

# VAN DE GRAAFF RAIJIN

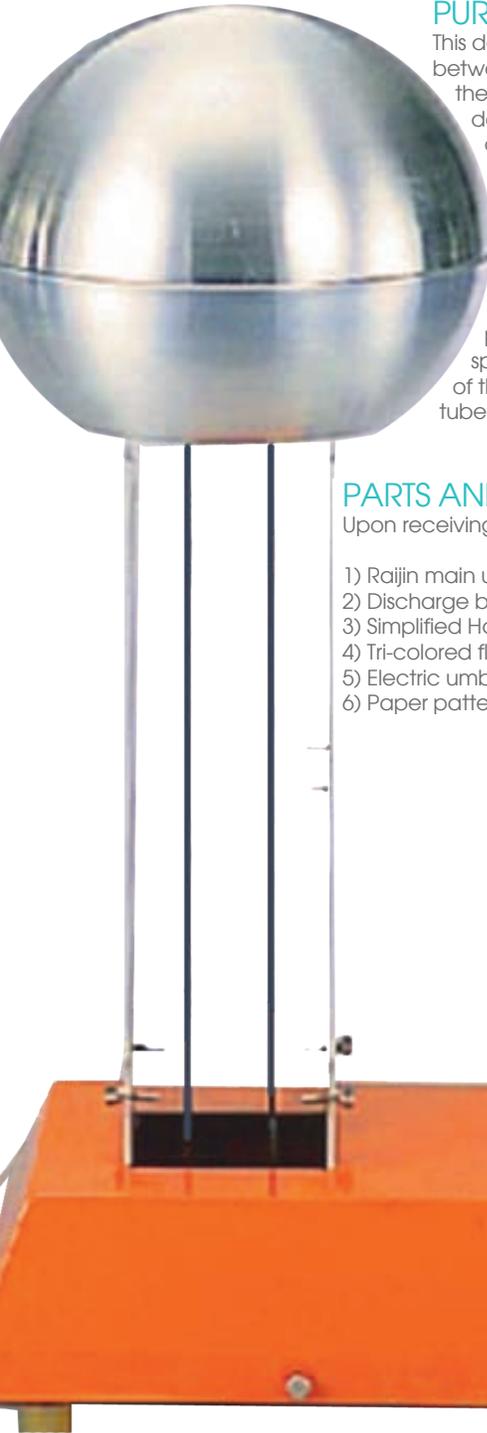
N99-B10-1323

**RAIJIN**



## Manual of Operations

**IMPORTANT!**  
**Read the following before using this equipment:**  
Carefully follow all instructions and observe all precautions given in this manual



## PURPOSE

This device is a Van de Graaff-type electrostatic generator. It uses static electricity generated by friction between the belt and rollers to ionize air molecules and accumulates the air ions in the collecting bulb at the top of the electrostatic generator. The generator's performance varies from season to season or depending on the generator's maintenance condition. Therefore, we strongly recommend the user to diligently conduct generator maintenance to allow it to deliver optimal performance. The Raijin model is constructed such that it can be serviced far easier than comparable models. We hope that the Raijin is properly maintained and utilized in various electrostatic experiments.

## CONSTRUCTION AND PRINCIPLES

An electron gun consisting of a cylindrical plate, a cathode, and a heater is attached along with an electrode deflecting plate inside a CRT-type Crookes tube filled with argon gas. An electron is propelled from the cathode into the cylindrical plate. Voltage applied on the plate accelerates the speed of the electron up to a specified velocity by the time the electron is projected through the hole of the plate. The emission resulting from the collision of the electron with the argon gas contained in the tube allows its path to be clearly visible.

