

1984 R100RS  
Rear Main Seal Replacement v1.1  
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This technical article is a compilation of articles and technical tips I have garnered from many sources including the Airhead Archives, Oak's Tech. tips in the Airmail magazine, Snowbum's Internet site, and my own personal experience. References are at the end of the article.

**Read this article through a couple times before starting!**  
*(Increase pdf magnification to 200% for a better view of the pictures)*

Obviously, start with a clean and well-lit shop, have the proper tools and parts, and approach it with patience and determination to do it right, not fast.

Model 247 engines used two different types of clutch assemblies; one from 1970-Sept 1980 which have a large heavy flywheel, and then from October 1980 onwards with a "clutch carrier" assembly and a "rear main seal guide ring". The procedure is pretty much the same although there are a few differences, which I will point out as we work through this process. Let's begin:



### Parts to have on hand...

- Rear main seal 11 11 1 338 342
- O-ring for seal guide ring 11 22 1 337 099 (October 1980 and later)
- O-ring for oil pump cover 11 41 1 335 895
- Four new oil pump cover bolts 07 11 9 913 464
- Five new flywheel bolts 11 22 1 262 060 (earlier models have smaller bolts)
- Four new (short) driveshaft bolts 26 11 1 230 414
- Six new clutch carrier bolts 21 21 1 338 680 (optional)
- Six new clutch carrier bolt washers 21 21 1 242 377 (optional)
- Proper transmission input shaft spline lube

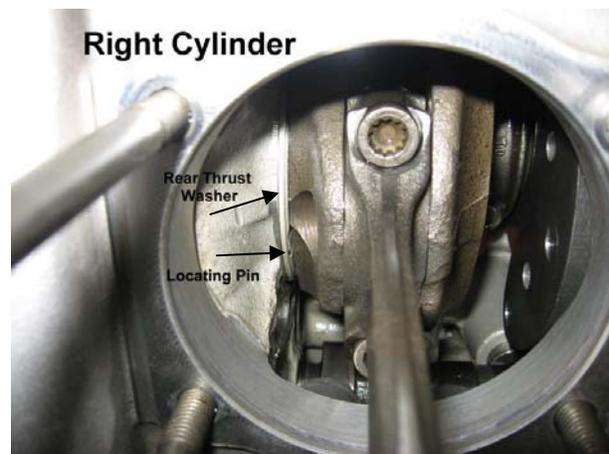
### Special tools...

- Clutch compressing bolts (you can get from Jeff Trapp or make your own)
- Flywheel brake (make your own or get from Jeff Trapp)
- Rear main seal installer: from Jeff Trapp, BMW or others.

- Torque wrench
- 27 mm or 1-1/16" socket (turned or ground down on outside-or from Jeff)
- Small slide hammer with hook/screw attachment
- Drill, sheet metal screws and 5/64" bit
- Two-three cans of CRC Brakleen (Tetrachloroethylene) and lots of rags.

## Disassembly...

1. Begin soaking the new rear main oil seal in clean oil. An hour before installation warm it to about 200 degrees. Some don't do this at all. Opinions vary.
2. Place the bike on the center stand (if a "Ride-off stand", block up on 2X4s); you want to be able to turn the rear wheel freely.
3. Drain the gearbox if work is planned on it.
4. Drain the driveshaft, as oil will spill when it is disconnected (pre-paralever models).
5. Remove the gas tank, set it aside out of the way.
6. Take the carbs off the cylinders and hang over front of cylinders, out of the way.
7. Remove the air cleaner box.
8. Open seat, tie or prop open, take out tool kit tray and place with gas tank.
9. Remove battery. Remove the 10mm nut that secures the battery box on each side to the frame, this allows you to tip the battery box back a little, or, like I did, removed the box.
10. Remove engine front cover and spark plugs and rotate the engine to Top Dead Center (OT on timing mark) by using a wrench on the (top) crankshaft/rotor bolt; either cylinder is OK. I then replace the spark plugs (to prevent dirt or parts falling into the cylinder).
11. **Important!** Secure the front of the driveshaft (rotor) so the crankshaft cannot move forward. I removed the rotor bolt and replaced it with another bolt and then used baling wire and secured it to the engine (see picture). Snowbum's and Jeff Trapp's Internet sites display another method where a bolt is used and the front cover is placed back on. Failure to do this can result in the crank moving forward, after the flywheel is off, and allowing the crank thrust washer to come off its pin INSIDE the engine. You REALLY don't want this happening!



