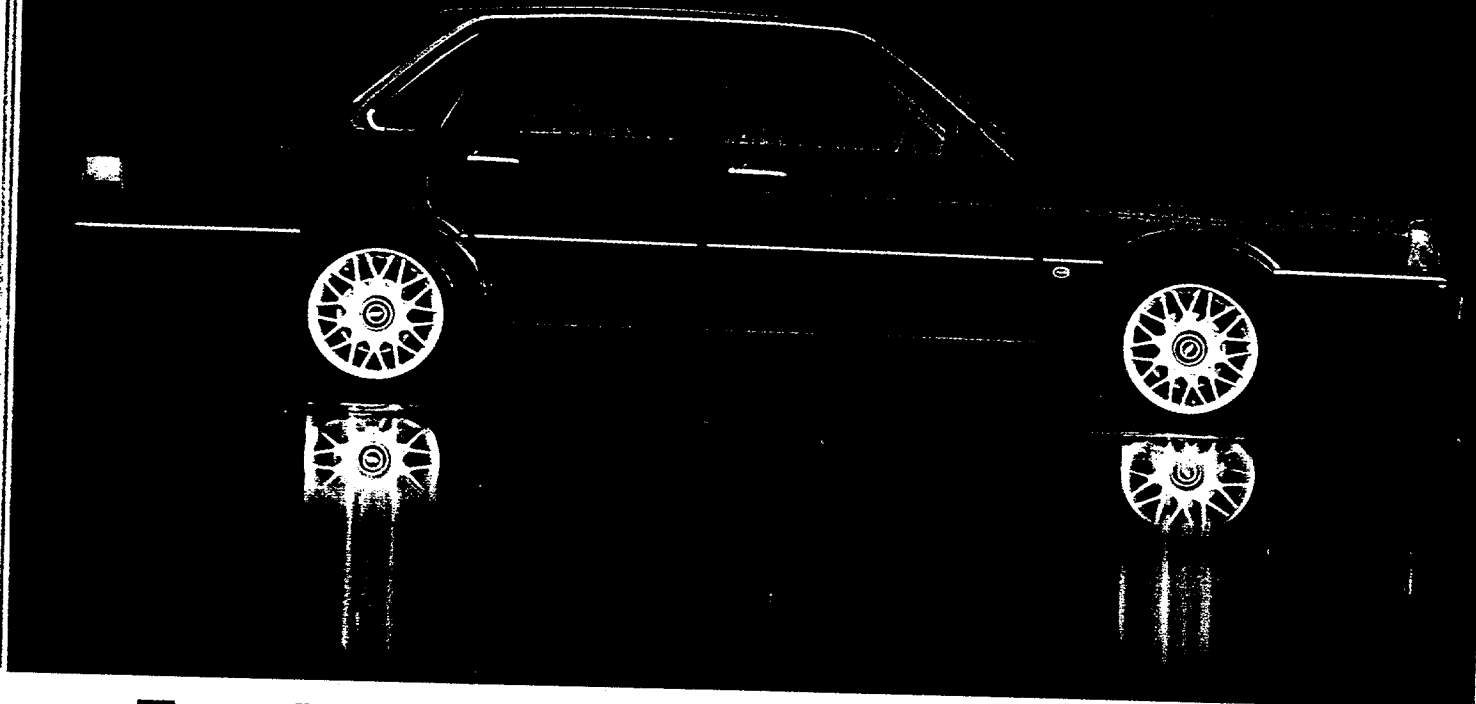


Project



Audi 4000 CS Quattro

Part 8:

Suspension component overhaul

by **Brendan M. Lopez**

PHOTOS BY THE AUTHOR

When we installed the suspension kit on our project Audi (July 1995), we found a number of other components in need of replacement. I wrote, "Inspection of the other chassis components has revealed that some additional parts will need to be replaced soon in order to completely restore the chassis." This seems to have caused a bit of confusion.

Some wrote in asking why we didn't address the control arm bushings while we were already there, as the bushings are a known Achilles heel on the Audi 4000. Another reader was wondering if perhaps there was a problem with the spring/strut insert combina-

tion that we chose. Well, we could have covered the entire suspension in one fell swoop, but the information presented would have been less than adequate when pared down to a printable length.

So, on to the task at hand. Closer inspection of the control arms revealed the bushings and ball joints to be in a sad state. The control arm bushings are made of rubber and steel. The inner sleeve is surrounded by two layers of alternating steel and rubber. When the bushings wear, the inner sleeve begins to separate from the next layer of rubber. When the sleeve tears away, it rotates on the rubber, causing the rubber to chafe. It is pretty easy to check if the bushings are bad. Put the car on jack stands and move the wheel/tire forward and aft. If the control arm moves where it mounts to the subframe, the bushings are in all likelihood thrashed.

