My Winter Project
The Nissan Conversion

by Gary Orloff

This whole thing started when my good friend Stu called me and asked if I wanted to go get a cup of coffee. Being the morning person I am, I said sure I'll be right over. Upon arriving at Stu's and chatting about motors for a bit, Stu said hey I've got something for you if you want it. Of course this piqued my curiosity as Stu used to be in the race circuit and had quite a stock of old Merc parts and memorabilia. What I didn't expect was a lowly blue and gray 5 hp Nissan with a box of parts next to it.

Stu explained to me that some guy had dropped it off and asked him to look at it and see if it could be repaired. The power-head seemed to be intact but the lower-unit was in the box of parts and from a quick glance looked to be in sad shape! Stu said he'd never worked on one and didn't even know where to go for parts. I should preface that statement with the fact that Stu is a certified Mercury mechanic and has repaired more Mercs than most people have ever seen. He asked, "do you want it?" Naturally I said yes!

As old Grandma Gerda always said, every gift is good no matter what it is. Upon getting my new prize home I took the box of parts and the remainder of the engine into my garage shop. My first glance was fairly accurate. As I took the lower-unit apart further I could see it was full of rust and beyond saving. (photo 5) The parts alone would probably cost more than the motor was worth. So at this point I thought, just put it aside for now and go look up what the parts would cost.

I found a couple web sites that had parts for Nissans and with the model number I determined it was a 1992 year, single cylinder, water cooled long shaft. And yes the parts would be well beyond the value of the motor. So repairing it just didn't make sense! Maybe if I got lucky one might come my way that had a good lower-unit. I still hadn't looked at the power head closely to determine if it was worth keeping.

Someone once said. "You only have one chance to make a good first impression."

So when I took the hood off the little Nissan I was surprised at how good it looked. (photo 2) Everything seemed there and in great shape. I pulled it over and felt very good compression. The next step was to check for spark. I pulled the plug and put my spark checker on the wire. It produced a nice blue spark. After pulling it over the first couple times I didn't think it was necessary to do a compression check. Not knowing when it had been run last and being a newer engine by antique outboard standards, I didn't think I needed to go to in depth engine surgery.

This model of Nissan has the gas tank mounted under the hood and someone had taken it off. The good part is it was with the box of parts along with all the nuts, bolts and washers. The tank mounts above and behind the power-head on four rubber snubbers. It has a fuel petcock/filter under the tank with a long shaft that connects to a knob on the front of the lower cowl.

I decided to take the carburetor off and clean it. It's a fairly simple model and there wasn't a bit of dirt in it. The throttle linkage is operated by a cable similar to a motorcycle throttle. One of the things I didn't care for was how the

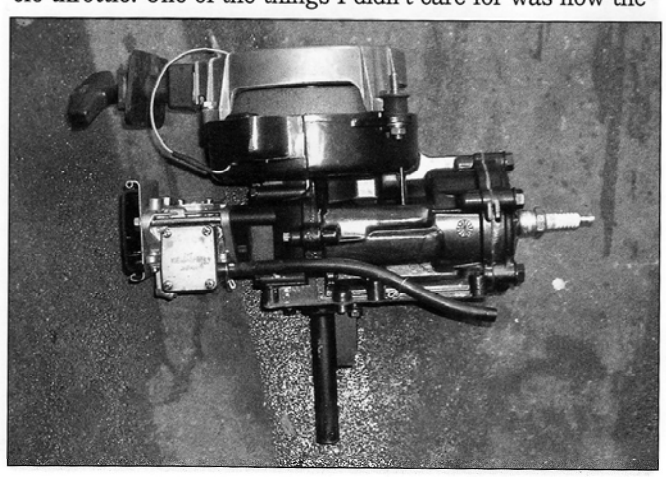


Photo 1: The complete Nissan.

L: Photo 5: Nissan gearcase parts.

R: Photo 2: Powerhead.

choke arm connected; it used one of those little plastic clips that always breaks when you try to snap it in. But I guess that's a sign of the times as most on the newer motors use them.