12. Loosen the four bolts that secure the driveshaft to the gearbox. Apply rear brake to lock up everything and loosen one bolt with your 10mm 12 point box-end wrench. Rotate the rear wheel and driveshaft (in neutral) and repeat for the other three bolts. Remove the bolts after the swingarm assembly is moved rearward (see 15 below).

13. Take out the pin (that the rear brake pivots on) and allow foot brake lever and rod to drop down.
14. Use a 27 mm or ground down 1-1/16 socket to loosen lock nuts on swingarm pivots. Use 6mm Allen wrench and remove the pivot pins.
15. Pull back the driveshaft and rear wheel assembly about an inch or so and strap in place. Bag mounts may interfere and have to be removed (mine do). Some folks remove the rear wheel and entire swingarm at this point. Watch for broken lock washer parts that could fall down into the driveshaft housing. **Important!** Throw away the lock washers and these long bolts! Do not re-use short bolts.
16. Slacken clutch adjuster on handlebar perch and remove the clutch cable at the back of the transmission.
17. Loosen the rubber boot clamp, and remove the lever and throw-out assembly at the back off gearbox. Remove the spring and throw-out bearing and set aside.
18. Remove the neutral switch wiring and then the three bolts and one nut that secure tranny to engine block. Pull back on gearbox and lift it up and out on left side of bike.
19. Pull out throw-out rod (from the rear) from input shaft and set with other throw-out pieces. Set gear box and throw-out assembly aside.
20. At this point, while preventing the engine from turning over, I first remove every other clutch bolt (three of them) and install the three clutch spring compressing bolts and nuts. Bottom each bolt against the flywheel (finger tight) and then tighten the nuts against the face of the clutch to retain the spring pressure.
21. Then I remove the three remaining original bolts and in their place install, finger tight, my three home-made clutch removal/mounting studs (heads were cut off a normal bolt). These simply allow one person to slide the clutch assembly (three separate parts) on and off the flywheel allowing the holes to all line up. They are not necessary, but ease removal and re-installation. See the picture and sidebar below.



This shows two of the three clutch spring compression bolts and nuts (12 o'clock & 7 o'clock, my home-made flywheel brake (3 o'clock) and my three home-made clutch removal/mounting studs (the smooth ones at 1, 4 and 8 o'clock). The flywheel brake bolt is finger tight and will be removed to install the third compression bolt and nut.

22. Release the clutch spring pressure by evenly loosening the three nuts one turn at a time. Once the nuts are loose, remove the bolts.
23. Remove the clutch assembly as one unit. Set on your bench and be sure to clearly mark each of the three parts (clutch housing cover, the friction disk, and the pressure plate) so you can reassemble it as it was **originally balanced**. The assembly easily slides off the

removal/mounting studs. Note that the clutch spring is the fourth part of the assembly (see picture below step #33...below).

24. Check clutch plate with micrometer or calipers: replacement point is at 4.5mm thickness; new plates are at 6mm. Set aside. My disk was 5mm, so I replaced all four parts of the clutch (Oak says replace everything):
  - a. Spring: 21 21 1 242 353
  - b. Pressure plate: 21 21 2 302 200
  - c. Friction disk: 21 21 1 451 512
  - d. Clutch housing cover: 21 21 1 457 280
25. **Important!** Is the engine still at TDC? **Mark the 12 o'clock position of the carrier/flywheel** to assure same position in reassembly. Install a flywheel brake (same tool I used to remove the clutch) so that the engine will not turn.
26. Remove the five flywheel bolts and large washer (with five holes) and the brake and gently lever the clutch carrier (flywheel) off the end of the crankshaft. Heating helps sometimes. Set aside. The older models do not have the large washer.
27. The older models with the flywheel have the rear main seal contact area on the front side of the flywheel. Clutch carrier models have a separate part called a guide ring.
28. To remove the guide ring, utilizing a brass drift in the holes, gently tap the ring about 10-20 degrees around the crankshaft. This may loosed it enough to remove by hand. I had to then use small screwdrivers to gently pry it loose from the crankshaft where the holes are now off center from the threaded crankshaft holes. Patience and gentleness and it will come off. Inspect this guide ring very carefully (magnifying glass?). The ring has a hard coating and when it wears out very sharp miniscule "edges" appear on the surface. Order a new part if necessary (11 22 1 337 284).
29. It is at this point I clean the bell housing. First I re-install the five flywheel bolts into the end of the crankshaft to prevent dirt from getting into the threads (and crankcase). I like to use CRC Brakleen with lots of paper towels or rags to clean parts and the usually grungy clutch compartment (bell housing). Not unusual to go through 2 or 3 cans on this sort of job. Get it real clean.
30. Now remove the rear main seal.

