft nut.

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

3. 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.

4. Disconnect the wheel speed sensor cable from each hub unit, and release from routing clips.

5. Release the nut securing the outer end of the toe link to the hub carrier, and use a ball joint separator to release the joint from the carrier.

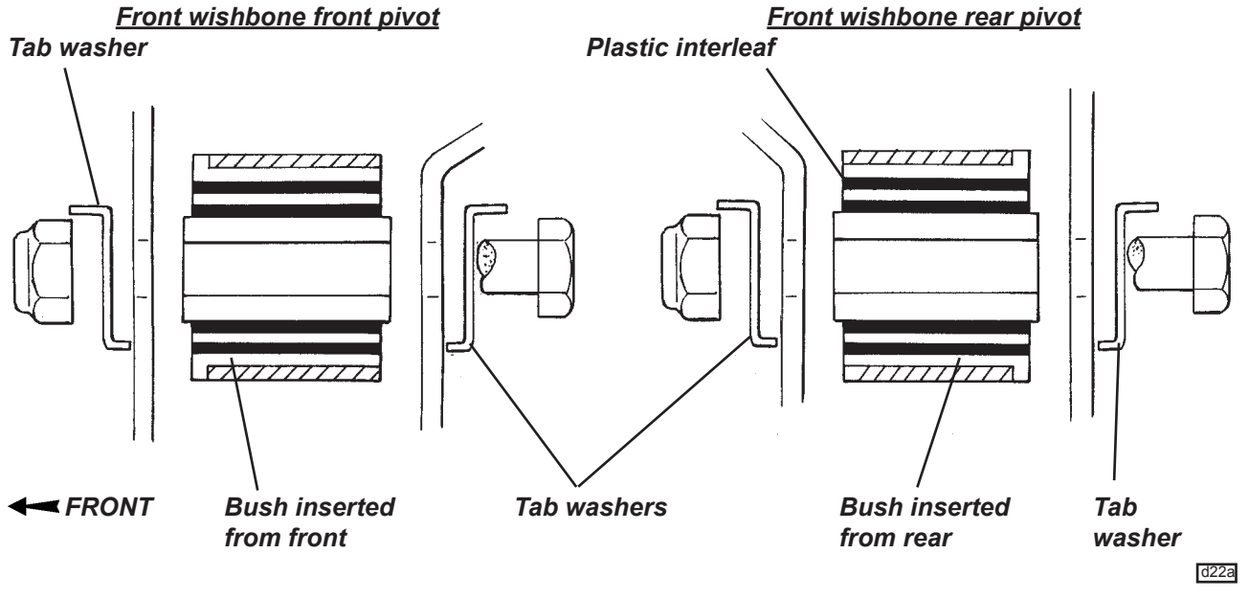
6. Remove the nut securing the ball pin of the lower ball joint to the hub carrier, and use a ball joint separator to release the joint from the carrier.

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

8. Withdraw the hub carrier assembly from the driveshaft, using a suitable puller tool if necessary to release the shaft from the hub. Do not allow any pulling force to be applied through the driveshaft C.V. joints, or damage to the joints will be caused.

