

Owner's Manual

Index (Currently, the index Cannot be selected as a link)

Scroll down to browse through the Owner's Manual.

Access Port Plug	Nose O-Rings
Batteries	O-Rings - Motor Compartment
Battery Charging	Reed Switch
Battery Connections	Relay
Battery Packs	Riding the Scooter - Body Position
Blades	Salt Water Diving
Body O-Rings	Seal and Clutch Assembly
Clutches	Switch Connectors
Latches	Tow Cord
Motor Connections	Trigger Cable
Multimeters	Trigger Pins

The Gavin needs little or no maintenance (either version), but there are certain things that should be checked periodically. We highly recommend that you read and understand this manual fully to ensure the proper functionality, performance and longevity of your Gavin scooter.

When all is well with your Gavin Scooter, the motor should NEVER get hot, it should never leak through the seal, and it should never need any kind of servicing whatsoever. These are continuous duty electric motors and are highly efficient. Any and all questions on your Gavin Scooter should be directed to [George Irvine](#). George has extensive experience and makes use of that knowledge base. What takes him seconds to figure out and minutes to fix, could take the uninitiated days. He also likes to see how they are doing from time to time and can easily spot developing problems and correct them. He has all the parts and special tools to perform any type of job on these, and he likes doing it.

Access Port Plug

Be sure the access port plug is all the way down before use, or it could leak hydrogen. If the fittings get disturbed for some reason, they could back out of their threaded slots slightly and leak. This has not yet happened, but some people must tinker with things, so be aware that these are threaded through the lid and must be held firm from the top when tightening the bolts.

Batteries

Batteries can be quite frustrating. They will test perfectly and then fail for no apparent reason. They can not tolerate heat. Do not store them in your car or in a hot place. 110 degrees F is all it takes to kill them. They otherwise should get 200 cycles, but we throw ours away after less than 100, or if the burn test falls more than 5 minutes short of optimal.

If you get bad ones from us, we can have our supplier ship new ones right to you. It's best to get them locally so you can take them in and exchange them. This saves weight in shipping, which costs more and may damage the scooter.

The other thing to remember is that all batteries off gas - even Ni-Cads. Never leave your scooter sealed or pull the trigger out of the water. If you leave it sealed, it may blow up and that can be extremely dangerous and cause serious injury.

Battery Charging

You will need a 24V Battery Charger to charge your scooter batteries. Sears has one with 12 and 25 volt settings, gel cell settings, fast, normal or maintain charge settings, an analog ammeter, 2, 10 or 20 max amp settings, etc., and it is in a proper

case for good ventilation and costs about \$80 in the automotive section. The Interactor charger does not offer settings, therefore allowing no control of the charge process, and is overpriced at \$110. Xenotronics has a high quality charger for about \$400, but the Sears charger is more than adequate.

With the Sears charger, you must be sure the "gel" switch setting is in the right place or it will put out too much and give you all kinds of bad signals, not to mention improper charging.

They also give bad signals if the connection is not perfect. Make sure your charging port plugs are not getting loose or oxidized.

Brownies has some chargers they found that seem to work. We ordered one but have not tried it.

To check to see if the batteries are charged if you are not sure that the charger is telling the truth, put your multimeter on amp dc and move the non com plug to the amp slot and then clip it in between one side of the circuit (you will need to jumper the other side) and turn on the charger. If it will not take current and the charger is reading voltage, then it is charged. You can check the charger for volts first and then the battery, then the amps, and then the resting voltage of the battery.

Battery Connections

The connections from the battery are gold and should never cause a problem. They are two-part connectors that hold the fitting without pulling the wire - use the handplugs to disconnect. Inside they have set screws holding the wire, which is tinned with silver to go against the gold fitting. At the other ends are merely high temp connectors, crimped and soldered. The charging port is a simple Radio Shack connector. The wire is all boat cable, #10.

Battery Packs

The battery packs need to have their bulkheads spaced properly. The upper bulkhead needs to be such that the lid can go all the way down without the O-ring. The nose cone has inserts in it to hold the top of the battery rods in position so the pack will not move. You can put a piece of foam in there as well. We do that to keep pressure on the nose cone when the O-ring is out. See the FAQ page for more information on balancing your scooter and battery packs and spacing.

