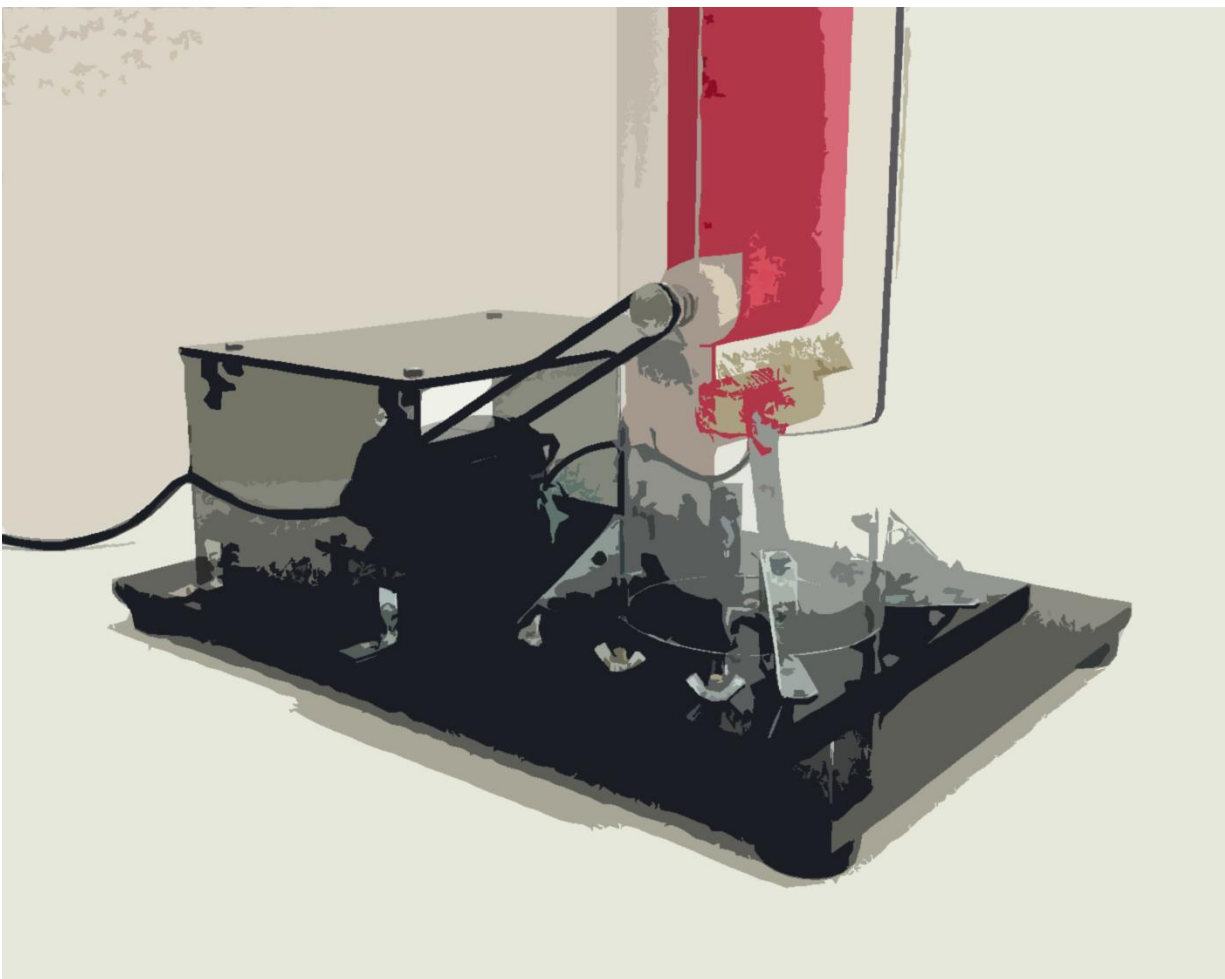




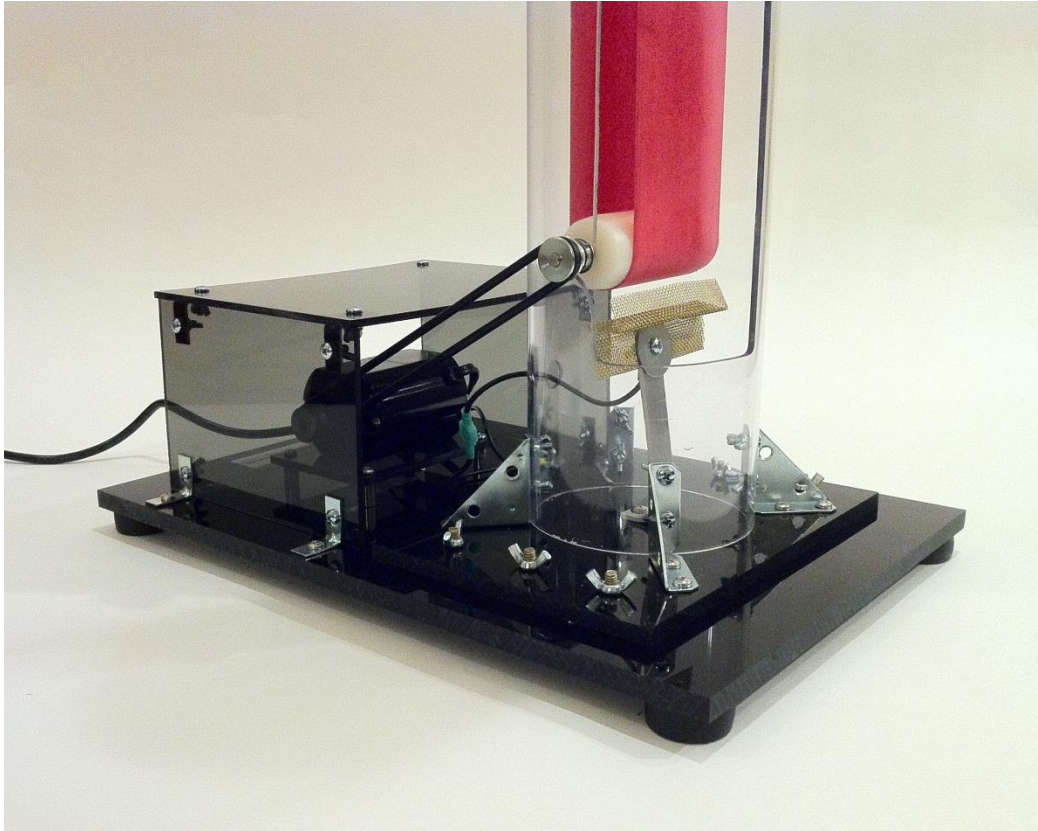
700KV Van de Graaff Generator Built Instructions