**Important!** Do not pry against the crankshaft and do not use a standard seal puller to pry it out as you may damage the aluminum engine block. What I did was drill two small holes in the outer ring, install two sheet metal screws, and then with a helper we pried it out with a claw hammer arrangement using the back of the engine block for the fulcrum. Again, patience and gentleness is required. Torch heat may be necessary. Others use a slide hammer with a deck screw.





Guide ring (on left) and rear main seal with sheet metal screws used for removal

31. Remove the oil pump cover. If they are Phillips head screws they are probably original and have not been updated to the new bolts. Use an impact driver. All of the guru's recommend removing the cover and installing a new O ring since you have the flywheel off. Leaks from this area may be misinterpreted as leaky rear main seals!

32. Disassembly is complete.

33. The following picture displays all the parts, in order, as they came off the engine (October 1980 and later):



From left (rear of the bike):

- a) Three clutch parts including the clutch housing cover, the friction disk, and the pressure plate in one bundle (marked to re-install in same orientation for balance). Note the tie-wrap.
- b) Clutch spring.
- c) Five clutch carrier (flywheel) bolts and large washer.
- d) Clutch carrier/flywheel. See note at end of article about clutch carriers.
- e) Oil pump cover below the clutch carrier (note orientation on the inside-picture below)
- f) Guide ring (note red O-ring inside guide ring-below)
- g) Rear main oil seal



Oil pump cover and O-ring



Guide ring with O-ring

# Replacing Seal and Reassembly

1. I install the oil pump cover first by using some grease in the O ring groove and installing the new red O-ring. Make sure to use new bolts and that the bolt holes have been cleaned real well with Brakleen. Use a small drop of blue (medium) loc-tite on each bolt and torque in steps (in a cross pattern) to **ONLY 7 foot pounds** (84 inch pounds or less).
2. The new rear main seal goes in, using the installing tool. BMW makes a nice one, so does Jeff Trapp. (*"The main seal depth-don't worry about it. With the new type seal you pull it in place with the tool until it bottoms out in the engine block. It will be very close to the outer casting surface of the motor. That's it. Will work perfectly. The depth setting of the seal is from the old days when the seal had a lip that had to be placed properly especially on the early models, 1975 maybe, and earlier. The new seal is an entirely different design."* Oak 11/23/2007).
3. Replace the guide ring with a new inner O-ring (newer models).
4. Before installing the carrier/flywheel touch up the timing marks ("F", "OT, etc.) with a white paint stick while the flywheel is off. The carrier/flywheel goes back EXACTLY as it came off. Is the OT mark where it was when you took it off (in the timing window)? Make sure the flywheel holes are exactly centered with the five crankshaft holes, install the five new bolts; some folks do re-use the much heavier /7 bolts (I have). Bolts are installed clean and dry. Torque them to 74 foot-pounds (in steps) after installing the flywheel brake tool.
5. Remove the flywheel brake and remove the crankshaft "stop" at the front of the engine and make sure the crank turns easily. If not, the rear crankshaft thrust washer may have fallen off its pin and is now crushed. **If true, tear the engine apart and start over!!!!**
6. The clutch goes back next, with cleaned up parts and maybe a new clutch. Utilize the three home made clutch mounting studs (those smooth ones) to help you get it all together. The spring goes in first with the fingers "out". Install and snug up two of the bolts. There are clutch centering tools, I use them but if you don't have one, get it "pretty close" to center. The first time the clutch is used, the plate will line up anyway. Remove the smooth clutch mounting studs and install the remaining four bolts and washers and torque all six to 15-16 foot pounds.
7. The gear box is next, with nicely cleaned up splines on the input shaft (the part that goes into the clutch plate). Put the throw-out rod back into the hollow input shaft, tapered end toward the clutch, with a bit (small bit) of antiseize on the end, with a bit of grease or gear oil on the shaft of the rod. Coat the transmission splines with a thin layer of proper spline lube (a do-every-20K task) and install the gear box in the reverse of the method you used to take it out. Don't forget to re-attach the neutral wires to the switch on the bottom.
8. Re-install the cleaned and greased throw-out assembly and clutch lever. Loosen and back out the adjuster bolt a little. When properly adjusted the forward part of the throw-out lever is 210 mm from the back of the clutch cable boss on the engine block which makes the throw out lever parallel to the back cover of the gear box.
9. At this point, I install the four new short driveshaft-to-transmission bolts with a drop of blue-medium loc-tite on each bolt. It's much easier with the swingarm held back. They will be tightened after we reinstall the swing arm pivot pins. If you are putting on a new boot, now's the time. The "OBEN" marking goes on top.
10. Reinstall the swingarm and pivot pins while centering the swingarm in the frame. Some folks use calipers to measure the equal spacing. I find eyeballing with a ruler is fine. Tighten one side's lock nut with your 27 mm socket to 74 foot pounds. Go to the other side, set the pre-load on the bearing to 14, then back off to zero, then 8 foot pounds and

