Removing your Two-blade Hartzell HC-12 (?) 20 prop off a Franklin Engine

(Or "How do I change the prop cylinder O-rings!")

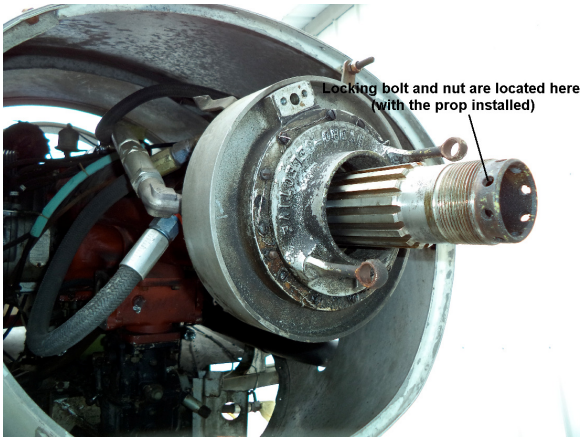
If you are having oil leaking around the propeller piston/cylinder assembly and trouble figuring out how to remove your prop so you can change the o-rings inside the prop cylinder, this procedure may help.

Make sure you have your ignition switch OFF and it's a good idea to disconnect the spark plug leads just to be sure. Remove the plugs for even more safety. Thanks to member Ed Porter for his great help in making this article possible. Below are two different scenarios; one is the RIGHT way (Ed's), one is the WRONG way (mine). Leave the piston attached to the propeller when removing it for routine maintenance (5-year AD, etc.).

First make sure you have an extra man and a small boy (not really) to help. Second the platform you stand on should be totally stable. I made a platform years ago that does the trick quite nicely. The plans are available on the Seabee website under the "Maintenance" section. Plans are available here:

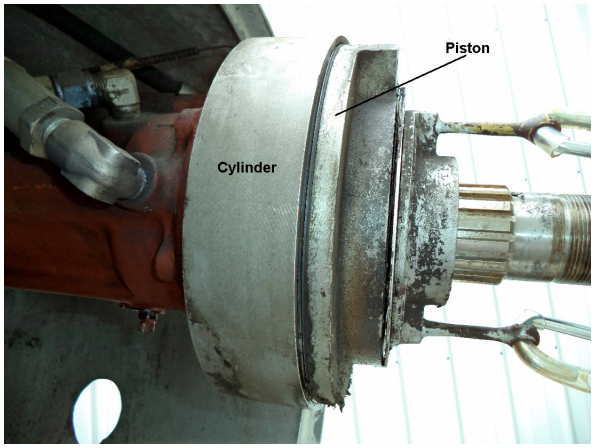
http://republicseabee.com/Files/Seabee%20Bridge%20Stand.pdf.

1-If you plan on reinstalling the prop on your Seabee, leave the engine in the same position while the prop is off the airframe. You can also mark the propeller control cylinder and the prop so that you can reinstall it in the same position as when you removed it. Unless you know of some engine vibration problems you are having this should give you the same engine "vibration", or lack thereof, you had before. If you do have vibration problems you will need to access to a professional that can help you place the prop in the correct position with the proper vibration equipment. I've had this done and it's no big deal. The biggest problem is getting your Seabee to the shop.

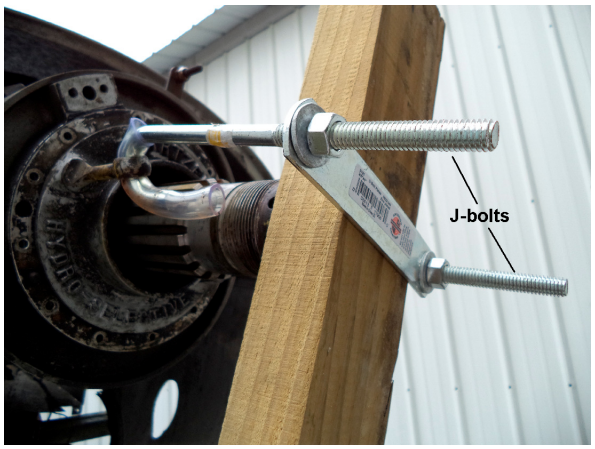


2-Place a 1-gallon bucket under the propeller cylinder to catch the oil that will come streaming out after the prop comes loose. It will be about a quart or so.

3-Remove the locking nut and bolt going through the engine prop shaft and prop nut and throw them away. This bolt is inserted sideways between the prop nut and the engine prop shaft; usually a 3/16" bolt.



