

Rear Suspension

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Rear Suspension Identification. Solid (Live) Rear Axle or Multilink? How do I tell if my rear axle is solid or multilink?

[Response: Rob Bareiss] If you look under the back of the car, and see a big round differential in the middle of a tubular axle, that's the "live" or regular solid axle rear. If there is a big framework in the center and long control arms and little constant velocity flexible driveshafts running from center out toward each wheel, then it is multilink (Independent Rear Suspension). The only cars with IRS in the US/Canada market are: late 760 sedans, 940SE sedans, all 960 sedans, late 960 wagons, and S and V90's.

Nivomat or Normal Shock? Nivomats have springs integral to the shock absorber. See the Illustrations.



Rear Bushings.

[Symptom:] When you accelerate from a stand still or when you decelerate suddenly, you could hear and feel a jerk from the rear. This is when the rear suspension is beating the chassis as it is taking up the clearance due to the worn

bushing. [Diagnosis:] Try this: Jack up the rear end of the car and first with the car in neutral and the park brake off, turn the drive shaft back and forth quickly. You will see if there is much play in the torque arm bushings. The rear end will actually swing back and forth. With the weight off the rear end, you should be able to pry on various portions of the trailing arms close to the bushings and notice if there is excessive play. If your trailing arm bushings are bad, you'll need a special tool to take them out and press them back in. The torque arm can easily be taken out and the bushings pressed in and out.

Clunk in Rear End: Bushing Diagnosis.

[Inquiry:] 87 740 wagon with 190k, M46 trannie, new to us. Have replaced shocks, struts, u-joints, trannie mount and center support bearing on driveshaft, and some front bushings. Acceleration from standstill in normal traffic results in a clunk which seems to come from rear end. Trannie output bushing and pinion bushing have no play. Wheel bearings are good. Nothing is rolling around in rear of car or spare tire well. The only thing I can figure is bushing(s) in rear, but which one(s)? (none are visibly broken up, although I haven't yet given them the prybar test.) Can anyone guide me to the most likely culprit on this one?

[Response: Steve Seekins] I would focus on the rear suspension bushings. There are 7 - two on each of the torque rods and three on the sub frame to body mounts - one at the front and two at the rear. I would suspect the subframe mounts, probably got accelerated wear from soft torque rod bushings. The Haynes manual is adequate for procedures here. Of course you should first check for loose upper or lower shock mounts or loose sway bar mounts. If the lower shock mount has loosened, check carefully for elongated hole in trail arm - if so, consider replacing the trail arm if tightening the bolt does not do the job.

Rear Suspension Vibrations. Panhard Rod Bushings.

My 745 with a solid rear axle has a single arm with large rubber donut bushings connecting the underside of the differential to the frame just ahead of the diff. The lower rubber donut has gone really soft, allowing about 15 degrees of angular rotation of the rear axle; enough to seriously deflect the drive shaft under acceleration at low speed and causing the U joints to grumble loudly. At speeds over 15 kmh the noise is gone; I suspect the momentum of the drive shaft resists the deflection and the acceleration force is lower. The side bushings are fine; also I have a heavy IPD swar bar.

Loose Rear Shock Bolts.

After hearing vibration that I thought was coming from the rear axle, I grabbed the shock absorber and found there was a very small amount of movement. I tightened up the lower and upper mounting bolts and presto !! Noise be gone ! Amazing how much noise there was coming out of that little bit of movement on that one rear shock. If you've got some knocks coming out of one or both of the rear corners of a 940, try tightening up those shock bolts before you spend a lot of time trying to find a problem with one of suspension bushings.

Bilstein Touring Shocks.

[Editor] Numerous anecdotes from Brickboard show that Bilstein Touring shocks often clunk in the rear suspension thanks to poor quality control on bolt hole diameters. Replacing the shocks with another brand solves the problem.

Multilink Rear Axle.

[Tip from ImportCar Magazine, Apr 2003] The multi-link suspension systems, which independently suspend each rear wheel, allow for improved ride and road handling, and for each wheel to be aligned separately. The only failure we've seen is the upper carrier housing bushing, as it's made from rubber and has a plastic housing that cracks over a period of time. Volvo offers a tool to cut the repair time in half, with no need to remove the complete center housing and use the hydraulic press. Multi-link suspensions require alignment any time the suspension components are disassembled. When aligning, start at the rear first setting up the camber, then the toe. Caster is fixed by the design of the suspension and cannot be changed, except by replacement of damaged parts.