With the lower-unit being trashed and the water pump impeller shot I wondered if I could just hitch a hose up to and try starting it. So after I got everything back together less the lower- unit and pump assembly, I put together an adapter to fit the water tube coming down from the power-head, gassed up the tank, connected the hose to the adapter and fired it up. It started on about the third pull and idled about 3000 rpm, or at least that's what it sounded like. Being a single cylinder it sounded like a big chain saw. I wasn't sure what type of piston or induction design it had but guessed it was a loop-charged style. I later confirmed that looking at the parts break down. The engine ran smoothly and accelerated strongly.

All kinds of ideas were running through my mind on what to do with it now that I knew the engine ran and was in good shape. In looking more closely at the paint job, I think it was used in salt water, as there are areas where the metal was corroded under the paint and only took a little scratching to chip it off. Also the lower-unit had a lot of corrosion along with the rusty gears and shafts. I decided to put it aside for now till I could figure out what to do with it.

Another project came along to keep me occupied, so the Nissan wasn't number one priority any more, but I kept thinking about what to do with it and an idea was starting to form in the back of my mind.

Going back in my life to when I was in my late teens or early twenties one of my favorite things to do was to go to all the army surplus stores located throughout the Cleveland area. Somewhere in my travels I came across a half a turbo charger from something. (photo 6) It was the blower side that pushed air into the carburetor to increase HP to the engine. I don't remember all the details of where I got it or how much I paid for it. But I think I was going to try putting it on my car engine to beat all the hot rods around the area. For whatever reason it never happened, but I kept the turbo kicking around all these years. I had always thought some day I might try making a jet drive for an outboard with it and even went so far as to adapt a Lawnboy mower engine to it to make an inboard jet drive for a canoe. Again for some reason I never finished it. Since that time with the Lawnboy engine I just kept thinking some day an outboard will come along that the lower-unit will be in too bad a shape to use and I can make the jet drive.

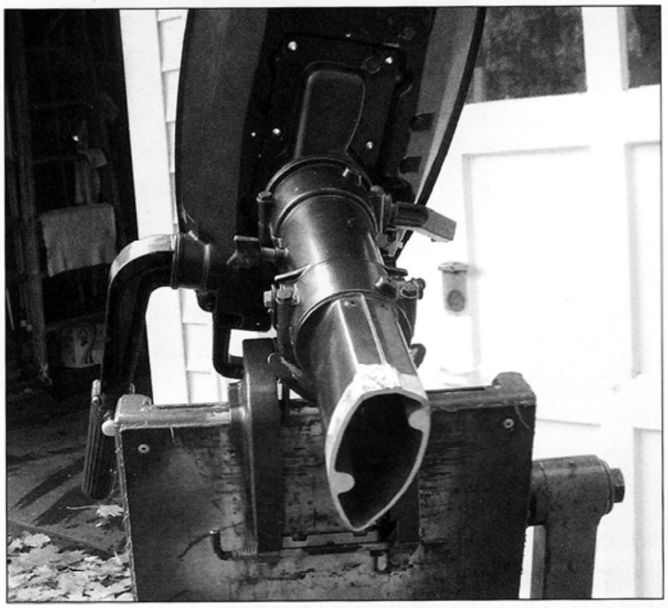
Enter the Nissan, the perfect solution for my old dream to come true. I knew it would be a long shot and the results could be an attempt in futility, but I had wanted to do this for as long as I can remember. So my first step was to look at the mid section of the Nissan to see how much I needed to cut off to position the turbo pump housing at the right height for it to work properly. (photo 3) The boat I planned on trying it on is my little Arkansas Traveler a 14 ft. long rowboat with a standard transom i.e. short shaft. It measured about 15½" from the top of the transom to the bottom of the boat. I guessed that I needed most of the turbo housing to be above the bottom of the boat and just the intake slightly below it. My next step was to calculate exactly where to cut the mid section to shorten it. (photo 4) As I mentioned this model Nissan was a long shaft and I would need to cut out about 12" from the mid section. I thought the turbo housing was made out of aluminum and I would be able to weld it directly to the mid section. What I found out was, it's magnesium! At the time I didn't think this to be a problem as I still thought I could weld it!

The discharge of the turbo housing was off set from the center of the vertical shaft and would require adding a piece of tubing the same size to correct it to centerline. (photo 6) (photo 7) The housing had a flange on it that

Photo 3: Starboard view of lower cowl and swivel, after tower was shortened.

