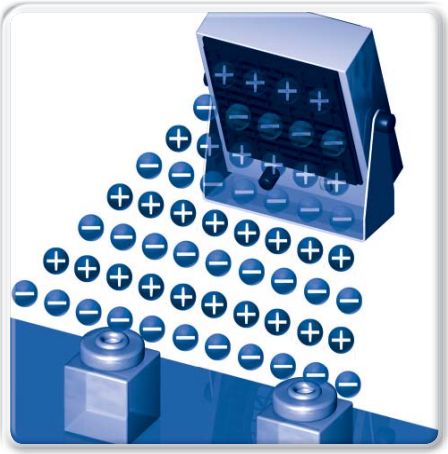
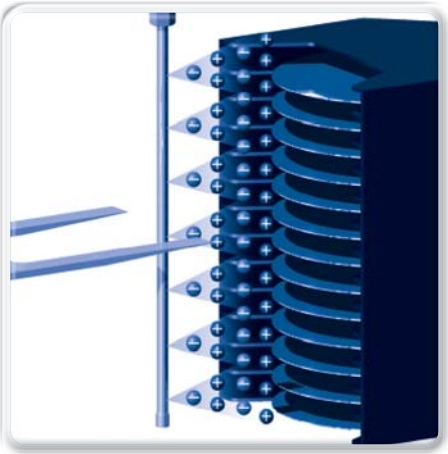
KOGANEI
http://www.koganei.co.jp

No.BK-SP005

Static Electricity Removing Unit
IONIZER
Technical Information Guidebook



Reference

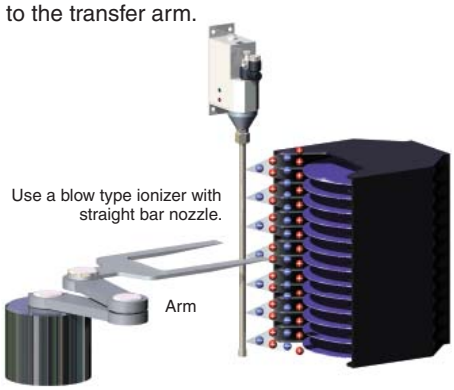
Contents

Application Examples

Blow Type Application Examples

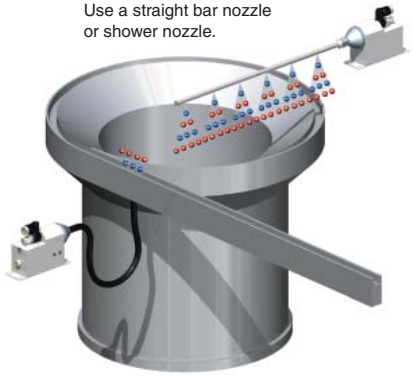
Removal of static charges when taking out or storing wafers

Avoids electrostatic discharging when taking wafers out of their cassettes, and prevents the stored wafers from being attracted to the transfer arm.



Removal of static charges on parts when carried by a parts feeder

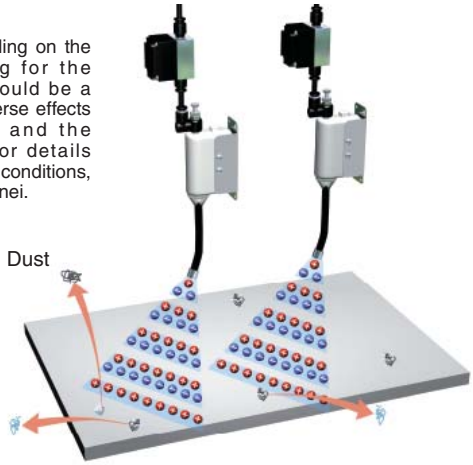
Static electricity is generated due to friction of parts while the parts feeder conveys them, and the parts stick to the feeder's surface.
Use the blow type ionizer to prevent parts from becoming stuck due to static electricity. Also, simultaneous use with a fan type is effective for the static electricity removal.



Removal of static charges and dust using intermittent ion air blowing

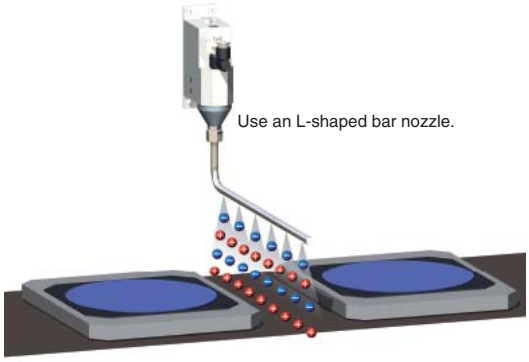
Works in combination with the high-cycle solenoid valve, using high-tact intermittent blowing of ionized air for removal of static charges and dust .

Caution: Depending on the ON/OFF timing for the ionizer, there could be a possibility of adverse effects on equipment and the environment. For details about application conditions, consult with Koganei.



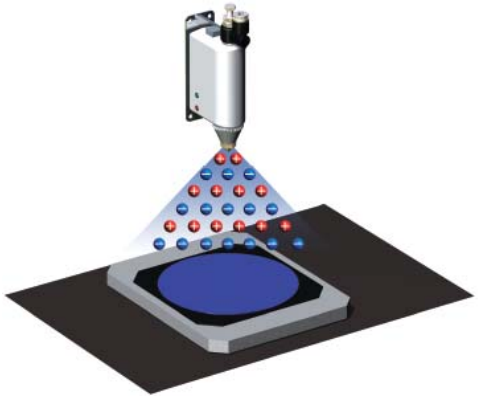
Removal of static charges when conveying wafers

Prevents dust from being attracted to the surface of wafers. Prevents the internal patterns from being damaged.



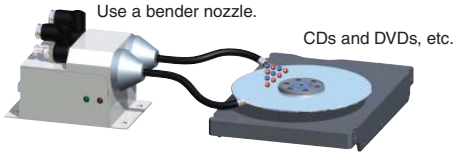
Removal of static charges on wafers

Use blow type ionizers with shower nozzles that provide Ionized air flow with a wide angle to remove static charges on wafers.



Removal of static charges and particles on CDs and DVDs

Use 2-head types with bender nozzles to remove static charges and particles on CDs and DVDs from both sides.

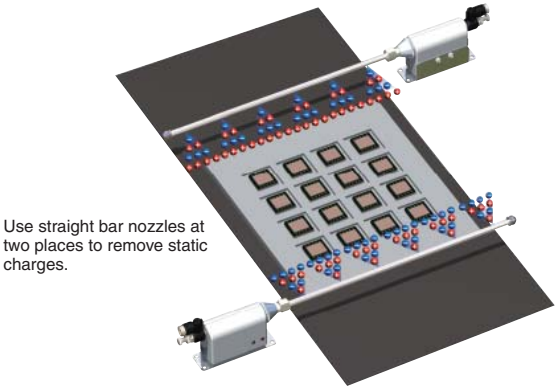


Removal of static charges on workpieces using a controller

Simultaneously controls the ionizer power supply and air ON/OFF function.

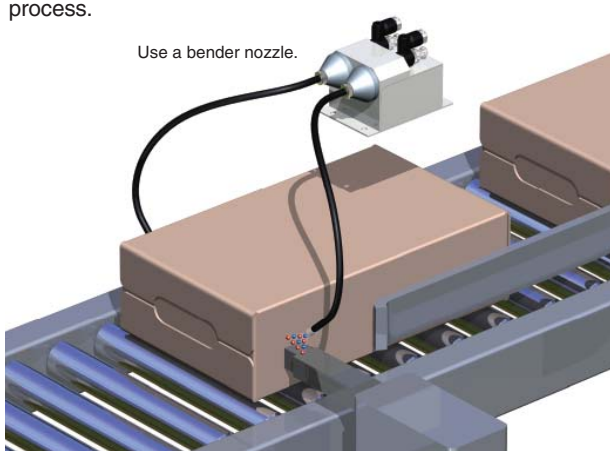
Removal of static charges on devices carried by pallets

Use blow type Ionizers with straight bar nozzles to remove static charges on a wide carrying pallet.



