Steering and Suspension

Last updated 01-Nov-2011

A-Arm Inner Bushes Anti-roll Bars NEW Centre-lock Wheel Grease Cap Column/Rack Alignment Converting between Wires and Rostyle Dimensions Front Bearing End-float Front Damper Replacement Front Spring Replacement NEW Hydraulic Damper Fluid Leaf Spring Lubrication Rack Gaiters/Track-rod Ends Rear Lever-arm Dampers Rear Spring Replacement Ride Height Spring Specs Steering Wheels Tubular Dampers Vehicle Heights Vehicle Weights Wire Wheel Splines Links

There have always been intermittent complaints from North America that new springs sourced locally raise the rear way too much and sometimes are too stiff or arched to get the rebound straps or even the shackles installed without some serious extra weight in the boot/trunk. If you have to do that then at the very least the rear will be higher than it should and may even be fully extended instead of mid-way between the extremes of its travel which is obviously very wrong. With the vehicle on its wheels, even with nothing in the boot/trunk, the rebound strap should be curved round in an arc, the lever-arm damper arms approximately horizontal, the springs nearly flat, and the shackles around vertical or pointing slightly rearwards, as shown in the pictures on the left of this paragraph (click to enlarge). The rebound straps must **not** be straight and under tension.

Currently there seems to be a real spate of problems, and people in the UK are beginning to complain of the same thing. You **should** be able to fit the rebound straps by jacking each spring up under the body - without any extra weight in the boot - **before** the body starts lifting off its supports. On UK-sourced springs I have done this without difficulty, even putting the harder rubber-bumper springs on a chrome-bumper car. Similarly people have asked how to get the shackles pointing to the rear instead of the front. Again it is a matter of spring hardness - the correct springs should be almost flat with just the weight of the unladen body, and as they take the weight of the body and start to flatten they will move backwards. If the weight of the car is on its wheels, even unladen, and they aren't pointing slightly backwards, the springs you have are simply too hard or over-arched for your car. However it occurs to me that all the work I have done has been on a chrome-bumper car. With the lower shackle mounting position relative to the chassis rails of rubber-bumper cars it is possible that these can lock in the fully forward position unless levered downwards while jacking slightly higher. However once the rebound straps are fitted this shouldn't occur again. *Updated August 2007:* Since writing this I've had to replace the rear springs on the V8. Having now bought three sets of springs from three different suppliers and fitted them to two different cars I have never had any problems using simply the weight of the body to compress the springs enough to attach shackles, damper drop-links and rebound rubbers, and this includes fitting harder RB roadster springs to a CB roadster. Nor have I had any problems with the shackle 'locking up' in a forward position on either CB or RB car. See Rear Spring Replacement.

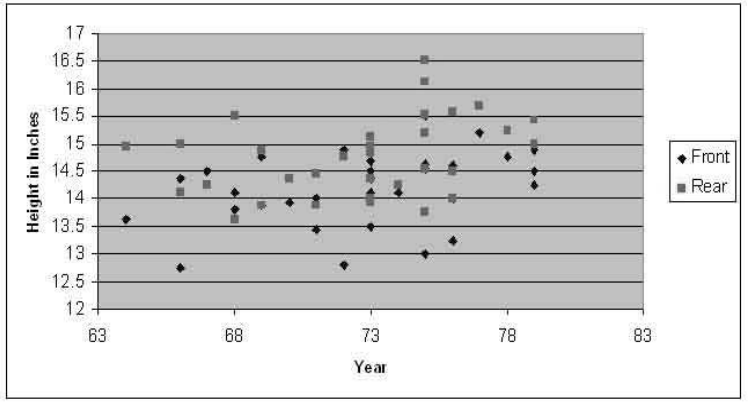
My problem has been the opposite - ride-height too low and grounding over 'sleeping policemen' and rough ground particularly when laden (we use the car frequently for holidays with a comprehensive tool kit and trolley-jack as well as luggage). I had tried and removed rubber-bumper roadster springs as part of another exercise which raised the ride height just fine, but being harder they gave a very unpleasant choppy rise over some surfaces. In July 2003 I modified some shackles by 'cutting and shutting' to give about an inch extra height at the rear, as described below in 'Extended Shackles'.