Photo 6: Curve pipe with turbo pump.

Photo 7: Curve pipe in position on pump.



apparently connected it to whatever tubing it was originally intended for. I thought maybe I could find a similar flanged piece to correct the discharge but then thought no I'll just weld it on, as it would make a smoother flow inside the tubing. I decided to cut the flange off and prep it to weld my adapter tube to it. Not having ever welded magnesium, I

thought I better try doing it on the piece I cut off before I tried welding the final piece. When I first tried welding on the magnesium it seemed to go pretty well, but wasn't quite right, something was out of sorts! Thinking maybe I was doing something wrong I decided to check into it on the internet. After doing some research I found several forums that talked about the process. I then found a Q & A site and just asked the question what process do I use to weld aluminum to magnesium. What I got back as an answer surprised me. They said you can try welding it but if it hits anything harder than an egg it will crack like glass!

Hearing this, I thought it can't be that bad as I already welded a little bit on the flange I cut off, so I tried tapping it with a hammer! Wow it did crack like glass and the weld area looked like crystallized quartz. So this really threw a monkey wrench in my process of assembly. Back to the drawing board.

Fortunately I have many creative friends to tap into when I run into a brick wall. Tony one of my more inventive buds suggested, could you epoxy the two pieces together? I said I'm not sure, as I don't know how much pressure the water would put on that elbow piece I intended to attach. So what if you wired it together! Brilliant! The idea lit up in my mind like photo flash bulb. I could drill a series of holes around the edges of both pieces and string some stainless wire through the mating holes then twist it to tighten the joint up! Then coat it with epoxy inside and out. Much to my surprise, it worked pretty well. Even the epoxy, which I thought would sag and droop, making a mess, stayed in place and hardened up, producing a fairly smooth discharge tube. (photo 9)

I should mention how I made the piece I used to correct the flow. I had gone to a place that bends tubing for all kinds of applications, like fire engine plumbing, decorative tubing etc. What I needed was a piece of 3" diameter tubing about 10" long with a short section bent at about 30 degrees. I left the turbo housing with them so they could make up an estimate. When I got the price, I almost fell over, $300 and change, just a bit out of my budget. Well necessity is the mother of invention, so my next pursuit was to find a piece of tubing I could cut and weld forming a curved piece. One of my other friends, Kevin, who happens to own our local prop shop just happened to have the exact size I needed and was good enough to give me a piece long enough to do the job. After doing some calculatin' and figgerin', I made a couple cuts with my chop saw and had the curve pipe I needed, it just had to weld it together. That was the easy part.

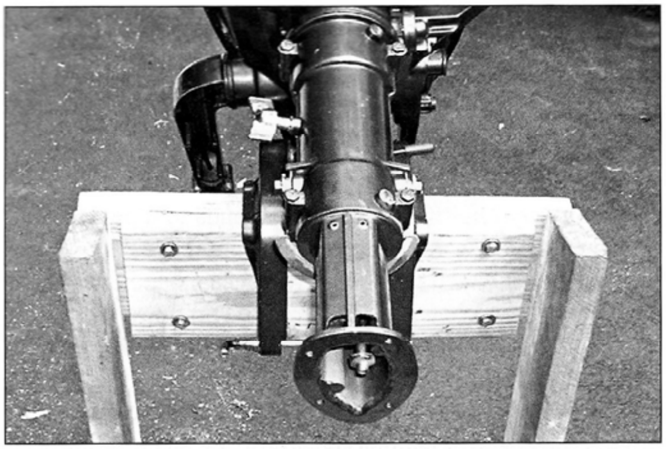
Now I was on my way. The next hurdle to get over was how to attach the housing to the mid section. The top of the turbo housing has a flat surface that bolts to the housing. (photo 12) It actually holds the bearing area for the