4-The special tool you need for the prop nut is also a must-have. Check with your local mechanic or maintenance shop for availability. Most Hartzell props use the same wrench. To get the prop nut off any other way would be futile as the prop nut is torqued to 450 ft-lbs. To purchase one from Hartzell is VERY expensive so it would be worth your while to track one down locally. Member Ed Porter has built his own wrench. It is a 10' x 2" pipe welded to square steel stock that is the same dimension as the prop nut groove. It must have worked! (Photo above)



5-Using one or two men to hold the blades of the propeller (with gloves) and the other standing on the stable platform below the prop, turn the prop nut counterclockwise using the above prop nut wrench (lefty-loosey). It will take some effort to overcome the locking properties of the prop nut to the brass cone force. Or, you can do what Ed Porter did. He says:

"I placed a 5 foot step ladder under my propeller blade. Then I put several pieces of 3/4 " pine on the top. On top of that, I placed a 6" section of NEW Douglas Fir 2x4. This is for the prop to press against. I positioned it such that it is about 8" from the prop blade tip. Better to direct this force to a heavier section of the blade than the tip, which could bend. A hard rubber piece might also be a good idea to distribute the pressure on the edge of the prop blade over 6 inches or so. It's better to have this solid base to hold the prop than to have a person do it who might accidentally let it slip and cause an accident. Remember, this is 450 foot lbs of torque! Use the same method on the other side for tightening when you re-install the prop."

I have done it both ways. Both work equally well but, in any event, keep it safe and protect your propeller blades.

6-After you break the nut loose, keep turning the nut at least an inch or more until it is loose. The propeller will not come loose just yet. You must overcome the force of the propeller piston seals, which is the big round thing just forward of the propeller. I made the mistake of removing the pitch-change arms before removing the piston, which you don't need or want to do. Leave everything attached to the propeller and pull the propeller and piston out as a unit. If you did what I did, you MUST send the prop to the prop shop to get it airworthy again. My bad!

7-I used two J-bolts with vinyl tubing to protect the pitch change arms as shown. If your prop is installed don't do this! You will thank me later.

8-With the prop nut loose (you will feel it), get one man on each propeller blade and wiggle it back and forth slowly and gently until it comes loose. Keep the piston "square" with the cylinder otherwise binding will occur and you'll never get it loose. There is a seal inside the propeller cylinder that needs to be forced loose and it does take some effort. This is where the bucket comes in; once the prop piston comes loose, oil will be pouring out of the prop cylinder! (It might be a good idea to remove or at least loosen the inlet and outlet hoses to allow the assembly to be removed easier)

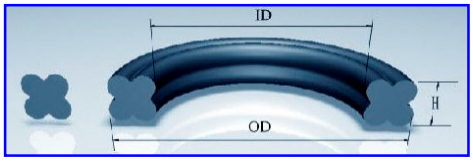
Here is Ed Porter's explanation of the above procedure and reinstallation. It's a good one if I may say so:

"I was reluctant to pull hard enough to remove my prop this way. But my mechanic, with 40+ years of experience was confident this was the right way. He and I pulled the prop off this way. But, in 20-20 hindsight, it's a shortcut for someone not having a good puller customized to the large piston and pitch controls.

"When I went to replace the prop assembly, the piston would NOT go into the cylinder completely. It was one of the 3 guide rods being slightly out of position. But, we didn't know what at that time. We DID know we shouldn't force it. So I decided to take it off again and correct whatever problem was stopping the piston.

We proceeded with the same 2-person method to wiggle off the prop and piston assembly. But THIS time, the cylinder, the 3 interior guide rods, and the 2 prop pitch control guide rods had ALL become mis-aligned! It wouldn't come off!!
Now a helper and I continued to try to pull the assembly off but, the pitch control arms slid off their smooth chrome guide posts and the prop came off without the control piston! Most annoying! AND, Now, I couldn't get the piston to slide out!
Well, once again my doctor, the experienced mechanic, came to save the day. With his fingers, he re-aligned the piston and pulled it right off!
In 30 minutes or so, we carefully wiped the O-ring grove in the piston with clean flannel cloth.

I installed replacement O-rings but NOT standard O-rings. I purchased special QUAD-rings (called X-rings by another manufacturer) If you haven't seen these quad-rings before, imagine 4 O-rings together manufactured as a single seal. The cross section looks something like a 4-leaf clover. This design seal is MUCH better than a standard O-ring (see illustration below).