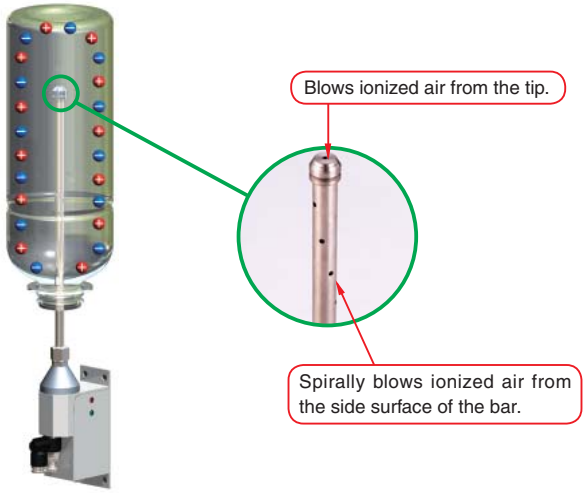
Removal of static charges in printing process

Use 2-head type Ionizers with bender nozzles. Prevents faulty printing caused by static charges in ink jet printing process.



Removal of static charges in bottles (Removal of dust)

Use a spiral bar nozzle to remove static charges inside a bottle.

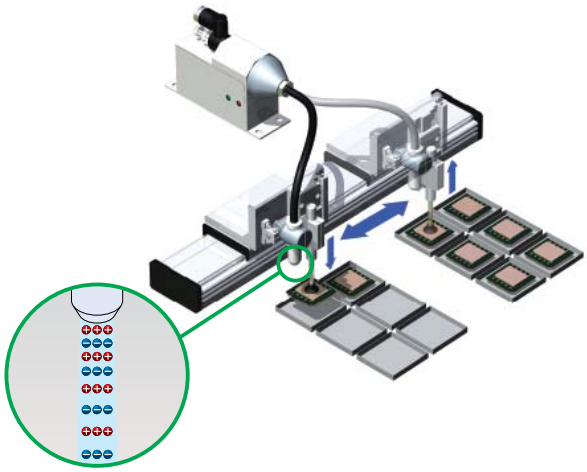


Removal of static charges on electronic parts

Very low generation of electrical noise

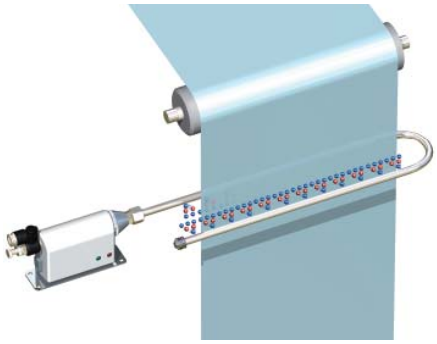
- No damage to a device caused by induction electric field by the discharging needle.
- Removal of static charges with pinpoint accuracy. (It is possible to place the nozzle close to a device by using the tube.)

Note: Select a tube in accordance with the degree of tube flexibility.



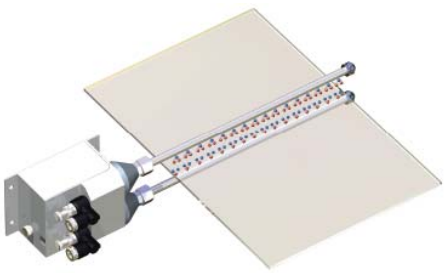
Removal of static charges on wrap film

Use blow type Ionizers with U-shaped bar nozzles in confined space to remove static charges on both sides of the wrap film.



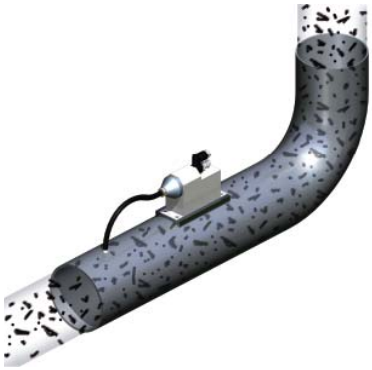
Removal of static charges on glass substrate

Use 2-head type Ionizers with two straight bar nozzles to remove static charges on FPD glass.



Removal of static charges in pipes (ϕ50 or less)

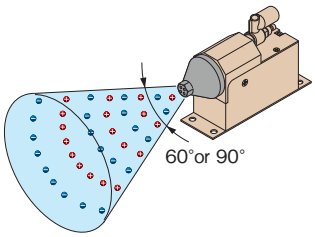
Inserting the tube inside a pipe enables removal of static charges.



Select the proper nozzle for your application

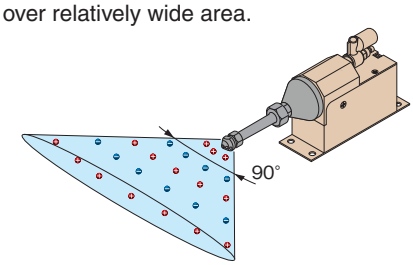
Shower nozzle

- Blows ionized air at 60° or 90° angles.



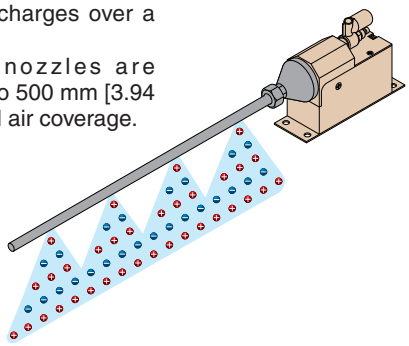
Flat nozzle

- Blows ionized air at 90° angle, suitable for removal of static charges over relatively wide area.



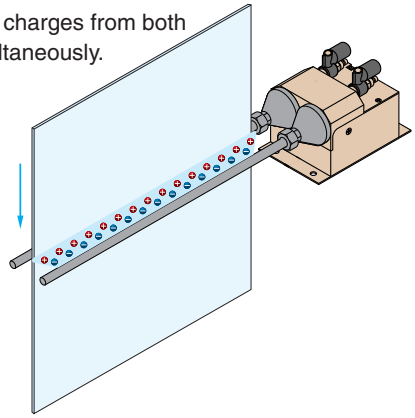
Straight bar nozzle

- Removal of static charges over a wide area.
- 5 types of bar nozzles are applicable for 100 to 500 mm [3.94 to 19.69 in.] ionized air coverage.



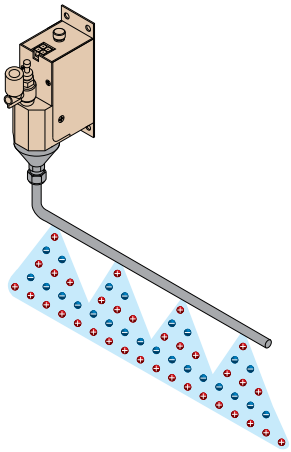
Use of 2 straight bar nozzles

- Removal of static charges from both sides of film simultaneously.



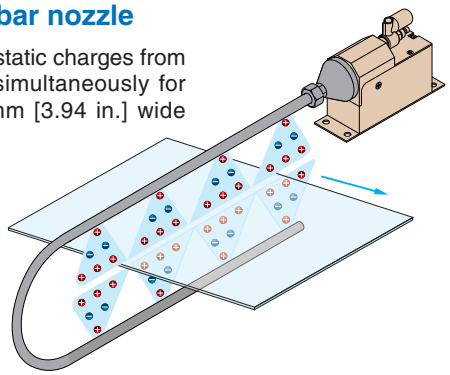
L-shaped bar nozzle

- Space saving and suitable for locations where straight bar nozzles can't reach.
- 2 types of L-shaped bar nozzles are applicable for 100 and 200 mm [3.94 and 7.87 in.] ionized air coverage. (only 100 mm [3.94 in.] for DTRY-ELL01)



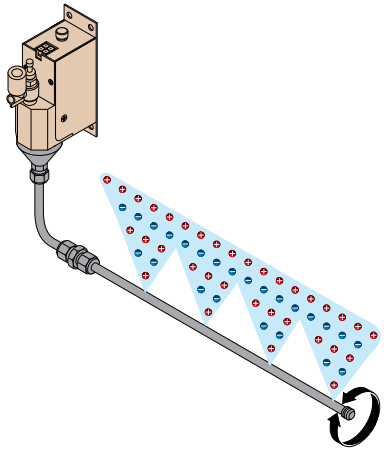
U-shaped bar nozzle

- Removal of static charges from both sides simultaneously for up to 100 mm [3.94 in.] wide film.



