

Rebuilding the Jaguar 5.3L V12 Fan Jockey Pulley

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Background

NOTE: Unfortunately, I have to report that my rebuilt jockey pulley, described below, failed two months after installing it on the car. I have not fully determined why, but it looks like at least one of the bearings froze and the pulley spun around it. Could be the bearings picked by the machinist were not up to the loads or temperature, or he did not make a tight enough interference fit when the hole was bored. I will leave this write-up here until I figure out what went wrong. Meanwhile, I have been running a used jockey and have ordered a rebuilt one from an eBay source.

I had some front engine noise that was getting worse, so I finally decided to find what was causing it and fix it. I first listened with a mechanics stethoscope, holding against various things driven by belts.

Note: This has to be done carefully because you could do real damage to yourself or your car if the probe got caught in the belts or fan. Experiment with placing the probe before starting the engine, carefully noticing distances between it and moving parts.

I got the most noise when holding the probe against the fan bearing housing. So, I removed the fan belt and started the engine and no noise! At this point it could be either the jockey pulley bearing or the fan bearing. Spinning the jockey pulley produced a little noise and I could feel a little bit of roughness, whereas the fan felt pretty smooth. Although still not 100% certain, I decided to go after the jockey pulley.

Is it a Jockey or an Idler?

In this writeup I will be talking only about the fan idler, called the Jockey Pulley in the ROM. Don't confuse this with the stand-in for the air pump on non-emissions controlled cars, called the Idler Pulley in the ROM and the Jockey pulley in other places.

Construction of the Jockey Pulley and Arm

The Jockey pulley is mounted on an arm as shown in Figure 1. The center hole of the arm is for the bolt that screws into the fan bearing housing on which the arm pivots. The hole at the other end is for attachment of the adjustment bolt. The pictured arm is aluminum alloy, but on later cars it is steel or cast iron. Also, in this example the shaft is pressed into the arm and peened. On some early cars the shaft was threaded and held to the arm by a nut.



Figure 1 Fan Jockey pulley and arm.

Looking at the other side we see the face of the bearing that is pressed into the pulley, Figure 2. It is the type of bearing normally used in water pumps.



Figure 2 Front of Jockey Pulley.

Water pump bearings are unique in that they have two ball bearings and an integral shaft. The inner races for the two bearings are ground into the shaft. Figure 3 shows a typical water pump bearing. The shaft protrudes from both ends, as a water pump has a pulley on one and an impeller on the other. The one used in the fan Jockey needs a shaft only at one end to attach to the arm. Obviously, Jaguar or its supplier got one of the water pump manufacturer to make a special bearing with a single shaft.



Figure 3 Typical water pump bearing.

Disassembly

As stated before, the bearing shaft is either threaded and held on by a nut, or pressed into a 3/8" (nominal) diameter hole in the arm and peened. If yours is the pressed and peened type only way to remove it is by drilling it out, Figure 4. The shaft material is soft and drills easily. As can be seen in Figure 1 there is already a pilot hole about 1/8" deep in the shaft end which makes it easy to start. I used a 5/16" diameter bit in a hand drill to drill about 1/4" or so into the end of the shaft.



Figure 4 Drilling the shaft out of the arm.

After drilling I held the arm in a vise to drive the shaft out. First, I used a punch to strike angled inward blows around the edge, folding the peened rim of the shaft inward, then, a couple axial blows to drive it out, Figure 5. There is a washer to help distribute the load over the pad on the arm. You can see that my drill bit wandered a little off center, breaking through the shaft diameter. It nicked the hole in the arm a bit but this didn't matter much since I intended to use a bolt to attach the new pulley.



Figure 5 After drilling and removal

Once the pulley and bearing assembly has been removed from the arm the bearing can be pressed out of the pulley. The machine shop at a local auto parts shop I frequent did it for me without charge. Figure 6 shows the bearing after removal. Apparently, the machinist found it necessary to grind off the shaft a bit to get a good surface to press against.



Figure 6 Bearing after removal.

New Bearing Design and parts

This repair has come up in the XJ-S Lovers Mail List a couple times. Several recommended replacing the bearing with a water pump bearing, cutting the shaft off at one end. This advice made it's way into Kirby Palm's book, along with mention of a specific bearing, FAG W52315-1. I found the FAG Web site (<http://www.fagauto.com/products/waterpump/index.htm>) and learned that the number given in The Book

doesn't exist, but there is a WS2315-1, which is probably what the contributor refers to. However, that bearing is not right, at least for my idler arm. It has dimensions

- Part number: WS2315-1
- Length of outer case: 1.314" (should be 1.063")
- Diameter of outer case: 0.9448" (s.b. 0.941")
- Shaft diameter: 0.5015 (The arm hole is 3/8", but could be drilled out)

So the main problem is this bearing would stick out of the pulley about 1/4" and would be a very tough press job to insert it in the pulley. There is actually a better one on the same page:

- Part number: WS2307
- Length of outer case: 1.063" (should be 1.063")
- Diameter of outer case: 0.9448" (s.b. 0.941")
- Shaft diameter: 0.4724" (The arm hole is 3/8", but could be drilled out)

Another problem is both of these bearings are in the FAG "Special" group, meaning they are hard to get. I found a local dealer who listed the WS2315-1, but did not stock it. His book didn't even show the WS2307. He volunteered to try to locate it, but thought that some significant quantity would have to be ordered.

The XJ-S Aftermarket Parts List (<http://home.earthlink.net/~pcohen/index.html>) also lists some idler bearings, but from the sizes given it must be referring to the air pump stand-in idler.