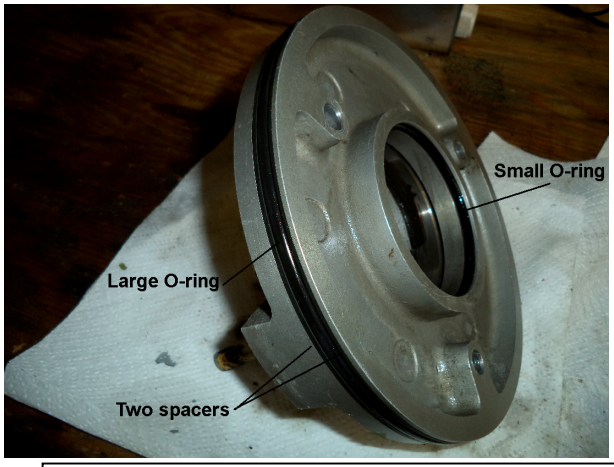


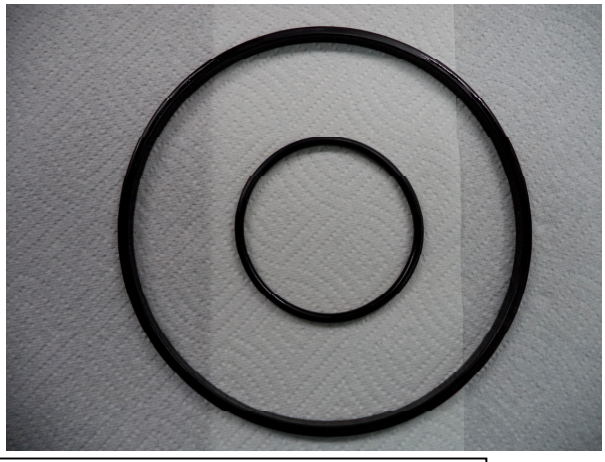
We put it all back together and, I add, its quite useful to exercise the pitch of the blades to assure its all aligned correctly and you get full travel..
Then another hour of putting everything back in place and doing the safety wires.

Note: The Quad-ring is an exceptional improvement over the standard O-ring. After I ran the engine, I was stunned to find that there was not a single drop of oil leaking out! I have owned this airplane for 25 years and this was a perennial oil leak. I was told Seabee owners just have to accept the leak. NOT TRUE! This is one of my best days since I bought my BEE in 1990!

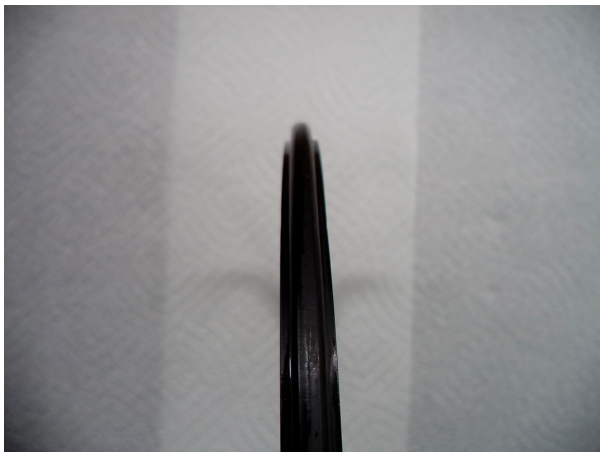
One final thing: I had put in a quad-ring set previously. I guess then I forgot about it. The prop went for its 5-year service to the prop-shop in January 2011. ONLY last week when I re-did the seals did I learn they had taken out my Quad-rings and replaced them with standard O-rings! Don't let them do that!!!!! Tell them in advance! Either keep the current Quad-rings or else put in a NEW Quad ring set! Standard O-rings leak a little, Quad-rings: MUCH LESS!!!!!

9-Once the prop/piston assembly is removed, check the prop cylinder for any scratches or deformities. ANY scratch in the cylinder will cause an oil leak. Replacement of the cylinder or major rework will be required if scratches are evident. Also check the three guide pins for damage or misalignment. The guide pins are very important to the proper operation of the propeller system; they must operate flawlessly.

