

## Audi UrS4 Rear Differential – Right and Left Side Seal R&R

The following describes the procedure I used to remove and replace the right and left side rear differential seals on my 1994 Audi S4. This procedure should apply to the 1992 – 1994 S4 and the 1995-1997 S6 (the left seal process may be different on the '96-'97 cars) and should be used in conjunction with the Bentley Repair Manual.

### **Right Side Seal**

1. Jack up the right rear of the car and support solidly on jackstands. The higher you jack the car, the better the access and the less likely oil will be lost when you remove the seal.
2. Remove the plastic gravel tray (four 13 mm bolts/nuts).
3. It is not necessary to drain the differential oil. When the axle flange and seal are removed, a small amount of oil may drain out. This can be caught in a drain pan. If you do decide to drain the differential oil, remove the fill plug BEFORE removing the drain plugs. These steel plugs corrode into the alloy case, and if you drain the differential and then can't remove the fill plug, you have a "situation" on your hands.
4. Detach the emergency brake cable from the caliper and pull the rubber cable mount from the support bracket above the right rear gravel tray bracket. Move the cable out of the way.
5. Remove the right rear gravel tray support bracket (13 mm bolt).
6. Place a jack under the inner rear trapezoidal arm mount. Remove the bushing bolt (19 mm bolt, 19 mm nut, torque 85 Nm, 63 ft.lb.) and lower the trapezoidal arm (see Photo 1). Note that the bracket secured by this bolt has a slot that engages the emergency brake cable bracket above it. Remember this for re-assembly.
7. Remove the 6 bolts securing the inner CV joint to the differential right axle flange (torque 80 Nm, 57 ft.lb.). Note that these are Triplesquare No.10 bolts NOT Torx bolts. Triplesquare drivers are available from specialty tool shops and some chain store tool outlets. If you use a Torx bit you will strip out the heads. Make sure you clean the rust and dirt out of the heads before inserting the Triplesquare bit. Drive the bit in to ensure it is well seated, there is a lot of torque on these bolts. The bolts are only accessible at the top of the joint (see Photo 2). One removal procedure is to place the transmission in first gear, loosen a bolt, put the transmission in neutral, rotate the axle to access the next bolt, put the transmission in gear, etc. An alternate procedure is to thread all the wheel bolts into the wheel hub, put the transmission in neutral, and use a bar between two wheel bolts to hold the driveshaft while loosening the flange bolts. The same method(s) apply for torquing the bolts on reassembly.