Converting RB to CB. *Added January 2008*
A number of factors to consider here:

- Standard CB springs on a standard RB shell will do very little as the mounting points for the rear springs are lower on RB cars than CB cars, and at the front the car sits higher on the cross-member. Special flattened or lowered springs must be used, or at the very least the rear modified by turning over one leaf, or replacing the main leaf with a reverse-eye one. You can fit lowering blocks between axle and spring and use longer U-bolts, but that increases the leverage on the bushes in cornering. Altering the rear spring mounts themselves in order to use standard CB springs is a major job, particularly the rear eyes.
- With flattened or lower springs if you do nothing else you will almost certainly 'bottom' the suspension over relatively minor bumps and humps. RB cars have a higher pedestal that sits on the axle under the bump-rubber, so the shorter CB item can be fitted instead to increase the compression travel. This now means the axle has greater travel under compression than before, which means you could hit the limit of movement of lever-arm dampers and damage them, so you must also fit CB drop-arms which are shorter. But then that means you run the risk of hitting the damper limit when the axle is extended, so you must fit CB rebound straps as well.
- But if you fit lowering blocks between axle and springs you must use the original damper drop-links as you haven't changed the relationship between the body and the springs and hence the bottom plate the drop-link attaches to, just the body and the axle. This will still need the lower CB bump-stop pedestals and the shorter rebound straps as before as they are both on the axle.
- And after all that, as Kevin Jackson has pointed out, you now run the risk of grounding the exhaust, as it is angled to sit lower to clear the lower axle position of the RB car!
- Kevin also pointed out one benefit of achieving a lower ride height through flatter springs and that is less leverage on the bushes and so probably better axle location, i.e. the opposite of lowering blocks.

Ride Heights round the World

Following a question on the MG BBS the information on ride heights below was posted, all measurements are taken from the centre of the hub to the bottom of the chrome strip. If you would like to add to this resource please mail me with your year (state CB or RB if 1974), Roadster/GT, measurements, and any notes regarding age/mileage of springs, departure from stock etc.



Car	RHF	LHF	RHR	LHR	Owner	Notes
64 Roadster	13.75	13.5	15.375	14.5	Mike Jones Malaga Spain	All new springs and bushings. First two sets of rears from MGOC were 2" too high, 3rd set MGOC got from British Springs.
66 Roadster	14.5	14.25	14.25	14	Bud	
66 Roadster (?)	12.75	12.75	15	15	Max Heim	Original Fronts new rears 175R-14 tyres.
67 GT	14.5	14.5	14.25	14.25	Barrie Parkinson	Rebuilt front end with V8 bushings, stock springs. Rear all new plastic bushings and fibreglass springs. No bumpers, alloy head, no spare, 1 battery.
68 GT	13.625	14	15.5	15.5	BobMunch Boise	
68 GT	14.25	14	13.625	13.625	John Hubbard Huntsville Alabama	The fronts are up from 13.625 following a front-end rebuild. The wishbones and pivots were badly worn.
69 Roadster	14	13.75	14.75	15	Tony Elphick Wagga Wagga Aus	Standard. Rears reset 15 months ago, fronts new
69 Roadster	14.5	15	13.5	14.25	Miguel Clemente	50k miles all original except for front bushes.
70 Roadster	13.875	13.975	14.25	14.50	Joe Lucas of Winipeg Canada	Stock all around except for new bushings front & back. Spare tire on board, single 12 volt battery in place.
71 GT	14	14	13.75	14	Bill, Montana	Front springs new, rears original with new bushes and pads. 200k+miles
71 GT	13.5	13.375	14.375	14.5	Bob Wilson	Fronts (red) 3k, rears (original?) 113k?
72 Roadster	12.8	12.8	10.24	10.24	Richard Thompson	These seem very low but are much modified. See the full story on Richards own site.
72 Roadster	14.875	14.875	14.75	14.75	Iain MacKintosh	
73 Roadster	14.5	14.5	14.25	14.5	Paul Hunt, Solihull, UK	Original fronts (120k+miles?) new rears (20kmiles), new rear bushes
73 Roadster	14.25	14	15.125	15.125	Paul Hunt, Solihull, UK	CB GT front, RB Roadster rear, red poly bushes at rear, 10k miles
73 Roadster	14.75	14.625	14.25	14.25	Paul Hunt, Solihull, UK	Returned to standard springs and bushes but 1" extended shackled rear (15k), new fronts (5k)
73 Roadster	15	14	15.375	14.313	Ken Earnhardt, USA	All worn suspension parts replaced. New rears fitted.
73 Roadster	14.875	14.5	14.875	15	Ken Earnhardt, USA	New fronts fitted to the above, at which time the RH rear was found to be too high, the spring having a greater arch. LH and RH rears swapped over. Updated figures after a little settling, 165SR-15 tyres in use.
73 GT	13.5	13.5	14	14	Paul Tegler	
73 Roadster	14.25	14.5	13.875	14	Richard Smith USA	New Victoria British rears c1994, original fronts. Rears originally too high and at the limit of rebound straps, settled since. 185/70 x 14 tyres rub slightly on left-hand rear wing.
74 GT	14.25	14	14.25	14.25	Steve Cioffi Everett Ma	Original springs, all new bushings and mountings
75 Roadster (?)	15.5	15.5	16.125	16.125	Bob Hacker, Vancouver, Washington	Stock springs, V8 bushes
75 GT V8	14.5	14.625	15.125	14	Paul Hunt, Solihull, UK	Original, LHD sag on a RHD!
75 GT V8	14.5	14.625	15.375	15.6875	Paul Hunt, Solihull, UK	New fronts and rears (5k)
75 GT V8	14.5	14.75	15.125	15.25	Colin, UK	Pretty standard apart from Koni dampers, springs probably original, 77k
75 Roadster	15.5	15.5	16.5	16.5	Dave Tetlow, Bucks, UK	CB & V8 conversion, CB rear springs, still trying to reduce the height
75 Roadster	13	13	13.75	13.75	Dave Tetlow, Bucks, UK	As above, but now with 1" shortened V8 front springs, reverse-eye rear springs. Standard dampers with uprated valves, 15" MGC wheels with 185-65 tyres.
76 Roadster	14.625	14.5625	15.625	15.5625	Barry Kindig, Escondido, CA	New springs all round, 1.25" lowering blocks at rear, 185R70 14 tyres
76 Roadster	13.25	13.25	14	14	John Leader, Austin, TX	Lowered fronts from BritTex, 2 1/2" lowered rears from Moss. Pirelli P6000 205/55 15 on Minilite. 28psi front, 31psi rear.

