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## Rear Drive-Unit Failures 1970 to Current Should You Be Worried?

by Ron Schmidt

**Preface:** BMW has recently been hit very hard by the press and owners of the bikes for rear drive unit failures. Unfortunately, this has been an area that has plagued BMW for decades.

**Airhead Problems:** Most airheads produced from 1970 to 1984 have a splined coupling to transmit the power from the rear drive unit to the rear wheel. The ring gear of the rear drive has a male spline protruding outward from the drive unit. A female coupler is riveted to the rear wheel. The wheel itself is supported on its own bearings riding on an axel that goes through both sides of a dual sided swing arm. As a result, the splined couplers are not subjected to any support of the rear wheel; their only job is to supply torque to the wheel.

This design is very robust, certainly stronger than it needs to be to support the power output of those early twins. However, due to a number of issues, they are prone to failure. If properly maintained, the splined couplers could outlast several owners' worth of interest in the bike, yet the next bike off the assembly line might have a low mileage failure. BMW requires a new ring gear and matching pinion gear to facilitate a repair. This is a horribly expensive solution.

**The Craig Hansen Fix for Airheads:** The after-market, particularly Hansen's BMW in Medford, Oregon, addresses these failures in a more realistic and higher quality manner. Craig Hansen suggests that there are a few possibilities that could cause the failure.

Metallurgy, particularly in the hardness of the spline on the ring gear, is one of the main issues. The hardness of the spline may not have been consistent from unit to unit. The "match" of the hardness of the ring gear spline and the coupler riveted to the rear wheel has to be happy together.

If either is too hard or too soft, the wear will accelerate beyond that of ideal mixes. This possible inconsistency could explain why two identical vehicles could have radically different wear in this area.

Craig also notes that there could be an issue with alignment of the mating splines. In Hansen's process, the new spline on the ring gear is precisely aligned with the center of the ring gear by using the ring gear bearing surface as the machining guide for the new spline.

Any splined coupler needs to have some "slop" in it to allow the coupler and spline to be able to be removed and replaced. Ideally, for longevity of the splines, that "slop" should be as close to zero as possible. In the real world, however, that sort of fit would make installation of the rear wheel tedious, if not impossible. So, BMW has allowed a less than perfect fit of the two splines to allow the wheel to be accessed more easily. The Hansen set-up has tighter tolerances, which makes the wheel removal and replacement only slightly more difficult than stock, but not bothersome.

Craig Hansen is a very modest individual and would never claim this, but I will on his behalf. Since 1981, I have been using his repair and to a unit have never had to have the repair repeated. In my opinion, it is a forever fix.

**Monolever Rear Drives:** In 1981, BMW introduced the first Monolever design on the R80G/S. This rear drive unit no longer has a splined coupler to drive the rear wheel. Instead, it has a ring gear that had 3 threaded posts on it. The rear wheel slides over these posts and conical spacers, secured with nuts, and holds the wheel directly to the ring gear. The swing arm is single-sided, so the rear drive not only has to supply torque to the wheel, but also has to support the weight of the vehicle/passenger/accessory load of the bike as well as the forces generated by anything the wheel might hit while the motorcycle is operated. This design requires much larger bearings to handle these additional loads, particularly on the wheel side of the ring gear. I do not recall even a single early-life failure on this system. Bikes with very high mileage occasionally need a new seal, but as a rule this unit has proved to be very reliable.

Starting in 1985 (and proceeding to the end of Airhead production), BMW opted to change the ring gear with 3 studs on it to one with 4 threaded holes in it. Four bolts with conical spacers hold the wheel directly to the ring gear as on the R80G/S. We did see a few of these units delivered with improper shimming, but once corrected proved to be dead reliable. It is my opinion that the increase to 4 bolts rather than 3 studs was probably due to public opinion that the 3 studs just did not appear to be strong enough. The bearing size was not changed. There was a modified version of this rear drive used on the R100GS and R100R with an early Paralever swing arm that used a different housing to accommodate the paralever, but was quite similar in design.

These Monolever rear drives have proved to be the best and most reliable units to date. Failures were so infrequent that they can be considered to be a non-issue.

**Paralever Design Rear Drives:** A new design rear drive came about with the 4-Valve Oilheads in 1994 with the advent of the modern Paralever rear suspension. Recall that the power of the 4V engine was about 50% more than the Airhead it superseded, and the motorcycle was much heavier. The rear drive still used 4 threaded holes in the ring gear to mount the wheel directly, just as the Monolever models had. The large ring gear support bearing was NOT changed from the lighter and less powerful models.

