

How to fix your VDG:

Even though your generator may be about 50 years old, if it has a functional motor and a set of rollers, you are still in business. So let's approach this with a worst case scenario. You are a science teacher and on a budget as we all are, and you go to your neighbor's yard sale and you find a generator, take it home, plug it in and nothing. Here is what I would do.

~Motor Concerns~

Check over the motor. Most of the motors used for the generators unless it is battery operated will be ran from a single phase AC motor. Now these motors should last a life time so first check to see if all of the connections within the wiring system are intact including the plug. Should the motor still not work then it's time for a new one. Bellow, I have listed a few motors that work very well for VDG applications and they can be controlled using a router speed control , fan speed control, or even light dimmer switch plus they usually come with ¼ inch axles which most ID drive parts are designed with.

Dayton 1/15hp 5000RPM (very reliable and good RPM)

- Sewing Machine motors
- Shaded pole motors however they are only good for 3000 rpm (Must be greater than 1/40hp)
- Blower motors for very large VDGs

~Belt Material~

Now considering that this was purchased from a garage sale, I would guess that it has been sitting around for at least 5 years which means that latex belt is now corroded and seen its days. For latex material, yes you can purchase some at www.phycsplayground.com however there are other sources sad for me to say. I have heard of some people using the work out "Stretch Bands" which is latex, you can also find material on eBay and of course many other sites. Some may not want to use latex. Other common materials are neoprene, non marking white neoprene, HD polyethylene, and nylon sheeting.

My material of choice is latex because it has excellent electrostatic properties and last forever if you just keep in out of the sunlight. When making a latex belt here is what you have to do. Make sure you have a very sharp pair of scissor or a rotating cutter blade and cutting mat. Next, you want the belt to be 75% of the overall circumferential distance. Cut the ends at a 30 or 45 degree angle and then mend the ends with a half inch lap joint using **Gorilla Super Glue**, just don't use too much. It took me 7 years to find the right adhesive and it only cost me about 200 bucks to figure out. Look, I am saving you money already!

~Rollers~

If the VDG has been sitting around for awhile and it's old, more than likely you will find oil on the tubing and rollers because the manufacture will try to save every penny it can and use sintered bearings which will leak oil during operation. Since the VDG operates at extremely high voltages, the electric field created by the VDG will suck out the oil excreted by the bearings spraying it on the VDG tubing and rollers. In the end, this oil will shut off the VDG until cleaned. So, the first step to fixing the rollers can just be cleaning them using only soap and water. When finished, because regular water is full of conductive minerals, it would be good to take the extra step and rinse the VDG rollers with distilled water.

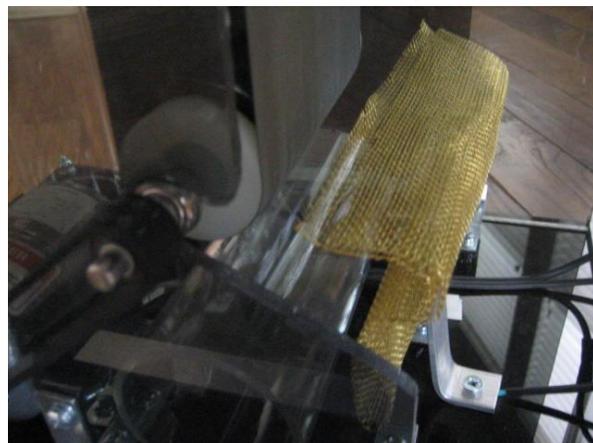
Now some VDGs will have rollers with extra high friction coating. For example some manufacture will place 100% wool felt on one material and a contact cement called Pliobond on the other or even a clear packing tape. If you have notice that these coatings have come off or would just like to add the extra high friction coating, which I strongly recommend, you will want to add **100% wool felt** to the positively charged roller and **Pliobond** to the negatively charged roller. So how can you tell which is which. Most manufactures will use nylon and an acrylic, teflon, PVC or delron (refer to triboelectric series for charge produced by material). The nylon will be off white and the acrylic will be clear. Some may even be both acrylic with one having the wool coating and the other pliobond. Lastly, VDGs with a teflon, PVC or delron being all negatively charged materials will created a VDG with a negatively charged dome which creates a better electric field then a positively charged sphere, meaning that you should try to set your VDG to run with a negatively charge sphere if possible.

In short, just do this. Get **100% wool felt** and **Pliobond** and coat the rollers with the wool on the nylon and Pliobond on the (more than likely) acrylic. If possible, keep the roller with the **Pliobond** on top. That was easy!

~Discharge Combs~

For the VDG to work, the electrons must have a place to come from, a place to push them on the belt and a place to be pushed back off of the belt being the top and bottom discharge combs. If I were checking over an old VDG, I would place a good bet that the combs were made from copper or steel and after the VDG was ran at very high speeds a part of the latex belt would have began to peel at the seam and began hitting the combs which either complete mangled them or broken them off.

Before looking over the combs, lets first make sure that the VDG is grounded. The bottom comb must be connected to a ground wire so it has something to pull electrons from or at least a wire that connect to something in the lab such a sink or any large metal object in the room. Next make sure



the combs are facing the rollers otherwise they will not extract the electrons. For the comb material, you can use any metallic screen just make sure the end points at the belt and roller as seen in the diagram to the right. I am using a brass screen which I enjoy because it is very durable because it does not become brittle after bending as with aluminum and brass. When running the VDG, keep the belt material about ¼ inch away from the rollers. The closer the better however just don't let them touch!

~Discharge Sphere~

Most of the VDGs will come with a spun aluminum discharge sphere with polished finish. Therefore the one purchased at the garage sale will only need cleaned off, however if you are a VDG builder, you will want to make sure there are no point locations on the sphere. Should this be the case, you will want to layer these locations with regular electric tape which will have a very high break down voltage being perfect for your application. If the VDG till does not work however you can observe that the VDG is producing a significant charge, check the room that there are no pointed metal object within a couple of feet from the VDG. This will shut off the VDG so make sure you run it in an open environment.

The Weather

Yes, the VDG all depends on the weather. Even if you have all of your components in great condition, once the humidity starts to get above 50%, the rollers system will not be able to create an efficient charge because of how the moisture affects the electrostatic properties of the materials. The quick fix is to blow a hair dryer across the VDG belt and rollers while in operation. You may even want to find a humidity controlled environment such as an air conditioned room. Just an interesting fact, the VDG charging system was first discovered in the Midwest during the late 1800's while running belt driven farm equipment in the winter time because the worker would develop shocks from the equipment during the cold dry days. So, make sure your VDG has a dry place to run!

I hope this maintenance list has given you useful insight into fixing your VDG that now you do not have to buy a new one. If anything here is a rule of thumbs, keep it dry, keep it clean. This fixes about 90% of the problems.

Thanks for looking!

Frederick Graff