76 Roadster	14	14	14.5	14.5	Mark Garrett, UK	Lowered fronts, lowered parabolics on rear (all plates on top of springs), Spax all round.
77 Roadster	15.25	15.125	15.625	15.75	John, Brisbane, Australia	
78 Roadster	14.56	14.96	14.96	15.55	Peter Bird	
79 Roadster	14.5	14.5	15	15	Martyn Harvey, Ontario, Canada	V8 conversion, early GT fronts, de-arched GT rears.
79 Roadster	14.25	14.25	15	15	Mike Cook	V8 conversion, late GT fronts, lowering blocks on original rears, 79k miles.
79 Roadster	14.75	15	15.75	15.125	Lars-Erik Kallstrom	Front: Moss Road uprated springs AHT21, V8 bushes, 500 miles. Rears standard, 70k miles.

By-the-way. The V8 always had a higher ride height to compensate for its reduced ground clearance. At the front this was achieved by using a special cross-member, which eventually became the cross-member on all rubber-bumper cars, and at the rear by using lowered spring mounting points. Clausager states that the V8 ride height was not altered with the introduction of rubber bumpers. My rubber bumper V8 has lowered front **and** rear hangers for the rear springs, but I have it on good authority from Kelvin Dodd that a chrome bumper V8 he has seen definitely only had the lowered front hangers, the rear hangers were standard. If the rear hangers **were** altered for rubber bumpers, i.e. to make then the same as rubber bumper four-cylinder cars, then there **would** have been a change in V8 ride height.

Extended Shackles

The roadster had always looked low at the rear to my eyes, and the springs were almost flat even when unladen, so I thought they were worn out. Fitted a pair of new OE items and was surprised to find that they made very little difference. As we use the car frequently for trips away from home laden with a comprehensive toolkit and trolley jack as well as luggage, speed-bumps and uneven ground were a real problem, with frequent grounding of the exhaust. I had also never been able to change a wheel by jacking under the axle as the tyre was too far up inside the arch and always had to jack under the front mounting, which means lifting the car quite a long way before the tyre cleared the ground. However this was minor compared to the Navigator's wincing when grounding.