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

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

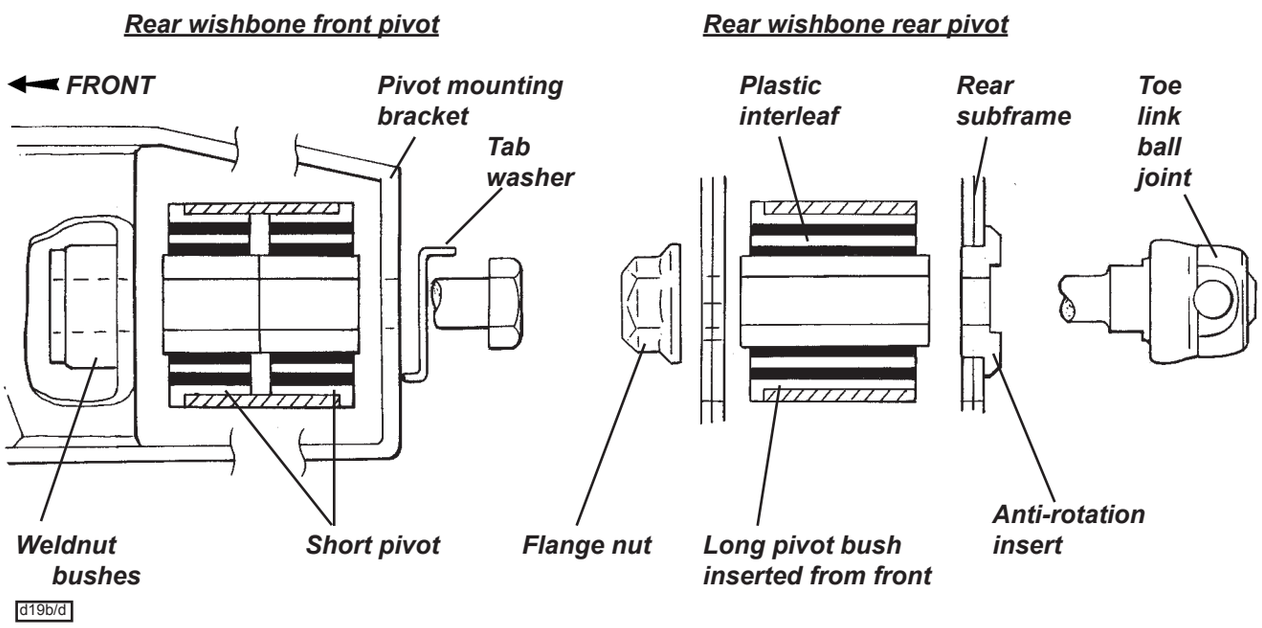


11. Remove the heatshield over the toe-link inboard ball joint, release the toe-link stud, remove the lower wishbone front pivot bolt and withdraw the lower wishbone and toe link.

12. 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.

13. 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.



14. 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 square section circlip in a groove in the damper body:
- Standard Elise: Use centre of 3 grooves for mid-laden ride height of 130mm.
- USA Elise: Use lower of 3 grooves for mid-laden ride height of 135mm.
- Elise with Roadsports suspension package and non-USA Exige: Use the upper of 2 grooves for mid-laden ride height of 130mm.

15. 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.