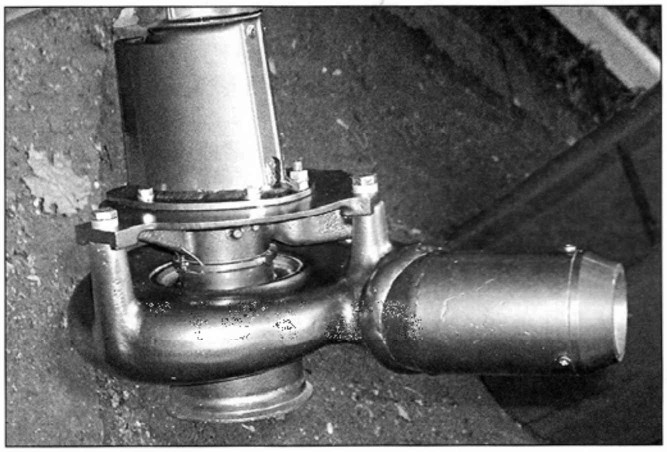
Photo 4: Nissan midsection cut.

Photo 9: Intake turbo.

L: Photo 12: Impeller.

R: Photo 8: Turbo pump body.





vertical shaft and impeller. (photo 8) I decided it shouldn't be too hard to make a flange and weld it to the mid section then bolt it to the flat surfaces of the turbo. Part of that problem would be establishing the exact center for the vertical drive shaft and making the cut on the mid section as perpendicular to the shaft as I could. In talking with some of my friends in our club I had offers to do a milling job after I made the initial cut, being that would require taking the part down to my buddy Scott, about a two hour drive, I opted to try doing it myself.

While making the cut I had flipped the engine upside down so I could look down the inside of the mid section. What I found the clever people in Japan had done was to cast an area around the drive shaft just above where I made my cut that would hold a circular piece in position to perfectly center the drive shaft. I measured the area for the needed diameter and turned a piece of plastic to fit. I also drilled it to the diameter of the drive shaft. This would hold everything centered so I could slip the flat section of the turbo housing down the shaft till it touched where I had made the cut. I then kept filing and fitting it to the mid section till it had contact all the way around where I had made the cut. I made the flange about ¾" larger than the mid section and clamped the flat section of the turbo and the flange together with vice grips so I could weld it. (photo 17) This seemed to work pretty well and once welded I marked where I would place the bolts to hold it together. (photo 16)

While I was doing all this measuring, cutting, fitting and welding I was also making a short shaft to assemble the turbo housing with the impeller in it to do a proof of concept i.e. see if it would actually pump water!

The shaft was the short section I had cut off the original vertical shaft, so I knew it would fit the bushings I made for the turbo housing. The idea was to get everything put together, put the turbo housing down in a tub of water and power it with my electric drill. Great idea Gary, electric drill, tub of water, sounds like a recipe for disaster, but being the adventurous individual I am I decided to give it a try. I used our washtubs in the basement and filled them about half way. When I turned the drill on, wow it actually moved quite a bit of water, but it also seemed to come out swirling like a corkscrew and not with enough velocity to push a drunk seagull off its perch. Back to figgerin! I determined I needed a restricting nozzle, but first I needed a fair sized chunk of aluminum to make it out of. Good buddy Tony came through for me again. Now using the mathematical equations of SWAG and dropping the inside diameter from 2¾", it calculated out to $1+{}^{15}/_{16}$th for the discharge. The piece Tony brought me was plenty big, about 3" dia and about 3" long. It took a fair time to saw a hole through the slug of aluminum then bore it to the correct dimensions. I tapered the inside from the 2¾" down to the $1+{}^{15}/_{16}$th with a lead in of 1½". Once all the machining was done I needed a way to lock it in place; three small screws did the job.

The impeller is about $3^1/_4$" in diameter with 5 blades and about 1" deep. The blades have a slight curve to them to grab the air and pull it in. As the impeller was originally designed to push air I thought it should work somewhat the same. Someone once told me movement in water is much the same as it is in air and things react similarly; water is just thick air. We'll see! (photo 12)

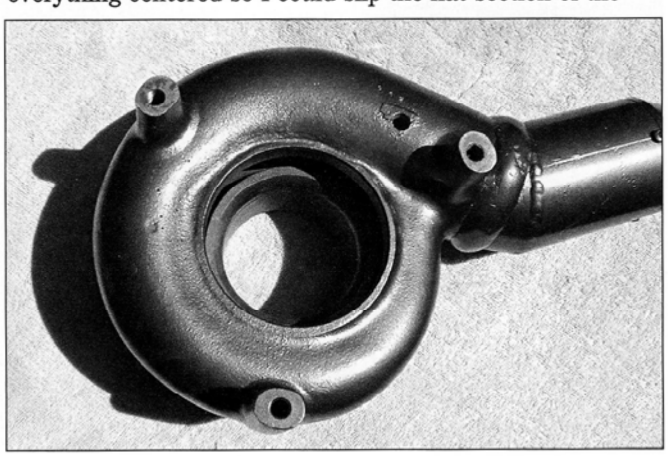
Back in the test tank i.e. wash tubs I turned on the drill