700KV VDG Built

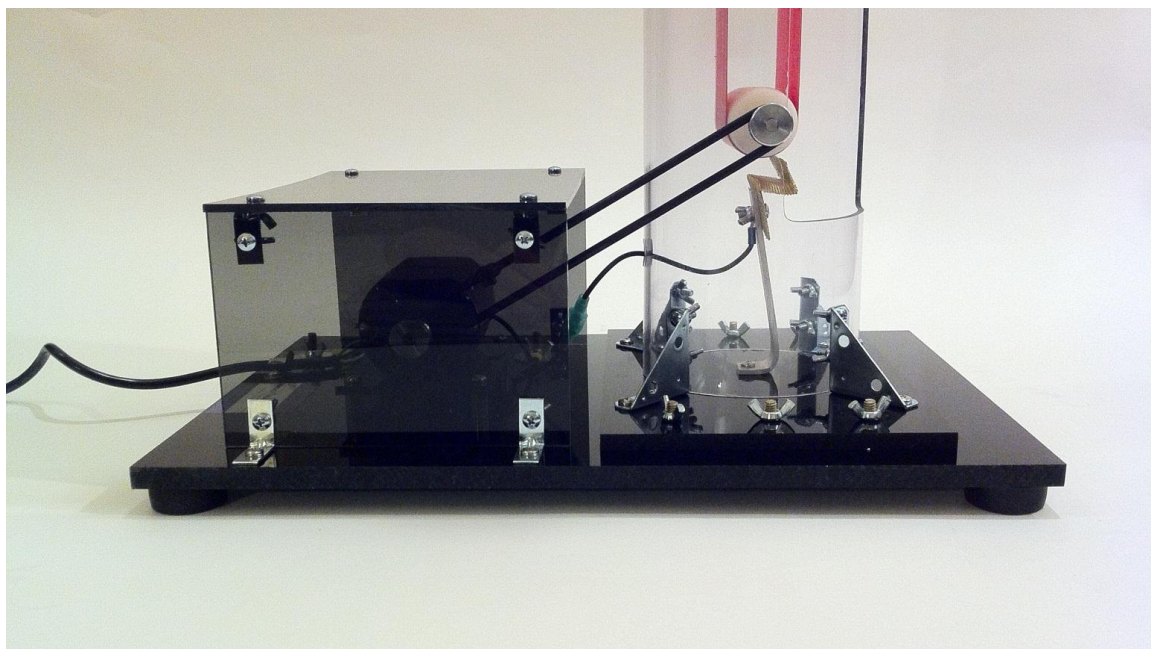


700KV Base Illustrations



Tower and Sphere Assembly

Prior to assembly, some units will be shipped with the base completely broken down due to high shipping cost. All international shipments will be shipped this way. These instructions will first address the units that need the base constructed.



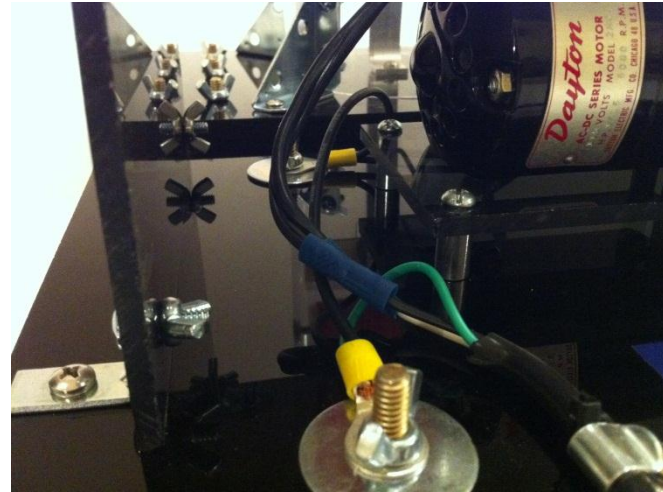
Base Construction:

- 1) Begin by first attaching the motor using the 10-24 x 1 inch machine screws that will pass through the aluminum stand-offs as seen in the illustrations.