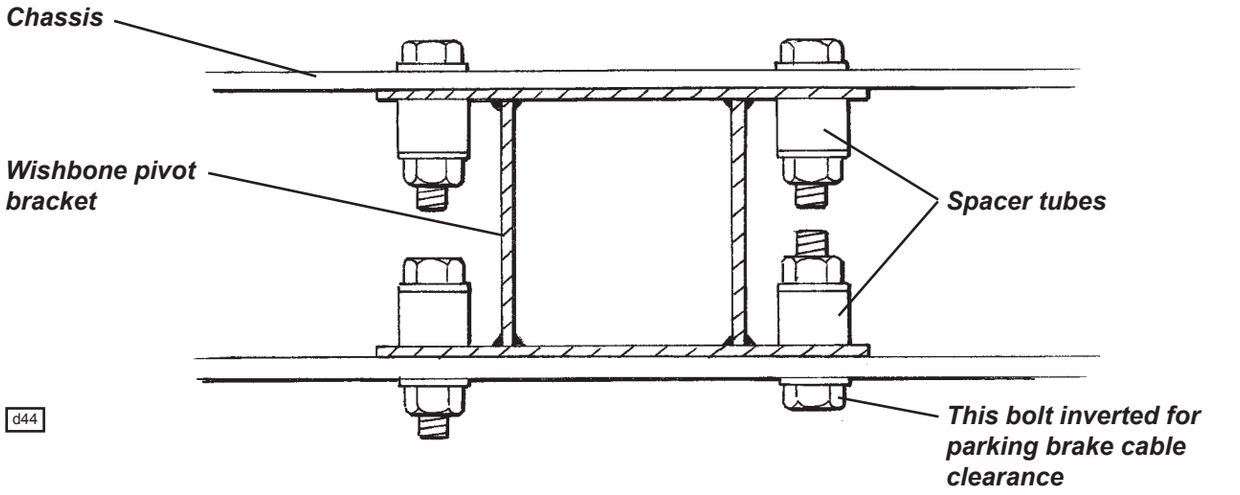
Reassembly

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

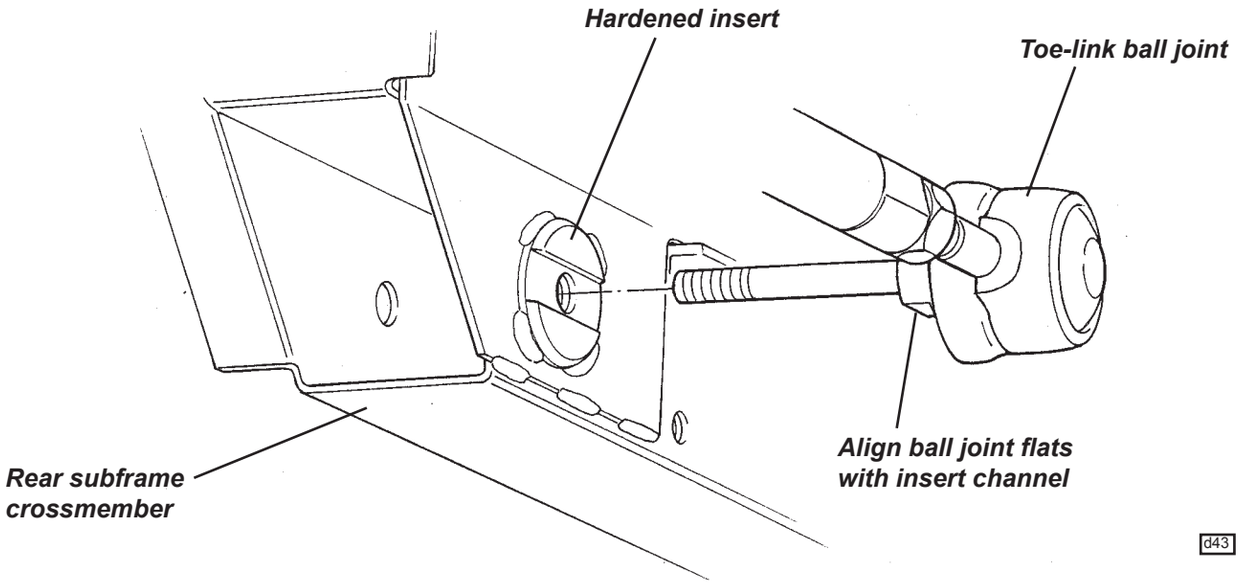
- Take care to assemble each pivot bolt with the correct washers/snubbers/spacers as shown in the diagrams.
- Smear the shank of each pivot bolt with PBC grease, but do not allow contamination of the threads.
- Take care to refit the original camber adjustment shimpack.

- Top ball joint plinth fixing bolts:
  The bolts securing the top ball joint plinth to the hub carrier were upgraded in March '04 at VIN serial number 1537 (approx.) in order to commonise with motorsport applications. Earlier type 8.8 grade bolts should be tightened to 45 Nm; Later 10.9 grade bolts to 68 Nm. The bolt grade is stamped around the head of the bolt. The thread of both bolt types should first be treated with Permabond A130 (A912E7033V).
- 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.
- If the lower wishbone front pivot brackets have been removed from the chassis, ensure that a spacer is fitted on each of the four bolts securing each bracket, in order to allow the required bolt stretch to be achieved.

