

# **Gavin Scooter User's Manual and FAQ**

By George Irvine

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The Gavin needs little or no maintenance (either version).

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 or Pina Porceddu, who will relay the question to George and deliver an answer from him. George has extensive experience, make 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.

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**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 five minutes short of optimal.

If you get bad ones from us, we can have our supplier ship new ones right to you. 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 offgas - 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 in 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 which 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 on Balancing Your Scooter for more information on 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.

### **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 (40 bucks for the body). 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.

### **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 possible 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 (see FAQ on Vacuum / Pressure Test). 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**

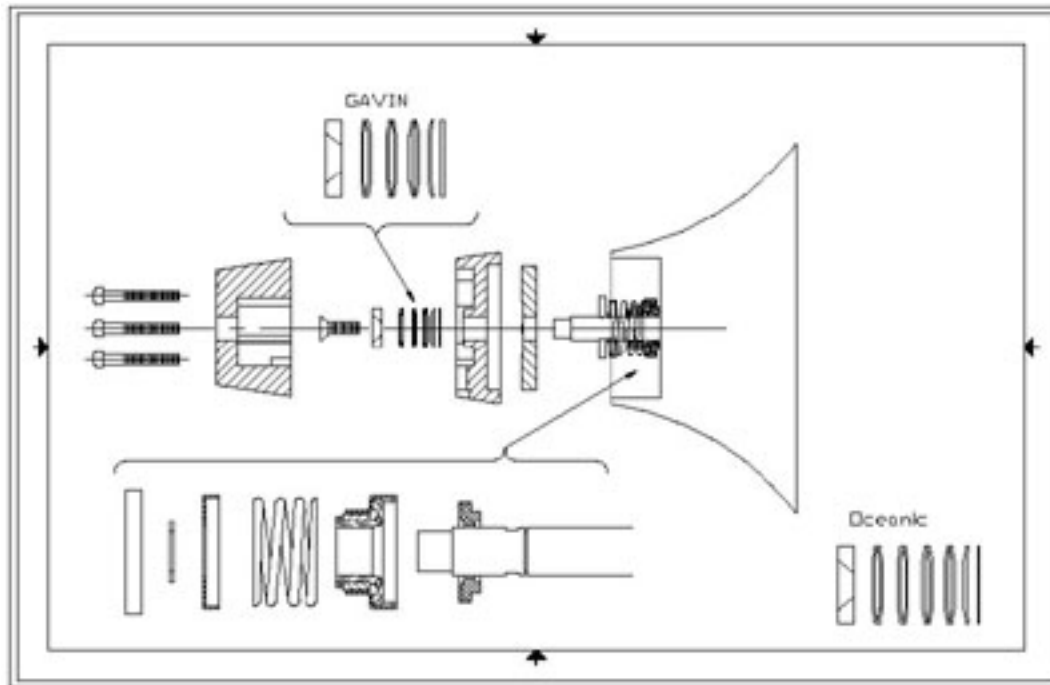
Any scooter used in salt water needs to be rinsed in fresh water afterwards. Don't let it sit, as the salt water will leave salt crystals which will then react with the metal parts and get into the surface of the motor seal. The way a seal works is by a molecule layer of water across its face, not because 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 part 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 counterclockwise.) It is a good idea to have a few spare trigger pins and keep one on the tow cord.

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### **How Do I Properly Balance the Scooter?**

The best balance for the scooters is to have the batteries positioned in the center relative to the tube walls so that it has no bias. If you want a bias, make it so that your tow strap is on the area of the scooter that ends up on the bottom relative to gravity. This will allow the scooter to tow properly.

The fore and aft balance is best set so that the nose is slightly up when the scooter is hanging free. This will keep it up out of the silt, reef, wreck or other objects below you. It is great to have the scooter neutral, but keep in mind that the compression of the o-rings changes the buoyancy by about .7 pounds, so make the scooter that much positive at the surface, or neutral at the surface. You do not want the scooter floating up around you and tangling, unless you are diving a sensitive area like a reef where you might be catching lobsters, in which case positive will keep the scooter off of the coral. However, watch out and don't let it get behind you if it is positive.

Batteries are always slightly different in weight, the tube walls always have varying amounts of material in them, and different water has different buoyancy characteristics. For those reasons I make the tubes a little longer than they need to be, and I make the bulkheads such that there is room for spacers. The short pack makes no difference, so that one can be made without spaces and still have the nose up attitude, but the others may need different positioning of the spacers in the battery pack. Weight can be added to achieve exact balance.

The packs must end up 1/2 inch below the end of the tube. The lid should be able to fit onto the scooter snug to the tube with no o-ring. That way you know you have to correct positioning of the tube. You want the pack to hold the motor compartment shut tight (it has latches and double o-rings, but still needs to be held tight). You also want all of the stresses of the scooter to be distributed throughout, not concentrated in any one area.

### **How Do I Vacuum Test / Pressure Test the Motor?**

The port plug opening is for vacuum testing or pressure testing.

Get a plug the same size and thread, bore it out and install a nipple in it for a hose to the vacuum pump, or purchase a premade plug or the whole kit from us (priced according to cost of the pump at the time.)

To test the vacuum, remove the hose from the special plug and screw the plug into the port in the motor compartment. Then re-attach the hose and pump it down to neg 15 inches in vacuum and it should hold indefinitely. If it does not hold, release the vacuum and move the hose to the pressure port on the pump. Then pressurize it and stick it underwater to see where the leak is, or spray liquid soap on the possible leak areas to find it.