Rusted and Stuck Bolts: Removal Techniques. See the [link](#) for more ideas.

Rear Spring Replacement

[Inquiry:] I am thinking about installing new springs and shock in the rear of my live axle 745. How do I do it? [Reply] This is one of the easiest things I've done to that car. The procedure below pertains to all 7xx/9xx cars with live (aka non-IRS) axles. [Editor] Use antiseize when reinstalling nuts and bolts since this is a high-rust area.

1. Chock the front wheels.
2. Loosen the lug nuts on the rear wheels.
3. Elevate one rear quarter of the car with the jack, and place a jack stand under the rear jacking point. A convenient place to lift is the front of the trailing arm.
4. Remove the wheel.
5. Place a floor jack under the axle. Note: jacking under the trailing arm is hazardous since the jack can slip down the sloped arm. Use the axle instead. Jack up the axle to unload the lower shock mount. Loosen the lower shock mount (requires 18mm wrench for inner nut and the outer bolt head is 17mm). [Tip from Chris] **MAKE SURE** you have the **floor jack under the axle** when you remove the lower shock bolt or that side can fall to the ground, ripping the rubber brake hose in the process. If the brake hoses appear strained, then unbolt the line mount above the wheel to relieve them.
6. Remove the 17mm nut holding the upper spring seat in place. If you're replacing a Volvo spring, chances are it is not a variable rate spring, so you can get to the nut with just a ratchet wrench and a socket. If you're removing a variable rate spring, however, you'll probably need a fairly long extension. Examine the spring placement so you can replace the new one in the same manner.
7. The trailing arm can be lowered to just before the point at which there is strain on the brake line (disconnect the line clip on the fender well if needed), then the bottom of the spring will come loose and the only thing holding the

spring on the car is the 17mm nut. Lightly tug on the spring at the top and pull it out. I did NOT have to remove the brake caliper on either side, and I did not find the exhaust system to inhibit the removal or installation on the passenger's side.

8. When you get the spring out, inspect the rubber seats and the large curved washer for wear or deterioration. Replace if necessary.
9. Reinstall the top seat and washer and insert the spring bottom first, making sure you install it in the rubber seat.
10. If you're replacing your springs with variable rate ones (recommended), you'll need a long extension for your socket to reattach the upper spring seat because you won't be able to get your ratchet to fit comfortably between the coils until about halfway down the spring's length.
11. Re-attach the upper spring seat. Use a 17mm deep well socket to hold the NUT while starting it: turn it the wrong way until you feel the threads click, then turn the correct way. Torque to the nut to 45 Nm (35 ft-lb).
12. Reinstall the shock bolt, coating it with antiseize first. Use your floor jack to re-align the sway bar end link so the bolt end will pass through. Don't pound on it to make it go through. A mirror helps to align this. Re-torque to 85 Nm (63 ft-lb)
13. Reverse the above steps for the remainder of the installation.

[Spring Note:] I recently installed a set of Moog cargo coils on the rear of my 89 765T and while I've been happy with the ride etc. I'm not happy with the sagging rear end they left me with. It sags about 1.5". I've talked with the reps at Moog and they say the cargo coils are for sedans only and do not have an application for wagons. I've ordered a set of IPD overload springs which incidentally list different part #s for 7xx sedans and wagons. RPR also sells Moog cargo coils for sedans only. In speaking with them they've had a lot of complaints of rear end sag when used on wagons [Editor] I installed a set of oversized Scan-Techs (13.5mm instead of 11mm) and they solved my sagging problems. When you replace the springs with heavy duty or "overload" coils, make sure your shocks have damping characteristics that match. Using too heavy a spring with the stock OEM shock may result in underdamping and a bouncier ride. You may have to upgrade to a stiffer shock.

Shock Absorber Notes. [from Import Car Magazine, Mar 03, by Gary Goms]

How does a shop diagnose worn shock absorbers? The answer isn't simple. Many racing teams are now using shock absorber dynamometers to test how well a shock absorber will maintain its effectiveness throughout a long race. But, since most commercial import shops can't afford new shock absorber dynamometers just for testing old shocks, a quick visual check usually reveals most of the symptoms associated with worn shock absorbers.