For several years, we did not see any failures in the system. Then in 1999, BMW introduced the K1200LT, a monstrously heavy bike with prodigious torque. That large bearing began to see a

much higher failure rate than it had previously on the lighter and less powerful models predating it. About the same time, we began to see failures on the R1150GS models. It seemed that this bearing might be near its design limit for these applications.

On the other hand, the failure rate is still quite small; the last presumably accurate number I heard was in the 4% range. This brings up a query: if the design is actually poor, why are there not a much higher percentage of failures? Furthermore, of the large number of bearing failures on these models that we have repaired here at Motorcycle Repair and Rendezvous, we have had but one return with repeated failure. On that one unit, there was a lot of damage to the ring and pinion gears because the rider continued to operate the bike too long with the bad bearing. We suspect that the second failure was as result of the wear on these parts. The second repair is still out there (Marcia's K1200LT) — time will tell if it will fail again.

**Our Findings:** Our records here show that we have had almost no failures in the 1995 to 1998 models. 1999 and later K1200LTs and the R1150GSs of 2000 MY and up seem to be most affected. The mileages on the failed units vary wildly from sub 20,000 to over 50,000. The use of the GS models also varies from severely used off roaders to garage queens. My personal R1150GS turbo has 96,000 miles on it, a ton of which is near abusive off road, overloaded with camping gear, and the turbo certainly adds to the stress load. It has had no problem, although putting this in print will likely cause its demise on my way to Death Valley for the Air Head Rendezvous this February.

These facts make me believe that the design is not the problem. Possibilities that exist are poor quality control during assembly or poor quality bearings. If the original shimming set up were incorrect, it could lead to early failures. I understand that these units are hand measured and shimmed. If the person doing the work is not paying close attention, or if his/her tools are worn and no longer accurate, or he/she is just having a bad hair day, it could result in this low percentage of failure. Also, if the

aluminum rear drive housings are not thoroughly cleaned of machining debris, there could be failures as a result of those particles getting into the bearings.

If the bearing manufacturer is not holding their tolerances of fit and hardness, that could result in failures as well. At one point, BMW began to supply a replacement bearing with fewer balls in it (17 rather than 19). We thought that they might be on to something (not that BMW would ever actually admit to having a problem!), but soon after they started supplying bearings with the 19 balls as the original again.

Interestingly enough, the BMW part number did not change when the 17 ball unit was supplied. BMW does not produce bearings, but buys them from various manufacturers.

I wish I would have had the forethought to keep a list of the failed bearing manufacturing companies just for curiosity sake. The above items would more likely be the cause of such low percentage failures than a poor design, and all could be common to the affects of human error.

**Hexhead Rear Drives:** With the advent of the Hexhead R1200s and the transverse mounted engine K1200s in 2005 MY, another new rear drive design was introduced. Originally they were said to be maintenance free units that never needed to have their oil changed. These rear drives did not even have a drain bolt, nor did they have any easy fill point. Early failures were rampant according to the internet. Beginning in 2007 MY, BMW changed its mind and stated that a 600 mile oil change was needed, after which the unit could be considered maintenance free.

There was no drain for the earlier 2007 models, so the units had to be unbolted from their stay and hung down to drain from the level check plug. Later 2007 and the 2008 and later units have a drain hole. The failure rate dropped noticeably when the oil change at 600 miles was implemented.

**Which Oil Is Best:** There is much discussion of oil viscosities being the cause of failures on the Hexhead style units. I personally think this is bunk. BMW now recommends using 75W90 GL-5 synthetic gear oil in the final drive. I agree that if Crisco cooking oil were used a failure would be predictable, but the difference between a 75W140 GL-5 synthetic oil as used in the earlier models and the 75W90 GL-5 synthetic oil suggested for these units would not be significant. High quality gears are high quality gears and good bearings are good bearings. We used to run 80W90 *non* synthetic oils in everything from Chevy pickup trucks to airhead motorcycles without failure. I once saw Bob Brown fill a transmission on his R80G/S with 10W40 SG **engine oil** during an emergency when we were in Baja Mexico and ran that oil for the next many thousands of miles because we forgot to change it back at the end of the trip. These heavy metal parts are just not that fussy about oil. That's my story and I'm sticking to it.