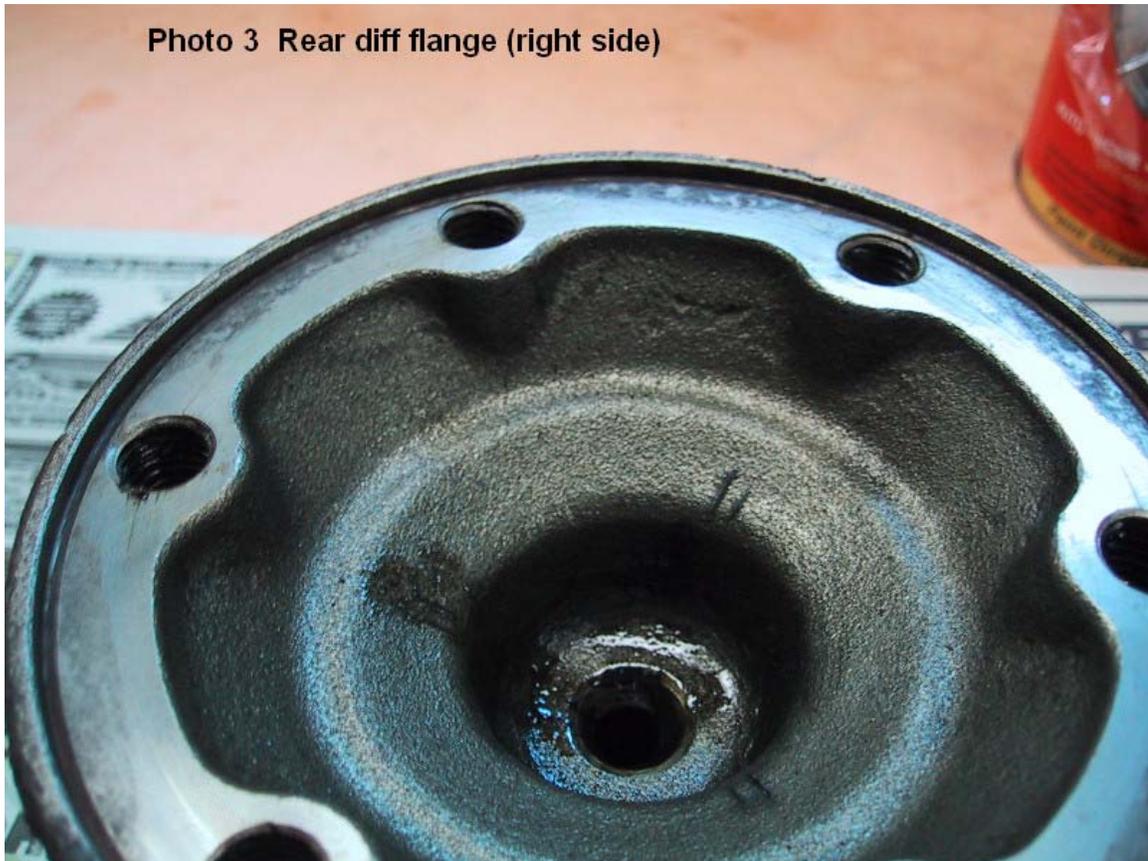
Photo 1 Remove inner rear trap arm bushing bolt (right side)



Photo 2 Remove diff flange bolts (right side)



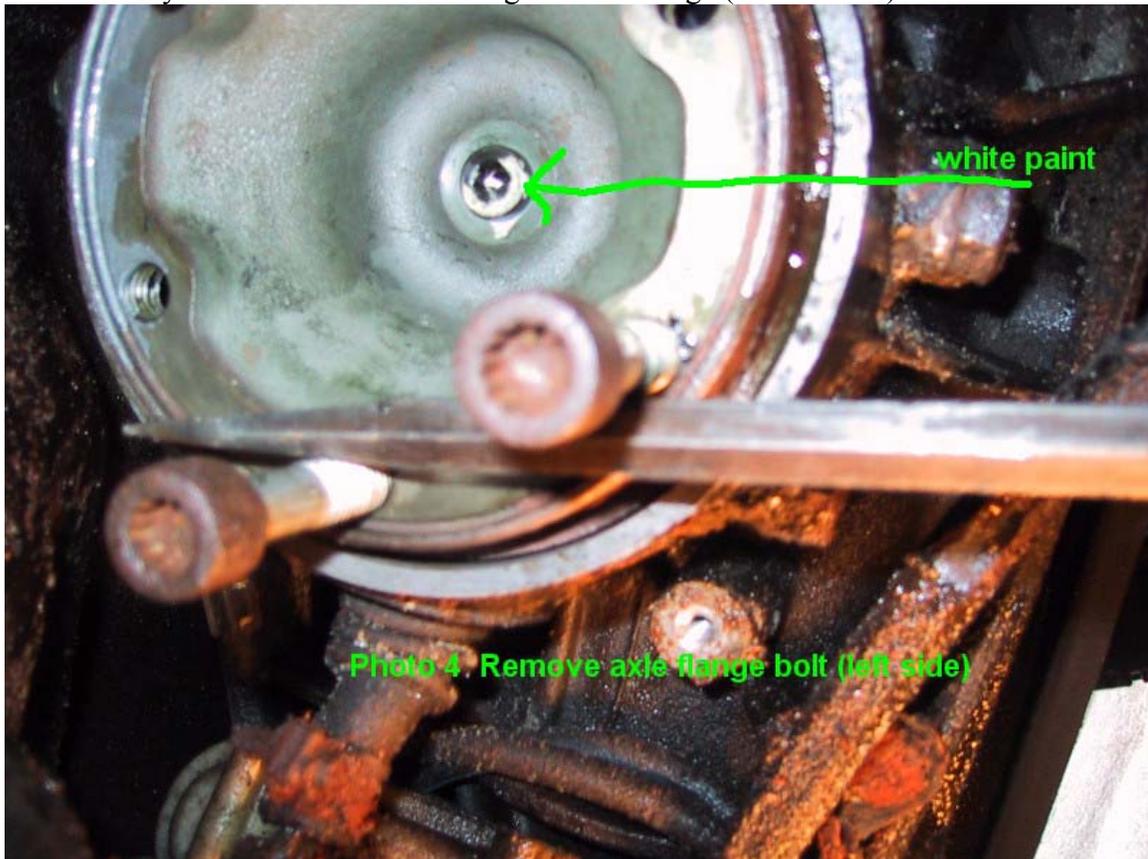
8. Now comes the hard part of the procedure – getting the CV joint off the axle flange. If you drive in the rust belt, the joint is probably rusted to the flange at the rim. The rim is shallow (see Photo 3), but it can hold the joint very tightly when corroded.



