VAN DE GRAAFF GENERATOR

MODEL N-100V

UNPACKING AND INSPECTION

After unpacking the unit, immediately inspect for damage that may have occurred during transit. If any damage is noted, file a claim at once with the carrier or call the dealer from whom the unit was purchased. Save all of the packing materials so that the carrier's claim representative can inspect them. Be sure to retain the shipping carton, the inside pillows and the corner braces. These will be of great help in properly storing the machine or when it must be transported. Always load and unload the unit from the bottom of the carton, using the handles on the cabinet base. Never lift the machine by the column or the dome.

DESCRIPTION OF EQUIPMENT

The WINSCO model N-100V Electrostatic Generator is designed to attain potentials up to 350,000 volts or more under favorable operating conditions. Potentials of 250,000 volts are perhaps more usual and provide more than enough voltage for forceful demonstrations. All units are shipped completely assembled, ready to operate.

The Van de Graaff Generator consists essentially of a motor-driven belt that runs between pulleys, one on the motor shaft and the other inside the dome at the top of the column. The variable speed motor is controlled by a rheostat whose knob is on the front panel.

When the Van de Graaff is new, it is normal for the motor to not start turning until the rheostat is almost at full speed. This is because the bearings in the motor and the upper pulley are still relatively tight. Over time those bearings will loosen up and the unit will start more easily.

FIRST USE

As received, your Van de Graaff is ready for use. In a very small number of instances, the Generator may not initially perform to your expectations. This will almost always be the result of its most recent temperature cycling experience. If the unit is unpacked in a nice warm building after a number of hours in a cold delivery truck, there will be immediate moisture condensation on the belt and pulleys and no or very little charge may result.

If, for any reason, your new Van de Graaff fails to perform, DO NOT CALL THE DEALER, but instead send an email to info@winsco.com. Include your name, phone number and the best time to call. A technical representative will contact you with help to get back up and running.

MAINTENANCE

Keep the dome and column free of dust and fingerprints. Clean with a soft cloth and an aerosol dusting polish. If dust and grime are allowed to accumulate, they present thousands of little discharge points on the surface of the dome. They can easily reduce the available voltage by 50%.

The latex transport belt is slowly attacked by the oxygen in the atmosphere, just as is an ordinary rubber band. The ozone created during operation is even more damaging, and so the belt will need to be replaced from time to time. We suggest that you have one belt on the machine and one spare.

Replacement belts are always readily available and may be purchased from your regular dealer or directly from our web-site at www.winsco.com. Select "Replacement Parts" from the main menu on the home page. Our buying service is through PayPal and accepts most credit cards.

Additionally, there are some special articles that you may find useful when working with your WINSCO Van de Graaff. For downloadable PDF files, please visit www.winsco.com, and look for them under the tab "Product Notes" in the main menu on the Home page.

©2009, WABASH INSTRUMENT CORPORATION. ALL RIGHTS RESERVED.

Wabash Instrument Corporation 300 Olive St., Wabash, IN 46992 Tel: 260.563.8406 www.winsco.com
For more information, please contact us: info@winsco.com

VAN DE GRAAFF GENERATOR

MODEL N-100V

WARNING!
THE DEMONSTRATIONS DESCRIBED IN THE FOLLOWING INSTRUCTIONS MAY INVOLVE HAZARDS ARISING FROM CARELESS HANDLING OR INCORRECT PROCEDURES. THIS EQUIPMENT SHOULD BE USED ONLY UNDER THE SUPERVISION OF A QUALIFIED, CERTIFIED SCIENCE TEACHER.

SUGGESTED DEMONSTRATIONS
The descriptions that follow are intended as an overview of a variety of demonstrations and include a brief description of each. More extensive guidance can be found in the instruction sheets for each specific product. Please visit www.winsco.com; see "Product Instructions" in main menu.

1. THE DISRUPTIVE ARC
One of the more attention-getting demonstrations using the Van de Graaff Generator is the arc discharge. Bring a round object, such as the N-122 Discharge Electrode, within 3 or 4 inches of the dome. Be sure you have properly grounded the unit to the binding post on the top of the generator cabinet. If the generator is operating up to voltage, there will be a sharp crack and a bright bluish-white arc as it jumps from the dome to the smaller electrode. With a discharge electrode of this size, about 4 inches in diameter, you can estimate the voltage on the dome at approximately 50,000 volts per inch of the maximum arc length. With a smaller diameter discharge electrode, the arc length would be greater but the intensity would be less.