First, use a tape measure to check the distance from the floor to a common reference point on the body such as the upper lip of the fender well. If a difference in ride height is indicated, the shock absorber may have lost its gas charge, or the vehicle may have a sagging spring. When disconnected from the chassis, a shock absorber with a full gas charge will quickly extend the piston rod. In other failure scenarios, a shock absorber may stick up or down due to a broken piston assembly. Next, check for oil leakage around the shaft seal. If the oil leakage looks

wet, or covers the length of the shock absorber body, the shocks should be replaced either in axle pairs or at all four wheels.

Rebound recovery tests, unfortunately, are a far more subjective type of shock absorber evaluation. During a rebound test, the suspension is cycled by placing the knee or hands on the front or rear bumper of the vehicle, bouncing the suspension and then observing the recovery rate. In theory, good shock absorbers should dampen spring bounce within one oscillation cycle. In reality, a technician should be very familiar with the suspension characteristics of the nameplate in question. Some auto manufacturers design soft suspensions; others design firm suspensions, depending upon model application.

If a chucking or knocking noise is detected during the rebound recovery test, at least one shock absorber may have a loose piston, a worn piston shaft bushing or worn mounting bushings. When the shock's rebound bumpers are worn or the tires show a mild cupping in the center of the tread, shock absorber fade may be occurring when the shock absorber fluid becomes overheated and loses viscosity during a long trip. When road testing, the most accurate observations are achieved by driving the vehicle over the same stretch of road. Worn shock absorbers will cause the vehicle to nose-dive during braking or roll during cornering maneuvers. Again, the feel of worn shock absorbers tends to be a subjective judgment that requires familiarity with the specific vehicle nameplate and application.

How Shock Absorbers Fail. How do shock absorbers fail? In most cases, the piston shaft seal fails and allows the fluid to leak out of the shock's oil reservoir. On high-mileage vehicles, the internal parts such as the piston seal or valving wear out, which alters the dampening characteristics of the shock absorber. Last, the nitrogen charge may leak from the shock absorber, which slightly lowers the suspension height and allows the fluid to foam during normal operating conditions. All of the above failures will, at some point in the shock absorber's service life, cause the shock absorber fluid to become overheated or foam during severe operating conditions or extended trips. Last, the piston itself can become disconnected from the shock absorber shaft. The shaft may then bend, which causes the shock absorber to bind at some point in its travel. Because some pistons are held onto the shaft by a threaded nut, tightening the piston shaft bushings or spinning the piston shaft with an impact tool may loosen the piston-retaining nut. The best alternative is to buy the appropriate tools needed to hold the piston shaft stationary while the retaining nut is being tightened.

Shock Brands. Consensus at [Brickboard](#) seems to be:

1. Bilstein HD: great shock, long lasting, very stiff but controlled ride
 2. KYB: great shock, not as stiff as Bilstein HD
 3. Koni: great shock, adjustable
 4. Tokico: great shock, hard to find
 5. Boge Pro Gas: great shock, long lasting, ride equivalent to OEM
 6. Boge Turbo Gas: great shock, long lasting, stiffer ride than Pro Gas
 7. Bilstein Touring: less expensive than HD, questionable quality (see Brickboard archive [notes1](#) and [notes2](#). Numerous reports of clunking and noise soon after installation.)
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Rear Shock Installation.

Non-Nivomat:

[Inquiry:] I am thinking about replacing rear shocks on my '89 745 Turbo Wagon (non-Nivomat) and would like to know how difficult a job this is [Response: Bill Woesthaus/Warren Bain] **Support both the car and the rear axle.** If you are not supporting the rear axle and it's hanging free, the shock is the suspension travel stop and if you remove the bottom bolt while unsupported, the **axle will fall**, the brake hose will tear and you will have much bigger problems. Take wheels off. Pull the rubber bolt hole cover off the top of the inside wheel well (which is probably covered with dirt). Unscrew the top shock bolt. Then, put PBlaaster, wrench and socket (you will need 17 and 18mm sockets) on bottom shock bolt and undo it. Lower the rear axle to relieve the stress on the bolt since the gas in the shock is keeping pressure on it. Guaranteed that this is corroded in place inside the shock bushing: you will probably have to whack this bolt out, or even airchisel the bottom shock mount apart. Wrestle shock out: the shock mounting bushing sleeves and rubber side bushings are often compressed by the shock mounting bolts and you may have to resort to pounding to remove it. Compress new shock and put it in. Replace the top bolt first then the bottom with antiseize or grease on the bottom bolt to keep it from rusting inside the bushing. It's a good idea to leave the retainer strap on the shock while you are installing it (you don't have to wrestle with live shock) Possible trouble? Top shock cavity could be too bent in from heavy bolt pressure to allow new shock in easily, or to get old one out!! I ground down shock ears to allow entry. If your holes aren't squashed tight it's a pretty easy job. Torque top and bottom bolts to 65 ft-lbs.