This is the procedure I used:

- a. Matchmark the joint. This is not essential on this joint, but I like to ensure these joints go back in the same orientation.
- b. Wire brush the rust off the joint and spray with favourite penetrating oil. Allow to soak.
- c. Pull out on wheel hub. This extends the axle shaft to the limit of the CV joints and pulls outward on the inner CV joint. Watch the differential bounce around in its mounts and the CV joint stay firmly in place.
- d. Use a dentist's pick to scrape the rust from the joint of axle flange & CV joint. Spray with more penetrant and allow to soak.
- e. Repeat (c.) above with the same results.
- f. Tap around the axle flange with a hammer to try to loosen the joint. Soak with more penetrant.
- g. Repeat (c.) above with more vigour but same results. Field questions from wife who asks whether you've left a bolt in.
- h. Throw caution to the winds and get out the air hammer. Use a blunt punch placed on the CV joint body and angle it away from the diff. Give it a short sharp burst with the hammer. Rotate 1/8 turn. Repeat until you have gone around the joint to shake it loose. Soak with more penetrant.

- i. Repeat (c.) above with the same results.
  - j. Muttering choice words, repeat (h) above. Make sure the joint is rotated and you don't hammer too long in one spot – a short sharp burst is all you want.
  - k. Repeat (c.) above and watch the joint pop off. Cover the CV joint with a plastic bag.
  - l. CAVEAT: I don't like using an air hammer on a shaft with a bearing, as the vibration may cause flat spots in the race. The diff side bearing is a tapered roller, so this is less of an issue, but be warned. In this case, the joint was firmly rusted in place and wasn't going to release without major persuasion. If you use an air hammer, make sure you rotate the joint and don't give it more than a half second shot in any one position.
  - m. On reassembly, I cleaned up the flange and joint and put antiseize on the mating surfaces to make disassembly a bit easier 200k down the road.
9. Clean the oil and dirt from the differential case in behind the axle flange.
  10. Insert two bolts into the axle flange and use a bar through the bolts to hold it stationary. Remove the bolt securing the axle flange (6 mm Allen) – see Photo 4.