Left hand bracket viewed from rear



- Note that on previous Elise models, there have been several variants of the toe-link inboard ball joint. The correct joint for 2005 model year onwards has a ball pin thread pitch of 1.25mm (vs. 1.5mm). The flats on the ball pin should be aligned with the channel in the subframe hardened insert. Note that the inboard joint has a LH thread into the toe-link tube, and the outboard joint a RH thread into the toe-link tube with a taper shank ball pin to fit into the hub carrier.



- Do not operate the car without the exhaust silencer heatshielding correctly fitted, and incorporating heat-shields for the toe-link inboard ball joints.
- Press the brake pedal to reposition the pads before driving the car.
- If the car suffers a suspension impact sufficient to damage a wheel rim, careful attention should be paid to all related suspension components. Such forces can cause stretching of the lower ball pin and consequent fixing nut torque loss. As a safety precaution, it is recommended that in all such cases, the lower ball joint and the two bolts securing the upper ball joint plinth to the hub carrier are renewed, together with both toe-link ball joints.

The Service Schedule specifies that the security of the front and rear suspension is checked at each service. For cars used on race tracks, or in similar conditions, suspension components and torque checks should be carried out between sessions. 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, be aware 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	- 8.8 grade	45
	- 10.9 grade	68
- Toe-link outer ball joint to hub carrier		55
- Toe-link inner ball joint/wishbone to subframe		50
- Toe-link ball joint lock nuts		45
- 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

DH.4 - 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. Note that all four hub assemblies are common, and incorporate a wheel speed sensor in the bearing unit, with a flying lead terminating in an electrical connector plug secured by a camber shim plate bracket.

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

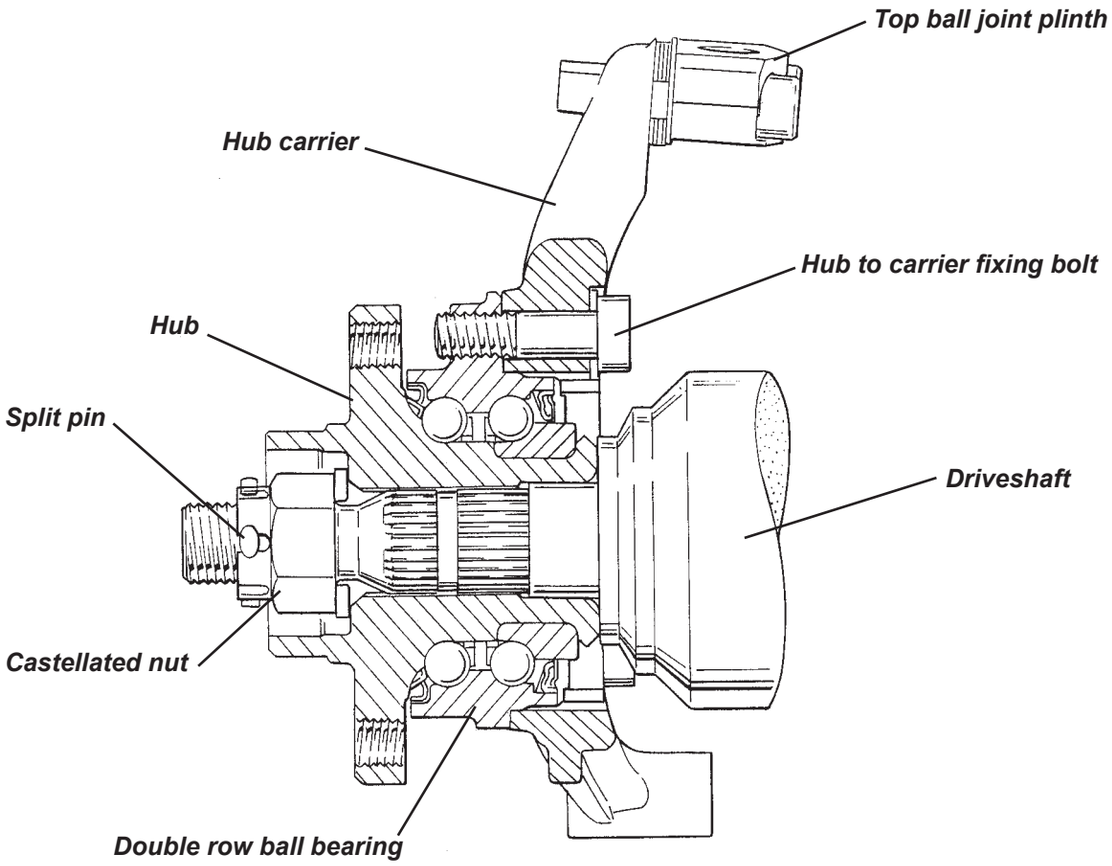
1. With the wheel removed, apply the parking brake, remove the split pin from the nut retaining the driveshaft in the hub, and release the nut.