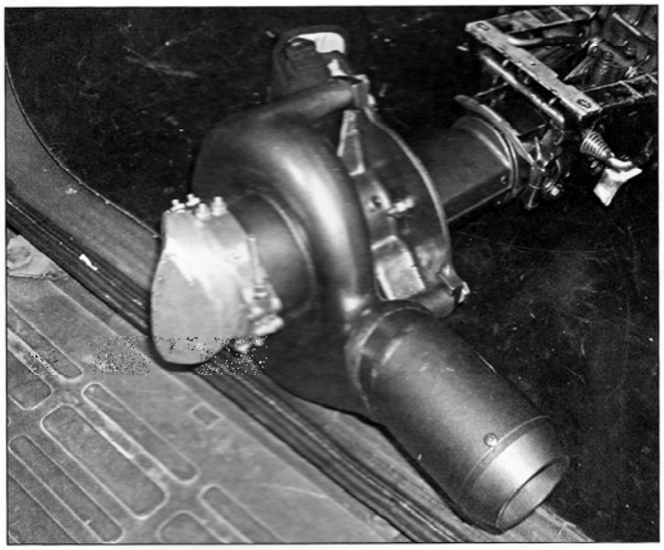
Photo 17: Mid-flange.

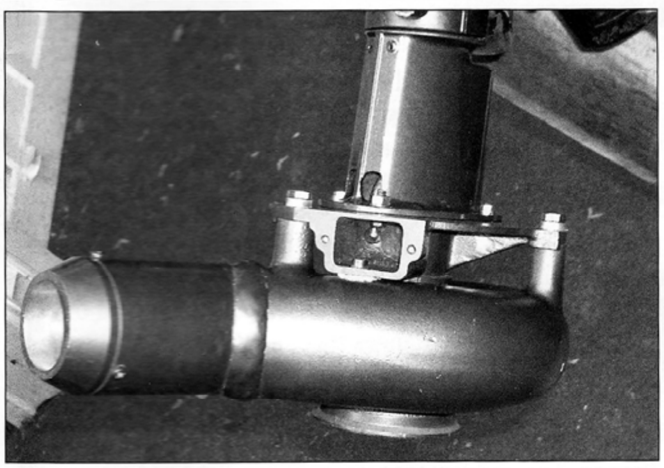
Photo 16: Nissan pump.

L: Photo 10:

R: Photo 11:







to full RPM. Holy Mother of Mary! I got a bath as well as drowning most of the surrounding area, but came up spitting and smiling from ear to ear! The SWAG theory worked. Plenty of thrust and at only 2000+ RPM! The Nissan engine should far exceed that!

My next hurdle was how to cool the power-head, which I had removed from the lower cowl & mid section to see how the water tube fit going into the engine. (photo 3) The tube is 1/4" diameter and made out of brass. It comes up through the mid section and has a 90 degree bend at the top with a rubber grommet on it. The grommet fits into a slotted area that feeds up through the powerhead. Of course the tube was too long for the now shortened mid section, and since there was no water pump to plug into, I thought I should be able to tap off the turbo housing to supply cooling. There is a section on the flat piece bearing housing that must have been for an oil wick or something and was in an area above the turbo housing that I could drill through with a small scoop fitting to pick up the water flow from the impeller. I made the fiting out of 5/16" copper tubing, and designed a small 90 degree elbow on the tip that went into the water flow. (photo 14) It worked pretty well at higher RPM but I'm not sure it will push enough water to cool at idle. That part of the concept will have to be proven when I first run the engine, and may be another hurdle to overcome. The little copper adapter fit into the area where the wick used to be and the water tube fit into a hole I drilled at the other end of the wick passage to feed the power-head. (photo 10) So at this point everything is ready to assemble and try out. One of the last things I might have to do is make some kind of an intake grid or screen to keep the big stuff from being sucked into the impeller. The bottom of the turbo housing is an opening about 3½" and has a flange on it like the one I cut off the discharge, only a little bigger. I think I can make a mating flange with a slope angled in the direction of flow. But I might just try it before I commit.

