How to replace bearings in Beau/UMC capstan motors

The Beau motors used in ITC cart machines are similar to the Beau motors made to retrofit Ampex transports. If your Ampex has a Beau motor with noisy bearings, you can easily replace them. Go to your local bearing house and order some R6ZZ bearings. I like the Japanese bearing manufacturers such as Nachi, KSK, and KYK. These bearings should be about $5 to $8 each. This is a double-shielded bearing, and while it's not a high-grade instrument bearing, they seem to be quite smooth and quiet (and for this price, you can buy a bunch and hand-select them).

(BTW, 608ZZ bearings are the ones for the Ampex reel idler assembly.)

Here's how I replace bearings in Beau motors (*disclaimer: this has worked for me but I make no claims as to it being the correct procedure*).

1) Remove the nut on the rear of the capstan shaft (don't remove the flywheel yet).

2) With a plastic mallet, **GENTLY** tap the rear of the capstan shaft. The dust shield on the front of the capstan shaft should pop out (nudged by the retaining clip on the front of the capstan shaft). Set aside the dust shield. Sometimes you need to use a heat-gun to warm the cast flywheel.

3) At this point, you should be able to press out the capstan shaft by hand. Wipe it clean and set aside.

4) Remove the flywheel. Be very careful to remove the special aluminum spacer and wavy washer(s) that go between the rear bearing and the flywheel. Also, the motor windings are now exposed and **EXTREMELY** vulnerable. Be careful here.

5) Remove the old bearings. There is probably a special tool for this (perhaps adapted from a gear puller), but I haven't found one. Using the largest flat-bladed screwdriver that will clear the inside hole of the bearings, **GENTLY** tap the inside surface of the bearing opposite the one facing you. The idea here is to push out one of the bearing assemblies (it doesn't matter which one). Tap gently using the screwdriver only—don't use a hammer—and tap different points around the bearing to drive the bearing out straight. If it doesn't seem to work, put the screwdriver in from the other bearing and try driving out the other bearing. **Warning**—this destroys the old bearings, so don't reuse them.

Note that it is often necessary to heat the aluminum bearing tube with a heat-gun first so that the bearings will pop out more easily.

6) After removing one bearing, press out the remaining bearing using a very large nut-driver or wooden stick. Tap gently.

7) Wipe the new bearings and carefully press them into the motor. In my experience, the Nachi bearings are sized properly and will press into the motor with hand-pressure only (press on the outer race only). At this point, the bearing isn't quite home.

Again, you may want to use a heat-gun to expand the bearing tube slightly to allow easier bearing insertion. If you don't, you may need to make a tool from one of the old bearings. Carefully pry off the dust shields, remove the balls, the ball cage, and the inner race; this leaves only the outside "ring" of the old bearing. Use the ring to press home the new bearing—the avoids any accidental pressure on the inner race.

8) Repeat the previous step for the other bearing.

9) Here's where it can get tricky. With the Nachi bearings, I have found that you can slide capstan shaft into the inner bearing races without any difficulty. With other bearings I have used, it was more difficult and I worried about putting excessive side-loads on the bearings, which can damage them. Make sure both the inner races and the capstan shaft are wiped clean before attempting this.

10) Reinstall the aluminum spacer and wavy washer(s) over the bottom bearing. Make sure the aluminum spacer is reinstalled with the "ridged" side inward, facing the bearing (this is important, since the idea here is to contact the inner bearing race so that it turns with the capstan shaft).

11) Carefully reinstall the flywheel. Make sure you don't dislodge the wavy washer(s) in the process.

12) Reinstall the nut and tighten moderately (on some motors, you may have to grab the top of the capstan shaft with your hand while tightening). Don't overdo it. What happens here is that the inner race of the top bearing is loaded by the spring-clip (near the top end of the capstan shaft) and the inner race of the lower bearing is loaded by that special aluminum spacer. You want it tight enough to keep the races turning with the capstan shaft but not so tight as to unduly load the bearings. Some finesse is required.

A side issue is whether to use an adhesive to secure the inner races to the capstan shaft. With Ashland and Bodine motors, I use one of the Loctite ® retaining compounds (use the one specified for bearings; don't use a permanent thread-locking type). I have not found this necessary with the Beau motors since these motors have a threaded capstan which permits secure loading on the inner races (as described in step 12, above).

I should add that I have never had to use force or make special tools to repair Beau motors. On the other hand, Ashland and Bodine motors seem to have much tighter tolerances. Removing ball-bearings on these motors typically requires an external-jaw bearing puller. Also, pressing in new bearings may require careful heating of the bearings (using a heat gun) and special pusher tools (or stacked layers of old bearings) to fully seat the new bearings. Remember, you want to avoid putting pressure on any part of the bearing other than the inner race.

Another nice thing about the Beau motors is that they don't need oiling and they are very quiet. I am not sure if they have enough torque for tape widths larger than 1/4-inch, but I have never tested them.

-Dave Dintenfass, Seattle, Washington 21 July 1998 (**revised 27 Feb 2009**).

Disclaimers: *Your mileage may vary; repair motors at your own risk. Also, "Loctite" is a registered trademark of Loctite Corp*