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 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. If necessary, use a suitable puller tool to press the shaft from the hub, but on no account allow an extension force to be applied to the 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.



DH.5 - TRACK USE CHASSIS REAR BRACE KIT - LOTAC05377

The purpose of the kit is to provide a 'double shear' mounting for the inboard ends of the rear toe-links and spread the load distribution into the chassis over a wider base. New spherical joints are used on the inboard ends of the toe-links, with a tubular steel crossbrace interconnecting the two pivot bolts and anchoring to the rear engine steady mounting on the subframe. For cars used on closed circuits, this arrangement provides an increased tolerance to abuse. It may be retrofitted on any Elise 111R/'04 Exige/USA Elise (i.e. Toyota power-train cars).

The rear toe-links comprise the existing outboard taper shank ball joint and toe-link tube, but the inboard joint is replaced by a new spherical joint with no integral stud. A bespoke spacer locates in the orientation groove in the (unchanged) subframe and provides a flat surface against which to clamp the pivot ball of the new joint. A flange head bolt passes through the ball joint and inboard pivot bush of the lower wishbone in a similar manner to previously, but also locates a brace against the rear 'overhung' end of the ball joint. The tubular crossbrace links the two inboard joints via machined adaptor lugs and turnbuckle adjusters, and is braced directly to the subframe by a welded bracket secured by the engine rear steady mounting fixings.

Kit Contents	**Part Number**	**Qty**
Tubular Crossbrace	A120D0040F	1
Turnbuckle, crossbrace adjustment	A120D0039F	2
Locknut, turnbuckle, M12, RH thread	A111W3150F	2
Locknut, turnbuckle, M12, LH thread	A111W3149F	2
Flange Nut, brace to subframe, M10	A111W3151F	2
Adaptor Lug	A120D0037F	2
Spherical Joint, toe-link inboard	A120D0036F	2
Spacer, spherical joint to subframe	A120D0035F	2
Pivot Bolt, toe link inboad, M10x120x1.25p	A120W2212F	2
Locknut, pivot bolt, M10x1.25p	A117W3189F	2
Fitting Instruction	LSL489	1

Procedure

1. Remove the rear undertray and diffuser.

2. At both sides, remove the toe-link inboard/lower wishbone rear pivot fixing nut, release the adjacent heat-shield fixings and withdraw the ball joint.

3. Cut a vertical slot in the ball joint heatshield at each side, to accommodate the crossbrace adaptor lug, removing only as much material as necessary.

4. Remove the two rearmost setscrews securing the engine mounting steady bracket to the subframe. If these screws use weldnuts on the subframe, the nuts must be chiselled or ground off.

5. Fit the locknuts onto the turnbuckles, and screw the LH thread of a turnbuckle into each end of the crossbrace tube. Fit an adaptor lug onto the RH thread of each turnbuckle. Loosely assemble the crossbrace to the underside of the subframe plinth using the original setscrews and new flange nuts.