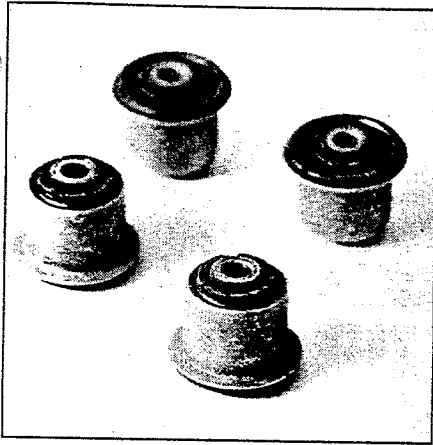
The ball joints also exhibited signs of wear. With torn boots and a bit of slop, they were quickly judged as rubbish bin filler. The tie rods were soon to join the ball joints and bushings.

The procedure for replacing the bushings and ball joints is fairly straightforward. The most difficult part of the job is getting the bushings out as they are tightly pressed into the control arm. Add a little rust, and removing the bushings becomes quite a task. It would seem not to be too difficult to remove and press in new bushings. With a press and set of dies the task shouldn't take but a few minutes. Yeah, right.

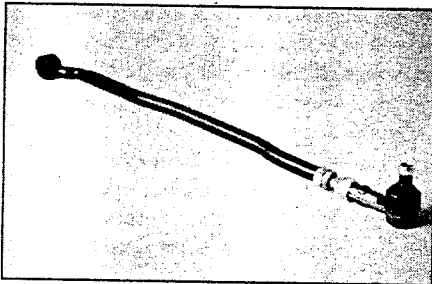
The first step is to park the car on a flat concrete surface. Remove the wheels/tires and support the car on jack stands. The layout of the front and rear suspension is similar as far as these procedures go. The differences are minor and shouldn't be disconcerting. The biggest difference lies in the mounting of the ball joint. The front has the ball joint mounted to the control arm, while the rear ball joint is pressed into the bottom of the strut.

Overhauling Front Bushings and Components

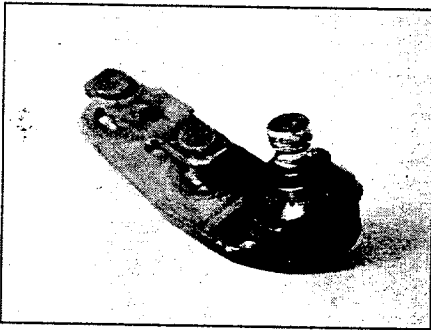
We'll start in the front first—for no other



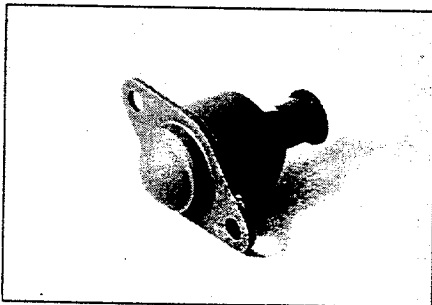
The inner control arm bushings are the Achilles heel of aging Audis.



Tie rod ends can be replaced individually or as a complete tie rod assembly.



The front ball joints are angled towards the front. The reference line facilitates positioning of the new unit.



A new Audi rear ball joint.

reason other than the front is usually worse than the back. Any slop in the front end is transmitted to the driver via the steering wheel—most annoying. As long as we're there, we'll be changing the sway bar mounting and end link bushings.

First, remove the sway bar end links. The links are held into the bushings with nuts. To keep the link from turning, you can use a thin, open-end wrench on the flat portion or use vise grips. When reinstalling, the sway bar end link should have the kink positioned 90 degrees from the direction of travel. It will fit naturally in one orientation. The swaybar is removed from its attachment at the subframe by removing the two nuts and two bolts. Note which way the bolts come out, as they are a special type of bolt threaded on both ends with a nut in the middle (more like a stud with a nut in the middle). This applies to the later 1985+ cars that have brackets over the sway bar mounts. One quick note about sway bars: People call them different things. Some call them sway bars, some anti-sway bars and other anti-roll bars. In the factory manual, they are referred to as "stabilizer bars."