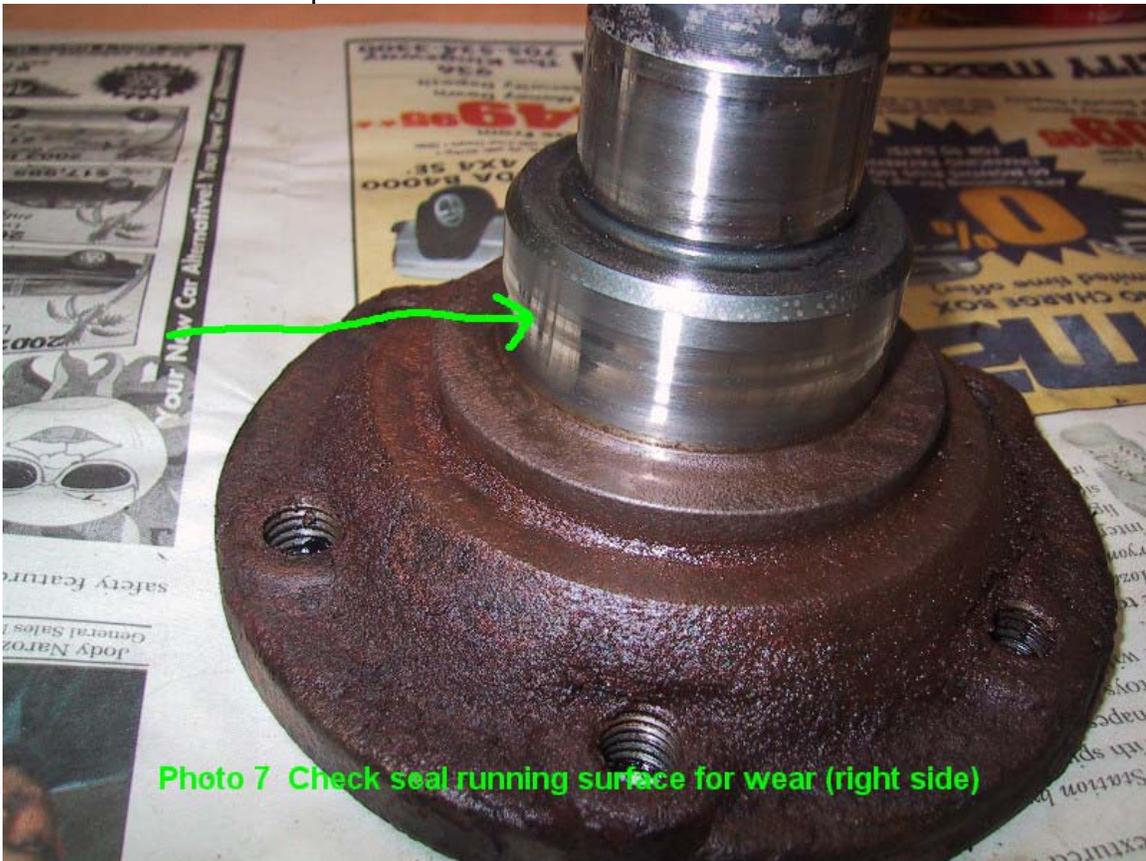
- Note this bolt has white paint on one side. This is to aid installation. This bolt is torqued to 10 Nm (7 ft.lb.) and then tightened an additional  $\frac{1}{4}$  turn. The paint mark is used to gauge the  $\frac{1}{4}$  turn.
11. Place a drain pan under the differential if you haven't drained the oil and pull out the axle flange.
  12. Measure the inset depth of the existing seal (see Photo 5).



There is no inner stop in the case (see Photo 6), so if you don't have the Audi installation tool with the built in stop, you have to measure the inset and install the new seal to the same distance.



13. Pry out the old seal with a large screwdriver or similar tool. Take care not to score the case with the end of the tool.
14. Clean up the case and seal seat. Lightly oil the outside rim of the seal. The open side of the seal (the one with the spring around the lip) faces the inside of the differential. Install the new seal to the same depth as the old seal. Make sure it goes in straight – it is easy to get this cocked. If it goes in crooked, remove it and re-install if you haven't damaged it on removal. DO NOT drive it in too far – it will pop right into the differential and I guarantee this will run your entire day. Pack the space between the two inner lips of the seal with multi-purpose or synthetic grease.
15. Clean up the axle flange and check the seal running surface for wear (Photo 7). The surface should be polished where the seal lips ran but should not be worn. If it is worn, replace the flange. You could try to get around wear by installing the seal to a different depth.