[Response: John B] The shocks ARE gas charged and can be difficult to compress and remove...same with the new shocks. IF the new shocks have a wire or strap to keep them compressed, try to install them with the wire or strap unbroken...you clip the retainer device to allow the shocks to expand and hit the stud hole for the top of the shock. Also, the lower control arm that the shock goes into may be tight or loose depending on the brand of shock you buy. If it's loose, make sure you tighten the bolt sufficiently to compress the control arm sides against the shock bushing...or the shock will clunk. If the shock bushing is too long, making the shock impossible to install, just wedge or expand the control arm sidewalls enough to put the new shock in. Jack the back of car up and put it on stands.

Stuck Shock Bolt: [Gustaf Kalle] To remove an impossibly stuck rear shock bolt, I ended up drilling away the bolt head, and sawing across the bolt on the inside half of the bushing tube. One advice was to try a SawAll (Tiger saw in Europe). Would have been quickest had I been able to lift the car enough. Instead I bought a metal saw blade holder for £1.90 and a Bi-Metal saw blade. This cut the bushing tube in less than 10 min. [Randy Starkie] On my son's 740, I couldn't turn the shock mounting bolt after removing the nut on the lower shock attachment. I used my die grinder with a well worn wheel (small diameter) to

make two cuts on bottom of the lower shock mount. That allowed me to remove the shock after removing the top bolt (no rust on the upper mount). After removing the shock I used a knife to cut away the three pieces of rubber and that exposed the entire rolled sleeve. A propane torch was enough to heat the sleeve and bolt enough that I could rotate the assembly to clearly see the seam on the sleeve. I used additional heat (mapp gas would have been nice) and then used a large cold chisel to open the sleeve before driving out the bolt.



Nivomat:

Shocks Differ. [Jerry Warren] The Nivomats on the solid axle cars are smaller (2.5-inches dia.) than those used on Independent rear suspension (3-inches dia.). That's what I found when I checked my 940SE sedan (IRS) and 940SE wagon (solid axle). Removal is similar to the non-Nivomat above. The top bolt is behind the small rubber plug in the frame rail above and forward of the wheel.

Installation. [Tip from Matt W] I've been told that with and Independent rear suspension they just drop out, no need for a spring compressor or any special tools...not always. Yes, in many cars the shock will just drop out through the control arm, and this is what I expected of my volvo, especially since I've been told that by others. I'm not sure if this was because they had 1989 7series, but it's not the same as my 1988 760T. We jacked the car up and unbolted both ends of the shock. This of course was before we bothered to realize that the hole in the bottom of the control arm was nowhere near big enough to let the shock fall out. This hole was just big enough for the shock to rest snugly in there when properly installed. Chiltons said the control arms needed to come off, and that requires two jacks. Afterwards the rear end would need alignment. We said screw it, and just decided to give the shocks to the local shop and let them do it.

[Contrary Advice from JohnB] Maybe, maybe not. Just jack the car up under the shock, use about three long cable ties hooked together to hold the shock compressed, and then jack the car up letting the suspension hang. Take the holding bolts out and remove the shock. The hard way (and I've done it both ways, thank you!) is just to jack the car up and let the suspension hang, remove the holding bolts, and then compress the nivomat by hand, hold it together and remove it before it expands. You don't need to disconnect the trailing arm (I did it once out of frustration but it wasn't necessary the next time) although that's one way. [Confirmation from Gene Stevens] A compressed Nivomat is short enough to wrangle out through the top of the control arm without unbolting it. Use bailing wire or long Ty-wraps to keep it compressed before it's unbolted, or you can try to jam the bottom up and over. [Tom Binkley] In my case with IRS I used a second jack to compress the spring. Jack your car at the jack point. Use jack stands for safety if you have them under the differential. Use the second jack to compress the spring. Once you have loosened the upper and lower bolts on the Nivomat, rotate it

to the right or left in order to get it out of the bottom. It will be a tight fit but they will come out. In order to get the full length of the shock out of the spring assembly it will need to be compressed a lot. [Shannon DeWolfe] compress the suspension by raising the car with the jack under the spring. When the wheel is off the ground, the shock is as short as it is going to get. Tie it off there. Let the car back down to the ground and move your jack to the jacking point to raise the car. The suspension will extend but the shock (being tied off and loosened from the suspension) will remain short. Now you can remove the top mount and the shock will be free but still inside the spring..