Blades

The blades will eventually wear out and the scooter slow down a little. This is because the holes that are used to control the pitch wallow out. New blades are 27 per set. It takes a while to wear them out. I have not personally worn any out, but my hard core divers have. If there is any other change in performance, sound, or speed, send us the motor immediately, without passing "go". It is either perfect, or it is not. If not, we fix it.

Body O-Rings

The body O-rings are number 375. They sometimes appear "cracked" on the outside - ignore this. You may never have to replace these, but they cost about a buck if you do.

Clutches

We have been testing clutches and have found that there is no set number of washers that work for any given combination of Arnold Jackson clutch and motor. The shafts are different on different motors. The step in the clutches is different for different clutches. What has to be done is that you have to add enough washers to clear to top of the shaft, but just barely. The clutch needs to slip easily; it needs to slip as soon as it touches anything but water. There is no number of thick washers that will work. You can check the thickness of the washers with a micrometer. They need to be .024. The .032 washers are too stiff. Just one too many washers will not allow the clutch to slip. The .032 are for the Mako clutch, which slips far more easily and will wear out upon repeated slippage, whereas the Arnold Jackson clutch is

designed to slip any number of times. The replacement Mako clutch costs about 4 bucks. The replacement Arnold Jackson clutch costs about \$120.

CHECK YOUR CLUTCH TO MAKE SURE IT WILL SLIP PROPERLY !!!

You must first check this on the bench with the relay bypassed or it will fry the relay if the clutch does not slip.

1. Open the lid
2. Disconnect the positive lead from the motor to the relay, jumper that leads to the battery.
3. Put a jumper on the gold pin in the black socket on the motor compartment lid.
4. Hold the prop and touch the black jumper to the battery. It should slip instantly. If it grabs, start removing washers until it does not grab.

If you are a weenie, and if you have one of my rewinds, you are not going to like it if it does not slip - consider yourself warned!

If it does slip properly, or after you have put the washers so that it slips properly, you are now safe to put it back together and put it in the water to test again.

5. Make sure it will hold with full pitch and with fully charged batteries. Grab it underwater and make it slip and be sure it will re-catch.

Sometimes it will ride on top of the plate and you just bump the trigger a couple of times to get it to reseat. I keep mine so that they nearly slip all the time, and anything that got into the prop, like cave line, would instantly slip the clutch. To give you an idea of how it should be set, you should be able to stick **any body part** in there with no worries. The Mako needs to be kept more tight and not slipped intentionally.

Do not add back in more than one washer at a time or you will lock it up and fry it. The other thing that happens, and this happened to me, is that if you stall the motor just right, it will arc on the brushboard and then the whole motor needs to be taken apart. To avoid this disaster, do your first testing on the bench where just touching the lead to the battery momentarily is all you do the first time. I was trying to see what would break and I found out. It was interesting when I took the motor apart - it was dated 1988. It took me 14 years to have to take it apart.

If you do not have the right washers, you need to get them from Arnold Jackson, or otherwise all of you get together and designate somebody to order them and distribute them, or get them from whomever you got the Arnold Jackson clutch from. While you are at it, throw away the Arnold Jackson screws and put in 8-32 1 1/4" pan head Phillips screws.

Latches

The latches are sometimes difficult or time consuming to get made, so don't break them. If you do break them, however, George Irvine will send you more. Leave the latches closed as the only time they like to break off or rip out is when they are open. Closed, the strikes will straighten out before you can shear those screws, even in the PVC body. If you mess up the latch holes, you can drill them all the way through and use a 3/8" ## 6-32 machine screw and some silicone to hold you over until a new body can be made. Bill Gavin used to run them through like that, but it is not necessary for strength, and leaves open that quick fix option if you do mangle one. The other option for quick fix is to hot air melt the PVC and put the screw back in. That can also be done with the HDPE parts. If you do mangle any part, like if you wreck your car or something, send it in to be welded back together - either version.

Motor Connections

When checking connections under the motor lid, be sure to not try to tighten them without holding both sides of the fitting (remember they are threaded, and tightening the gold nuts will turn the gold fitting the other way unless held.) Make sure these fittings are tight so there is no intermittence in the scooter. If there is, this is the problem.