**BMW's Stand on the Failures - From My Point of View:** BMW has an advantage in minimizing the failure-cause data available to the general public on these newer units. Almost all have been covered under warranty, which must be done at a BMW authorized service center. So, smaller independent repair shops like us here at Motorcycle Repair and Rendezvous haven't had the chance to see failed units to get good reliable data. However, the friends that I have working in BMW authorized shops have stated that the number of failures has radically diminished since the oil change at 600 miles has been implemented. This suggests to me that we are possibly looking at a problem with a machining/casting debris issue that is lessened when the oil is changed. Or, BMW has upped its quality control. Or both.

**BMW Extended Warranty On Rear Drives:** There are lots of rumblings on the internet that BMW has officially extended the warranty on rear drive unit failures. I have not seen this in print (we do get all the BMW Service Information Bulletins here, just like the big guys do) and I have spoken with dealership principals who also say they have not received anything from BMW stating that there is an official extension. However, there have been many instances when BMW has offered "Good Will" assistance on rear drive unit failures for bikes well outside the 3 year, 36,000 mile warranty. This "Good Will" coverage seems to be done on a case-to-case basis, but does seem to be available.

**Our Maintenance Suggestions:** The splines on the 1970-1984 style rear drives should be cleaned and lubed each time the tire is renewed. A high quality synthetic grease (we use the Wurth SIG 3000 grease here; it is terrific) used in this area will last the life of the tire, even if it takes years to wear it out. Make sure you have both male and female splines clean before applying the grease. It is tedious to clean the female coupler of the rear wheel, but if good grease is put over dirt it makes a fine grinding compound. Make sure not to use too much grease, particularly on the rear drive male spline in drum brake models because it will be pushed off and end up on the brake shoes. The oil in these units should be changed annually or every 10,000 miles, whichever comes first. We suggest the BMW 75w140 synthetic or similar.

On Monolever bikes the oil should be changed annually or every 10,000 miles, whichever comes first. We suggest the BMW 75w140 synthetic or similar.

On Oilhead models we suggest the oil should be changed annually or every 12,000 miles, whichever comes first. We suggest the BMW 75w140 synthetic or similar.

On Hex Head models and K1200s with the transverse engines we suggest that the oil be changed at 600 miles or as soon as possible after that if you have a 2005 or 2006 MY bike that did not have it changed during its 600 mile service. The 2007 and later bikes should have had their oil changed at 600 per BMW spec, but if yours has not, get it done ASAP. Here at Motorcycle Repair and Rendezvous, we still advise that you have the oil changed annually or every 12,000 miles, whichever comes first. The oil cost is

only a few dollars compared to rear drives that cost enough to flatten even a thick wallet. We suggest BMW 75w90 synthetic or similar.

**What Can You Do:** You can check, and frankly *should* check for upcoming rear drive unit failure on a regular basis. It is easy to do and requires no special tools other than a pair of gloves if you do not want to get your hands dirty. I would advise checking the unit each time you change the engine oil (6000ish miles). While the engine oil is draining, (which you will do with a hot engine, right?) check the warmed-up to normal operating temperature rear drive as follows. NOTE: The exhaust is HOT!! BE CAREFUL!

Put the motorcycle on its centerstand with the rear wheel off the ground. Visually check for oil leaks around the rear drive unit. Don't be fooled by road grime or rear brake dust. Oil is, well, oily! If any leaks exist, bring the bike on in. You need to get some help at this point.

If no oil leaks exist, call a friend to come and help so you don't tip the bike over during this next part. Apply about 10 pounds of push to the side of the tire at the top. Turn the wheel about 6 RPM (5 seconds for ½ turn — a tachometer isn't necessary, just turn the darn thing slowly!) and carefully feel for anything that is not perfectly smooth. If it is not perfectly smooth, bring the bike on in. You need to get some help at this point.

If it turns smoothly, grab the top and bottom of the tire from the side of the bike. Try to move the wheel side to side in a "push on the top, pull on the bottom" motion like you were trying to tip the bike over. Do so quickly, back and forth, without turning the wheel, to see if there is any play. If there is any play, bring the bike on in. You need to get some help at this point.

If all of these tests are good, go for a long, long ride and then do it again. As far as "Should I worry?" I say no. It just ruins the ride. Maintain, don't worry.



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