If it is the plastic, send it back to us to be welded.

If it is the motor seal, replace it.

If it is the o-rings, replace them.

If it is the connections (which it never is unless you screw with them and do not put them back correctly), send that lid to us for redoing.

Any connections need to be held on both sides to tighten or they will back out of their threaded slots.

### **What Does The Vacuum Hand Pump Look Like?**



### **What Type of Batteries Should I Get?**

Powersonic 33's for the long body and Yuasa 18's for the short body.

### **Where I Can Go To Purchase Batteries?**

One place you can get them from is:

TNR Technical in Sanford, FL  
(407) 321-7608  
Ask for Wayne.

(If you get the other 33's that he has,  
just leave out the small spacer since those batteries are longer.)

### **How do I manage getting off the boat with my Gavin Scooter?**

For boat diving, what we usually do is put the scooter at the stern and have a mate hold it steady so it doesn't fall in, then get suited up and go to the stern, clip it to us, pick it up and jump in. If there is not a lot of current you can just have them hand it down to you. If you are diving a single tank it is really easy, if you have stage bottles and doubles it is best if there is someone to help a little.

### **How do I properly rinse my scooter after diving in salt water?**

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.

For more information about the damage that can be caused to your scooter from not rinsing it properly after diving in salt water, refer to the Owners Manual section on Salt Water Diving.

**What should I do if my scooter sticks on while I am diving?**

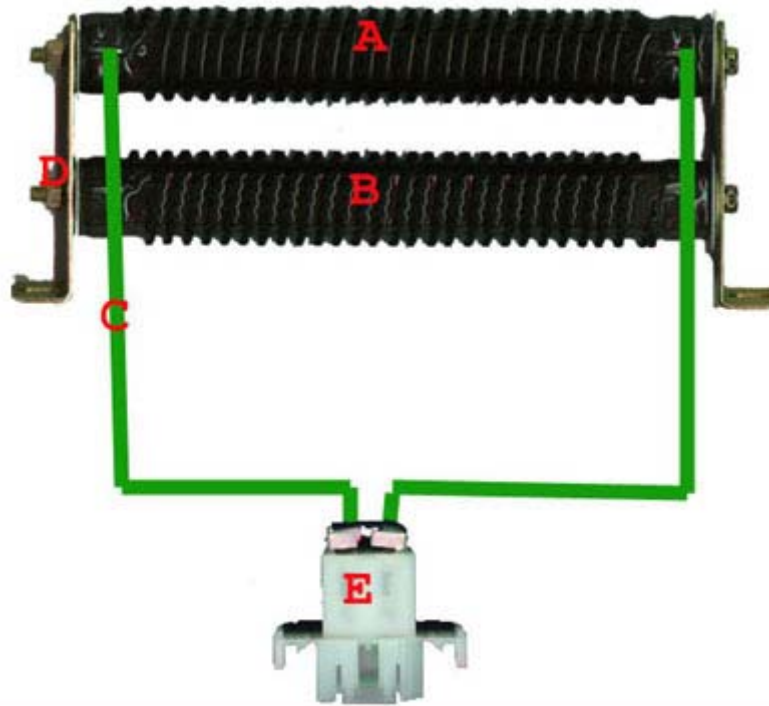
If the scooter sticks on for real, as in if the reed switch breaks or the relay welds shut or mechanically sticks, you can stop the blades with your hand and turn the pitch back while you are changing stages or decompressing, and then stop it again and reset the pitch when you want to travel. With the oceanic clutch, this will mean replacing the clutch, a very inexpensive part. With the WKPP clutch, you can do this indefinitely.

If it is sticking on because the magnet is not coming all the way back, just pull the magnet back gently with your fingers. If the trigger is stuck, do the same and then free the trigger. Sometimes you need to check the trigger to be sure it is smooth on the outsides.

The other mechanism of sticking is on is when you get grit in-between the wheel and the leg. Then you need to loosen it so that it does not recur.

If the relay welds shut or mechanically sticks, there is a problem with the motor, so check with George before you ruin your relay.

## Gavin Scooter 24Volt scooter Burn Tester



### **PART LIST:**

A. One of Two 3 Ohm, 300 Watt resistors.

(From Milwaukee Resistor the Part # is 061813603.00E

B. The other resistor from above.

C. Heavy wire. This means heavier than the wiring used in the scooter itself.

D. The Bracket. From Milwaukee Resistor the Part # is 301813602STD

E. Heavy-Duty Molded Nylon Connector.

(From Radio Shack Cat. No. 274-151)

Contact Milwaukee Resistor at (414) 362-8900.

## How To :

The goal is to test how long your batteries will burn without doing it on the scooter.  
Short burn times indicate bad batteries. (Trust me...)  
The circuit above represents the load of the scooter.

1. Wire the circuit. The resistance at E should be **1.5** Ohms.  
(If it is higher you either have not "zeroed" your meter or you have not done a good job soldering the wiring to the resistors.)
2. Charge up the batteries.
3. Reset your stopwatch.
4. Hook up the load and start your watch. The resistors will get **HOT!**
5. Measure the voltage while under load. When the batteries hit 20 volts under load you are done.

A short tube Gavin should burn about **50** minutes.

A long tube Gavin should burn about **95 to 100** minutes.

Ask George if you have questions.

100 minutes at **FULL TILT BOOGIE!** Bring it on...

\*\*\* Burn Tester text and image courtesy of Jeff Bentley's website, reprinted with his permission.