Starter sprag clutch problems in classic K bikes

The Classic K bikes are the "flying bricks": models K1, K75, K100, K1100, and K1200, all versions.

K bike section, article #1

kstartersprag.htm

REFERENCES:

A description of starting problems, starter sprag clutch, various fixes, photos, etc., are in an article entitled "Starter Clutches In K Series Bikes", published in BMW Owners News, authored by Paul Glaves, in the December 2004 issue. I HIGHLY recommend you obtain a copy of that article. Paul's article, as well as mine, below, lists some possible easy fixes, such as oil additives, etc.

MY article, below, will not cover some of the things in Paul's article.

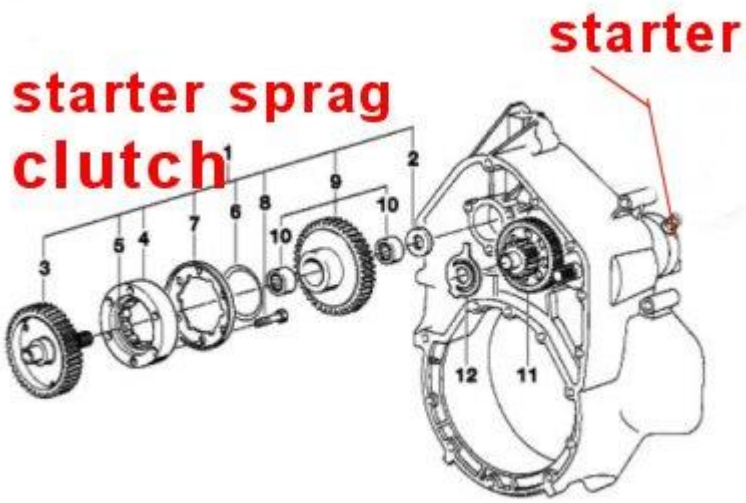
INTRODUCTION:

You really REALLY do not want the starter sprag clutch to fail. The LABOR to get to it is VERY HIGH. The entire rear end of the bike must come off, including wheel, driveshaft and rear drive (and Paralever if you have that), alternator, clutch, secondary gear case, etc.

The one-direction sprag clutch is driven by an intermediate gear, shown in the SKETCH below, from the starter motor. The sprag clutch, intermediate gear, and more is located in a secondary gear case, rear of the crankshaft.

The 3 starter sprag clutch photos below are from my 'analyze things for the Club' projects. This particular starter sprag clutch is of the later type having more sprags. The earliest K100 bikes had fewer sprags...the updated assembly turned out to be SOME of the answer to problems, but not entirely.

Below is an annotated copy of the sketch from BMW's fiche for a K100. To eliminate confusion, I have removed the alternator from the sketch.



The best fix is to do that, then drain the oil and filter, install fresh FULL SYNTHETIC oil and new filter. The oil that has the best reputation for no sprag problems is 15W50 Mobil 1.

What are the SYMPTOMS and simplest 'fix' for a starter sprag clutch acting up?:

Starter spins but the engine does not turn over, or poorly. Screech noise (maybe). Intermittent, perhaps. Can often start the engine by push-starting, pushing the starter button AS one lets out the clutch, to start the fuel pump. May vary with temperature conditions. Sometimes one can temporarily 'fix' the problem by having the bike in gear and trying to move the engine backwards. Note: It is possible for a combined problem, with the starter motor having a slightly dead spot it stopped at the last time you used it.

A possible fix, temporary or?, is to put some Rislone or CD2 into the oil. These are very high detergent cleaners. Rock the bike, in gear, backwards, if you have to, to enable engine starting. After putting some miles on the bike, drain the oil, replace the oil filter and install fresh oil, full-synthetic. 15W50 Mobil 1 is recommended by me. If

the Rislone or CD2 does not work, you will have to do a lot of work, and remove the starter sprag clutch. Because of the work involved, many will think about waiting until they need a clutch overhaul.

Additional notes:

You have done the large amount of labor to get the sprag clutch onto your workbench and you SEE mechanical damage. Sprags not spragging? Look at them carefully. You may see a "polished" flat where it runs on the inner cylinder lightly pressed there by the springs. When the springs get grunged-up, they end up exerting less force and so less friction for it to "lift itself" over the high point to start wedging.

You have the sprag clutch on the workbench and there is NO noticeable mechanical damage nor gunking-up. The starter clutch is a constantly running device that is designed to transmit force in one direction, and it is not supposed to have any appreciable grabbing engagement until the starter rotates, which is supposed to cause the sprags to move, and that movement should LOCK-UP that clutch, so the starter rotates the engine. When the starter is NOT powered, the starter sprag clutch is free-wheeling, with no appreciable friction in its innards. This starter sprag clutch is a ONE-WAY device. One direction, it locks up, other direction, it rotates freely, with no coupling between the two main parts other than quite minor friction except in the oil film contact involved.