## PARTS AND ACCESSORIES

Upon receiving the product, please verify that the box contains the following items:

- 1) Raijin main unit equipped with a controller to change the speed of the belt
- 2) Discharge bulb (small bulb) for conducting high-voltage discharge experiments
- 3) Simplified Hamilton flywheel assembly kit: 1 set (six discharge needles that have not been bent yet.)
- 4) Tri-colored fluorescent tube: 1 piece
- 5) Electric umbrella preparation kit: 1 set (plastic strings that need to be split by the customer)
- 6) Paper pattern for an electrostatic rocket: A4, one sheet



FIG. 1 BELT SPEED CTRL



FIG. 2 ELECTRODE TERMINAL

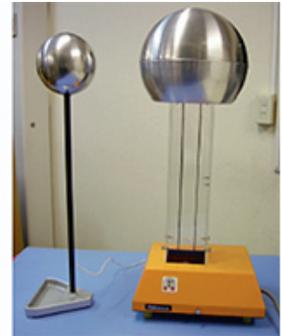


FIG. 3 CONNECTING THE DISCHARGE BULB

## OPERATION

- 1) Check that the Power switch on the controller shown in Fig. 1 is in the OFF position and then connect the AC power plug of the Raijin main unit to an electrical outlet.
- 2) There is a banana jack electrode terminal at a lower part of the side face of the main unit. Connect the cable of the provided discharge bulb (small bulb) to this inlet as shown in Fig. 2.
- 3) Provide a distance of about 6 cm between the collecting bulb at the top of the main unit and the discharge bulb as shown in Fig. 3.

4) Check that the belt speed controller's variable resistor knob is turned fully counterclockwise, turn ON the Power switch, and then gradually turn the knob clockwise.

5) Discharge occurs even at low revolution speeds, and as you increase the VR's turning angle, the discharge interval (time) becomes shorter. When this is consistent, gradually increase the distance between the collecting bulb and discharge bulb. When maintenance of the generator is successful, discharge can occur at a distance of more than 100 mm under dry conditions in the middle of winter. If this operation verification results in a significantly short discharge distance, perform maintenance of the electrostatic generator using the following method. The product is adjusted to optimal conditions at factory shipment; however, its performance may degrade depending on the season or the degree of humidity or dust in the environment in which it is being used.

## IMPORTANT NOTE

- Experiments of raising one's hair requires an insulated stool. Your hair will not rise up where static electricity flows to the floor through your legs.



FIG. 5

## HOW TO MAINTAIN

1) Unscrew the two screws installed in the side face of the Rajjin main unit's metal cover. (Fig. 4)

2) Unscrew the four screws attached to the lower parts of the clear, acrylic column (belt cover) and save the removed screws. (Fig. 5)

3) Remove the two panels from the acrylic column as shown. (Fig. 6.)

4) Bring the main unit's metal cover to the upper part of the column and hold the cover with one hand. Locate the threaded holes for fixing screws at a center part of the column and screw in the two screws removed in step 1. (Fig. 7).

5) Lower the main unit's metal cover carefully onto the screws fixed at the center part of the column. (Fig. 8).

6) When the cover has been raised to the center part of the column, the main unit's inside is exposed; first remove the orange timing belt connecting the motor at the rear of the main unit and the roller at the front.

7) Remove the top half of the collecting bulb and turn the screws attached to both ends of the upper roller shaft counterclockwise to loosen the belt. (Fig. 9-10)

8) Unscrew the set screw (the one with the black head) from the bottom roller and pull the roller out. Place the removed roller in a location where dust cannot settle on it. (Fig. 11)

9) Hold the roller shaft with both hands as shown. (Fig. 12) and pull it up together with the belt. For this step, exercise caution and prevent the belt from rubbing against the electrode.

10) Clean the removed rollers and belt using ethanol for disinfection. For the rollers, gently wipe their surfaces with tissue paper dampened with small amounts of ethanol. For the belt, immerse it into ethanol as shown (Fig. 13) to sufficiently remove oil, grease, and dirt. Then dry the belt in the shade as shown (Fig. 14)

NOTE: (Do not wipe the belt surface with a fluffy cloth such as a towel.)

FIG. 6

FIG. 7

FIG. 8



FIG. 9

FIG. 10

## CAUTION!

1. When raising the main unit's cover to an upper part of the acrylic column or lowering it to a center part of it, exercise care not to damage the column.

2. Do not drop the main unit's cover onto the screws, but lower it slowly. Otherwise, the threaded holes in the center part of the column may be damaged.

