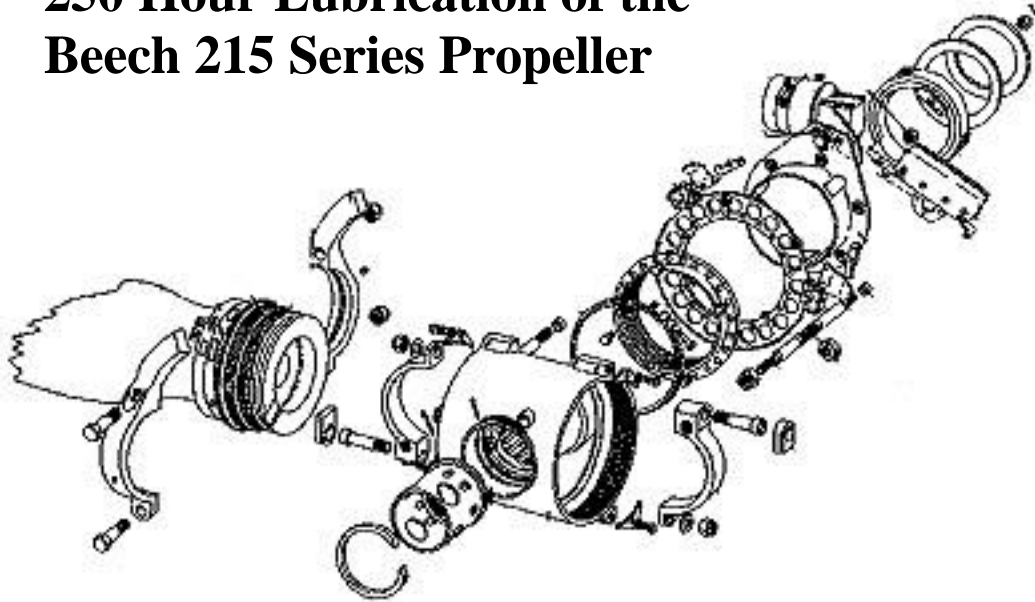


250 Hour Lubrication of the Beech 215 Series Propeller



By Mark R. Mantei

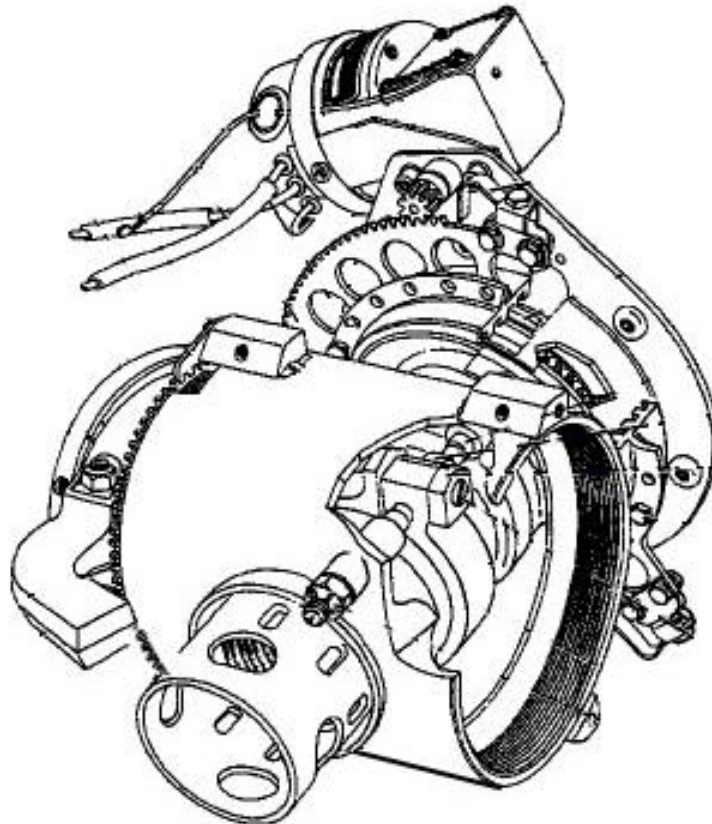
"In fifteen years of working on airplanes I have never seen one of those before"

Two years ago I became the proud owner of N303B a 1956, G35 with the original engine and Beech 215 electrically controlled propeller. Recently I had the opportunity to learn the finer points of propeller maintenance.

I had learned through researching the ABS Reference Library on CDROM that the prop pitch-change bearing needs to be lubricated every 250 hours. My studies showed that failing to maintain the bearing would risk a catastrophic bearing failure that, at the very least, would require finding a replacement, an almost impossible task in that they have not been manufactured in years.