In view of these problems I decided to abandon the water pump bearing idea and go with two normal shielded bearings. My design is shown in Figure 7.

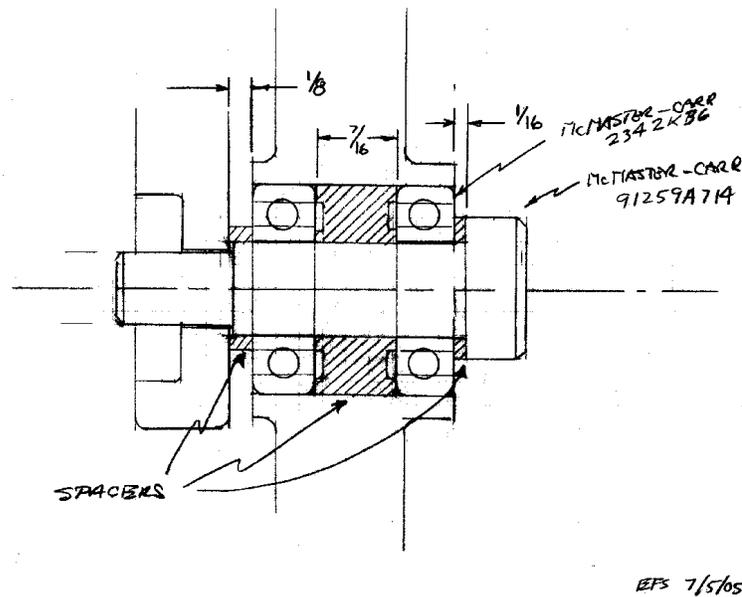


Figure 7 Bearing Replacement Design

The two bearings are pressed into an enlarged pulley bore with a spacer in the middle. The spacer allows both bearings to be clamped through their inner races to the arm with a shoulder bolt. At first thought it might seem that a simpler spacer catching only the inner races would suffice. However, it is also necessary to space the outer races or undesirable axial loads on the bearings will be introduced as they are pressed into the pulley. The relief on the faces of the spacer is to avoid contact with the bearing shields.

The bearing that looks best is from McMaster-Carr (<http://www.mcmaster.com>):

- R8 bearing, 2342KB6 (\$7.75 ea.)

ID 1/2"

OD 1 1/8"

Width: 5/16"

Shields at both ends.

The Shoulder bolt that seems best is:

Part number: 91259A 714 (Socket head, precision. \$2.35)

1/2" diameter shoulder diameter

1 1/4" shoulder length

3/8-16 thread

5/16" head height

Given the thickness of the pulley (1 1/16") and the length of the shoulder, two more spacers are needed. There needs to be a 1/8" spacer between the arm and the pulley back face in order to get the Vee properly aligned with other pulleys on the fan belt. Also, a 1/16" spacer is needed under the head of the bolt to "shorten the shoulder" a bit. The machinist used standard 1/2" steel washers in both places, although McMaster-Car sells (in 100 piece boxes) special shoulder shortening spacers for this purpose. He had to do a bit of machining on the thickness of the outside washer since they are 1/8" thick. The spacer between the two bearings had to be made, as it is nonstandard.

Cost

The machinist charged \$125. This included about \$18 for the bearings and shoulder bolt. I feel this is a good compromise between the \$240 for a new Jaguar arm and pulley and the \$65 for the cheap aftermarket pulley.

The machinist told me he could do these much cheaper in modest quantity, say 30-50 units. He could then set up to turn the pulleys out of steel on an automatic lathe cheaper than chucking and boring the Jaguar pulley.

Note: If you are interested in a group purchase of these, at a unit cost somewhere between the price for the cheap aftermarket pulley and what I paid for mine, send me a note.

Results

The pulley with newly fitted bearings is shown in Figure 8. It is held to the arm with a 3/8-16 friction nut. Good as new! And it sure is good to have a quiet engine again. Fortunately, it was the jockey rather than the fan bearing!



Figure 8 Rebuilt Jockey Pulley on arm

Some Final Thoughts

One concern that I had was that the shoulder bolt head clear the fan. I did some measurements as best I could and decided that it would. And it does, but just barely, as can be seen in Figure 9. It looks to be about 1/8". Since the fan and jockey pulley are solidly mounted on the same base I don't expect any relative movement so this should be enough, although I wish it was a little bit more. If I had to do over again I might make some changes to give it another 1/8" clearance, even though it might take a bit more machine work, e.g., a custom made shoulder bolt.



Figure 9 Fan clearance

Another possible issue is part differences among year models. I have already mentioned the differences in arm material, and methods of attachment of pulley to arm. Neither of these changes will make any difference in the design shown here. However, another XJ-S Lovers Mail List member has recently sent me his no longer needed 1986 jockey assembly (he switched to electric fans) and I notice some other small differences that could be important to you.

One, the bearing diameter seems to be a little larger, perhaps 0.970" instead of 0.941". It's hard to tell exactly without removal from the pulley. This would not be important if you wanted to use the dual R8 bearings like I did, but it does mean you *might* be able to find a suitable water pump bearing, although not from the sources I found.

Another difference is that the pulley is a little closer to the arm than mine was. Mine was 1/8" between the boss on the arm and the pulley boss, whereas the one from the '86 is about 1/16". I'm not sure why this is, but the parts book shows part number changes for *both the fan bearing housing and the jockey arm assembly* at VIN 104146, so there could have been corresponding changes in both parts to keep the proper pulley alignment. But regardless, what is important here is the spacer thickness you will need between the pulley and the arm. You should check that dimension before disassembly and use an appropriate spacer to keep your pulleys aligned.