

Basic Static Electricity Countermeasures

STATIC ELECTRICITY IN MANUFACTURING

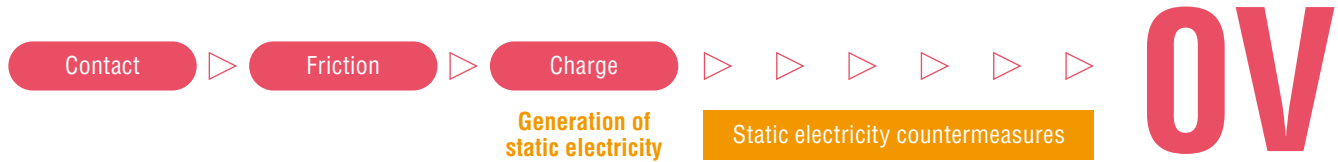
What are static electricity countermeasures?

Static electricity countermeasures with a static eliminator

1

What are static electricity countermeasures?

Static electricity countermeasures change the charge state on an object to 0 V after removing static electricity that has been generated by friction or peeling.



The static electricity countermeasure that should be implemented will differ depending on the material of the charged object. If the wrong countermeasure is performed, it will be ineffective and conversely, the object may also become charged. To address this, we will introduce the correct methods for countering static electricity.

2

General static electricity countermeasures

For static electricity countermeasures, it is necessary to consider that the materials are categorized into two types:

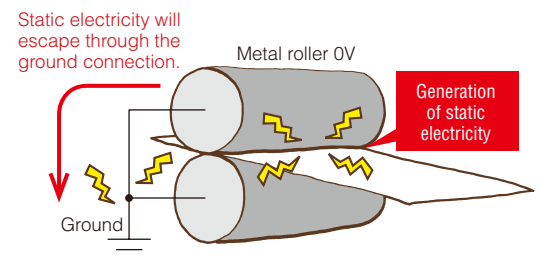
1. Conductors

2. Insulators

1. Conductors

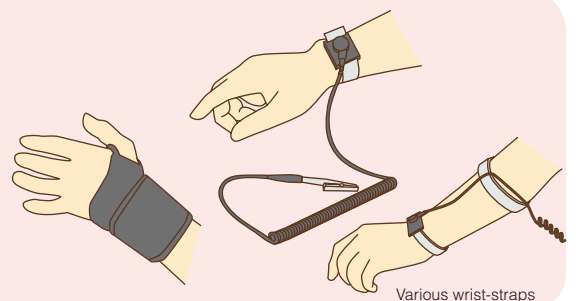
Static electricity is easily countered with grounding!

When metal objects (conductors) such as aluminum or iron are charged with static electricity, grounding changes them to a 0 V state. Static electricity countermeasures for conductors are low cost and very easy.



The human body is also a conductor!

The human body is also a conductor that passes electricity. During operation, friction or peeling between people and clothing always occurs, generating static electricity. To address this, a wrist-strap, like the one in the illustration on the right, is worn. This allows the electric potential of the person to escape to the ground connection, thus making it possible to prevent static electricity problems that are caused by humans.



In an environment that contains only metal objects (conductors), it is possible to counter static electricity just by grounding. However, grounding has absolutely no effect on insulators because they do not possess properties that allow for the flow of electricity. In a typical manufacturing plant, it is common for both conductors and insulators to exist. In other words, ground based countermeasures alone are not enough.

2. Insulators

There are various ways to counter static electricity for insulators. Two of them are explained below.

A. Change the material of the insulator

B. Humidity control

A Change the material of the insulator

Although it is impossible to remove static electricity from an insulator (plastic, rubber, etc.) even if it is grounded, it is possible to eliminate static by changing the material. There are two ways in which this is done. One method mixes the product or the material itself with conductive material (carbon, metallic powder, etc.), and the other method coats the surface of the insulator with an antistatic solution.

Countermeasure examples



Conductive plastic



Conductive rubber sheet



Anti-static spray



Creating conduction

By changing the conductivity of the material, it is possible to counter static electricity in the same manner as a conductor, even for insulators.