In July 2003 I decided I had to do something about it. I did have rubber bumper roadster springs on for a while (part of another exercise) and whilst these gave me the extra height they were also harder and gave a choppy and unpleasant ride over some surfaces and eventually the proper springs went back on. I considered re-arching these springs but felt that would be a bit hit and miss. The alternative was longer shackles. I was surprised to find that rubber bumper and chrome bumper cars used the same shackles. Seeing as how the front eye is only about an inch or so lower, but the car is 1 1/2" higher, the extra must come from

extra spring hardness and/or arching and this does seem to be the case on my RB V8. I did find some adjustable shackles but they are very expensive, more than I was prepared to spend. A few enquiries elicited no other sources of longer shackles, other than paying an engineering shop to produce some, or modifying standard ones myself.

The very expensive adjustable shackles mentioned above have three pairs of holes for the bottom pin, which is just a long bolt going through both plates. The originals have the pins pressed into splined holes in the shackle plate and the pins have a double shoulder at the threaded end, the smaller of which fits into the hole in the closing plate. This keeps the threads away from the side of the hole so protecting them, but more importantly makes the tightened shackle a rigid parallelogram, aiding spring and hence axle location. Plain bolts will allow the rectangle of the closed shackle to be distorted into a rhomboid during cornering, which will give more lateral movement of the spring and hence the axle. Over time this will tend to make the holes in the plates oval and wear grooves in the bolts so weakening them. There is also the issue of tightening the shackles. Even when the original shackle is tightened to 30 lb.ft. the bushes are only lightly nipped and there is clearance for the spring eye to pivot on them. But without some form of spacer tube a plain bolt is going to tighten the shackles onto the bushes and spring eye, restricting movement, and probably damaging the bushes in a short time.

I decided to modify some myself. But rather than cut up and weld a piece into my existing ones I bought two pairs of the standard items and used those. This was for two reasons - I wanted a 'proper' set to go back to if I needed to and I wanted only one weld in each rather than two. In the event it was an easy enough job and if I were doing it again I would extend the existing pair with two welds and a piece of flat bar and save myself £40.

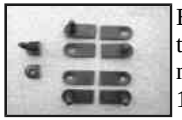
The first job was to decide how long - the distance between the centres of the shackle pins - I wanted them to be. The standard items are 2.5", I wanted about an extra inch as measured between the hub centre and the bottom of the chrome strip, and given the various angles and lengths of parts I reckoned on about 1.25" longer at the shackle, i.e. 3.75" in total. I didn't want to guess and get it wrong but be a bit more scientific, so I made up two wooden blocks to go between the spring eyes and the chassis rails, shackles removed, then added and removed further wooden 'shims' until I got my 1" extra between hub and trim. This was a bit of a fiddle jacking and lowering the spring and axle, but fortunately I got it right on the second go. I then measured the distance between the centres of the holes in the chassis rail and spring eye, and it turned out to be 3.75". Oh well, at least I knew it was going to be right.

At this point a word about removing the springs. I say 'removing' but I didn't actually remove them altogether, the front bolt was all that was left so the following process is good for complete removal too:

- Jack under the axle to raise the back of the car off the ground and securely support the body under the rear spring front mounting point reinforcing plates, high enough so that the wheels are off the ground when the jack is removed.

- Lower the axle so it is suspended on the rebound straps, or, if your straps are broken or suspect don't go any lower than good rebound straps would allow to avoid stressing the dampers or rear brake flex hose, and support the axle near the bottom of its travel on axle stands. Now would be a good time to replace bad rebound straps!
- Now jack under the spring itself, close to the U-bolts. Raise it a couple of inches or so but not so much as to start lifting the body off its supports.
- Remove the four U-bolt nuts, pull the damper mounting plate and spring locating plate down off the U-bolts and push them towards the front of the car so that they are under the front half of the spring. If you raised the spring and axle high enough above this is easily accomplished in the normal downward travel of the damper.
- Jack the spring down, it will clear the U-bolts, and keep going until all tension is released, pushing the damper mounting plate further forward if required.
- Remove the rear shackle. With no tension in the spring you should be able to wiggle it about to get it free once the closing plate is off. If the rubber bushes are damaged or perished change them.
- Removing the front mounting bolt now will allow complete removal of the spring, if required. Take care, they are surprisingly heavy! If the drivers side has sagged more than the passengers swapping over the springs will restore an element of balance when the car is occupied.