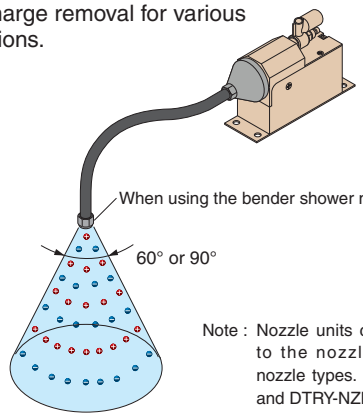
Free-mounting L-shaped bar nozzle

- Enables bar rotation to change the direction of the ionized air flow outlet.
- Applicable for 100 and 200 mm [3.94 and 7.87 in.] ionized air coverage.



Combining various nozzle units with bender nozzles

- Combining various nozzle units with the flexible tube enables static charge removal for various applications.

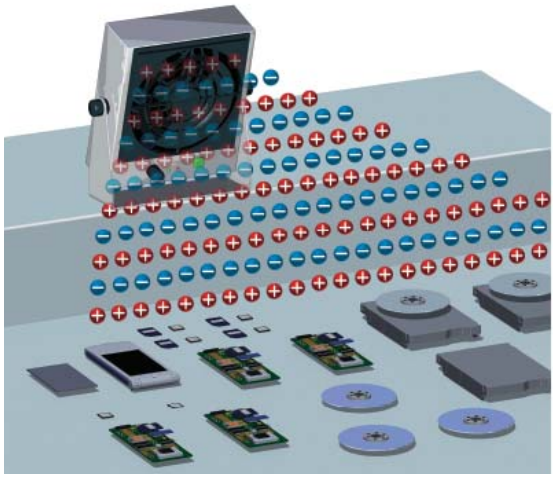


Note : Nozzle units can only be attached to the nozzles used in bender nozzle types. (DTRY-NZR □ 00ND and DTRY-NZL □ 00ND)

Fan Type Application Examples

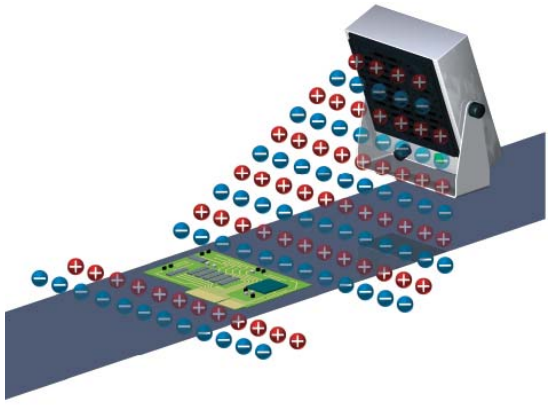
Removal of static charges of parts on working bench

Removes static charges from parts, during assembly.



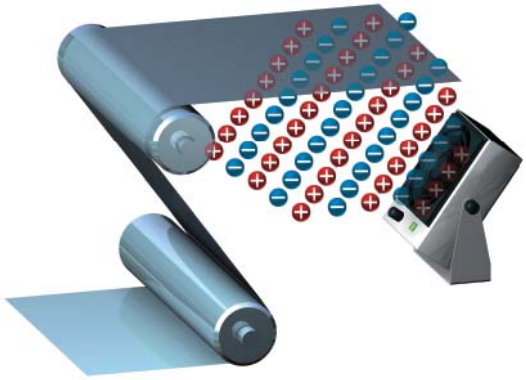
Removal of static charges on printed circuit boards

Enables static charge removal for relatively wide objects.

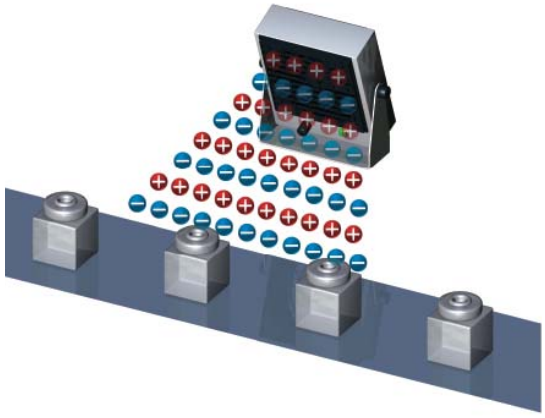


Removal of static charges on packaging films

Removes static charges generated when film is peeled off from a roller.

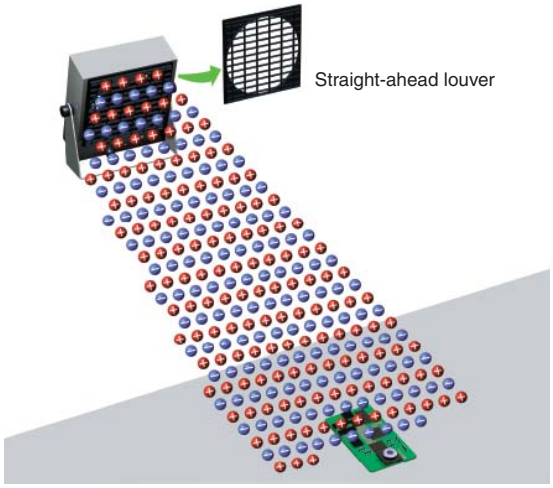


Removal of static charges on plastic containers and parts

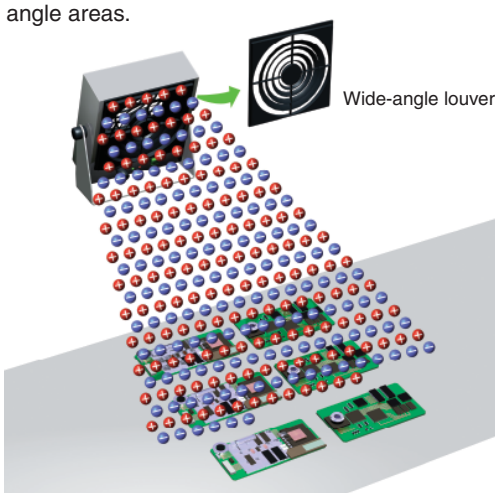


Replace Louvers to match workpiece size (For Steady Flow Fan Type only)

Use when removing static charges at high speed in limited areas, or when there is some distance to the workpiece.



Use when removing static charges in wide-angle areas.

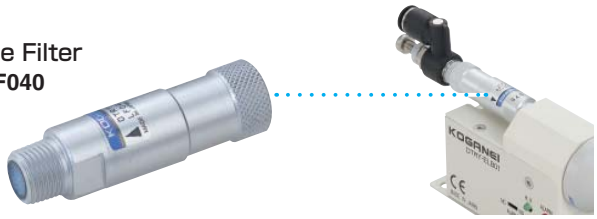


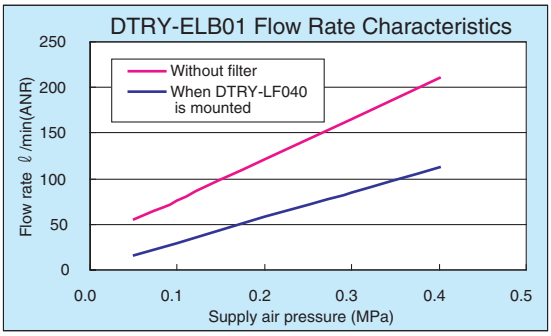
Remarks: While the application example is for the Steady Flow Fan Type only, the same method can be used for the Wide Flow Fan Type as well. Select the type to match the targeted object.