Multimeters

Learn how to use a multimeter. Get one from Radio Shack (if you don't have one, don't tell anyone because that falls into the "too stupid to dive" category). I am sure you have all seen Pina checking her backup lights with one before every dive, along with her primary light and her scooter. The continuity function will tell you if your reed switch is working, the ohms will tell you if your relay is welded, the amps will tell you if your motor is drawing the right amount of current and hence has no problems, and the volts... you guessed it, will tell you the resting voltage of your batteries which you will know is what it should be or not. We need to not be sending me back scooters that need a two dollar part. We need to find out what is really wrong and then figure out what to do about it.

If the relay mechanically sticks, well that is an odd one. If it fries in the on position, this means it took a severe current shock and that means the motor is broken. Do not keep replacing it and blowing it. Check it with the meter - relay for ohms, motor for current, etc. If it the thing just won't work, we get out the meter and start with the reed. Then check the relay, (which you can hear click) and then apply current directly to the motor. If the motor won't run, it needs to be rebuilt. It lost its brush board or the wires to it. If the relay clicks, the motor will run, but not through the relay, there is a broken solder joint and you must re-solder the five points on the back of the board. If the relay won't click or is stuck on but the reed and motor are ok, then the relay needs to be replaced. De-solder it from the board and replace it. The reed comes from any Radio Shack, the relay from any electronics place.

Nose O-Ring

The nose o-ring should be left out when not in use to reduce risk of hydrogen buildup if the batteries offgas. The ring should not be put in within an hour of charging. When you get out of the water, take out the ring. What happens is that if hydrogen comes out of the battery through its vents, as it does when charging or really at any time it wants to where the reaction gets behind, it builds pressure in the sealed scooter and could possibly find its way past the double O-ring seal on the motor compartment lid.

O-Rings - Motor Compartment

The O-rings in the motor compartment are numbers 252 and 256 for the HDPE and 252 and 256 for the PVC version, or both can be 256 on the PVC version for a tighter fit for the double seal. These are the only rings you should ever grease (silicone - but do not use spray or hydrocarbon sprays as the propellant could ignite later when you start the motor), but the main thing is to be sure the O-rings are "alive" and not "dead" (not flat or losing their resilience). and that there is nothing on them that would cause them to leak.

Be sure the lid is all the way down before use. When putting the lid on, it must go down evenly and not extrude the ring anyplace - you must feel no springing action at all. It is easier to get it all the way down if you remove the port plug first, and then put the plug back in after the lid is secure. On the HDPE version, the fit is even tighter so it is harder to get the lid in all the way. This is critical, so be sure it is in and sealed.

You should periodically check this compartment with a vacuum hand pump to be sure of its integrity. You should remove the access port plug after dives and hold the tail upside down to check for water and to observe any other problems. The motor

should NEVER get hot. If it does, there is a problem. If the motor gets hot, it will expand the air and push the lid off. To help ensure that the motor does not get hot, observe the following:

- DO NOT spray any conductive lubricant into the motor
- DO - Dive a streamlined gear configuration and maintain proper body position to keep from giving the scooter too much drag for the prop setting.

Check the motor temperature from time to time when using the scooter by touching the tail cone. If there is a problem, send in the motor. Do not run it into the dirt. Do not get lazy and blow these things up. Do not leave the nose O-ring in when not in use, transporting or otherwise after use and never seal it after charging without waiting at least 30 minutes to an hour.

To check the compartment for water after diving, it is best to merely remove the testing port and check for water, instead of removing the lid. Every time you remove the lid, it stresses all the connections unnecessarily. If you do remove the lid, be sure to keep one hand on top of the motor compartment lid when releasing the snaps. The lid that has the relay under it. If you allow the lid to pop up it will pull on the wires from the motor.

Reed Switch

The reed switch may be one of two types but we usually choose the Radio Shack window switch because it is widely available in most countries, even though there is no reason for one to break unless you bang it on something with the scooter apart. If you do replace it, use the same fittings and be sure to sand off the little flange so it will fit in its hole. The other type of reed switch is one that is threaded into the tail section. This type of reed switch you must get from me, but that is no problem. This one lets you adjust the trigger by turning the reed.

Relay

The relay is a 30 amp relay on a custom-made board. For replacements, either get them from me in one piece or de-solder the relay and put on one just like it - the part number is on the relay. Some relays are just faulty and can mechanically stick, but usually if there is a relay problem it is really a motor problem that needs to be fixed. Any motor problems need to be sent to George Irvine for repair or replacement at no cost. Just take out the motor by removing the four screws and send it to us in a double box that is well padded so the tail cone does not get damaged.

