Ten Minute Impeller Replacement

4JH4 Water Pump Modification – Hunter 49

Designer & Test Subject: Arthur Boas, Doc Editor: Jim Landon

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This document describes how the 4JH4's water pump can be changed for purposes of simplifying impeller maintenance.

Contents

Problem Summary

As you know, on the previous 4JH engines (they have since fixed this) the water pump faces the rear of the engine. To make matters worse, it is located under the alternator. With the sub-floor engine, the only way to get at the impeller is removal of alternator, belts, etc. It is a horrible job, and can only be done at dock in about 1.5 hours minimum.

I have never changed the impeller in my engine for this reason, but there was no way I was going to risk cruising. The only solution was to put in a more accessible pump. After much searching, I found a crankshaft pump, where the base spins, and the pump body stays stationary. Johnson has a perfect pump, as it used the same impeller as the original Yanmar pump (of course also made by Johnson). The problem was mounting on the crankshaft. The pump base has a bunch of really odd size & location holes drilled into it.

It should go without saying, but be sure to read this entire document so that you thoroughly understand what this modification entails. I expect some people to say that it's either unnecessary or too expensive. But what amount of money would you pay someone to rescue you in 30 knot winds blowing onto a lee shore when your engine failed owing to the impeller not being serviced yearly? Others might say, "Aw, forget it, 'cause it's gotten too complicated". But, irrespective of whether you have to remove an engine mount, this doesn't change the fact that if your impeller goes while you're at sea, you are totally screwed. So, just fix it, and be done.

More on the Problem

As I'm sure you'll recognize, here is a (more or less accurate) photo of the 4JH engine I have. You will see that I have the "Floor Modification", which opens up access to the front of the engine. Consider this a prerequisite. Refer to earlier write-ups on the Floor Modification.

As you know, the water pump sits below the alternator facing aft.

Now, if the engine was sitting above floor in a center cockpit boat, I could see this being accessible. This is a Yanmar photo showing exactly how the water pump is situated.

However, getting at the water pump requires removing the alternator, and the water cooler. It is a 2 hour job (typcially) *if* you are sitting at a dock. However, with the boat rocking around in the waves, this can be impossible.

Yanmar Water Pump Placement Design

First of all, the impeller housing placement was not Yanmar's best design, which they have remedied on their new 4JH. The water pump now faces the face of the engine. Short of buying a new AC 50, or dropping in a new engine, I'm stuck with what I've got.

I looked at many options, including making custom long reach tools, installing a few mini cameras to work remotely. None of these concepts work... At least not in a bouncing sea.

So, I figured out the obvious solution... Get rid of the existing pump!

So, this opened up other ideas, such as installing an electric water pump. Initially, this sounded like a good idea, but in reality it's not practical.

The engine needs about 10 GPM, which is a lot of continuous flow. More importantly, if you run water through the engine without exhaust gas pressure present, you will flood the exhaust, and get water in the cylinders. Not a great idea. So, electric is out.

Then, the thought of mounting another pump to be belt driven came to mind. Ok, not too bad, but there is definitely some work involved. Only two choices are to lengthen the existing alternator belt, and somehow mount a pump on the engine face. This would likely involve another idler pulley, so now I'm in the engine-redesign business. Plus, water pumps are pretty fussy about side loading, and as I've got the upgraded alternator, the belt needs to be pretty snug.

Plus, if you look at the above photo, there really isn't any room on the front of the engine to do this.

Decided to go through the Johnson pump catalog, and look for ideas. I then found the ideal solution: A crankshaft pulley pump, model F5B-9.

Not sure if you've seen these, but it's basically a pump which mounts on crankshaft center and the base rotates, while the pump body is held stationary. Here is what it looks like:

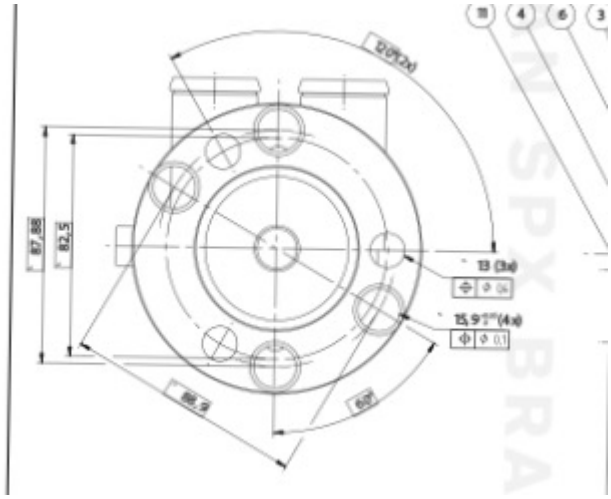
So, the black base mounts to the crankshaft pulley, and you affix a stabilizer arm to the small round threaded shaft which is sticking out the side. The body stays still, and the base rotates. Cool!