My first step was to talk to area mechanics and propeller shops both to get a price quote and to interview the experts and find out who in the area was familiar with my prop. I expected some difficulty but the most telling quote came from an experienced A/P who said, "In fifteen years of working on airplanes I have never seen one of those before." One local Denver area prop shop told me their technician who knew my propeller had retired, another quoted me a price in excess of \$1,200. The best advice I got was from Rit Keiter of Airborne Electronics. (Most owners of the Beech prop probably know of Rit, he and Dick Kramer developed the STC'ed replacement electronic prop governor that has been installed in many early Bonanzas.) Rit is retired now but was more than willing to offer many important tips, the best was his advice that I learn the propeller myself. He advised that the pitch change bearing lubrication was not difficult and if done under the watchful eye of an experienced mechanic, could be completed by an aircraft owner who is handy with a wrench. He also advised me to purchase the Beech prop manual. The drawings and procedures help **but be careful, the exploded parts drawings depict many parts disassembled that do not need to be taken apart for pitch bearing lubrication.** The part number for the prop manual is 115-187; it covers the R200, B200 and 215 propellers.

What follows is my semi-technical cookbook approach to pitch change-bearing lubrication. Initially, I wrote the procedure for myself in hopes of not repeating the same mistakes next time. I offer it here for other early Bonanza owners faced with a similar challenge.



Hub Gear Ring Gear

Before starting it is helpful to understand that the bearing lubrication process does not require removing or adjusting the propeller blades. Only a prop shop should undertake blade adjustments. The pitch-change bearing requires removing the prop hub, disassembling the bearing, lubricating it, reassembly and installation. The first step is to arrange with your favorite aircraft mechanic to oversee your efforts, you're not looking for instruction just an extra set of eyes along the way to be sure you don't leave a wrench under the cowl or forget a cotter pin. If the mechanic is hesitant, threaten to ask him to do the work, it worked for me. An experienced pro, if you can find one, can probably complete the work in four hours, next time I do it I will plan on two days. My first effort time took two weeks of nights and weekends learning what not to do along the way. Having the right tools or being able to borrow the right tools, made all the difference in the world. A high quality, thin walled 1/4" flex-head socket set was a blessing. I didn't have the right one but I borrowed a Snap-On set that has since become a part of my Christmas list.

I decided that while the prop was off I would remove the pitch change motor, grease it and install new brushes. It is not necessary to remove the prop to get the pitch change motor out nor is it required to remove the pitch change motor to pull the prop, but it is a good time to do both. Before disconnecting the pitch change motor leads, mark each wire and post with scotch tape to simplify reconnection. Remove the electric leads and motor. The motor is held in place with three Allen head bolts. Remove the most difficult one first because the only access to it is through one of the holes in the ring gear and it may be necessary to have an assistant sitting in the cockpit bump the manual prop pitch change switch to move the ring gear one way or the other. (The master will have to be on but make sure the key switch is off and stand away from the prop to be extra safe.) Taking the Allen bolts out in the correct order will save the half hour it takes to put the two easy ones back so you can move the ring gear and get to the third. The two easier bolts also hold the micro switch in place.

First, remove the spinner. The prop has to come off so remove the prop safety pin, it is the 1/2" pin which is loosely cotter keyed between the hub retention nut and the spline shaft. The hub retention nut doesn't look like a nut at all. It is the metal cylinder with holes in it. The holes are there to allow you to insert a breaker bar to apply a great deal of force. Unbolt the 6 sleeve bolts in the engine compartment. (Note, this is where that thin-walled flex-head socket and long extension helped.) Each of the 6 bolts has a self-locking nut and small washer. Also, once the prop is removed, you will find a metal bushing that goes through the rubber grommet and a larger washer on the prop side of the attachment sleeve. Be sure to pay close attention to where they land when you pull the prop because ordering replacements will put you days behind. Beech recommends replacing the grommets.

To pull the prop, loosen the hub retention nut. It loosens to the left and a breaker bar will be required, as it will take a lot of force. (The Beech manual says to torque it to 400 foot lbs when putting it back on so it will be tight.) Once the nut starts to loosen, continued loosening will draw the prop towards you, off of the shaft. Mine never dropped off but I was ready with help just in case. Have a pickle bucket or other sturdy stand to set the prop on once it's off. (Pickle bucket: white, 5-gallon strong industrial bucket also used for paint and hundreds of other fluids.) I found that it serves as an acceptable prop stand and the plastic will not mar the blades.