Technical Information

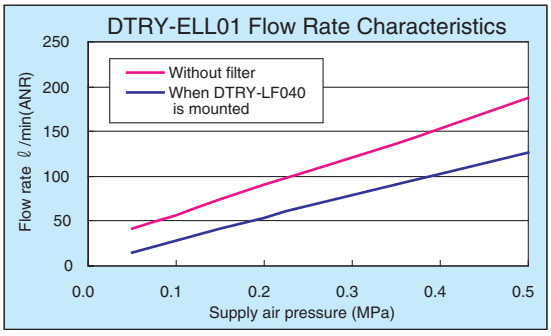
Blow Type: Flow Rate Characteristics

Mini Line Filter
DTRY-LF040





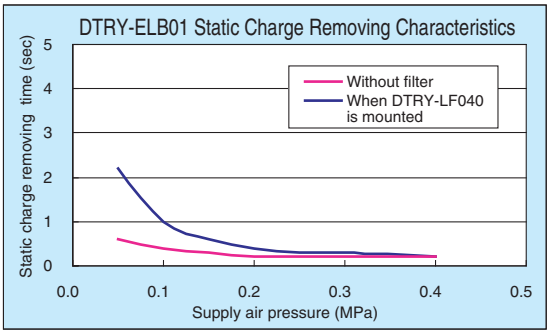
※Nozzle used: Shower nozzle (DTRY-NZR20SW)
※All nozzles have the same flow rate.
※When throttle valve is fully open.



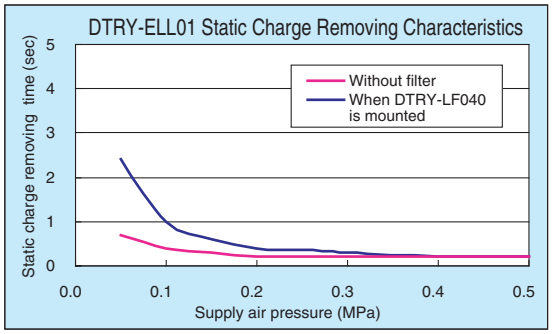
※Nozzle used: Shower nozzle (DTRY-NZL20SW)
※All nozzles have the same flow rate.
※When throttle valve is fully open.

1 ℓ/min=0.0353 ft.^{3}/min.
1 MPa=145 psi.

Static Charge Removing Characteristics When Mini Line Filter (DTRY-LF040) is Mounted



※Nozzle used: Shower nozzle (DTRY-NZR20SW)
※Measurement distance: 50 mm [1.97 in.]
※When throttle valve is fully open.

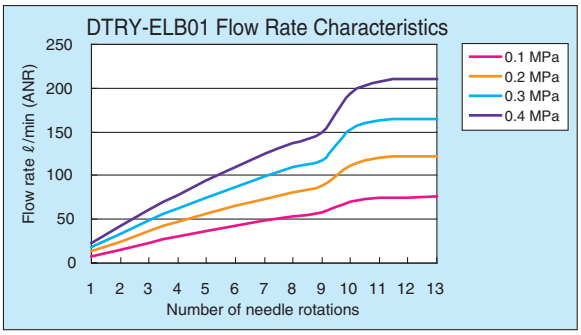


※Nozzle used: Shower nozzle (DTRY-NZL20SW)
※Measurement distance: 50 mm [1.97 in.]
※When throttle valve is fully open.

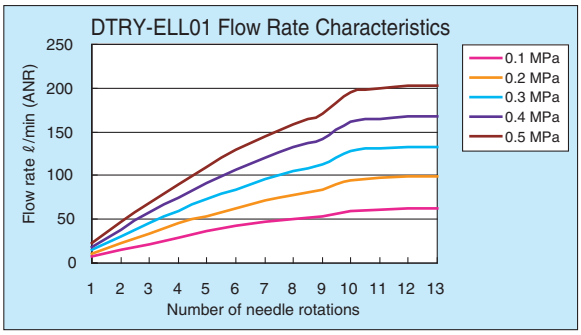
1 MPa=145 psi.

Blow Type: Flow Rate Changes in Relation to Number of Throttle Valve Needle Rotations

Needle



※Nozzle used: Shower nozzle (DTRY-NZR20SW)
※All nozzles have the same flow rate.



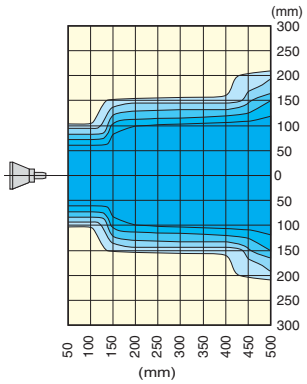
※Nozzle used: Shower nozzle (DTRY-NZL01NS)
※All nozzles have the same flow rate.

1 ℓ/min=0.0353 ft.^{3}/min.
1 MPa=145 psi.

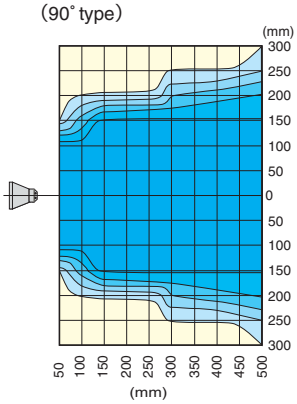
Static Charge Removing Range by Nozzle Type (Compact blow type reference values)

Static charge removing range for typical nozzle.

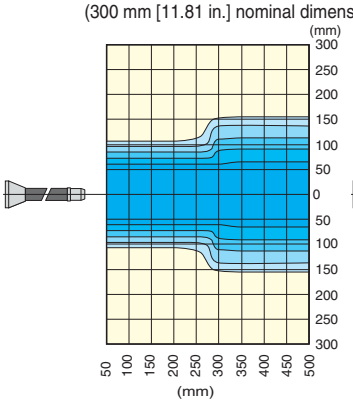
Standard nozzle
DTRY-NZL01NS



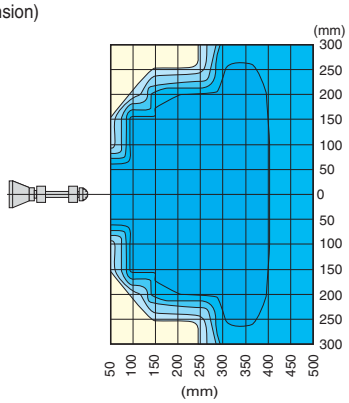
Shower nozzle
DTRY-NZL21SW
(90˚ type)



Bender nozzle
DTRY-NZL300ND
(300 mm [11.81 in.] nominal dimension)



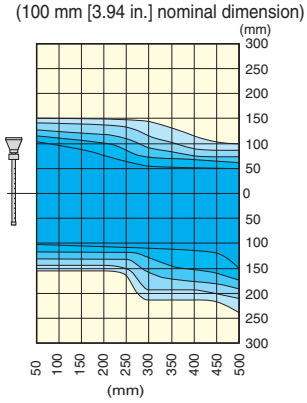
Flat nozzle
DTRY-NZL01FT



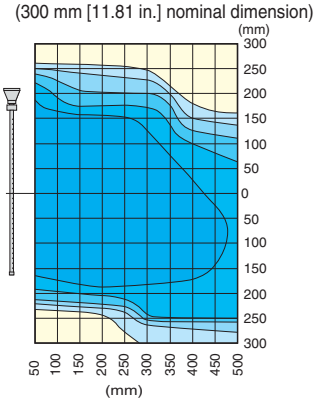
Static charge removing time
0～2 sec 2～4 sec 4～6 sec 6～8 sec 8～10 sec

1 mm＝0.0394 in.