Broken Upper Mounting Bolt or Stripped Mounting Nut. [Tips from Jason Vincent] I tried to remove the passenger side shock, but promptly broke either the bolt or the welded nut inside the channel behind the top mount. As barbarous as it sounds, the fix (as told by my Volvo specialist) is to use a hole saw to go through the opposite side of the channel. On the passenger side this involves removing part of the exhaust. I used a 1 3/4" hole saw to cut my hole in line with the shock, as high up as was physically possible. The nut is not normally exposed. To expose it the box section as I will call it needs to be cut, although on the opposite side of the box, parallel to the upper mount. This process seems barbaric, and it is in some respects, but remember how overbuilt this car is and I really don't think a couple of holes will hurt it. I did go through 2 holesaws and discovered the nut wasn't actually spinning, but the bolt was stripped and jammed into the nut somehow. However, the welded nut can often break loose and spin inside the box channel. I will attempt to extract it and install a helicoil. [Editor] To prevent this, use lots of antiseize on the threads and shaft of both top and bottom shock mounting bolts when reinstalling. **Stripped Nut?** [Jim Bowers] Get a Heli-Coil repair kit if you strip the upper shock mount nut. The nut is welded inside the frame and there is no easy access to it. The Helicoil can be installed from the wheel side. Buy the kit at a good auto parts or machine supply store.

Rear Shock Installation: 96+ 960-S90. [Tips from Warren Bain] I replaced the rear shocks on my 965 [S90-V90][1996]. It was pretty easy actually. I thought the IRS would droop too far since I couldn't see any stops for it anywhere. So I jacked the rear up, took off the tire and supported the trailing arm. I took the old one off and put in the new. I attached the top mount but the bottom was tough, since it is new and gas filled it was quite stiff. So I let the trailing arm down. Lo and behold, it went down far enough for me to easily out the lower mount in with no problem. It only took about an hour and while I had the tires off and the car in the air, I tightened all the bolts I could see, size 17mm and 18mm.

If you use Volvo shocks, look for the shock code contained on the plate on top of the radiator, 5th line, 4th character. My 4th line was blank. IE, 031Y35a, 'Y' is the shock code. [Editor] Consensus on Brickboard seems to criticize OEM shocks and recommend aftermarket.

Aftermarket Shocks for S90/V90 Cars. [Eric Seeger] There's finally an aftermarket alternative for our rear shocks! [Monroe](#) Sensa-Trac part #5979 is the new (and as far as I can tell, the only) aftermarket alternative for V90 and part #5978 is for S90 sedans. These are replacement for NON-Nivomat rear shocks. Aftermarket Nivomat replacements are available from Monroe as well. I got a pair installed on my wife's V90 tonight, and I can say that they work very well. At

Sears, they cost \$110 for the pair installed.

Rear Nivomat Conversion. See [Volvo 760/780 Nivomat Shock Conversion](#) for complete instructions and illustrations showing the conversion of Nivomats to normal springs and shocks.

960 Multilink Rear Axle and Leaf Spring Removal. How do you remove the

lower frame/differential from a Volvo 960 MK2 multilink in a safe way? Is there an easy way to replace the differential without the Volvo special leaf spring compression tool? And how to bolt it back on? The leaf spring is pushing both control arms down making it impossible to unbolt it without either jamming the bolts holding the control arm or shooting the wheel bearing house down when the bolt is knocked out.

Christian Lundheim] Put the car on stands and put two people in the backseats or the trunk, or secure the car so it can't be lifted



from the support stands otherwise. Loosen the bolt bolting the hub-house to the lower control arm. Place a jack under the lower control arm at the hub side and lift it up to compress the leaf spring enough so the bolt bolting the lower control arm to the hub-house becomes loose. Knock it out and then slowly lower the jack to release the spring tension. Then do the same on the other side.

Same procedure when mounting it. Mount everything but the bolt holding the lower control arm to the hub-house, this will allow the spring to still be slack. Then make sure the spring is seated correctly in the lower control arm, and jack it up until you can get the bolt to the hub-house in. If the multilink is disassembled from the car, the spring tensioning is easily done using a big spanner.

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