Steve, our chapter president, had sent out an email that he was hosting a meet at his place in a couple weeks and I thought this would be a perfect time to test the Nissan. Steve has a nice big test tank and he said he had just filled it up so anyone wanting to run an engine could bring it to the meet. I had a couple more things to do to the modified Nissan jet before it would be ready for its maiden run.

One of the most important things was to figure out where I was going to put the exhaust outlet. The flange I had welded to the mid section sealed off the area for the exhaust to exit, so it would be necessary to drill a couple holes somewhere above the flange to allow it to escape. I drilled the two ½" holes just above the flange on the back side of the mid section then opened them up a little more with a Dremel grinder. I didn't know if the two holes would be big enough to allow the engine to breath well, but thought I could always open them up a little more if necessary. The last thing I needed to do was to add a little grease to the bearing area just above where the impeller mounted. I had installed a zirk fitting in the bearing area to do this and with a couple pumps from my grease gun it was ready to go.

The morning of the meet arrived with rain in the forecast and dark cloudy skies above. But Steve has a nice

From the top:

Photo 19: Intake grid.

Photo 18: Grid intake.

Photo 15: Wick pocket.

Photo 13: Impeller house.

little shop out behind his house that is quite comfy and dry and had made arrangements for a canopy to cover the test tank area so we could still run our engines without getting too wet.

I got to the meet about 9:30 and unloaded the two motors I had brought along, the Nissan and a 5½ hp Johnson with a stuck power-head. The Johnson was going to be our teardown motor to see what it would take to put it back in good running condition. I had brought along a motor stand and mounted the little Nissan on it. By this time several of the guys in our chapter had gathered around to inspect the strange looking apparatus attached to the bottom of the Nissan. Questions of all kinds were being fired at me faster than I could answer them. What is that? What's it for? Is it a factory misfit? Where'd ya get that thing? Did it come off a diesel turbocharger? How does the reverse work? What's the gear shift do? It'll never work! So between trying to keep up with answers and explain the concept, it was an interesting time.

As I had mentioned earlier in the story I had my doubts if it would send enough water up the pipe to cool the engine and thought I'll probably be the laughing stock of the club with a futile attempt at building a jet drive outboard!

Several of the guys had put their engines in the test tank and were running them, adjusting the carbs and fine tuning things. Pretty soon one of the guys said "hey Gary, are you going to run that thing or is it just here to poke fun at?" So the time had come to put up or shut up. I got it mounted in the tank tilted up on the second highest pin hole, opened the gas valve and started pulling it over. It finally popped to life and much to everyone's surprise blew water all over everything! I think it would have sucked all the water out of the tank if I had kept it running. But I shut it off before it did, to lower the tilt angle. Most of the guys were surprised at how much thrust it had, and the best part was it was shooting a nice stream out the tell-tale. So pleased as I was with how it ran I still had a couple more things to work out, some paint to spray on it to protect it and an intake grid on the jet.

One of our members, Jerry K., has challenged me with one of his jet drive outboards, so now the race is on! My next step is to make an intake with some kind of grid on it. What I needed was another big chunk of aluminum to turn down and attach to the bottom of the turbo housing. Fortunately Tony had given me a couple pieces when I had asked him and one of them was just the right size to make the intake out of. It was 5" in diameter and about 2½" thick. I would need to bore a starter hole in it then open it up to the size of the intake, which was 3 3/16". I started by mounting the piece in my lathe and using a 3" hole saw, proceeded to try sawing the hole. After about a ½ hr and only making about a ¼" progress I figured it was going to take me the rest of the day to get through it. Not having that kind of patience I decided to try and old trick I learned back when I was working. I drilled 6 holes 3/16" dia. through the slug of aluminum in the diameter of the 3" hole I was trying to bore. Then I flipped it over and drilled the other side with a 7/16" drill about 2" deep centered on the smaller 3/16" holes. This gives a relief place for the chips to go. Once back in the lathe it sawed through it in about 5