6. On each toe-link, measure the distance from the locknut to the centreline of the inboard pivot ball. Remove the old joint from the link, and replace with a new spherical joint set to the same approximate position.

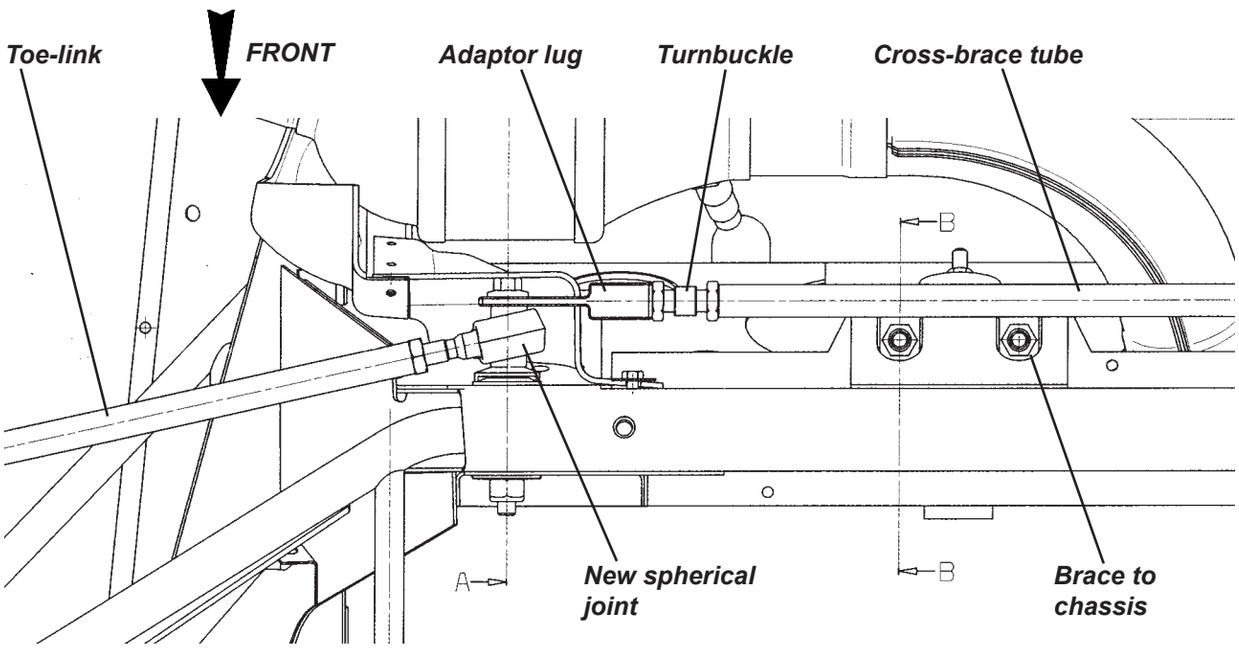
7. Fit a new spacer into the orientation slot in the subframe before positioning the toe-link ball joint and sliding the new pivot bolt through the crossbrace adaptor lug (adjusting the turnbuckle as necessary), ball joint, spacer, subframe and wishone and retain with a new M10x1.25p locknut. Repeat for the opposite side. Tighten the pivot bolts **only at mid-laden ride height of 130mm** to 50 Nm. Re-secure heatshield.

8. Tighten the turnbuckle locknuts to 45 Nm whilst holding the adjacent adaptor lug, and then tighten the engine steady mountings to 45 Nm.