The front control arm is attached to the subframe with two 10mm bolts. The strut is mounted to the ball joint with a clamp type affair on the bottom of the strut. The ball joint in turn, slides into the control arm and is clamped with two nuts. You will want to remove the bolt that fastens the strut to the ball joint first. Leave the strut attached to the ball joint for now.

To remove the front control arm, remove the two bolts that pass through the bushings. In order to remove the nuts, you will have to insert a box wrench into the hole in the cross member. We had to play with a few different wrenches to find one that would work in the tight confines of the cross member. In the end, it was a Craftsman™ offset box wrench that did the trick. With the two bolts removed, the ball joint can be levered away from the strut and the control arm removed.

The hardest part about refurbishing the control arm is removing the bushings. It is easy to envision removing the bushings with a pair of sockets (or press dies) on either side of the bushing and pressing with a hydraulic press or vise. Easier said than done. The press I have access to is simply the wrong size. If it was wider, the whole arm could be placed between the rails. If it was smaller, the "y" portion of the control arm could be placed around the rail and the bushings pressed.



Excessive control arm movement at the sub-frame revealed worn bushings.

This leaves two options: 1) Take the arm to a machine shop and have them deal with it. 2) Try to drive the bushings out somehow. Finding a machine shop to do such tasks can be a bit difficult. If you can find one that will do pressing, they can never seem to get at it right away. Between spits of tobacco juice, you will indubitably be told that they can't get to your work this century.

There are a couple of shade-tree methods for removing the bushings. The thick center sleeve in the bushing will fall out. Simply cut through the bushing with a hacksaw and collapse the steel shell. Make certain not

to cut into the control arm itself. It will be hard work moving the saw through the rubber. Provide some form of lubrication for the blade. Another method is to put the control arm into a vise and pound the bushings out with a socket. Ouch!

Neither of these two methods work all that well. The machine shop we took the control arms to suggested collapsing the tapered portion of the bushing on four sides and driving the bushings out with an air hammer. This requires a steady hand and a bit of finesse, but it seemed to work okay. Bear in mind that this is far from ideal. In a perfect world, you'll have all of the various dies mandated by the factory repair manual and suitably sized hydraulic press. When you have to make do, you find your own solutions.

The sway bar bushings are easily removed by pushing out the metal sleeve. Cut the bushing with a utility knife and push the remainder through with your finger. The factory manual makes a big production over removing the bushings; just do it.

Remove the ball joint and clean and paint the control arm. To facilitate reinstallation of the ball joint, measure or mark its position. When the new one is installed, you'll at least have it in the ball park (more like in the sta-



An offset wrench and a socket wrench make removing the control arm fairly easy.

dium parking lot). The ball joints on the 4000q should be angled toward the front.

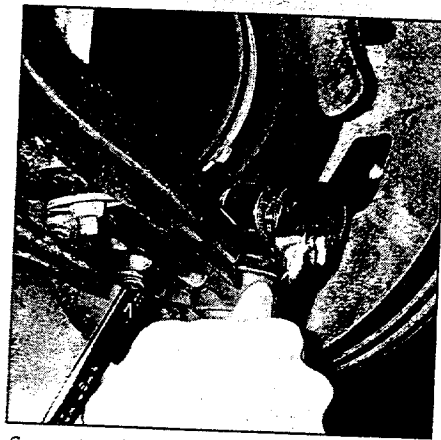
To install the sway bar bushings in the control arm, spray the rubber with silicone spray and push the bushings in with a flat-bladed screwdriver. It takes a bit of cursing to get them in, but it's still better than buying all of the unnecessary dies that the factory manual calls for. If you push too hard, you will tear the new bushings. The bushings in the end of the sway bars are replaced in a similar manner. **Warning: DO NOT ACCIDENTALLY BREATHE THE SILICONE FUMES** (or intentionally, for that matter). The silicone when

inhaled is harmful and can cause permanent lung damage, or so I have been told.

Installing the new control arm bushings is easy compared to the grief involved with removing the old ones. Coat the outside of the new control arm bushings with a little anti-seize or similar friction-reducing compound. Place the control arm into a press or vise. Press in the new bushings, taking care not to damage them. As the bushing begins to pass through to the other side, you'll have to provide clearance in order to fully seat the bushing.

Fit the ball joint to the control arm and re-attach the control arm to the subframe. Do not fully tighten the main bolts at this time. This should be done with the car resting on its tires.