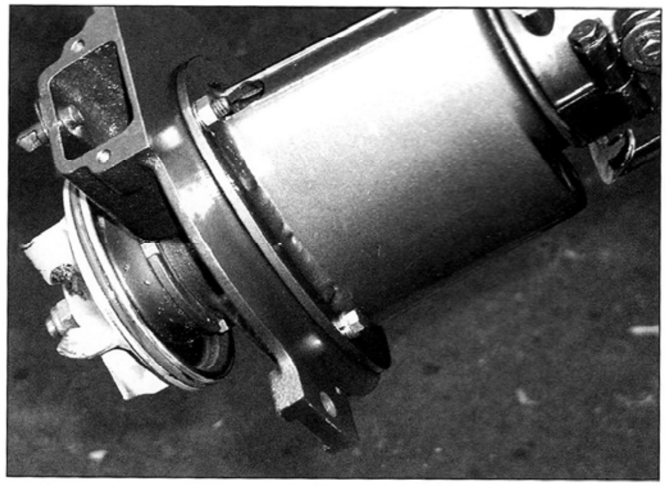


Photo 14: Water pickup.

minutes, I did have to remove the piece, turn it around and finish sawing it from the other side. But the whole process of drilling the holes and re-sawing it probably took about an hour, quite a bit faster than just bulling the hole saw in a solid piece. The next part of the machining process was to bore the hole to the correct size. That went pretty smoothly and only took a few minutes. The flange that would mate up to the housing was a little more involved, it was almost a mirror of the one that was on the housing and took another ½ hour to finish up. Once that part was done it was necessary to flip the piece around and start turning the taper for the intake. I wanted to make a bowl shaped design going from the 5" outer diameter down to the 3 3/16" on the inside. This worked out okay too and matching the outside to the inside taper produced the bowl shape I was thinking of. I then cut two sections off the bowl to produce a scoop. (photo 19) It needed a curved plate welded on the one side so it would channel the water into the turbo intake. Once the weld was done I drilled a series of holes in the edges of each side (a picture is worth a thousand words) and inserted 1/16" SS welding rods across the mouth of it. By cutting the rods short to the aluminum bowl I balled a weld on each end so they wouldn't come out of the holes. (no. 18)

Now that the part was machined and the scoop and grid were finished I needed a way to hold it to the bottom of the intake. What was needed was a clamp of some kind that would pinch the two flanges together and hold the intake in the correct position to direct the flow of water in. In my vast array of miscellaneous pieces and parts I found a couple hose clamps just the right size to go around the two flanges. The problem was it was just a flat band clamp with nothing to pinch the two flanges together. All the clamps I

Photo 20: Nissan jet in action.

had seen in the past to do this had formed V shapes that fit the two tapers and pinched the two together. The band on the clamp I had was ¾" wide so there was plenty of material to attach to. I decided to try making little V blocks and welding them to the band. I got as far as cutting out small ½" squares of 12ga stainless steel, and intended to bend them in a V shape, but gave up on that idea when I tried bending them. The next idea that came to mind was to use two small round head slotted screws and mount them equally around the diameter of the clamp band. Having tried two of them to get the proper measurement, 3/16" seemed to be about the right distance for the two screw heads to pull the flanges together. I drilled a series of 8 sets of holes to mount the screws in the band. Although it looks a bit like a spiked collar for a bulldog it did the job and pinched the two flanges together.

I was finally starting to see the light at the end of the tunnel and felt the little Jet was almost ready for the maiden test on a boat. I was really anxious to try it but the weather just wouldn't cooperate. Finally we got a break and I mounted it on the boat. I knew it wouldn't perform as well as a prop but I hoped it would at least push the boat. Once I fired it up I was pleasingly surprised as it did a fair job at about 4-5 mph. It also pumped water through the engine with a great tell-tale stream. Now I was ready for Jerry's Clinton.