By putting wooden blocks between the spring rear eyes and chassis rails and varying the thickness of the blocks with shims, supporting the springs under the axle on jacks and lowering the car till the tyres just touch the ground, you can get a reasonably accurate measurement of the distance between the centre of the hub and the bottom of the trim strip as it will be in normal use. The distance between the centres of the holes on the spring and chassis rail then determines the required shackle length. With a pair of dial calipers I used the outside jaws to measure the distance between the closest part of the two holes, then used the inside jaws to measure the furthest part, halved the difference and added that to the lowest figure to get the centres.



By cutting and shutting two pairs of shackles, as I was, you then have to determine where to make the cut. I felt it best to make each half the same length, which meant half of 3.75" i.e. 1.875" from the centre of one of the pins. Careful measuring, scribing and cutting produced the pieces as shown in the picture on the left (click to enlarge). As well as the pieces from four shackles which are going to be welded together to produce two, you can also see an example of the discarded parts of each shackle. 3/75" is just inside the flat part of the shackle plates, much more and you would be cutting across the dished part (which is no big deal but it would look a bit odd when welded together), and you only have about 0.25" available anyway before you reach the pin. Don't weld half of a closing plate to half of a pin plate as I have the top ones laid out! I didn't, but only noticed I had them laid out incorrectly when viewing the picture when I came to write this account.

I wanted to grind the welds flat after fabrication, so to get

maximum strength from the weld I ground both sides of each cut edge at an approximate 45% angle to make a 'V' groove each side when the pieces were put together, as shown in this picture. Not terribly clear, but you should be able to make them out.

Next came the job of welding them together. I decided to do the shackle plates before the closing plates as I considered the former easier to get aligned with reference to each other, then the closing plates can be aligned with reference to the welded shackle plate. The shackle plates need to be aligned such that the pins are parallel in two dimensions - one so that the centres of the pins are the same distance apart for the whole of their length, and the other so that the two pins are at the same angle when viewed one behind the other. Finally the two halves of the shackle plate should be as level and flat as the previous two alignment criteria allow. I opted for holding them lightly in a vice across their width, tapping first one then the other until all three criteria were met, then tightening the vice and making sure they were still correctly aligned. Because I was welding two halves of different shackles together they were of slightly different widths which meant that when one was tight in the vice the other was still loose, so I used some thick card as 'soft jaws' which deformed and gripped each half with relatively equal force. I MIG welded one side filling the 'V', checked the alignment again, then turned them over and welded the other side filling the other 'V'.

The closing plates are less critical, only having to get them flat and level, and using the completed shackle plates to ensure that the holes are at the correct centres. The welded and ground parts can be seen here.

All that remains is to fit them. With the U-bolts undone and the spring tension released you should be able to insert the shackles and bushes into the spring eye and chassis rail quite easily. Because they are longer than the originals and because the spring may be resting on the previously removed damper locating plate in its forward position, you may have to pull the rear end of the spring down a little against its tension in order to get the shackle in. You may also need a little Waxoyl or washing-up liquid on the bushes to act as a lubricant to aid insertion. Don't use oil or grease as it will rot rubber. Fit the closing plate, spring-washers and nuts. When tightening the nuts they may tighten up before the shoulder on the pin has located itself into the hole in the shackle plate, then come looser as they locate properly, before finally tightening up to 30 lb.ft.

Jack the spring up under the axle, fit the spring locating plate and damper mounting plate onto the U-bolts, and fit and tighten the U-bolt nuts. The Workshop Manual shows double-nuts which can be locked together, but Nyloc nuts seem to be fairly common these days. Some say Nyloc nuts should only be used once, but I have seen a reference in a manual that says as long as you can't turn them with your fingers they are fine to reuse. If in doubt replace them. All that remains is to jack under the axle so you can remove the body supports, lower the wheels to the ground, and measure your new ride height after a short drive to settle things. After a longer

drive recheck the tightness of the shackle and U-bolt nuts. The fitted shackles can be seen here, pointing slightly to the rear, and not far off right-angles to the spring which is nearly flat.

The before and after relationship between tyre and arch can be seen here, the white line is to emphasise the bottom of the arch. The 'before' picture (left) was taken at an earlier date (I forgot to take one immediately before changing the shackles) but both are taken under similar loadings.