B Humidity control

In winter and summer, the frequency with which one experiences pain from static shock differs. This is due to "humidity". In the summer when humidity is high, static is able to escape to the moisture in the air, thus making it difficult for static discharge to occur. In comparison, humidity in the winter is low and static electricity easily accumulates. This is why static shock is felt much more in winter than in summer. In other words, static electricity can be managed by controlling the humidity.

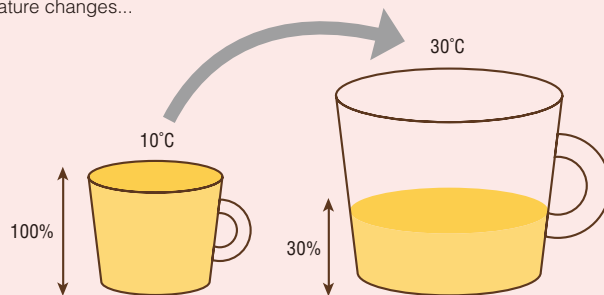
What is humidity?

There are two types of humidity: "relative humidity" and "absolute humidity". The humidity that is generally used indicates relative humidity. Relative humidity is a percentage of the amount of water vapor in the air in relation to the total amount that can be contained before condensation occurs (100%).

Absolute humidity expresses the mass (g) of water vapor that is contained in a single unit area of air (1 m^3).

Relative humidity

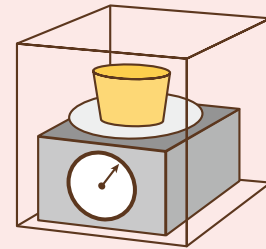
When the temperature changes...



Absolute humidity

The mass of the water vapor that is contained per 1 m^3

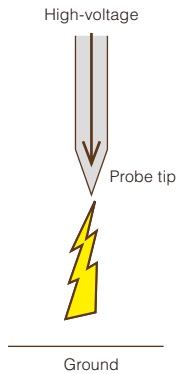
Unrelated to
temperature



3

Static electricity countermeasures with a static eliminator

Although we have introduced you to static electricity countermeasures for conductors and insulators, performing countermeasures to match the target material every time is difficult. One way to counter static electricity without concern for the type of material is by using a "static eliminator" (ionizer). Static eliminators generate ions from the tip of what is called an electrode probe and neutralize charged targets with ions. They use a phenomenon called corona discharge to generate ions. When ions are attached to matter that has been charged with static electricity, an exchange of electrical charges creates an electrically neutral state. This makes it possible to counter static electricity with greater accuracy than countermeasures involving conduction or humidity, and this continues to be a trend in manufacturing plants.



What is corona discharge?

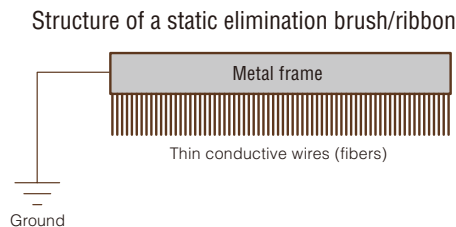
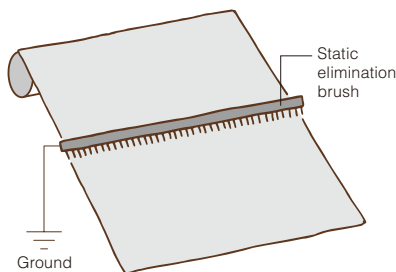
Corona discharge is the phenomenon that occurs when high-voltage is applied to a localized area such as a probe tip. Specifically, by applying a voltage of ± 3 kV or greater to the probe tip, the probe tip will produce a pale purple glow. Unlike spark discharging, sudden and sharp electrical currents do not flow to the target. Instead, electrical current is quietly discharged to molecules in the air. When this discharge phenomenon occurs, the molecules in the air become ions.