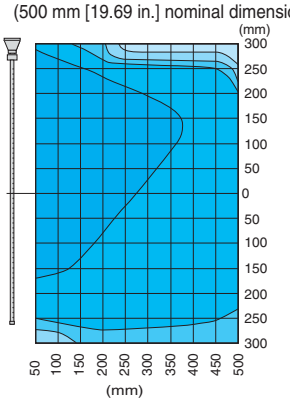
Straight bar nozzle
DTRY-NZL100B
(100 mm [3.94 in.] nominal dimension)



Straight bar nozzle
DTRY-NZL300B
(300 mm [11.81 in.] nominal dimension)



Straight bar nozzle
DTRY-NZL500B
(500 mm [19.69 in.] nominal dimension)



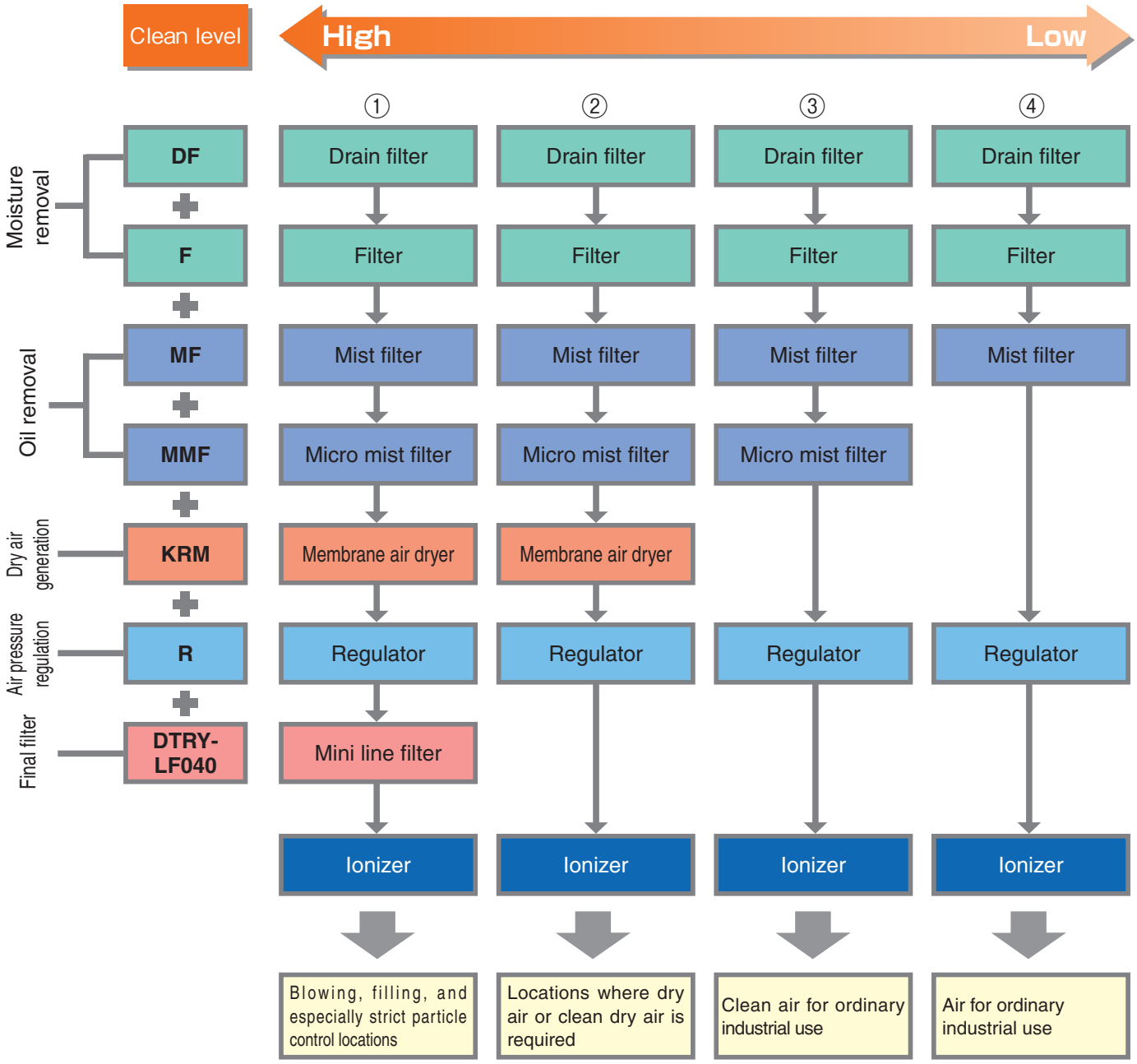
Static charge removing time
0～2 sec 2～4 sec 4～6 sec 6～8 sec 8～10 sec

1 mm＝0.0394 in.

Notes: 1. The method of measurement used a 20 pF, □150 mm [5.91 in.] charged plate monitor, and the measurement was performed using Koganei measurement conditions.
2. The static charge removing time is the time required to decay from ±1000V down to ±100V.
3. Graphs assume a supply air pressure of 0.5 MPa [73 psi.].

Selecting Pneumatic Equipment for Blow Type

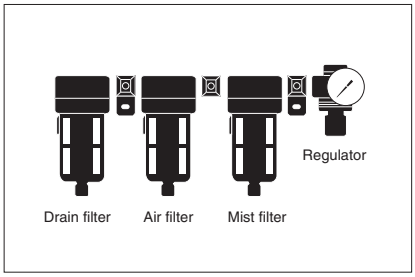
※ Select ionizer air cleanliness suited to your applications.
※ The combinations shown below are typical examples. For details, see p. 41 of the Accessories General Catalog. Please feel free to consult us.



● Example of combination (for level ④)

Item	Model
Drain filter	DF300-02-A
Adaptor	8-30D
Filter	F300-02-A
Adaptor	8-30F
Mist filter	MF300-02-A
Adaptor	8-30D
Regulator	R300-02

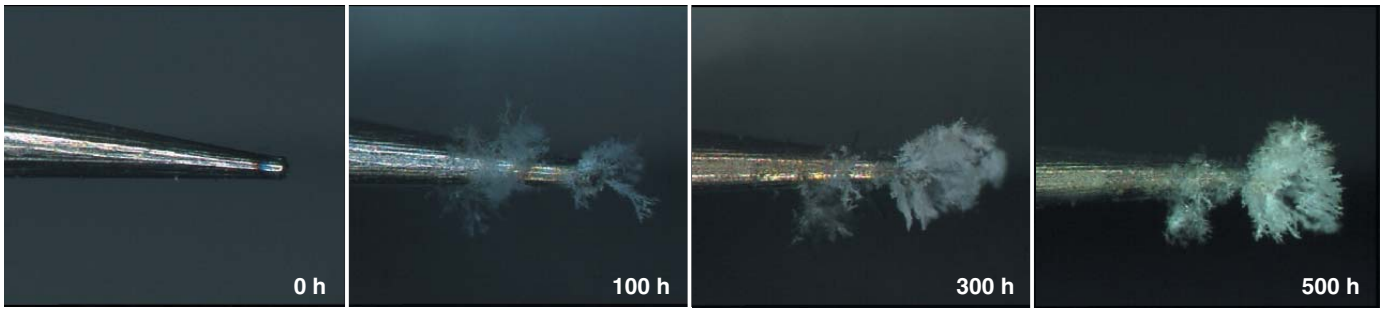
Note: When selecting equipment, check the flow rate.



Discharging Needle Maintenance Period (Rough Guidelines)

Periodic cleaning of the ionizer discharging needle is required.
The photographs below show the accumulation of dust on the tip of the discharging needle used in the steady flow fan type.

