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Re: alignment  
From: Esprit2  
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Gary,

The easy way is to follow the factory specs and enjoy the drive. Having said that, I get a little creative with the suspension set-up and alignment. I'm not suggesting you follow my lead, I'm just letting you know what I use and like. "My opinions"... make up your own mind.

#### Front Ride Height:

I've had two S2s and two Twin Cams (currently daily driving an S2). On all, I set the front ride height so the lower control arm is horizontal/ parallel to the road (like the illustration in the manual). The arm is a bit of a roller coaster ride, so I'm talking about the centerline between the inner and outer pivot bolts being horizontal... not any part of the physical arm itself.

The Federal Twin Cam used special long coil springs at the front in order to meet USA bumper and headlight height regulations. Those long springs do not appear in the parts manual (only the shorter 'Euro' front springs). I've even called Lotus Cars USA (LCU) back when they were in Atlanta, and they acted like they didn't know what I was talking about. They said something like "The front spring we stock for the Europa Twin Cam matches the specs given in the manual"... ie, which are the 'Euro' spring specs.

If you wish to lower the front of your Federal Twin Cam, just install new 'stock' spec springs, and you'll be there. Adjustable ride height shocks would still be nice to fine tune the ride height or corner weight the car, but the springs handle the big chunk of the change.

For the Federal Type 65 S2, I lowered the front via adjustable ride-height shocks, plus some creativity. I used SPAX, which have very thick aluminum spring perches. At the lowest setting, the front was still way too high. So I grabbed the old stock Armstrongs, ground the welds to remove the much thinner steel spring seats, and transferred them to the SPAX. That made a huge improvement (lowered the front), but not quite far enough.

The SPAX adjustable spring perch uses two ring nuts... one for adjusting, and one as a 'lock' nut. I deleted the lock nut and screwed the adjuster nut all the way down until it bottomed out against the weld. With that, the lowered ride height was almost spot on.

#### Rear Ride Height:

The rear susp'n involves the halfshafts and their U-joints, and you shouldn't run them at extreme angles. That means you don't have the option of making significant changes to rear ride height. Stock-type of U-joints should not be run 'straight'/ on-axis. When perfectly straight, the needle rollers don't 'roll', they just sit in one position. As such, they're prone to flat-spotting, and the mating journals can 'Brinell'... ie, develop grooves/ dents where the rollers sit constantly. That's not good. You want the needle rollers to move constantly.

So by design, any driveshaft/ halfshaft is set to run at a small angle as a minimum... more is optional. The Europa's stock rear ride height establishes a minimum U-joint deflection. That's not optimum susp'n geometry as much as it's taking care of the mechanical bits.

On the stock rear susp'n, measure the height of the inner and outer U-joints above a flat, horizontal floor. If 'stock', you'll find the inner U-joint is a little higher than the outer. It is reasonable/ acceptable to lower the rear ride height until the inner U-joint is LOWER than the outer one by the same amount. It was higher by 'X', make it lower by 'X'. That's a minor change, but

it won't alter the U-joint's service life.

#### Front Toe:

The Europa has Ackermann steering, like most cars. Ackermann turns the inside wheel more than the outside. That's increasing toe OUT as you steer. If you start with stock toe-IN, then the front toe moves to/thru zero-toe, then continues into toe-OUT.

The time spent at or near zero-toe is not good. Like trying to balance a pencil on its pointy end... the slightest thing gets it leaning and it falls over. In the steering, there are many sources for wee bits of slop in the system... play in the rod ends, backlash in the rack, free-play in the wheel bearings, susp'n bushings... you can't run with it 'tight'. The toe setting puts the wheels off the straight ahead position by enough that off-sets and rolling drag in order to cause the wheels to take a set in one direction. Like leaning the pencil a little in one direction, but leaning it up against a wall. Set toe-in, and they tend to want to stay toe-in.

I still use the stock toe range (1/16" to 3/16"), but I target the minimum of the range, and set it to toe-OUT. That way, the front wheels start by 'leaning' in the same toe-out direction that Ackermann is going to steer them toward anyway. They 'never' go through that unstable, darty, in-decisive zero-toe condition. And they don't flip from leaning one way to leaning the other way (steering slop) as they cross over the zero-toe position. Every other car with Ackermann steering and toe-IN crosses back and forth over that zero-toe condition all the time. It makes the steering feel indecisive.

"OH, but toe-OUT is unstable and dangerous!!" No it's not. Have you ever tried it? I've been driving cars with toe-out since late 1980s/ early 90s. Two Europa TCs, two Europa S2s, Two Eclats, one Esprit S2, and a handful of Mk 1 MR2s. No instability issues, they're easy 2-finger cruisers on the freeway. And their steering turn-in is quicker and more precise than they were with toe-in... and they were darned good before.

All Elan, Elan +2 and Europa models are prone to tramlining. That's a tendency to follow cracks in the pavement's surface. That's a separate issue, and not a function of toe. Our cars tramline when toe-in (stock), and they'll tramline when toe-out. Don't be too quick to knee-jerk blame any tramlining on a new toe-out setting. If you're conscious and honest, you'll realize it's the same tramlining you've always experienced. Actually, probably a little less with toe-out since the wheels are not passing through/ hovering around the zero-toe position.

Rear Toe: Again, I use the stock rear toe-in spec, but I target the minimum end of the range without going below the minimum.

1/8" to 1/4" Twin Cam Spec... target 1/8" or a bit more.

Zero to 3/16" S1-S2 Spec... Lean toward '0' but stay comfortably away. Never go negative! Arbitrary, but I shoot for 1/16"-3/36"... ie, bottom half of the spec range but staying away from zero.

Note that the Lotus manual's toe specs apply when measured at the OD of the wheel's rim at the horizontal centerline. On the metal. NOT at the tire's outside diameter/ centerline.

Front toe is measured between the two front wheels... total, wheel rim to wheel rim/ metal to metal. I target 1/16" (spec minimum), and that makes the total between the two wheels 1/16".

In contrast, rear toe is measured between each wheel rim individually and the chassis centerline. I target 1/8" (spec minimum), and the total between the two wheels becomes 1/4" (1/8" + 1/8" = 1/4"). 1/8" PER SIDE, wheel rim OD at the horizontal centerline to chassis centerline.

#### Tire Pressures:

They will vary with tire sizes, cross-section, etc... that makes the subject too big, and I've already burned a lot of bandwidth. But looking at the specs as given in the manual...

Below 100 mph

16 psi Front

26 psi Rear

The front is too soft, IMHO, and I don't go there. That pressure has more to do with absorbing road irregularities and giving a better, less harsh ride. But if you get into the twisty bits, autocross, or just enjoy driving in a spirited manner most of the time, then the low pressure at the front makes it feel like the car is connected to the road via rubber bands. Turn the steering wheel, then wait for something to happen... wait for it... it's coming.

Above 100 mph

22 psi Front

32 psi Rear

Tightens up the steering response at both ends, but most noticeably at the front... much better. It almost addresses my complaint with the <100 mph spec, above... but not quite.

My choice.

24-25 psi Front, depending upon what I'm doing.

32 psi Rear

I use DOT road race tires all around, all the time (currently R888r). They don't last as long, but I got used to the grip while autocrossing, and don't want to give it up.