After a LOT of discussions with Doug Dykens (Yanmar) and Johnson pumps, everyone said this was feasible.

One great thing is that this pump (F5B) is essentially the same pump as the existing Yanmar gear pump. As you may know, Johnson makes Yanmar's pumps, and the F5B even uses the same impeller that the gear pump uses. And they can be found for around $200.

First Problem and Resolution

The problem was mounting on the crankshaft. The pump base has a bunch of really odd size & location holes drilled into it. There are actually 3 holes on the flange on the identical bolt circle, but the holes are huge. And the other 3 holes on the engine crankshaft pulley are missing. So basically only 3 of these holes lined up with existing 6 bolts on the front of the crankshaft pulley.



As you can see in the above diagram, the hole pattern is a bit strange. Three of the seven existing holes will be used (blue stars below), while 3 new holes must be added to the F5B pump via a milling machine, and a qualified machinist (red stars). The 6 holes are on a bolt center as shown in the diagram photo below. You need to drill generous clearance for M8 thread.

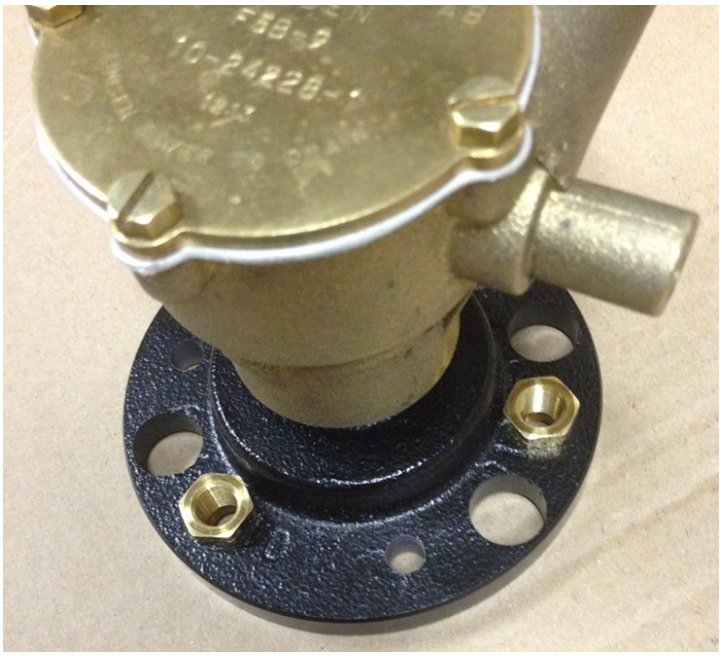
On the Yanmar crankshaft pulley, there are 6 holes, 8mm threaded, on a 82.5 mm bolt circle.

So, it wasn't a huge problem to put in the missing holes, but reducing the existing ones (blue stars in the above picture) meant machining some reducing bushings. Doable, but not free.