3. For cleaning ethanol, always use ethanol for disinfection that is diluted with water (ethanol diluted with water to about 75% volume). When cleaning a roller, use ethanol further diluted with water.

4. Do not immerse a roller into diluted ethanol for cleaning. (Otherwise, the roller may crack.)

FIG. 11



FIG. 12

FIG. 13

FIG. 14

**PREPARATION AND EXPERIMENT**

The six discharge needles of the flywheel have not yet been bent. As shown in Fig. 15, bend the needles at a point about 40 mm from the tip of one needle by hand to complete them. Conduct experiments with the needle bending position or bending angle changed to see how the rotation of the flywheel varies.

**HOW TO USE**

Use the Hamilton flywheel by placing it on top of the collecting bulb as shown in Fig. 16. In this case, if the legs of the supporting base do not sit on the bulb successfully, re-bend the legs of the base (tips of the regular triangle-shaped aluminum base) to a suitable angle using pliers. It is recommended that you wind PVC tape around the tips of a tool, such as a pair of long-nose pliers, (the areas pinching the workpiece) to bend a leg. This allows you to finish the workpiece without damage.

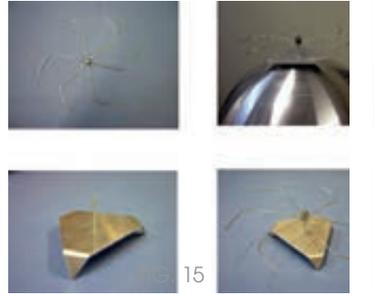


FIG. 16

FIG. 18



**ELECTRIC UMBRELLA**

**PREPARATION**

There is a 50-mm white PVC disk with a black O-ring to which eight approx. 90-mm long polypropylene strings are bonded. Separate these eight polypropylene strings into pieces using a pinholder or metal comb to complete the electric umbrella. When separating a string into pieces, do not excessively separate it. Otherwise, it will break into pieces, resulting in many lost polypropylene pieces.

**EXPERIMENT**

The electric umbrella (Fig. 17) is used by placing it on top of the collecting bulb as shown in Fig. 18. In this case, run the belt at low speeds. Otherwise, the umbrella may jump up and slip off the bulb when the belt speed increases. You may fasten it using Scotch tape or PVC tape to prevent it from slipping.



FIG. 17

**ELECTROSTATIC ROCKET**

**PREPARATION**

Cut out a rocket pattern with the blue logo mark and one with the red logo mark from the electrostatic rocket paper pattern provided with the product. Cut a notch along the 30-mm black line on each rocket pattern using a cutter, etc. Then, match the notched lines of these two rocket patterns by sliding one over the other. Then bond the contact areas using woodworking adhesive or Scotch tape to complete the paper rocket as shown in Fig. 19.

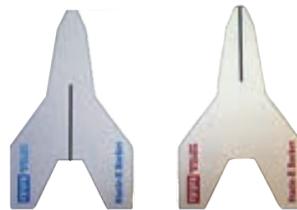


FIG. 19



**EXPERIMENT**

First, turn OFF the speed controller's Power switch and turn the speed adjusting VR fully clockwise (to a position where the belt moving speed is maximized). Then place the rocket on top of the collecting bulb, turn ON the Power switch. After a short period, the rocket will jump up.

**TRI-COLORED FLUORESCENT TUBE**

**EXPERIMENT**

The fluorescent tube provided with the product is an 8 Watt fluorescent tube to which three fluorescent paintings of green, red, and blue have been coated in the longitudinal direction.

With the belt moving at the maximum speed, hold one end of the fluorescent tube and slowly bring the other end to the collecting bulb. (Fig. 20) This causes the lamp to light up. In this case, always hold the lamp with your right hand.



**CAUTION!**

A person who has a weak heart, or an implanted heart pacemaker, or who is in poor physical condition must not conduct these experiments. Never force unwilling participants to conduct these experiments.

- For the Tri-colored fluorescent tube lighting experiment, adjustment of the controller or turning the switch ON/OFF **must be performed by anyone other than the person conducting the experiment holding the fluorescent tube**. Otherwise, an electric shock may be caused during operation of the switch because static electricity accumulates in the person conducting the experiment.