With the control arms sorted out, you can now turn your attention to the tie rod ends. Before removing them, center the steering wheel. Not only should the wheel be centered, the amount the wheel can be turned in either direction from center should also be the same. The tie rods are removed by loosening the nut at the strut and pressing off. At the rod coming from the steering rack, simply unscrew. When refitting, set the toe as best as possible. If you know any racers, they'll probably have a



Separating the control arm from the strut housing is easily accomplished with a box end and socket wrench.

crude alignment jig that will get you as far as the alignment shop for a proper alignment. You might want to forego the tie rod ends and have the alignment shop install them. They will be loosening them anyhow to do the alignment.

Overhauling Rear Bushings and Components

Refurbishing the rear suspension is much like the front. The control arm is removed in much the same manner as the

front, the biggest difference being the mounting of the ball joint. To separate the ball joint from its mounting on the control arm, you can use a small puller or simply lever it away. The ball joint is removed from the bottom of the strut by fabricating a flat piece of steel about 1.0 x 3.5 x 0.75-in. thick. The piece should have a hole in the center large enough to fit onto the protruding ball joint stud. Fasten to the ball joint with a nut. Screw in two 8mm x 40mm bolts into the mounting holes for the ball joint. By reversing the direction of the bolts and bearing against the steel bar, you can extract the ball joint. Or, wedge in a chisel between the ball joint and the bottom of the strut.

Surprisingly, the rear tie rod ends were okay and didn't need to be replaced. Perhaps the previous owner attended to those at some time.

The rear control arm bushings are removed in exactly the same manner as the front. An equal amount of cursing should do the trick. The ball joint carrier need not be removed when working on the rear suspension. If one feels compelled to remove the ball joint carrier, mark its position first. The angle on the ball joint carrier should point rearward, the

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exact opposite of the front.

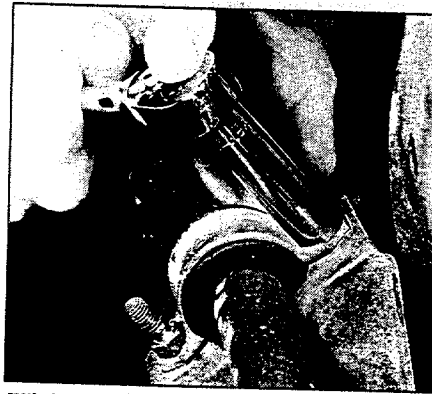
With all of the bushings and ball joints installed, the wheels and tires can be fitted and the vehicle lowered. With the vehicle on the ground, the final tightening of the control arm bolts can be done. Use new locking nuts and tighten to 43 ft-lb. The vehicle should be inspected once more to make certain nothing is amiss. Promptly drive to an alignment shop for a professional alignment job.

Discussing suspension setups invariably starts a whole conversation about alignment settings. Entirely too much emphasis is placed on this, that, or the other setting. Most people wouldn't know the difference anyhow. When in doubt, go with the factory settings until you feel comfortable doing otherwise.

When having the alignment done, be sure to follow the following guidelines:

1) vehicle empty; 2) correct tire pressures (yet another tiring subject for debate); 3) level test surface; 4) car settled; 5) steering free from slack and centered.

The chassis is now finally finished. The suspension is taut and the handling crisp. Our efforts have been validated by a quick jaunt up in the local mountains. Following a new Audi A4, our project car was able to



While we were there, we decided to change the anti-roll bar bushings as they are easily accessed.

keep up in the twisties. While it would be easy to conjure up a true sport suspension that would perform better, our combination is something that can be lived with day in and day out. Whether faced with a winding road or a pothole, our Audi is ready. ☒

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Torque Values

Control arm nuts: 43 ft-lb
Rear ball joint carrier nuts: 47 ft-lb
Rear ball joint mounting bolts:
29 ft-lb
Rear ball joint nut: 54 ft-lb
Rear tie rod nut: 29 ft-lb
Front stabilizer nuts: 14 ft-lb
Front tie rod end nut: 22 ft-lb
Front ball joint carrier nuts: 47 ft-lb
Front strut to ball joint mounting nut: 47 ft-lb

Factory Alignment Specs

Front axle:

Total toe: +10' 0 deg to +20'
Toe angle difference at 20 deg lock: -1deg -30'
to -1deg 30', left and right
Camber, wheels straight: -45' -15' to -1.15'
Max deviation between l & r: 30'
Caster, non adj.: +1deg 25' +55' to 1deg 55'
Max deviation between l & r: 30'

Rear axle:

Camber (up to chassis # FA 095 223): -30'
-1 deg to 0 deg
(from chassis # FA 095 224): -1deg
5' -1 deg 35' to -35'
Max deviation between l & r: 30'
Toe of each wheel: +10' +5' to +15'
Total toe: +20' +10' to +30'