2. CONTINUOUS DISCHARGE
If you point a finger at the dome from a distance of about 3 inches, you will feel a slight tingle on a continuing basis. If there is more of an intermittent zap, move your finger a little closer until the current flow is continuous. Instead of a finger, now hold a common nail or metal screwdriver pointed at the dome. Be sure to hold the screwdriver on some part of the metal and not by the handle. The effect of the metal point is more pronounced than the finger but, in both cases, we are continuously discharging the dome. If you now bring the N-122 Electrode near the dome while holding the nail, you will not get an arc as before. When this demonstration is performed in the dark, you will see a faint glow around the point of the nail. This is called a corona discharge. It is the continuous excitation and ionization of the air, causing the emission of light.

3. THE ELECTRIC WIND
Repeat the previous demonstration while holding a candle flame between the point (nail) and the dome, but nearer the point. You will see that the flame is bent over by a wind that is blowing away from the dome. The effect is caused by charged particles of air trying to get away from the dome and from each other. (Like charges repel one another.) The same wind effect can be seen by placing the N-127 Point Terminal on the side of the dome and holding the candle several inches away. A child's plastic pinwheel or a thin sheet of facial tissue are excellent demonstration devices.

4. THE ELECTRIC PLUME
Place the N-125 Electric Plume on top of the dome, making sure that the ribbons are not tangled with one another. When the machine is turned on and the voltage builds up, the ribbons will stand up and away from each other. They have acquired a negative charge from the dome and are repelled from it and from each other.

5. THE ELECTRIC WHIRL
Bring an N-124 Electric Whirl (or the N-124-IS Electric Whirl for use with N-140 Insulating Stand) near the dome when it is up to voltage. The three-arm pivoted assembly will immediately begin to turn. The direction of rotation will be away from the pointed ends of the spokes. What is happening is that the arms are being charged negatively by leakage from the dome and the points are in turn ionizing the air nearby. As these charged particles are repulsed by the point, there is also a reaction force that causes the arms to turn.

6. THE RACING BALL
Mount the N-141 Racing Ball assembly on top of the N-140 Insulating Stand and bring them near the dome. Connect a wire from the dome to the wire loop at the top of the Racing Ball. Any light-weight wire, either bare or insulated, will suffice. Ground the base of the Racing Ball by connecting a wire from the metal hook on the Insulating Stand to the binding post on the cabinet. If the pan of the Racing Ball is level, the ball will begin to roll around and will finally run continuously around the rim of the lower pan. The ball acquires charge from the upper disc and then is repelled, so it rolls. More charge comes in at the top of the ball and as it rolls further, the charge at the bottom of the ball is lost to the grounded lower pan.

©2009, WABASH INSTRUMENT CORPORATION. ALL RIGHTS RESERVED.

Wabash Instrument Corporation 300 Olive St., Wabash, IN 46992 Tel: 260.563.8406 www.winsco.com
For more information, please contact us: info@winsco.com

VAN DE GRAAFF GENERATOR

MODEL N-100V

7. THE HOLLOW CYLINDER

The N-142 Hollow Cylinder has small, lightweight pith balls tethered by threads. One pair of balls is on the outside of a metal cylinder and another pair is on the inside. When the unit receives a charge from a proof plane or an N-122 Discharge Electrode, the outside balls will become charged and stand away from the cylinder. There is no charge inside the cylinder and so the inside balls are totally unaffected.

The N-122 Discharge Electrode may be used as a proof plane. Charge up the Generator and then turn it off. Touch the N-122 to the dome and then use it to transfer charge to the small ball on the top of the N-142. The small N-135 Proof Plane will also work very well but you may have to recharge it from the dome several times.

This demonstration is best performed with the Hollow Cylinder at some distance away from the dome. If no transfer device is available, charge up the generator dome and then turn the machine off. Bring the electrode ball on top of the Hollow Cylinder up to touch the dome.

8. THE LIGHTNING PLATE

Hang the N-139 Lightning Plate on the small metal hook at the top of the N-140 Insulated Stand. The lower ring of the Lightning Plate should be connected to the grounding binding post on the cabinet base of the generator. Any light weight wire will be satisfactory. Now, when the Generator is in operation, small arcs will jump between each of the segments on the conductive surface of the Lightning Plate. Notice that the discharge follows the shortest cumulative distance to get to ground.