Our next meet was Saturday the 25th of June and I sent out a notice that the big race was on and if anyone wanted to compete they should bring their Jet drive outboard, nothing bigger than 5hp. I got several emails back with varying comments. My friend John said it wasn't fair because not that many members had jet drives (just kidding John). A couple others said they didn't have time to build one! So on to the race! Glenn, Jerry's grand son was sure he could beat me, so I said lets go line um up! I had mine on the boat and after Glenn saw it run I think he knew it was all over. (photo 20) We then put his Clinton on the boat and even Glenn admitted the Nissan was faster (sorry, Glenn). But he's a good loser and didn't pout too much. Actually he is a great kid and has picked up a vast amount of knowledge since I've had the pleasure of knowing him. Jerry Kay has been bringing Glenn to the meets since he was a tot and we've seen him grow and learn over the years. It's a wonderful thing to have youth interested in this hobby and I hope more kids find their way into the clubs.

So that's pretty much the story of the winter project, The Nissan conversion to a jet! Hope you enjoyed reading it as much as I did building it.

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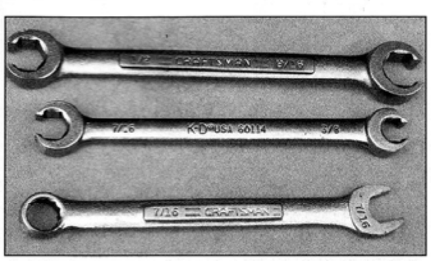
Outboard Tools

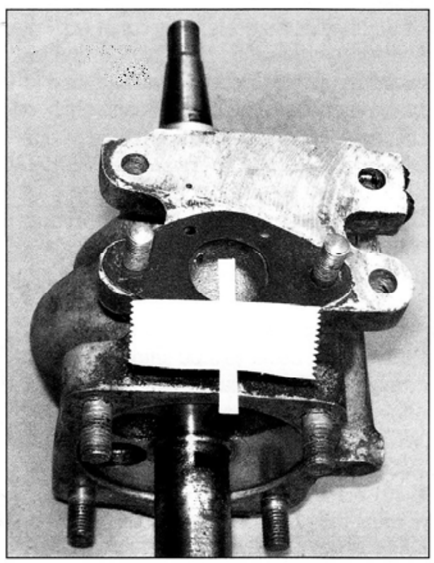
by Jim Moffatt

In this article we will look at a number of tools I have bought or made over the years. Some may seem trivial and some may seem to be of questionable value, but I have found them all to be useful in some circumstances.

First is my favorite set of special wrenches. The top two are flare nut wrenches. They will slip over water or fuel lines and provide a strong non-marring grip on flare or compression nuts. They are especially useful when you don't want to round off the corners of the nuts or the nuts are plated. The bottom one is a 7/16" combination wrench ground down on both ends to provide extra clearance In tight places. This was custom ground for the removal of many Tillotson carburetors.

The next "tool" is a simple strip of paper taped to an intake manifold.

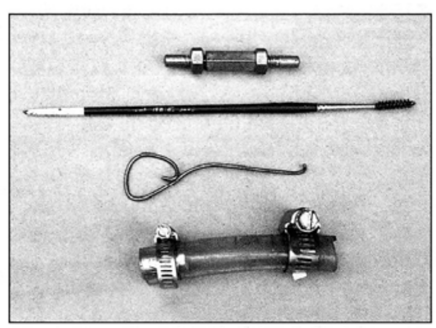




The strip acts as a reed and will show if the reed plate in the motor has any blow back. It bends into the manifold when air is drawn into the crankcase and will bend out if there is any blow back. I have found several leaky reeds with this tool. You can also do this test by feel or with smoke but the paper is simple, sensitive and safe.

The next photo shows a group of 4 tools. The top tool is a home made inside micrometer. The end pieces are screwed out to match the bore diameter being measured. The lock nuts fix the end pieces at the dimension and then vernier calipers are used to determine the measurement. It can also be used in reverse by setting a dimension and then checking the bore. The second tool is a round artists brush, useful for cleaning out carburetor passages.

The third tool is a simple wire hook which can be used to measure depth of a threaded hole that opens into a water jacket. The depth helps choose a screw length and will also tell if there is enough depth for a helicoil insert if the threads are stripped. The hook is also useful to pull cork floats out of deep float bowls. The bottom tool is a home made flexible coupling used between a variable speed drill and a drive shaft. The tubing has ½" ID and will fit most small hp drive shafts. The other end is tightened onto a ½" OD socket and is driven by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