Once the prop is off, remove the ring retainer. (Important: note which way it lays, there is a off-set screw that holds the ends together and it will interfere with the prop if you put it back on facing the wrong direction. It must tuck back towards the hub and ring gear and not stick out towards the nose of the plane.) Remove the two actuator bearing attaching crown nuts on each side of assembly. You will have to twist the bearing assembly to get access and each should have a small cotter pin.

It is not required that you unbolt the ring gear from the hub gear, but it is critical that you index the assembly. There are three lugs that ride in one race but have three different possible starting positions. Only the original alignment will allow the prop to properly change pitch. Slowly rotate the bearing assembly to better understand how,

when the assembly is turned, the lugs are drawn towards you and after about two turns, will disengage from the hub gear. Before allowing the lugs to completely disengage, use an indelible marker to mark which lug matches which starting race position. If it's not indexed, trying to figure out the correct starting position with the prop off is pointless, the maximum and minimum pitch settings do not make logical sense when the assembly is on the bench. If you do not index the hub gear and bearing assembly be prepared to install and remove the prop three times to find the correct starting point. Once indexed, separate the three parts of the bearing assembly and inspect for wear.

Next, remove the bearing snap rings and the black rubber grease seals by gently pulling on them with a flat edge. The bearing should be soaked, cleaned and dried. Do not use compressed air to spin the bearing as injury can result. Repack the bearing as you would automotive wheel bearings but use the grease that's mentioned in the "Consumables" section of the aircraft's Pilot Operating Handbook.

While the prop is off it is a good time to thoroughly lubricate the pitch control bolts that pass through the hub. (If you ever had a circuit breaker pop while changing pitch, it is probably the pitch control bolts that need oil.) There are two on opposite sides of the prop hub. Twist the blades by hand to expose as much of the bolts as possible then brush on clean engine oil and work it in manually.

Reassemble

If you properly indexed the starting point of the bearing assembly and match up the three lugs to their respective starting positions, reassembly should be very straightforward.

Oil the bearing race and replace the bearing. Replace the bearing assembly, bolt and cotter pin them together as a unit. Reattach the ring retainer. Before lifting the prop onto the shaft, notice that there is a triple wide groove in the center of the hub that needs to match up with a specific rib-stud-rib combination on the spline shaft. It is impossible to install it in an incorrect position but visualizing how it fits together before lifting it will ensure easier insertion. Replace the hub retention nut and turn it by hand to start it on the shaft. Move back into the engine compartment, line up the ring gear in the same position as when it was removed and replace the six sleeve bolts. It can be tedious, start with the bushing, and then work the bolt and large washer past the ring gear holes and into their receptacles on the engine plate. (It will help if you line up the pitch motor mount, put one bolt in backwards to stake the alignment then work your way around.) Tighten the prop nut by hand until it is initially tight, you will notice that as you push the prop on the shaft the blade pitch changes, reach back to the ring gear and turn it to reduce the pitch, you will have additional slack and can then continue tightening the prop nut. (The prop nut pushes the prop in which pushes the prop blades towards course pitch. When you take up the slack with the ring gear the blades move back to minimum pitch.) Once the prop is taught, tighten the six sleeve bolts to the recommended torque value. Torque the prop nut to 400 foot lbs. I used a two-foot cheater bar and since I weigh 200 lbs, I gave it all my weight. (200 lbs. X 2 Feet = 400 foot lbs.) You will need an extra person or three to hold the prop back while tightening. Install the prop safety pin and cotter pin it in place.

Check the alignment of the ring gear in relation to the expected pitch motor position. It should be in the same position as when you started. Install the pitch change motor and attach the motor leads. Manually pull the prop through to verify that there is sufficient clearance. Ground check the pitch change operation with an assistant before starting the engine. Install the spinner and again, pull the prop through to verify clearance between the spinner and the fixed portions of the plane. Finally, double check the engine compartment, close and secure the cowl doors and carefully preflight the plane before flying. Oh yes, save your notes because you will do it again in another 250 hours.

I would like to acknowledge the people who offered advice and assistance, without them I would not have been successful. Ben Watkins, owner of Executive Maintenance at Jeffco Airport made sure I stayed on track and allowed me to use some of his tools. Dave at Rocky Mountain Propeller lent a hand on numerous occasions and helped try and figure out the correct starting position for the bearing assembly. Lew Gage was available and most generous with his phone support. Finally, Rit Keiter of Airborne Electronics gave me the motivation and confidence to attempt the work in the first place.