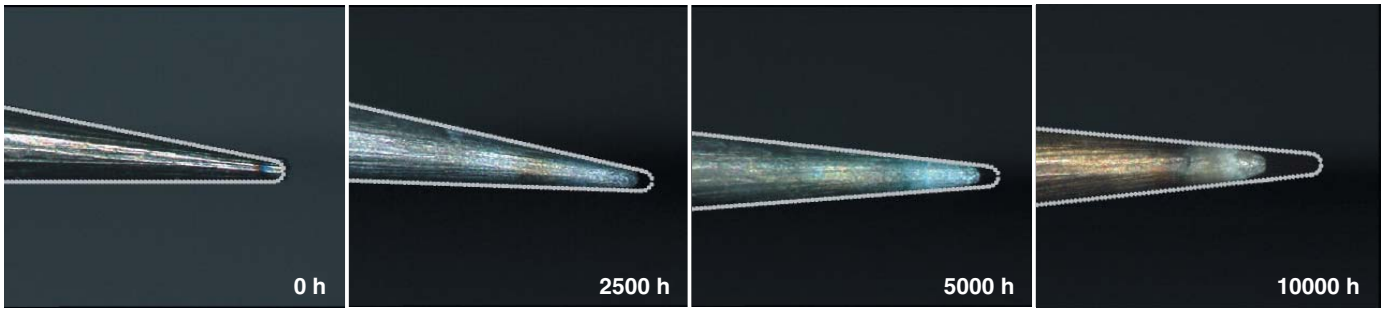
Depending on the application conditions, perform the cleaning after 300 to 500 hours of use. When cleaning the discharging needle, cleaning the louver and the inside of the ionizer body at the same time is recommended.



Note: Based on Koganei measurement conditions.

When operating the DTRY-ELF04 (without back filter): Appearance of discharging needle

The photographs below show the shape of the discharging needle after cleaning. The tip of the discharging needle can wear down from repeated use. While it depends on the application environment and conditions, replacement is recommended after around 10000 hours of use.



Note: White lines denote the discharging needle shapes when new (at 0 hours of use).

DTRY-ELF04 (without back filter): Appearance after discharging needle cleaning

Cleaning Procedure for Discharging Needle

An example of the cleaning procedure for the blow type discharging needle is shown below.

- Apply alcohol (isopropyl alcohol, etc.) to a cotton swab, and clean the tip of the discharging needle using the swab.
- Also remove any contamination inside and around the metal cap.

Note: Before cleaning, check that the power supply and air are switched OFF.
Never use a wire brush.

For cleaning the fan type, use the nylon brush provided with the product or a cotton swab dampened with alcohol. For details, see the Owner's Manual.

Precautions for Maintenance and Cleaning

- Contamination on the tip of the discharging needle can cause the static charge removal effectiveness to deteriorate. If static charge removal effectiveness has reduced, clean the discharging needle.
- The discharging needle is a consumable part that must be replaced if used over long periods. For replacement, use a dedicated tool (DTRY-ELB21).
- After cleaning, flush the needle. Activating the ionizer with residual alcohol on the needle could result in unstable performance.

The ionizer requires periodic maintenance and checks.

Example: Ionizer Performance Check Sheet

Ionizer type	Inspection No.	Date (YYYY/MM/DD)	Static charge removal time [sec]		Ion balance (V)	Measurement conditions	Cleaning check	Discharging needle replacement	Operation hours (h)	Remarks
			Plus side	Minus side						
Koganei Compact Blow Type **DTRY-ELL01**	1	20XX/4/15	1.2	1.0	−9	Device installation condition (100 mm distance)	レ	—	—	Initial condition
	2	20XX/5/15	1.1	1.0	+11	〃	レ	—	160	
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									

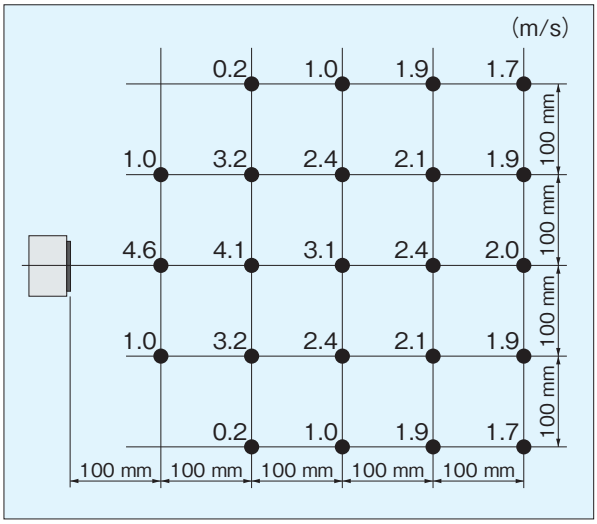
Memo

＊＊＊ Device: No. 1

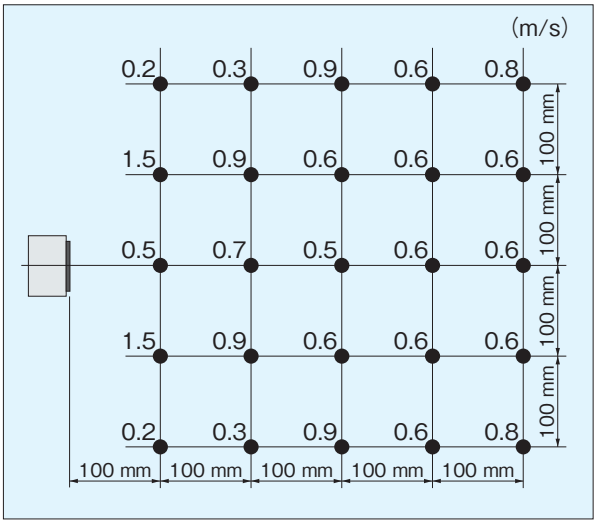
- Ionizer operations begin: 20XX/4/15
  ※ 8 h/day × 20 days/month
- For the static charge removal time and ion balance, the charged plate monitor manufactured by ＊＊ was used.
- Static charge removal time is the time required for decaying from ±1000V down to ±100V.

Steady Flow Fan Type: Wind Speed Data (Reference value)

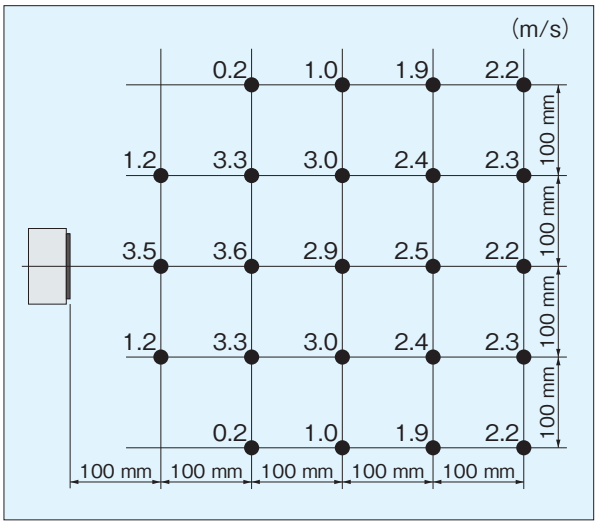
●DTRY-ELF02 When straight louver is used



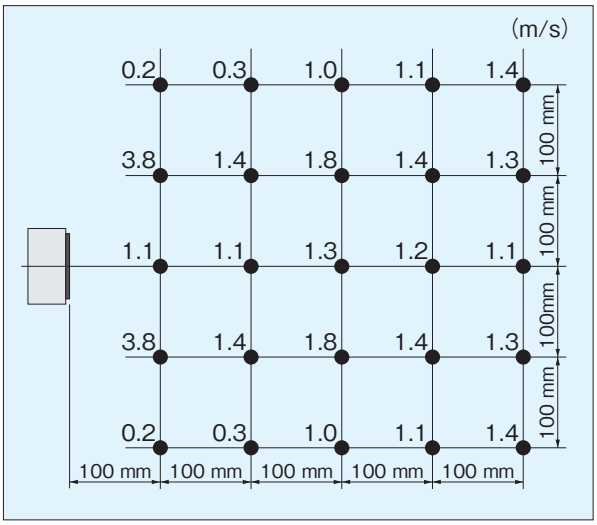
●DTRY-ELF02 When wide-angle louver is used