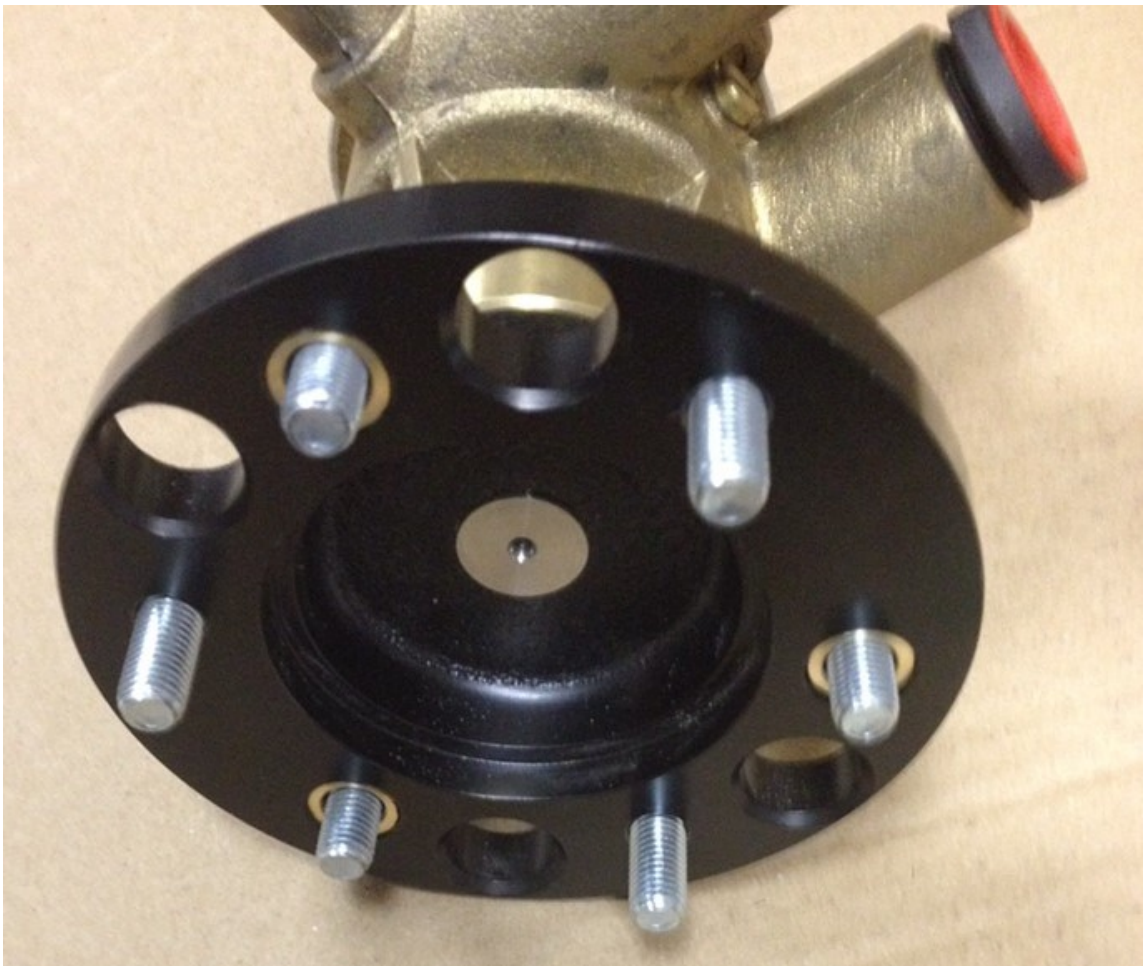
So, I did what I do whenever I get stumped. I go to Home Depot, and a bunch of other hardware stores.

And, surprise, surprise... I found some brass plumbing adapters which required a tiny bit of modification; I made 3 brass reducing bushings for the 3 oversized holes, and drilled 3 M8 clearance holes for the other 3 locations, and they bushed the huge holes down to 8mm perfectly. And, they cost 90 cents!

Here is how the pump now looks.



This shows 8mm bolts sitting in all six holes. Perfect!



Again, the pump's black mounting plate attaches to the crankshaft pulley, which is also acting as a flywheel. The balance of this pump by adding some brass bushings is insignificant.

Second Problem and Resolution

As stated, on the Yanmar crankshaft pulley, there are 6 existing M8 bolts on a 82.5 mm bolt circle.

But, as you can see, in the center there are guide wedges which sit above the pulley surface. Therefore, the pump won't sit flat on it, and the pump cannot just be mounted directly on the pulley.

I thought of making an aluminum adapter plate, but (1), this is a lot of work, and (2), if you remove all 6 bolts to install the plate, something might shift between the harmonic balancer & the pulley. Therefore, you just don't want to pull all the bolts.

I thought of putting flat washers between the pump and pulley, but you'd have to stick them to the back of the pump, and this all gets messy.

So, here's what I did:

I bought stainless M8 set screws 50mm in length. Then I threaded on a nut, flat washer & lock washer.