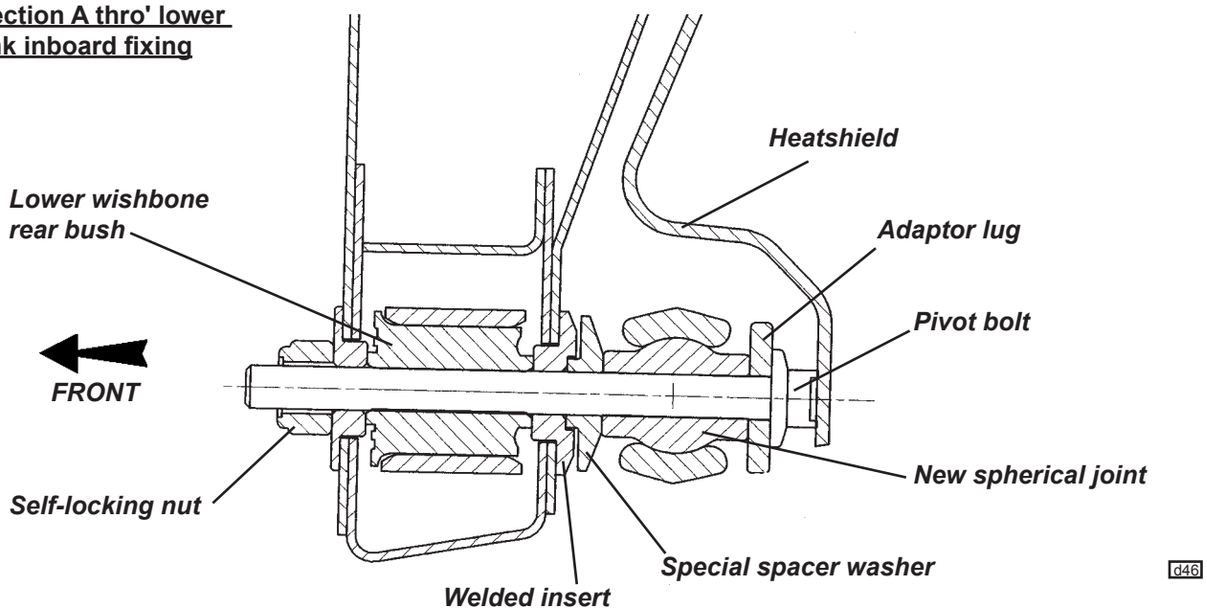
9. Adjust rear wheel alignment **only at mid-laden ride height of 130mm** to 1.5mm toe-in each side (± 0.3mm) and tighten the toe-link ball joint locknuts to 45 Nm. Ensure ball joints are phased at 90° to each other to allow maximum joint articulation.

10. Refit undertray and diffuser.

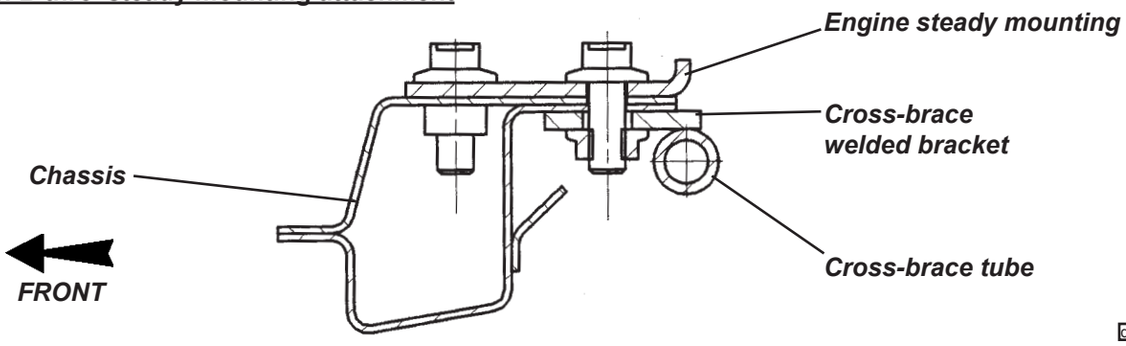
Viewed from below



Section A thro' lower link inboard fixing



Section B thro' steady mounting attachment



General view