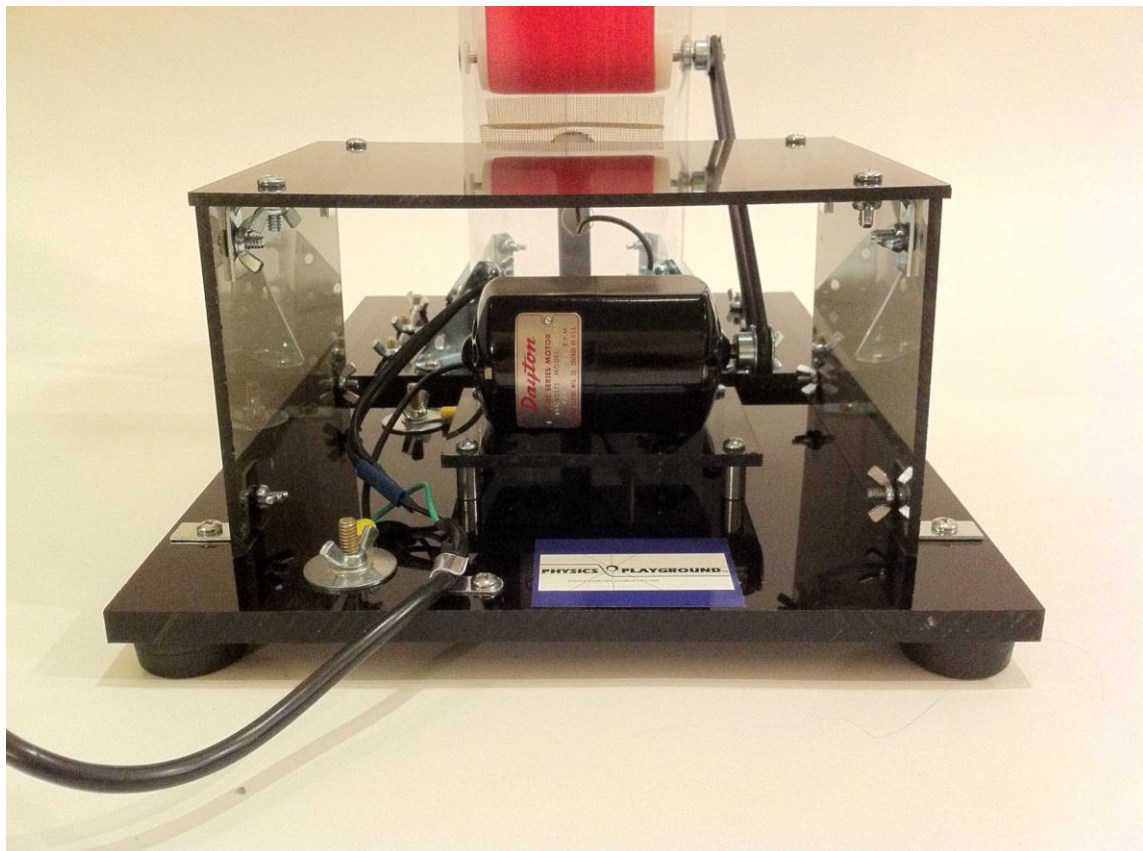


2) Attach power cord to the aluminum wire brace and then attach the yellow ring connectors to the two $\frac{1}{4}$ -20 x 1.25 inch bolts.

3) The motor cover is assembled with the 10-24 x $\frac{5}{8}$ machine screws and wing nuts. Attach the motor cover to the base using the shorter 10-24 x $\frac{3}{8}$ machine screws.



4) Attach the tubing base using the 6 $\frac{1}{4}$ -20 x 1.25 machine screws. The L-brackets to the tubing base is connected with the 10-24 $\frac{3}{8}$ machine screws.



Tubing Top and Bottom Installation:

- 1) Attach the bottom large 2 inch L-brackets to the VDG tubing. Please notice from the illustration the orientation of the brackets. To attach the brackets to the tubing, use the 10-24 x 3/8 machine screws with the wing nuts attaching from the inside. Some units may come with nylon thumb nuts instead of steel wing nuts.



- 2) Feed the discharge comb ground wire through the small 5/8 hole in the back of the tubing. This wire will connect to the grounding wire from the middle large grounding bolt.
- 3) Attach the tubing to the base through the 2 inch L-brackets using the 10-24 x 3/8 machine screws.