16. Oil the seal running surface (and the splines and bearing surface) with gear lube and reinstall the axle flange. Remember – cleanliness is next to godliness.
17. Install the axle flange retaining bolt as noted in (10) above.
18. In the immortal words of the Bentley, re-assemble in the reverse order of removal. NOTE: before tightening the suspension bushing, use a jack under the hub assembly to raise the suspension to its normal ride position (i.e. take the weight off the jackstand – see Photo 8). This will ensure the bushing is in a neutral position with the suspension at its normal ride height.



## Left Side Seal

The left side seal is a bit more work as the exhaust system has to be removed. The left seal covers the differential lock on the '92-'95 cars and is much larger (and more expensive) than the right side seal. I don't know if the same seal was used on the newer cars with EDL replacing the differential lock.

1. Jack up the left rear of the car and support solidly on jackstands. The higher you jack the car, the better the access and the less likely oil will be lost when you remove the seal.
2. Unbolt the front exhaust slip-clamps and slide them back on the pipes (see Photo 9 – install torque on clamp nuts is 30 ft.lb.). Unhook the rubber exhaust hangers and lower the exhaust system to the ground – CAUTION: this system weighs over 100 pounds, so don't drop it on any sensitive body parts. Slide the exhaust system out of the way.
3. It is not necessary to drain the differential oil. When the axle flange and seal are removed, a small amount of oil may drain out. This can be caught in a drain pan. If you do decide to drain the differential oil, remove the fill plug BEFORE removing the drain plugs. These steel plugs corrode into the alloy case, and if you drain the differential and then can't remove the fill plug, you have a "situation" on your hands.



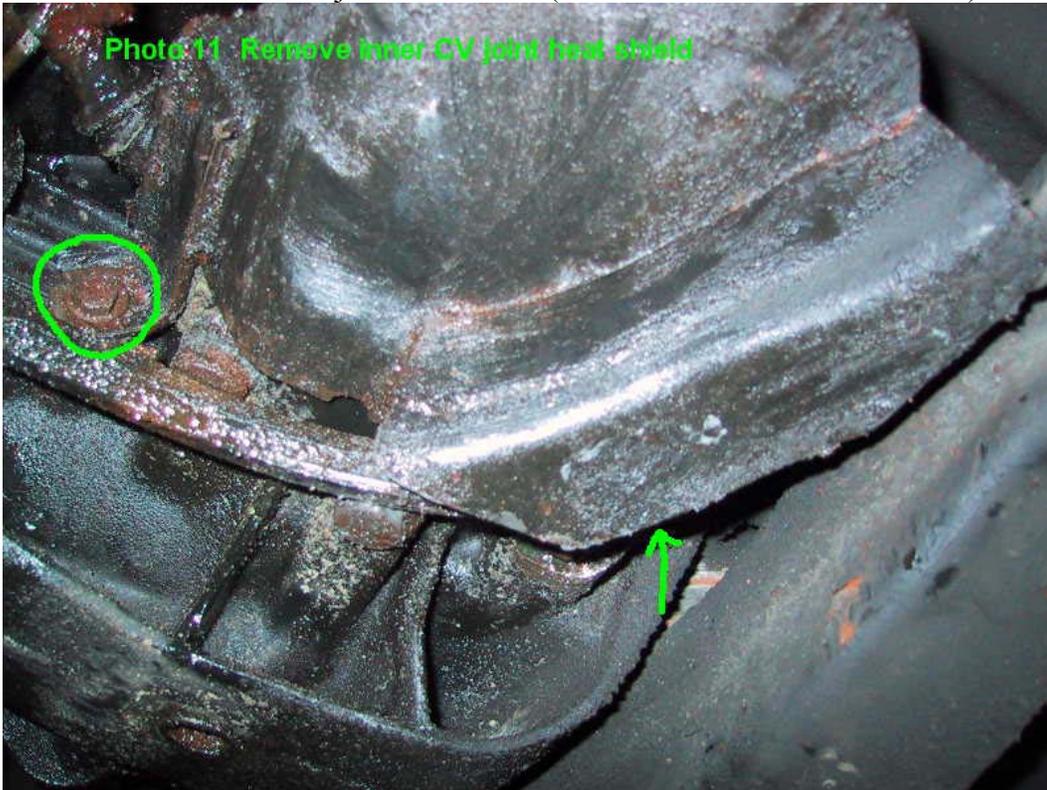
Photo 9 Loosen exhaust slip-clamps

4. Detach the emergency brake cable from the caliper and pull the rubber cable mount from the support bracket (see Photo 10). Pull the cable out of the inner CV joint heat shield and move the cable out of the way.

