Setting up a Small Saloon's Suspension

Tuning for go, not show

Story and photos by Craig Talbot

The Mark 2, S Type and 420 front suspensions are all similar and can be aligned in a similar way. There are instructions and specifications in the workshop manual for how to set camber, castor and toe, but these can give unsatisfactory and possibly dangerous steering angles.

I finished off a complete restoration of a 1966 S Type; followed the specifications in the workshop manual and ended up with negative castor. The car was very unstable to drive above 50 mph, and it felt like it was hydroplaning. It was tough work to keep the car within the 12-foot-wide lane markings! I had adjusted the upper ball joint shims such that the ball joint was as far back as possible, yet I was still unable to obtain positive castor.

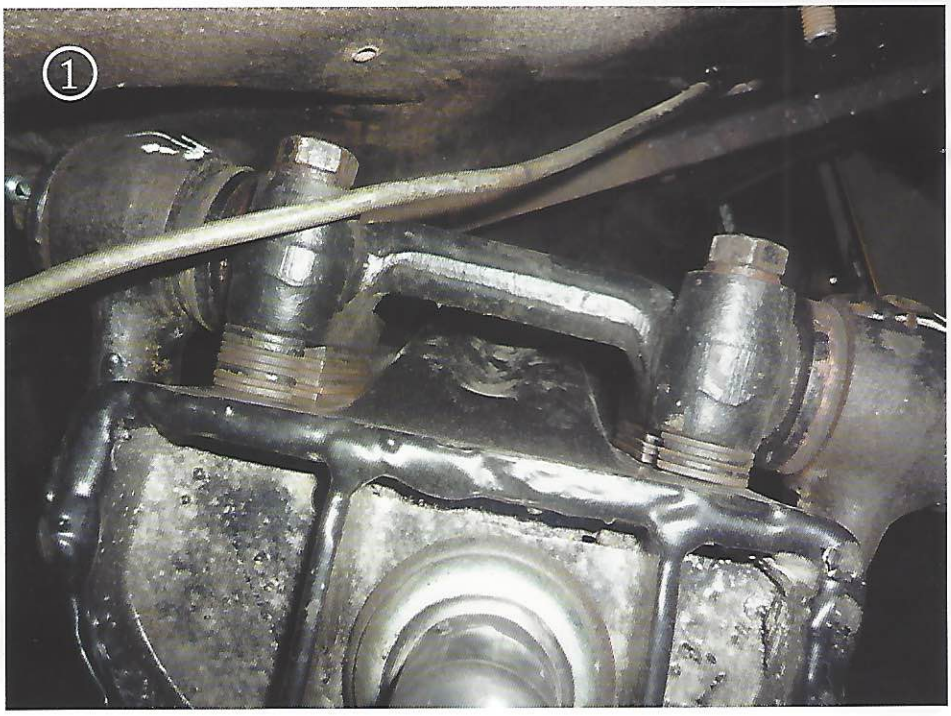
The original specifications are for the castor to be 0 ±1/2 degree, Camber ½ ±1/2 degree and toe parallel to 1/8" toe in. Since these cars were introduced radial tires have become universal and this changes the way the wheels need to be aligned. With experience, these cars have the best handling at 2-3 degrees of positive castor, between ½- 1 degree negative camber and about 1/8" toe in. However, if the workshop manual is followed, it is impossible to obtain this much castor.

It is possible to get increased castor if you forget that you are working on a Jaguar, ignore the workshop manual, and pretend you have a 1973 Buick Electra in front of you. Just don't go looking for the 455 V8 under the hood! The older GM cars have used a single pressed steel upper control arm with an integral ball joint and adjust the castor by shimming the mounting locations, just as Jaguar does with camber shims. Unlike Jaguar, which specifies the number of camber shims must be equal under each mounting point, GM uses the shims to rotate the upper control arm. The number of shims front and back can be varied to essentially rotate the upper control arm around an imaginary vertical axis that passes through the road spring. More shims under the rear mounting point compared to the number under the front will shift the upper ball joint rearwards, or clockwise if looking down on the control arm, making the castor more positive. Moving the shims to the front will rotate the control arm the opposite direction, producing negative castor.