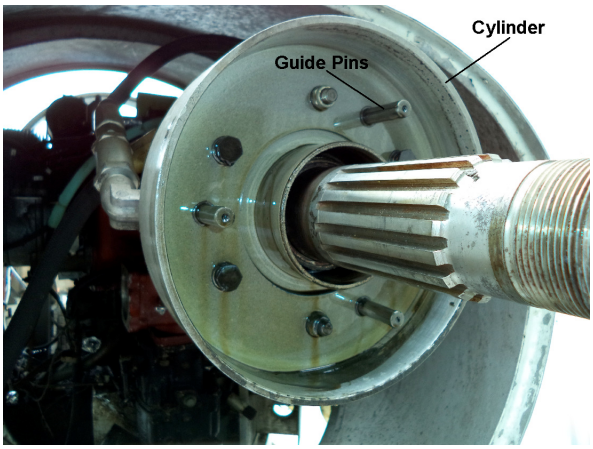




If you see two large spacers (above) next to the seal, it is the original installation. Replace the seal with Quad-seals. That will eliminate the spacers.



Original Seals (above): Large one is not really an O-ring as it has two flanges on the sides of the seal and is flat on the inside of the seal. Smaller seal is a standard O-ring



Check the guide pins for distortion. Check cylinder for ANY scratches as these cause oil leaks.

10-The prop piston has a very large (8") seal on the outer circumference. There are also two flat spacers that ride next to each side of the seal. The newer Quad-seal O-rings are much better and will eliminate the two spacers. Ed Porter says,

"Now that I see your pictures, my old O-ring, and my new Quad-Ring, I'm convinced the original design was a "leaker" from the start and used a woefully inadequate seal. My "old" O-ring that the prop-shop put on my pitch control piston is about half the thickness of the Quad-Ring. I can't imagine it actually sealing. And with 50 lbs of hot oil pressing on it, I bet it leaked constantantly! And I wiped the oil off the back of my plane on every flight to confirm that guess...

We too often surrender our power. This is a good example: I knew in 1990 that I wanted a Quad-Ring for this piston. Yet, the prop shop, apparently more than once, discarded my quad ring and replaced with the old, poor design O-ring. I should have realized it! But, the prop shop is the FAA approved agency that can sign it off.... Go Figure!"

The newer "Quad-seal" O-rings are a much better seal than the original 3-piece seal as Ed explains. The Quad-seal is wide enough to take up the space in the piston groove so a nice tight fit is assured. Clean the piston and check for scratches and damage. There is also a smaller O-ring (≈4") inside the propeller piston. This will be replaced too. A Quad-seal O-ring would work nicely here as well.

11-Once you are satisfied with the condition of the cylinder and piston, coat the O-rings liberally with grease or engine oil and replace them. There are four O-rings in the prop cylinder assembly. Two on the piston and two smaller ones inside the propeller control valve; one is WAY inside the valve.

12-Reassemble the propeller/piston assembly back on the engine carefully keeping the same propeller orientation as when you removed it. This, again, is a two-man job. Use care when aligning the propeller and piston and reengage the prop nut. Turn the nut slowly making sure the piston goes in straight and that the guide pins are engaged correctly. DO NOT TIGHTEN TO 450 ft-lbs YET. Ed made sure the propeller pitch changed and the piston moved in and out by twisting the blades before the toque value was reached. With no oil in the propeller cylinder and the inlet and outlet hoses removed, this should be relatively easy to do. If there is any binding or no movement at all you must remove the propeller again and check for the cause (as Ed did above).

13-Ok, now have the other men hold on to the prop blades (with gloves) and using a torque wrench, torque the prop bolt to 450 ft-lbs. (Or you can use the procedure Ed Porter used above). A two-foot wrench will require a 225-pound man to torque the nut; or you can use a wrench extension like Ed did above. His 10' wrench required a 45-pound force to give 450 ft-lbs which is much easier. Just make sure you do the math to get the torque right:

(450 ft-lbs ÷ wrench arm in feet = wrench torque in pounds required).

14-As you get close to the torque value (450 ft-lbs), check the prop nut locking holes are in alignment with the propeller shaft holes and reinstall a new 3/16" locking bolt and nut when 450 ft-lbs is reached.

AUTHOR'S NOTE: I must explain that I had no intentions of using the propeller I took off, as the Seabee it came off of is a parts plane. Not ever having a Franklin Seabee it was surely a learning experience for me.

NOTE: Any mechanic can help you do this procedure, however, if you remove any of the propeller hardware like I did, you MUST send it back to the propeller shop for re-certification. That could be very expensive.

I hope this helps you and please let me know if you need any additional information. Contact me at **smestler@pbtcomm.net** or go to the Seabee Club website at **www.republicseabee.com**. And thanks again to Ed Porter for all his help!!