9. VOLTA'S HAIL STORM

Bring the N-132 Volta's Hail Storm near the dome of the Generator and the small particles of vermiculite will immediately begin to jump up and down. They are first attracted to the upper plate, but when they get there, they receive a charge that causes them to be repelled. When the particles again reach the grounded lower plate, they lose their charge and then the process will repeat.

Just holding the base of the N-132 will usually provide enough grounding for successful operation. When the N-132-IS Volta's Hail Storm is used with the N-140 Insulating Stand, the metal clip at the top of the stand should be connected to the grounding binding post on the cabinet.

10. SMOKE PRECIPITATION

Remove the vermiculite from the N-132 Volta's Hail Storm (or the N-132-IS Volta's Hail Storm for use with N-140 Insulating Stand) and stand the little piece of wire screen on edge. If necessary, roll the screen into a partial cylinder to help it stand on its side. Fill the N-132 with cigarette smoke or equal, replace the top and then bring the unit near the dome of the Generator. The smoke will immediately become charged and be attracted to one of the electrodes. It will vanish almost instantly.

11. NEON WAND

The N-146 Neon Wand is a very sensitive indicator of the extent of the electrostatic field near the dome of the generator. Pointing the glass tube at the dome from a distance of 2 or 3 feet will cause it to light up with the typical orange neon glow. As you bring it closer to the dome, it will become brighter. If you stick a small piece of foam on the wires at the end of the tube and then hold it against the dome, you should get the very brightest output. In this case, the foam is providing a small amount of insulation so that the dome has to build up to a high charge level before it can arc to the wires. The neon tube now receives a quick repetition of high-energy discharges that create more light than the continuous current flow that was present without the foam.

12. THE FLYING BALL

Hold the "fishing pole" of the N-144 Flying Ball so that the ball is perhaps 6 or 8 inches from the dome. Note carefully that, at first, it is attracted to the dome, but if it touches the dome, it is then violently repelled. Until this newly acquired charge is dissipated, the ball will "fly" at the end of its thread and remain quite far from the dome. If you touch the ball and thereby remove the charge, the performance will be repeated. First, attraction by induction, and then repulsion after it touches the dome. The round, smooth shape of the ball allows it to hold a charge for quite a long time.

The N-144 Silver Snake is a metallized ribbon that will be attracted to the dome, but repelled as soon as it touches. Its geometric shape with edges causes the loss of charge into the air very quickly and so the cycle repeats.

©2009, WABASH INSTRUMENT CORPORATION. ALL RIGHTS RESERVED.

Wabash Instrument Corporation 300 Olive St., Wabash, IN 46992 Tel: 260.563.8406 www.winsco.com
For more information, please contact us: info@winsco.com

VAN DE GRAAFF GENERATOR

MODEL N-100V

14. CHARGING A PERSON'S HAIR

This is fun for all the class but not necessarily an easy demonstration to pull off. If you can raise the entire person to the voltage level of the dome, then their hair should act in much the same way as the electric plume did in paragraph No. 4.

The first step is to **insulate the subject from ground by having them stand on something like a sturdy plastic milk crate or some glass building blocks**. You need to get the subject about one foot above the floor. A rubber mat or plastic sheet simply will not work. Have your volunteer place his or her hand on the dome and then start the machine. The subject must understand that he is not to remove his hand or he will receive a shock when he puts it back. In a minute or so the subject will have been raised to about as high a potential as you're going to get. If the hair is now standing up, you have succeeded. If not, it's time to consider what might be wrong.

First, the N-100V is not a huge machine, so the smaller the person you have selected, the better. There will be less surface from which to lose charge. Second, be sure there are as few "points" of loss as possible. Things like rings on fingers, metal barrettes, and belt buckles should be avoided. Third, be sure the machine is in good operating condition and is putting out plenty of voltage. Do not even think about trying this demonstration on a day of high humidity. The generator output will be low and leakage will be high.

The repulsive forces available are relatively small and are quite insufficient to untangle hair or overcome any type of hair spray. The best results will come from clean, straight, dry hair of perhaps 3 or 4 inches in length.

For more information about these Van de Graaff Generator demonstrations, or for questions or suggestions pertaining to this instrument, please contact us at info@winsco.com, or visit our website at www.winsco.com. We are continuously making additions and updates to our website, so please check in often.

©2009, WABASH INSTRUMENT CORPORATION. ALL RIGHTS RESERVED.

Wabash Instrument Corporation 300 Olive St., Wabash, IN 46992 Tel: 260.563.8406 www.winsco.com
For more information, please contact us: info@winsco.com