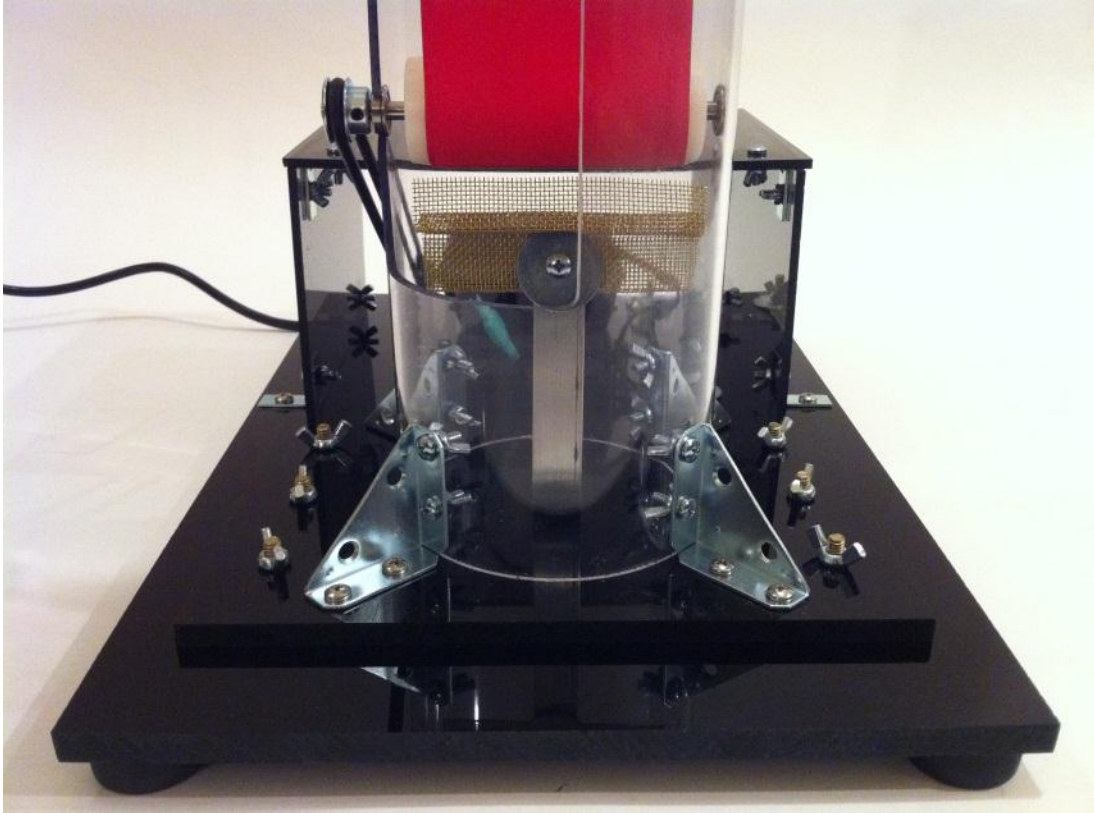
Sphere Support System:

- 1) Attach the aluminum supports on the outside of the sphere using the nylon screws.
- 2) Adjust the top discharge comb support bar to the upward position for the roller and belt installation.
- 3) When ready, the sphere is braced with a ¼-20 nylon thumb screw.

Belt and Rollers:

- 1) Though the belt and rollers are ready for use, it is good practice to first clean the belt and rollers with light dish soap and water. The cleaning is necessary because dirt and/or oil could have infected the system during the packing and unpacking of the unit during shipping.
- 2) If opted to clean the belt and rollers, clean with light soap and water and then dry with a paper towel.
- 3) To install the top black roller, first place the belt around the roller and feed the belt down through the tube. Attach the top roller in the roller insertion holes.
- 4) Holding the bottom roller in your left hand, reach up the tubing from the bottom with your right hand and pull down on the belt past the bottom roller insertion holes. There will be a significant amount of tension in the belt.
- 5) While holding the belt material with your right hand, place the roller through it and connect the bottom roller into the bottom roller insertion holes.
- 6) Release the belt onto the bottom roller and connect the drive belt.

- 7) Make sure the combs facing the belt material and are .25 to .5 inches in spacing. Do not let the combs touch the belt material.



VDG Operation Instructions

As stated in the instructions, it is advisable to first wash the belt and rollers with light soap and water and then dry with a paper towel. For best performance, VDGs need a clean roller and belt set and must have a clean sphere.

- 1) Turn the generator on without the dome attached and feel the top support system for a continuous stream of 1 to 2 inch arcs when ran at mid speed. If there are no sparks, blow a hair dryer through the bottom opening until it develops a charge. This may take from 5 to 10 minutes only if the system was just cleaned. A majority of the time the VDG will start right up, however if it is still lagging, rewash the belt and rollers and allow it to run for about 10 minutes. You will find the more you use the VDG, the stronger it will operate.
- 2) Gently place the dome on top of the support system and screw the nylon bolt through the top dome insertion hole. As with the belt and rollers, make sure the sphere is clean.
- 3) The sparks should average about 12 inches, with max sparks at 30 inches. If you are not getting 12 inch arcs, it could be due to a variety of reasons such as high humidity levels or sharp pointed grounded objects in the vicinity that create ion jets and pull the electrons from the dome, hindering the VDG from building a charge.
- 4) When running the VDG, never stand closer than 7 feet from the sphere while operating the speed control. Charge coming off of the sphere will damage the speed control. If the operator feels a shock coming from the control, it is because they are capturing charge from the unit. The operator should ground themselves before retouching the control. Speed controls are not covered under warranty and may be purchased through Physics Playground or replaced by a router speed control.