I have seen TWO of these sprag clutches (of the later types...not the earliest K bike ones before the factory updated ones) that have failed, withOUT any apparent real wear on any part. I have ONE of these in the shop. PHOTOS of it are above in this article. I was so curious about it, that I paid the owner to send it to me. I have compared it to a brand-new one, with no good conclusions, beyond the fact that dimensions have not changed enough to mention. My suspicions are STILL that it failed due to unseen-by-the-eyeball microscopic surface glaze, or other type of surface change... on the inner friction 'drum' part (and likely also the sprag parts that contact it). I have not proven this....might be able to at some point. The owner told me he had tried both Seafoam and CD-? additives. The owner did not try Rislone. I am not sure of exactly how the owner used the additives.

No one that has used Mobil 1 (a TRUE full synthetic), has had a problem that has been reported to me. It is entirely possible that OIL is THE major factor.....or not. I do NOT want to imply that wear is not a concern. I HAVE seen worn starter sprag clutches; and the springs, if gunked-up enough, could cause reduced tension. My suspicion is that it was also the OIL that enabled excessive wear, when that is seen, but I cannot be 100% sure about it. The only way I can get a handle on that, is maybe to actually be present at some teardowns, and MEASURE side-play, and so on. I am a bit hesitant to state that it could be a problem, because there is no indication of side-play wear on the needle bearings in the starter sprag clutch here....that I can see...nor on the ones I have looked at in that particular regard (two of them). Keep in mind that a starter sprag clutch works by friction, and it is not supposed to be friction of metal to metal, but friction using an oil film between the parts. Most do not understand how oil films work. There is an in-depth article on this website for anyone who wants details.

My guess is that there is more than just one thing at work with the starter clutch problems. I suspect basic failure modes; OIL film failure where the result is mechanical damage; or, failure due to a glaze or gunked springs. I am beginning to think that all the other failures, which manifest themselves as WEAR failures, are due to a combination of oil, perhaps side forces, and maybe there is some sort of production tolerance...and maybe contaminant/protectant problem at work too.

I am aware that MANY have NEVER have had a problem with the later starter sprag clutches, and many have used fairly conventional oils. My mind jumps to the same situation with camshaft and followers, in the Airheads. Many got HUGE mileages without problems; others, even running the same oils, had problems. I have personally witnessed these engines apart. WHAT was the answer? Seems to be heat treatment variations. For the Classic K bikes, I think we have a combination of effects, and anecdotal evidence TENDS to point towards recommending the use of a REAL synthetic oil (Castrol Syntec is NOT!), like the Mobil 1 I have been recommending. It may well be that the higher amounts of ZDDP in Mobil 1 is helping with the WEAR failure modes. In addition, in what APPEARS to be the case, Mobil 1's formula does not leave the surfaces such that the sprags do not properly grab, nor leave messes in the springs.

Until someone does a serious laboratory analysis, right down to the surface's molecular analysis, I doubt we will know

much more.

Because of the huge amount of labor involved ,...not to mention the $$$ parts cost...I personally use ONLY Mobil 1 in my K bike. I am simply using the oil that the majority of information I have points towards it being much less of any problem. I have nothing against someone using Mobil 1 20W50 oil, called V-twin oil, that has even higher amounts of certain additives. Maybe the 20W50 is a bit better if someone rides mostly in the hot Southwest, etc., where temperatures can exceed 100°F relatively often.

I leave my Mobil 1 15W50 in my K1100LT for the entire year; unless I have put more than 8,000 miles on the bike. A FULL synthetic, like this oil, really does not need to be changed often, particularly if one does not do a lot of very short commutes particularly in quite cold weather. My K11 also works hard; so is hard on oil...it hauls a big sidecar. I do change the filter at the same time, sometimes every other oil change.

The in-depth analysis by a lab showed that the additives in Mobil 1 hold up quite well over time and mileage. You get, sometimes, what you pay for. I also use nothing but BMW filters. I have no problem with folks using aftermarket filters, but find them highly variable internally, so I don't use them.

K bikes seem to use less oil, if the oil is a quality one, and if the oil level is NOT maintained all the way to the top of the sight glass. I like the middle. I use higher levels if on a long tour.

There are other synthetic oils that likely do a good job; particularly the Golden 4 type from Spectro Oils.....and Spectro does make a full-synthetic version. If the Mobil 1 becomes hard-to-find, I may switch.

It has been reported to me by a trusted source that after removing a starter sprag clutch that has failed or gotten intermittent, but exhibits no signs of bad mechanical wear, that it can be repaired by a very thorough cleaning in strong solvents. I have, myself, done this to ONE, and I also used about a 2000 grit paper in 'polishing' the contacting surfaces; with no further problems from the starter operation; so it was nice to hear that someone had used JUST solvents to effect cures. I would recommend the polishing by super-fine grit paper, as I did, plus VERY thorough solvent cleaning (and scrubbing by turkish toweling with the solvents). I used a 50-50 mixture of MEK and Acetone.

Rev:
04/29/2010: Update slightly; +clean up excessive verbiage, etc.
10/08/2012: Add QR code; add language button; update Google Ad-Sense code; very minor other editing.
04/21/2013: Revise article for clarity. Add photos. Add more commentary.