then tighten its lock nut to 74 foot pounds. Lube the assembly with your grease gun/needle tip.

11. Re-assemble the brake assembly, and then tighten the four driveshaft bolts to the appropriate “grunt” by turning the rear wheel as you use the 12 point 10mm box end to tighten the bolts. Use the rear brake as necessary. There are devices for measuring torque; I just give a good grunt to the wrench.
12. Reinstall the clamp that anchors the drive shaft boot to the gearbox with the open end of the clamp on the side of the boot (not the bottom).
13. Replace the battery box, battery, air cleaner, carburetors, fuel tank, tool tray, fuel lines and front cover. Connect the battery cables. Replace any drained fluids and you are all set.

## **References:**

1. Airmail Tech Articles by Oak: July 2000, August 2000, October 2002, January 2003, February 2004, May 2004.

2. Snowbum (Robert Fleisher) web pages:

<http://bmwmotorcycletech.info/techindex.htm> (Index)

<http://bmwmotorcycletech.info/drivshftboltstoolstorque.htm> (driveshaft bolts)

<http://bmwmotorcycletech.info/flywheelremovalwarning.htm> (Flywheel removal)

<http://bmwmotorcycletech.info/clutch.htm> (clutch information)

<http://bmwmotorcycletech.info/inputsplinthrowout.htm> (clutch/spline stuff)

3. Airhead Web Site Technical Pages:

<http://www.airheads.org/content/view/322/98/> (main seal driver)

<http://www.airheads.org/content/view/157/98/> (rear crank thrust washer)

<http://www.airheads.org/content/view/239/98/> (rear main seal replacement)

<http://www.airheads.org/content/view/240/98/> (more rear main seal replacement)

<http://www.airheads.org/content/view/241/98/> (more rear main seal replacement)

4. Anton Largiader Web Site Technical Pages:

<http://www.largiader.com/articles/throwout/> (Throw-out assemblies)

5. IBMWR Airhead Tech Pages:

<http://ibmwr.org/r-tech/airheads/clutch.shtml> (clutch adjustment)

<http://www.ibmwr.org/r-tech/airheads/throw-out.shtml> (throw-out bearings)

6. Jeff Trapp Tools:

<http://www.northwoodsairheads.com/Tools.html>

*“Note on Clutch Carriers: BMW made 3 versions of the clutch carrier since introduction in 1981. The first one was a disaster. Many of them either broke, vibrated, caused erratic clutch operation or some other problem. It was flimsy construction with unstable stamping for lateral movement. The second one was better and the final version was the strongest. Use the 3rd version for replacement. Here are the part numbers.....Oak-ABC # 35”*

First version, early 21-21-1-242-372

Second version 21-21-1-451- 511

Third version 21- 21-1-338 -722