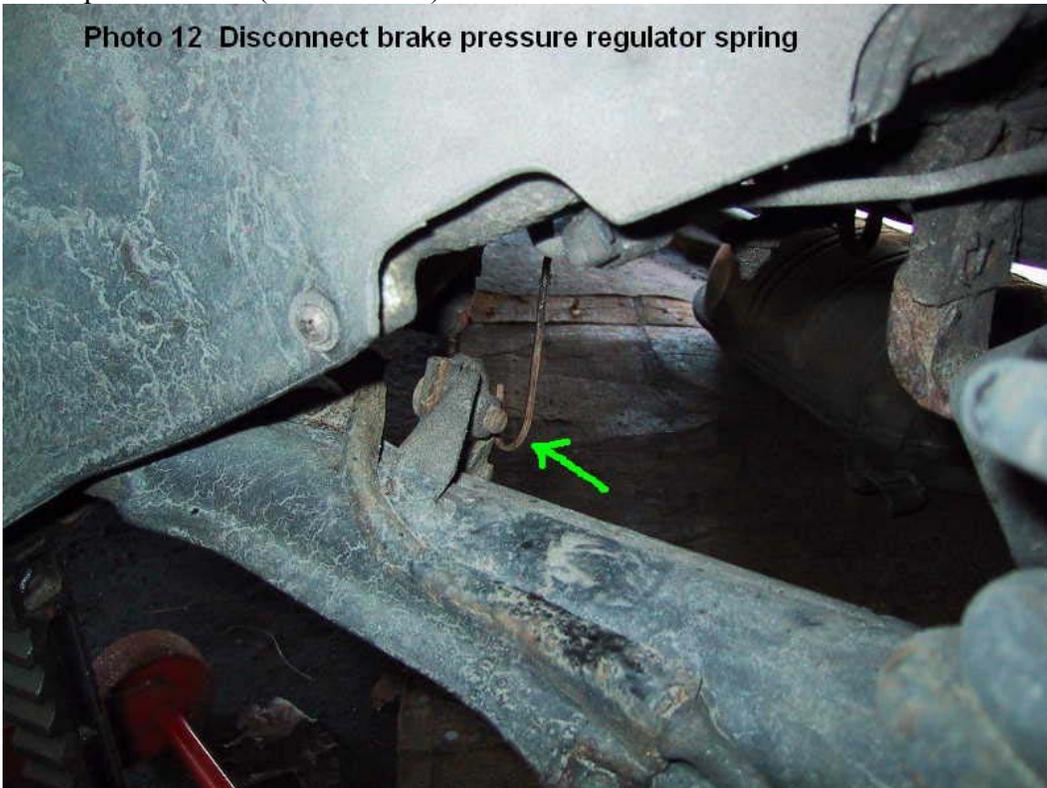


Photo 10 Remove a brake cable rubber mount and cable from heat shield

5. Remove the inner CV joint heat shield (two 10 mm bolts – see Photo 11).



6. Disconnect the brake pressure regulator spring from the mount on the lower trapezoidal arm (see Photo 12).



7. Place a jack under the inner rear trapezoidal arm mount. Remove the bushing bolt (19 mm bolt, 19 mm nut, torque 85 Nm, 63 ft.lb.) and lower the trapezoidal arm (see Photo 1).
8. Remove the 6 bolts securing the inner CV joint to the differential right axle flange (torque 80 Nm, 57 ft.lb.). Note that these are Triplesquare No.10 bolts NOT Torx bolts. Triplesquare drivers are available from specialty tool shops and some chain store tool outlets. If you use a Torx bit you will strip out the heads. Make sure you clean the rust and dirt out of the heads before inserting the Triplesquare bit. Drive the bit in to ensure it is well seated, there is a lot of torque on these bolts. The bolts are only accessible at the top of the joint (see Photo 2). One removal procedure is to place the transmission in first gear, loosen a bolt, put the transmission in neutral, rotate the axle to access the next bolt, put the transmission in gear, etc. An alternate procedure is to thread all the wheel bolts into the wheel hub, put the transmission in neutral, and use a bar between two wheel bolts to hold the driveshaft while loosening the flange bolts. The same method(s) apply for torquing the bolts on reassembly.
9. As in Item 8 on the right seal procedure above, I used an air hammer to loosen up the CV joint from the flange. This one came off more easily than the right side did.
10. Clean the oil and dirt from the differential case in behind the axle flange – I used non-chlorinated spray brake cleaner.
11. Insert two bolts into the axle flange and use a bar through the bolts to hold it stationary. Remove the bolt securing the axle flange (6 mm Allen) – see Photo 4. Note this bolt has white paint on one side. This is to aid installation. This bolt is torqued to 10 Nm (7 ft.lb.) and then tightened an additional ¼ turn. The paint mark is used to gauge the ¼ turn.
12. Place a drain pan under the differential if you haven't drained the oil and pull out the axle flange. Note that there is a shim washer at the end of the spline on the axle flange.
13. Pry out the old seal with a large screwdriver or similar tool. Take care not to score the case with the end of the tool.
14. Clean up the case and seal seat.
15. The left side seal has a stop built into the differential case. The new seal is driven in until it seats against the stop. There is a special tool (see Photo 13) for installing this seal. The tool has a threaded bolt 18 cm long with a M8 x 1.25 thread on the inner end to engage the axle flange bolt threads in the differential.