This procedure will affect camber as the castor is adjusted, so both have to be checked. Once castor is correct, then the camber can be adjusted by following the Jaguar procedure by adding or removing an equal thickness of shims from both mounting points. I use a combined castor/camber gauge so I can keep an eye on the camber when adjusting castor. It was worth investing in the digital level to make reading camber in 1/10 degree increments easy, and be able to measure castor and camber with the same tool.

To change the shims it is best to keep the car's weight on the suspension. This keeps the spring compressed and the upper control arm off the bump stop. The mounting shaft is then easy to move to insert or remove shims; otherwise it will be a very difficult job to add shims. Loosen the retaining bolts only as much as necessary, do not remove them. For cars with wire wheels, an effective way to hold the suspension is to put an axle stand under the splined hub, making sure the splines are protected and let the axle stand carry the cars weight. For cars with steel wheels, blocks of wood can be put under the lower ball joint or spring pan. Always make sure the car is securely held and will not fall.

[FIG 1] Unequal amount of shims have rotated the control arm rearward to give positive castor.



[FIG2] Both bolts of each upper control arm retaining bracket need to be loosened to allow shims to be removed or added. Insert the shims open end on the bottom bolt first, then rotate the shim into the top bolt

[FIG 3] Measure the shim packs for the front and rear positions. As a starting point, try having the rear shim pack 1/8" to 3/16" thicker than the front shim pack.

[FIG 4] The hub supported on an axle stand so that shims can be added or removed. Note the upper control arm bump stop is not resting on the suspension crossmember.

[FIG 5] When setting castor and toe, the wheel needs to turn, and for all adjustments the car needs to be at normal ride height. To do this, the wheel needs to be set on a "turntable".

I did this with 2 pieces of Plexiglas and some chassis grease in between. The grease allows the wheels to move freely. After jacking the car up, set it down on the turntables and bounce the car a few times. This will let the suspension settle to normal ride height as the wheels splay outward. Here camber is being measured with the combined camber/castor gauge. It is very important that the car is on a level surface before doing these measurements. Here the digital readout is showing 0.6 degrees negative camber, tilting inward.

For left hand traffic (i.e. the UK) camber should be about ¼ degree more positive on the right side, and for right hand traffic (i.e. North America) the camber should be more positive on the left side to compensate for road crown.

[FIG 6] Castor is measured by attaching the magnetic gauge to the hub, levelling it and zeroing the castor bubble, turning the wheels 20 degrees, and releveling the gauge. Turn the wheels through straight ahead to 20 degrees the opposite way and read the castor from the bubble.

[FIG 7] Castor here is showing 2 degrees positive. The gauge must be centered on the hub.

[FIG 8] Toe gauges are also magnetic, and again must be centered on the hub and leveled. For cars with steel wheels there is a pin in the gauge that engages the centre drilling of the spindle to make sure the gauge is centered on the spindle. For wire wheels I judge it by eye as best I can and make sure the magnets are evenly spaced around the splined hub. These gauges have a light inside, and project a bull's eye image on the red and while flag of the gauge on the opposite side of the car. This bull's eye image is adjustable for distance and focus to give a sharp image.

On each flag are lines that indicate the toe in inches, either in or outward. Total toe is obtained by adding the readings together. For example, if one flag indicates ¼" toe in and the other flag indicates 1/8" toe out, the total toe is 1/8" toe in – right where we want it.

The steering wheel is held in the straight ahead position with a small special clamp and when finished the wheel should be in the straight ahead position and the car should go straight. If the steering is tiled when driving straight ahead, then the toe adjustment on each wheel needs to be moved by an equal amount to preserve the total toe.

Cars with rack and pinion steering have the toe adjustable by turning the tie rods, after slackening off the rack gaiter clamp. I have replaced the fixed tie rods on my S Type with a threaded rod and standard tie rod ends, so the toe is adjusted by removing the tie rod end from the upright and screwing it in or out and re attaching. On some cars the centre track rod can be adjusted to achieve proper toe. On Mark X/ DS420 cars the centre track rod is to remain a fixed length.

[FIG 9] The projected bull's eye from the opposite gauge. In this case, the flag is on the right, the light is on the left and indicated the toe of the left tire is about 1/32" in. Each wheel's toe adjustment will affect the other, so toe setting can be an iterative process.

With this guide and your car's workshop manual you should be able to tune your small sedan to your taste.