Below, are the two types of static eliminators:

1. Self-discharge systems
2. Applied voltage systems

1. Self-discharge systems

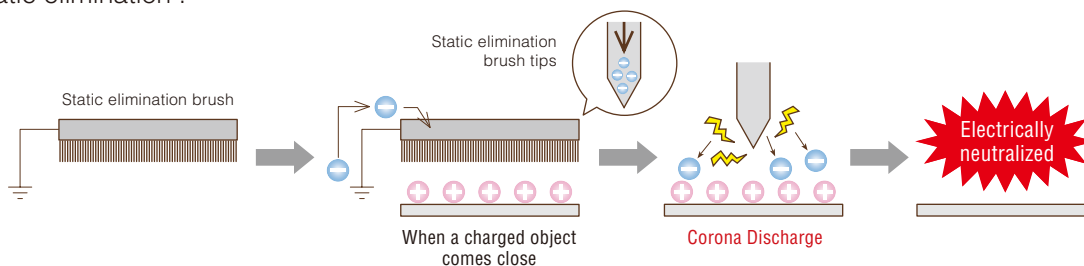
Self-discharge static eliminators connect their static elimination brush or ribbon directly to a ground and use the charge of the target to generate ions. They are easy to install and do not need a power source, so their advantage is their ability to easily perform static elimination.



Actually, the brush-shaped object that is often seen at the outlet port of a copy machine is a self-discharge system static eliminator. Copy paper becomes charged with static electricity while repeatedly experiencing friction and peeling inside the copy machine. Due to this influence, problems occur in which the paper does not stack properly at the outlet port. To address this, a self-discharge system static eliminator is used to counter static electricity, making the paper stack cleanly.

The mechanism of self-discharge systems

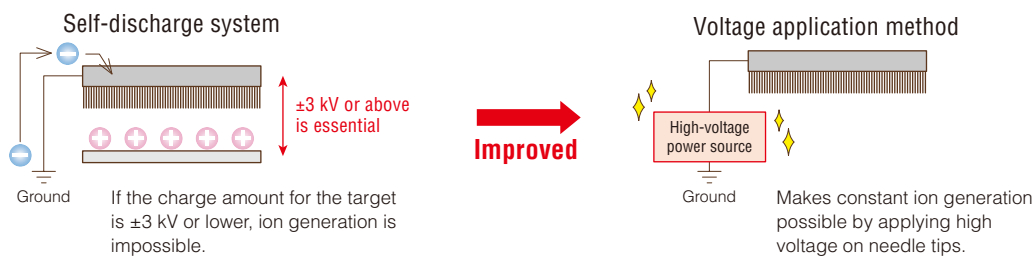
When the static elimination brush comes near a charged object, the charge of the target and the charge of the opposite polarity accumulate at the tips of the static elimination brush through a phenomenon called electrostatic induction. If the accumulated charge exceeds a voltage of ± 3 kV or above, corona discharge will occur and ions will be generated. The generated ions are drawn towards the static electricity of the target and a charge is supplied. Through this mechanism, the static electricity of the target is neutralized to create an electrical state of 0 V. This is called "static elimination".



Static elimination brushes/ribbons are methods that can easily be implemented due to their low price. But their disadvantage is that they cannot eliminate static when the charge on the target is too low. Specifically, static electricity cannot be removed when the charge on the target is about ± 3 kV or less, which cannot be felt by humans.

2. Applied voltage systems

With self-discharge static eliminators, principles state that only charges of ± 3 kV or greater can be removed. To address this, the newly developed applied voltage system has a built in power source and constantly applies high voltage to the probe tip. By constantly applying a voltage of ± 3 kV or greater to the probe tip, it is possible to stably generate ions without being influenced by the charge amount of the target. Through this, it has become possible to conduct high-accuracy static electricity countermeasures that do not require workpiece selection.



ADVANTAGES OF APPLIED VOLTAGE SYSTEMS

- Can perform high-accuracy static electricity countermeasures
- No need to select the target material
- Can be installed after the equipment has already been setup



TRANSFORMING TECHNOLOGIES

OUTSTANDING ALTERNATIVES IN STATIC CONTROL

View Transforming Technologies Static Eliminating Ionizers here:

<http://transforming-technologies.com/product-category/esd-ionizers/>

Do you have additional questions? Ask your ESD questions and get answers from certified ESD and Static Control experts:

- **Phone Support: 419-841-9552**
- **Email: info@transforming-technologies.com**
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