Riding the Scooter - Body Position

The body should be held in a flat position with the neck tilted back to see and the feet at body level or higher. If you are at any angle, you are inefficient and will be slower. If your feet are pointed down, you will be much slower and under unnecessary stress. You should be able to operate and steer the scooter with one finger if it and you are properly balanced and positioned. JJ and I ride these things for 6-7 hours straight with no fatigue of any kind. That is what you are shooting for no matter how long your dive is. You should never be fighting the scooter, and length makes no difference. Pina rides a Magnum Gavin in Manatee with no problem what so ever, and she is 5'3", 110.

Improper riding of the scooter merely makes it draw too much current. My motors are set to 57 pounds thrust with a static draw of 16 amps (that is what the burn times are based on and the battery condition tests (see the [WKPP page for burn testing details](#)). If you are a good diver, you should draw a lot less than 16 amps. Speed adjustments allow the team to all move together.

Salt Water Diving

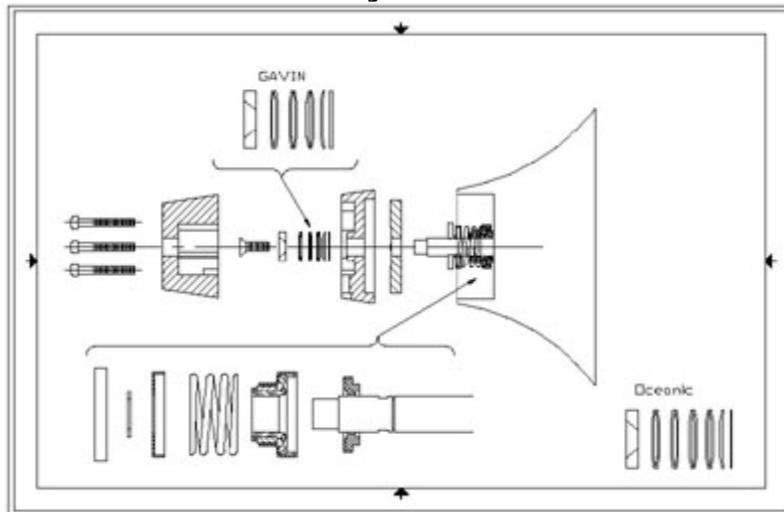
Any scooter used in salt water needs to be rinsed in fresh water afterwards. Don't let

it sit, as the salt water will leave salt crystals which will then react with the metal parts and get into the surface of the motor seal. The way a seal works is by a molecule layer of water across its face, not because the material has some magic properties. We use ceramic seals which will not rust, but will be scored if left with salt on them or around them. To break in these seals and start the process, we use a drop of motor oil, but once the scooter is put together, it is not a good idea to disturb this device.

A rinse in fresh water after diving, followed by a spray of CRC or WD40 around the area of the seal, will do a lot to prevent any problems. You do not have to take the props and clutch off, merely use the little tube that comes with these cans to spray under the clutch and into that area. The idea is to prevent the cone around the seal from reacting with the salt and eating away. Eventually this process will leave the seal unable to hold at its edges, even if the two seal plates are not damaged. Then the whole motor cone has to be replaced, which is extremely time consuming.

An easy way to rinse a scooter is to put it in a fill bin and run it a few seconds (with the pitch turned down). You can also use a hose and force water in under the clutch. Most of the snap rings are stainless steel, but even that will rust out and let the seal spring loose, which will push back the clutch plate from the shear pin and allow the whole prop assembly to unscrew. Once in a while that ring needs to be replaced. It is just under the clutch plate. The snap ring under the seal is hard steel. That ring needs to be in place or the shaft will have play in it, causing the seal to leak when you first put the scooter in the water. There should be no play in your shaft; if there is, that ring needs to be replaced, which means removing the seal all the way. The bottom ring comes out with an O-ring pick - this does not hurt it at all. Check your prop set before putting the scooter in the water and push the whole thing inward to be sure the seal is shut. Otherwise they will leak a little when you first put them in before the pressure closes the seal. That is where all the leaks actually happen - right at the surface when you first put them in the water.