VDG Maintenance:

- 1) Do not allow the belt to come in contact with the combs during operation in order to maximize the belts life.
- 2) Latex will oxidize when in the presence of ozone or UV light. The ozone is inevitable due to the voltage produced, however the UV will inflict a significant amount of damage over time, therefore **always store the belt as removed and in a dark place when not in use.**
- 3) Never clean with alcohol or acetone due to sever cracking of the acrylic or CAB tubing.
- 4) The VDG belt and rollers may be cleaned with dish soap and water. Try to avoid water contact with the bearings.
- 5) All parts of the VDG charging system (dome, belt and rollers, and tower should be cleaned every 2hours of run time.

VDG Safety:

- 1) VDG's should not be used around people with heart condition or pacemakers.
- 2) Participants with nervous disorders may be very sensitive to the VDGs such that the VDG may cause heightened levels of anxiety. This is not a well-documented and support fact in the education or health care community, however there have been situations inquired about that alluded to this being a possibility.
- 3) Be careful not to make items that will act as high voltage capacitors. The current from the VDG's are safe, however when the current is allowed to be stored at such high capacitances, they can become lethal when discharged.
- 4) Larger VDGs can produce welts from prolong exposure to arcs.
- 5) Keep away from all electronics and do not use in the same circuit that is used for other electronics
- 6) Operate in well ventilated areas due to the ozone produced.
- 7) Avoid making human chains.
- 8) Keep the speed control away from VDG while in operation. Never touch the speed control while standing closer than 7 feet from the VDG.

Experimenter Ideas:

- 1) Insulate yourself and touch the VDG while pointing at various objects in the room to place a charge on. When done to a chandelier it will cause arcs within the chain.
- 2) Insulate and charge yourself with 700,000V and then step off of the insulated material and experience the feeling of your body just electrically shut off from the field.
- 3) Wrap the bottom roller with a metallic coating and force feed it with a 15,000V charge to induce higher currents. These VDG are designed to do so.
(Dangerous)
- 4) Wrap a balloon in foil and then hang it from a string attached to the ceiling so that it can touch the dome. Turn on the VDG and watch the outcome.
- 5) Take two pie pans and attach a positive and negative lead from the VDG to each pan. Next place small foil leaves between the pans or string. Very cool to see!
- 6) Bring fluorescent tubes near the VDG. This makes a great visual for examining electric fields. The tube will begin to glow at 5 feet away.
- 7) Charging Lynden Jar and high voltage beer cup capacitors (Dangerous)
- 8) Place pie pans on the generator and watch them fly.
- 9) Static electricity motors and ion jets.
- 10) Just insulate yourself to feel your entire body light up from being immersed in the 320,000V electric field. ABSOLUTELY AWESOME!!! However, if someone touches you....ouch! This seems to be my students favorite thing to do especially with the x-large 700KV VDG where they will develop 8 inch arcs coming off of them when approached. Yes, this is a crowd pleaser!!!

Warranty and Replacement Parts:

Warranty: Physics Playground generators and high voltage equipment are covered under a two year warranty except for static belts and speed controls. Sign of rough use, such as dropping, over tightening hardware, and exposure to caustic chemicals will dismiss the equipment from eligibility of the warranty.

Prior to sending a replacement part, the buyer must email a photo of the damaged part to frederickgraff@hotmail.com for verification. All replacement parts will be shipped within 4 business days.

Consumable Parts: Please visit Physics playground for replacement parts. Both belt material and pre-made belts will be sold on the website. For those who wish to mend their own belts, the belt sizes are listed below.

- 500KV to 700KV High Current VDGs:
(4.5 in x 48 inch)

Warning: Van de Graaff generators are not a toy and should only be used by those familiar with high voltage devices. Physics Playground does not hold responsibly for the use or misuse of the purchased high voltage equipment. Use at your own risk.