Spring Specs *Updated October 2008*

Front:

Car	Free Height	Spring Dia	Free Coils	Loaded Height	Load Weight	Rate lb/in	OE Part No.
Pre-72 Roadster	9.9	3.238	7.5	7	1030	348	AHH 6451
Pre-72 GT	9.1	3.28	7.2	6.6	1193	480	AHH 5789
72 Roadster	10.2	n/a	7.5	7.24	1030	348	n/a
72-on CB GT	9.32	n/a	7.2	6.84	1193	480	BHH 1077
73-on Roadster	10.2	n/a	9	7.44	1030	373	BHH 1225
RB GT	10.2	n/a	9	7.44	1030	373	BHH 1225
V8 (all)	9.32	n/a	7.2	6.84	1193	480	BHH 1077
Competition lowered	8.63	n/a	n/a	6.14	1193	480	C-AHT 21

Notes:
1. Information from Clausager, Factory WorkShop Manual, Factory Parts Catalogue, Special Tuning Manual, and Haynes.
2. The 73-on Roadster, CB and RB, and RB GT all had the same front springs as indicated above.
3. 'Loaded Height' is at the specified 'Load Weight' i.e. partially compressed. The difference between the free height and loaded height is the deflection, or the working load divided by the rate.
4. Clausager refers to the 1972 change as a 1/2" increase to all models to prevent excessive settling on export models when lashed down on ships decks for long periods, however the workshop manual shows a change of about 1/4" at that time.
5. Clausager makes reference to what he calls a 'Part number change only' in November 1972. However the Workshop Manual has three sets of specs for the CB roadster - I have assumed (maybe wrongly) that the third set is in fact the November 72 set that Clausager mentions. I have called these '1973 Roadster'. Dave Wood states he received a recall notice for his 72B later that year for a spring change to raise the height by 1/4" to meet minimum headlight heights which would seem to concur with

the workshop manual. The Parts manual only has two part numbers covering the change early in 72, not the change in November 72.

Rear:

Car	Leaves	Interleaving	Width	Gauge	Load (flat)	Rate lb/in	Deflection in	OE Part No.
Pre-May63 Roadster	5 + bottom plate	None	1 3/4"	7/32in	400lb	99	4.04	AHH 6453
May63-on CB Roadster	5 + bottom plate	1/2 2/3 3/4	1 3/4"	3@7/32in, 3@3/16in	450lb	93	4.97	AHH 7080
Pre 72 CB GT	6 + bottom plate	1/2 2/3	1 3/4"	3@0.2187in, 3@0.1875in	510lb	99	3.20	AHC 31
72-on CB GT	6 + bottom plate	1/2 2/3	1 1/4"	3@0.2187in, 3@0.1875in	510lb-540lb	99	3.20	AHC 31
RB Roadster to Sep75	6 + bottom plate	1/2 2/3	1 3/4"	3@0.2187in, 3@0.1875in	510lb	n/a	n/a	BHH 1767
RB GT	6 + bottom plate	1/2 2/3	1 3/4"	3@0.2187in, 3@0.1875in	510lb	n/a	n/a	BHH 1767
Post-Sep75 RB Roadster	5 + bottom plate	n/a	n/a	n/a	n/a	n/a	n/a	BHH 1779
CB V8	6 + bottom plate	1/2, 2/3, 3/4, 4/5	1 3/4"	3@7/32", 3@3/16"	550lb	n/a	n/a	BHH 1133
RB V8	6 + bottom plate	1/2, 2/3, 3/4, 4/5	1 3/4"	3@7/32", 3@3/16"	550lb	n/a	n/a	BHH 1171
Competition	n/a	n/a	n/a	n/a	375	100	3.75	C-AHH 8343
Competition	n/a	n/a	n/a	n/a	542	124	4.37	AHH 7346
Competition (lowered AHH 7346)	n/a	n/a	n/a	n/a	542	124	3.37	C-AHT 20

Notes:
Information from Clausager, Factory WorkShop Manual, Factory Parts Catalogue, Special Tuning Manual, and Haynes.

Unloaded Rear Spring Dimensions

A question about this was asked on the BBS and as I still have the relatively new rubber-bumper items I posted the following as a guide:

A	eye centre to eye centre	41 1/4"	
B	inverted height from floor to top of top spring	8 5/8"	
C	front eye centre to pin top centre	19 1/8"	

See also the picture on the right of the table.

Remember these are relatively new rubber-bumper roadster springs, but all others should be close. If your dimension A is significantly less and B is significantly more then over-arching is the problem. If the dimensions are close but you still cannot compress them enough during installation or the resultant ride-height is much too high, then the leaves are much too hard. In either case get your money back and source them from a reputable supplier in the UK.

See also Front and Rear Suspension Considerations from Doug Jackson's British Automotive site.