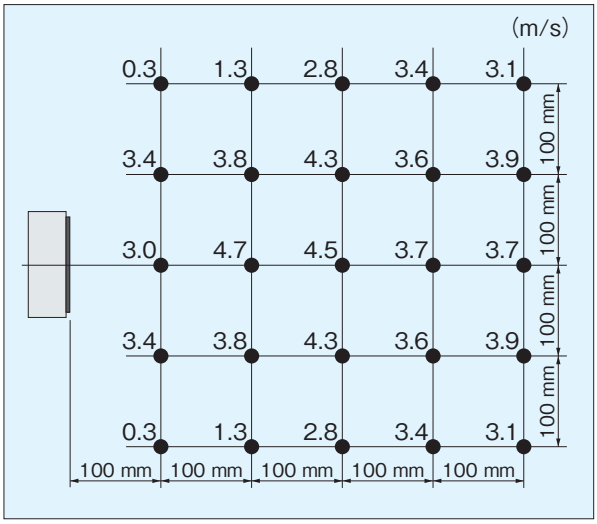
●DTRY-ELF03 When straight louver is used



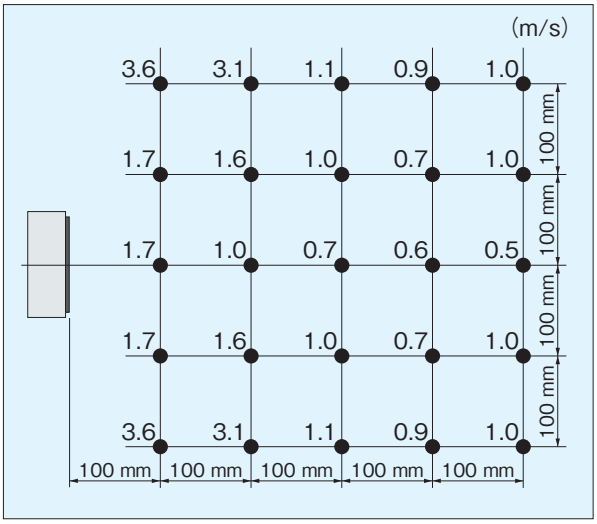
●DTRY-ELF03 When wide-angle louver is used



●DTRY-ELF04 When straight louver is used



●DTRY-ELF04 When wide-angle louver is used



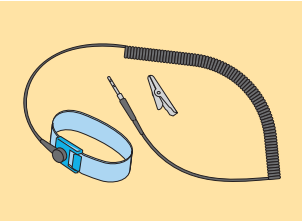
Notes: 1. The wind speed at maximum wind volume is measured at each point.
2. The measurement values are the actual measured values and are not guaranteed performance values.

1 m/s=3.28 ft./sec.
1 mm=0.0394 in.

Other Materials

Static Electricity Countermeasure Accessories

※ Koganei does not offer the static electricity countermeasure goods shown on this page.

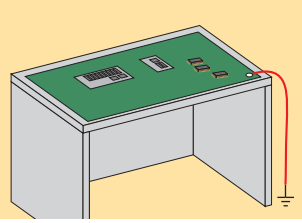


● Wrist Strap

Because the operator's body maintains a constant, low-level electrification potential, use a wrist strap to ground the body.

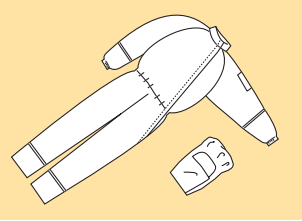
● Antistatic Shoes

Use shoe soles made of synthetic rubber or plastic that containing conductive material to prevent the build-up of static charges. An electrical resistance range of 10^5 Ω to 10^{10} Ω is recommended.



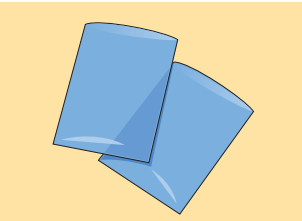
● Antistatic Mat

To prevent workpiece damage or personal injury due to the build-up of static charges on the worktable during electronic device assembling, use an antistatic mat or sheet on the worktable.



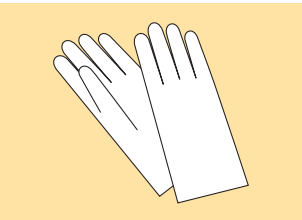
● Antistatic Work Clothes

Use antistatic work clothes equipped with conductive fibers woven in at regular intervals (5 to 25 mm [0.20 to 0.98 in.]).



● Antistatic Bags

Antistatic bags are made with material that is blended or coated with antistatic agents. They also have intermediate shield layers to prevent the build-up of static charges on the packaging material or on the packaged content. Use the bags to protect contents from breakdowns or damage due to static electricity.

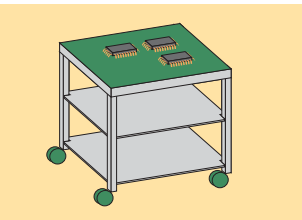


● Antistatic Fingerstalls and Gloves

Fingerstalls and gloves are made of natural rubber containing carbon black, or synthetic rubber containing antistatic agents. Use them to prevent contamination or corrosion to workpieces due to sebum, or sweat secreted from skin when work is performed with bare hands, and to protect against nicks or punctures.

● Antistatic Chair

Use an antistatic chair to suppress the build-up of static charges on work clothes, the operator's body, or the chair itself.



● Antistatic Dolly

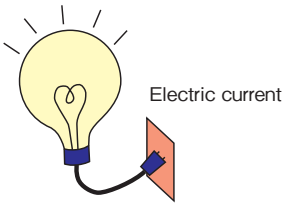
Use an antistatic dolly equipped with conductive casters that prevent the build-up of static charges on the metal frame when the dolly moves on the floor surface.

Static Electricity Q&A

Q What is static electricity?

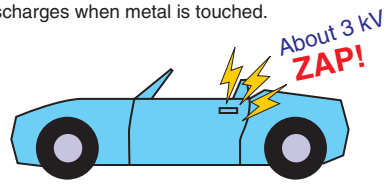
A

Dynamic electricity (regular electricity)



Static electricity (electricity stored on materials)

Static electricity is generated by clothing or seat friction.
Discharges when metal is touched.



When friction between materials causes the plus-minus balance to collapse and to tilt electrically toward one polarity, this condition is called static electricity. The zap that comes when a person touches a car door on a dry winter day is static electricity.

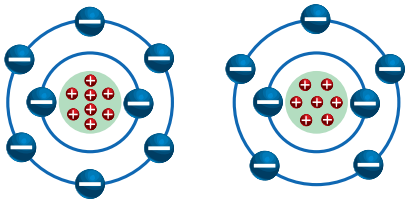
Q What is the mechanism for the generation of static electricity?

A

- All materials are made up of atoms. Atoms consist of electrons holding a negative electrical charge, and a nucleus holding a positive electrical charge (the nucleus further consists of positive protons and electrically neutral neutrons). The electrons revolve around this nucleus. And it is these electrons that form the basis of static electricity.

Oxygen atom
8 positive protons
8 negative electrons

Nitrogen atom
7 positive protons
7 negative electrons

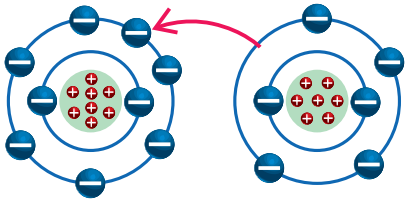


Electrically neutral | Electrically neutral

- In normal conditions, the positive electrical charge held by the protons is balanced against the negative electrical charge held by the electrons, so that the atom overall is electrically neutral.