16. Lightly oil the outside rim of the seal. The open side of the seal (the one with the spring around the lip) faces the inside of the differential. Start the seal by tapping with a small hammer around the circumference of the seal. Make sure it goes in straight – it is easy to get this cocked. If it goes in crooked, remove it and re-install if you haven't damaged it on removal. The special tool will not in itself install it straight – I tapped it in flush and straight with a hammer and then used the tool to seat it (see Photo 14 & 15). You could seat it with a hammer and a block of wood – the tool isn't really required. Pack the space between the two inner lips of the seal with multi-purpose or synthetic grease.

Photo 13 Left seal installation tool



Photo 14 Seal fully seated using tool





17. Clean up the axle flange and check the seal running surface for wear (Photo 7). The surface should be polished where the seal lips ran but should not be worn. If it is worn, replace the flange. You could try to get around wear by installing the seal to a different depth.
18. Oil the seal running surface (and the splines and bearing surface) with gear lube and reinstall the axle flange. Remember – cleanliness is next to godliness.
19. Install the axle flange retaining bolt as noted in (11) above.
20. In the immortal words of the Bentley, re-assemble in the reverse order of removal.  
NOTE: before tightening the suspension bushing, use a jack under the hub assembly to raise the suspension to its normal ride position (i.e. take the weight off the jackstand – see Photo 8). This will ensure the bushing is in a neutral position with the suspension at its normal ride height.
21. When re-installing the exhaust system, adjust it so it hangs tension-free when hot. To do this, hang it cold and slide the slip-clamps into position. Pull the exhaust system forward 3/8 inch and tighten the clamps. This pre-loads the exhaust forward cold so that when it increases in length as it heats up there will be no fore or aft tension on the hangers.
22. Top up the differential oil through the oil fill plug or the open seal. Often the only way to ensure there is the proper amount of oil in the differential is to drain it completely and then fill it with the recommended volume (1.5 litres) of gear oil GL5 SAE 90. Before draining the differential, make sure you can remove the fill plug. On the older cars these plugs take a 17 mm Allen socket wrench. When I

removed the drain plugs on my differential, the bottom  $\frac{1}{4}$  inch of the case threads came out as white powder from galvanic corrosion over the years.

There! No more smelly GL5 drips in the driveway!

Fred Munro  
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