Seal and Clutch Assembly



The exploded diagram of the drive train shows the correct sequence of clutch washers. In the WKPP clutch, there are three matched sets and the one facing down at the ring on the bottom. With the Mako clutch there are four sets plus the one facing down.

The seal is easy to replace. Remove it with channel locks, remove the inner donut with an o-ring pick. The snap ring is under the inner donut. There must be no play in the shaft. Check and be sure that the ring is in place. It is steel, not stainless, since it needs to be as hard as possible. Place the new donut into the hole without any kind of silicone or

lubricant. Spray the bell side of the seal with lubricant. Put a drop of motor oil on the donut. Slide the bell down and then press the rubber ring down all around with a flat bladed screwdriver. Then add the spring, cap and stainless snap ring. Run the motor for a couple of minutes to break in the seal.

You do not need to take the motor out of the scooter to replace the seal.

Switch Connectors

These small "banana connectors" need to be kept splayed out or they will not have as good a connection or hold as well. This also needs to be done to the HID light banana connectors or they will get intermittent.

Things come apart, screws back out and so forth, due to vibration from a misaligned vehicle or from a boat with a bent shaft or misaligned motor, which is 99% of the scows they use as dive boats. I never personally have this problem, but I see it from some of you. If the scooters vibrate too much in transport, the big bananas may come apart, but they don't unplug as they are held down by the lower bulkhead being too close to them for them to unplug by themselves.

I also have something that is not apparent in the photos that some of you may want to use on your scooters. I put a short piece of clear tubing over the banana connectors. You have to unscrew them, then unscrew the inside, slide the hose on and then the back and then the inside and screw it all back together. The hose should be slightly curved and just barely reach the level of the lid spacer. The wires then go through the normal access hole. This makes it impossible for the bananas to come unplugged.

Tow Cord

A proper tow cord length is a must with these scooters, as well as the positioning of the length of the two sides. Also it is suggested that you have DIR gear configuration if you want to get the most speed, use the least current, and be the most efficient. The length of the tow cord must be such that the scooter is as far out in front of the diver as possible and the diver's right hand is merely relaxed on the right handle, and so that the left hand can easily reach the shroud. This will allow the full effect of the scooter breaking the water and crating a "shield" around him so that the stages and such do not add significantly to drag if rigged and carried in the DIR prescribed method. This positioning will also prevent the scooter from 'reverse thrusting' against any part of the diver. If you can feel the prop wash, you are riding the scooter improperly.

For tight areas, you may want the scooter in a little closer, in which case you can take a wrap around each handle, or make your cord shorter by the length of a double ender and just add or remove the double ender as needed by clipping into the double ender or just the main clip without even removing the double ender. This way you can "shift gears" for changing conditions. Most of the time, you will want the scooter as far out in front as is comfortable. If you are new to scootering you may find that you feel more comfortable in the beginning with the scooter closer to you, but you should strive to keep it out as far as possible. Once you are more comfortable riding it, you will not want it in close anyway as this does not allow you to relax the way you can with it outstretched.

Trigger Cable

To replace or change the trigger cable, take the wheel off and screw on a new ends section of wire, thread it through the handle, and then put the wheel back but tighten the nut so that it stays in the "on" position while you crimp the cable with the trigger in the depressed position and then loosen the lock nut again. For the tapered version, leave it in the "off" position and crimp it with the trigger all the way out (that one has a bolt threaded through the leg which does not allow you to tighten

past the optimal point.)

Usually, the way you break the cable is by catching the magnet on something while transporting the scooter. I try to keep that magnet at about the edge of the tail so it does not stick out. I also watch that when carrying and do not use that leg as a handle. With some of them, and more so with the tapered version, I have reversed the direction of the magnet so you are pulling it from inside to out to prevent this.

However, it is then harder to operate if broken.

If the trigger cable jumps or breaks during a dive, you may operate the scooter from the wheel by resting your right hand on the shroud strut and holding the magnet in place with your thumb or index finger with no change in riding stature.

Trigger Pins

Trigger pins are just standard boat trailer hitch pins and can be found at any hardware store or marine supply store. The scooter should always be pinned when not in use. When towing, staging, or leaving a scooter on the line, pin the trigger and turn the pitch of the blades to zero (by turning the knob at the blades counter clockwise.) It is a good idea to have a few spare trigger pins and keep one on the tow cord.