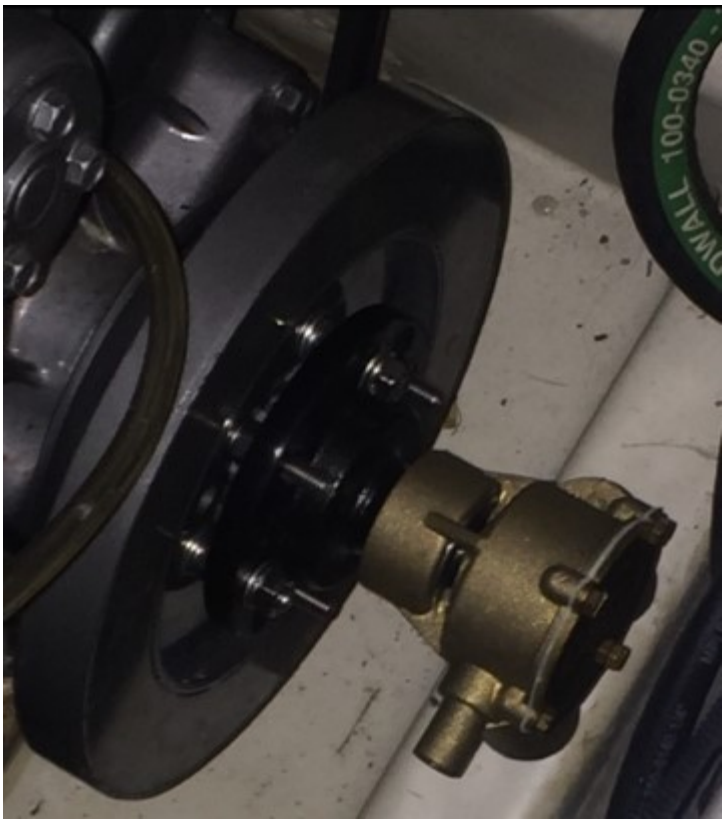
This photo also shows the new bolt in comparison to the old. Notice the objective is simply emulating the original bolt while having a stud protrude from the back side.

I removed the existing bolt, screwed in the stud, and tightened the nut. Then I slipped on another flat washer.

Now, I have a M8 stud screwed into the pulley. And this lifts the pump base clear of the wedges.

One at a time, I removed each bolt, and screwed in a stud. It then looked like this:

So, now the pump just pops into the threaded studs.



Then you put on flat washers & nuts, and you're done.

Here is a huge benefit to this: as you know, my engine is mounted sub-floor, and is sorta boxed in at the front end by my generator.

Third Problem and Resolution

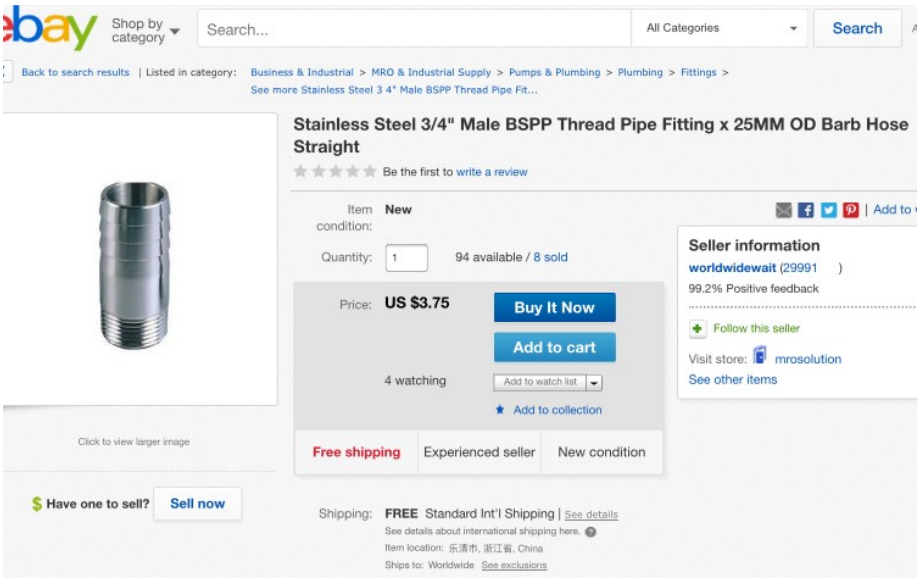
The Johnson F5B-9 pump comes with outlet ports which are designed to have 1-1/4" hose slip directly over it. You will notice on the ports of the pump there are threaded plastic bushings that screw into the pump ports. These pump ports are threaded with 1" BSP (**British Standard Pipe)** threads.

The sole purpose of these bushings is that they add a "lip", which a 1-1/4” hose slides over. Once you fasten a hose clamp onto the hose, the hose forms around the lip, firmly holding the hose onto the port. If you didn't have this interference lip, then the hose could slide off of the port if the hose wasn't really cranked down tension -wise. The lip is a good idea.

Unfortunately, the through hull fitting for engine sea water intake and strainer, on my boat, are both barbed for 1" hose and not the 1-1/4” hose.

Again, the plastic outlet port on the F5B-9 pump has a 1" **BSP** thread on it, which is a parallel thread, unlike the typical bronze barb fittings which have NTP (**National Pipe Thread**) male threads designed for tapered threaded pipes and fittings. The reason they used BSP was so that the plastic bushing could screw in easily. It didn't need to have a leak-proof, tapered, thread seal, because the hose was slipping over it.

A NPT thread is a tapered thread, and forms a seal by having the threads interfere or lock up on each other as you tighten up the fitting. Conversely, the BSP is a straight thread, similar to a standard machine screw. It doesn't bind up as you insert it. So the problem is, I needed to somehow adapt the pump ports to accept 1" hose. And for the "magic solution", I went on eBay, and they had the exact parts. Not in bronze, or Marelon, but in 304 stainless. And for $5 including shipping!



And here is the pump with the threaded barbs installed.

And here is a close up with the pump installed and the hoses. Yes, you will need to buy some more hose. I was not able to get the same hose that hunter has. Mine has a thicker OD and it's from Trident. Top quality stuff; do not skimp here.

So, with this spiffy modification, to work on the impeller I have two choices:

(1) Undo 6 M8 nuts, and the pump pops off. I can basically have it in my hand with the hoses still attached. Removing it will be less than 5 minutes at tops. And because they are studs, re-installing is a breeze; just slide it back on.

And (2), later, with the Jabsco impeller puller (see below), I am actually able to remove the impeller without removing the pump. It is super easy, as you have lots of room in front of the genset once you do the floor mod (again, refer to the Engine Access document!).

Here is an image of the Jabsco impeller puller, a standard tool, which you can find on EBay for 1/2 the price.

Anti-rotation Solution

A side note regarding your possible concern with movement of the engine from torque and thrust. If you look at the little stud protruding from the right hand side of the pump body, it has a female thread. This should be attached to a mechanical arm which is somehow affixed to the engine. Now, I tried very hard to formulate a rigid arm which screwed to the engine block, but was unable to come up with a proper solution. Realistically, the hoses themselves will keep the pump from rotating, but you don't want to rely on that. So for my solution, I mounted an aluminum angle bar across the engine bed, and mounted another piece which screwed to the pump. Now, this is generally an awful idea, because the engine moves on its mounts, and the bed is stable. You would never want to rigidly attach the pump between the engine and the bed. But what I did was grossly oversize the screw hole, so that the shoulder screw "floats" in the hole, making this solution palatable. In actuality, it doesn't even need to be a hole. It could just be 2 bars on either side of the shoulder screw to stop it from moving. I'm planning on re-doing this once the boat is hauled out to somehow make the rotation-stop arm attach to the engine.

You will note that in my solution I installed a shoulder bolt and there is a significant amount of play between the size of the hole, and the shoulder bolt. So, effectively, the hole is equivalent to a stop rotation ledge, which just keeps the pump from rotating further. I then installed a shock cord which pre-tensions the pump in the opposite direction, to hold it the other way. The effect of this is that when the engine starts, the pump moves to the right hand stop, and stays there. When the engine turns off, it goes to the other stop. Without the shock cord, the pump would bang once or twice between the two stops because of system inertia.

Here is a photo of this anti-rotation solution.

Cleanup

When you pull the original pump, you need to install a cover plate and a gasket. The cover plate is Yanmar part #129150-01870 and gasket #129150-01881. These parts are cheap and in stock.

However, on my engine, I do need to mention one other thing about the impeller upgrade, which took a bit of work. On my boat, (may not be the same with all 49s), the engine mount stud interfered with removing the pump. If you look at the photo of the engine & relative location of the pump, it becomes very obvious from the photo showing how the pump is mounted on the engine.

So, I had to pull the engine mount to remove the pump. This isn't for the faint of heart, and depending on your skills and comfort level, you may need a pro on hand to help you. What I did was put a heavy bar across the top of the companionway, and a chain hoist took the weight of the engine when the mount was removed.

However, if you simply want to change the impeller in the existing pump, you DO NOT need to pull the engine mount. But you do need to pull the alternator, etc., hence the motivation for this modification. And of course this unmounting business is a one-time thing.

Project Time Estimates

If you are an expert, these instructions should take about a day.
If you have an expert's help, these instructions should take a bit less.
If you are an average Joe and tackle this by yourself, this may be a two day exercise.
But any way you look at it.. it's definitely easier when someone (me) shows you the solution so you don't need to figure it out from scratch ☺

Conclusion

Yes, this has been a real challenge to come up with this. But, I just feel that something had to be done, and lying chest-down on an engine for several hours to change an impeller doesn't work for me. Again, 30 knot winds blowing onto a lee shore when your engine failed doesn't seem like an option to me.