Oxygen atom
8 positive protons
9 negative electrons

Nitrogen atom
7 positive protons
6 negative electrons



Electrification turns negative | Electrification turns positive

- When a neutral atom is moved by friction, contact, or peeling, addition of an electron gives it a negative charge, while removal of an electron gives it a positive charge.

Q What types of electrification are there?

A

Electrification is due to contact:
Electrification is induced when two objects come into contact.

- Triboelectric electrification

  Static electricity induced when the surfaces of two objects in contact rub against each other.

- Peeling electrification

  A type of contact electrification. Because static electricity appears to occur whenever a peeling action is performed, it is sometimes called peeling electrification. The amount of static electricity tends to become larger with faster peeling speed.

- Rolling electrification

  A type of contact electrification. The static electricity is induced when an object such as film or a roller is rolled on another object. (Repeated contact and peeling)

- Spouting electrification

  Static electricity induced by friction with a nozzle, etc., during spouting of a high-pressure gas or liquid.

Electrification due to induction: **Electrification induced without contact.**

- Induction electrification

  Electrification is induced when an object charged with static electricity is brought close to or taken away from another object. This phenomenon of static electricity between objects even without mutual contact is called induction electrification. For example, a charged body can induce a charge on an IC merely by proximity. (Electrostatic induction)

Q What factors determine the amount of electrification?

A

Factors determining the amount of electrification (static electricity) can vary depending on the environment, as described below.

Contact surface area	Pressure	Friction	Temperature	Humidity
The larger the surface area, the greater the amount of static electricity generated.	The higher the pressure, the greater the amount of static electricity generated.	The greater the friction, the greater the amount of static electricity generated.	While not a major change, a higher temperature results in a smaller resistance value. (Insulator)	The higher the humidity, the smaller the amount of static electricity generated.

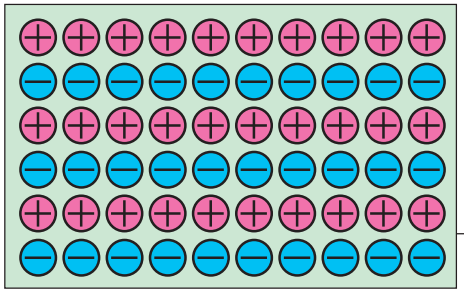
Q What is the difference between a conductor and an insulator?

A

Electrification acts differently between a conductor and an insulator.

Conductor:
Materials that conduct electricity easily → Iron, copper, aluminum, carbon, etc.

Conductor image



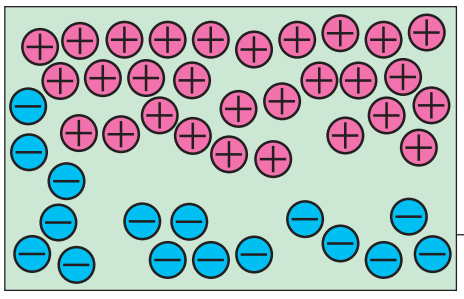
Since electrons move freely through the conductor, grounding the charged conductor results in 0V.

Electrically balanced state

Grounding the conductor results in 0V.

Insulator:
Materials that conduct electricity poorly → Plastic, rubber, glass, etc.

Insulator image



Since electrons do not move freely, grounding the charged insulator does not result in 0V. In addition, the amount of charges varies by location, resulting in different polarities from one point to another.

Grounding an insulator does not result in 0V.

Insulator charge is not evenly distributed.

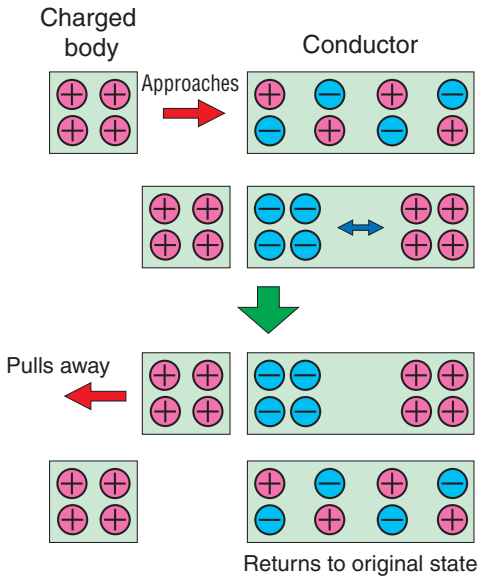
Q What kind of phenomenon is electrostatic induction?

A

Bringing a charged body close to a conductor (metal, etc.) causes a build-up in the opposite charge in regions near the charged body, and a build-up of the same charge in regions farther away. This is called electrostatic induction.

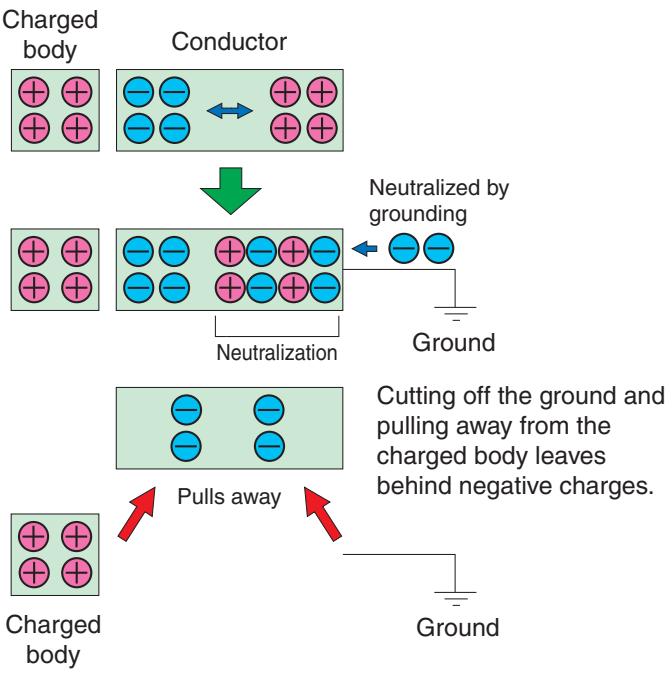
For example, when a positively charged body is brought close to a conductor (in an ungrounded state), a negative charge appears on the surface of the conductor closest to the charged body, and a positive charge appears on the opposite surface.

Next, pulling the charged body away returns the charge of the conductor to its original state.



When a positively charged body is brought close to a conductor, grounding the conductor neutralizes the charge.

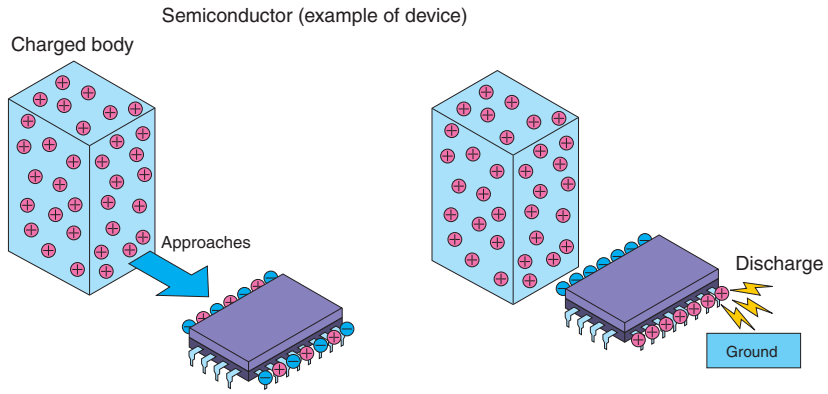
If the conductor is cut off from the ground and then separated from the charged body, the negative charge remains, and the conductor becomes negatively charged.



Q Is there an example of work-related trouble with electrostatic induction?

A

Even if a workpiece has no charge, bringing a charged body close to a conductor can cause polarization within the conductor due to electrostatic induction, resulting in a discharge.

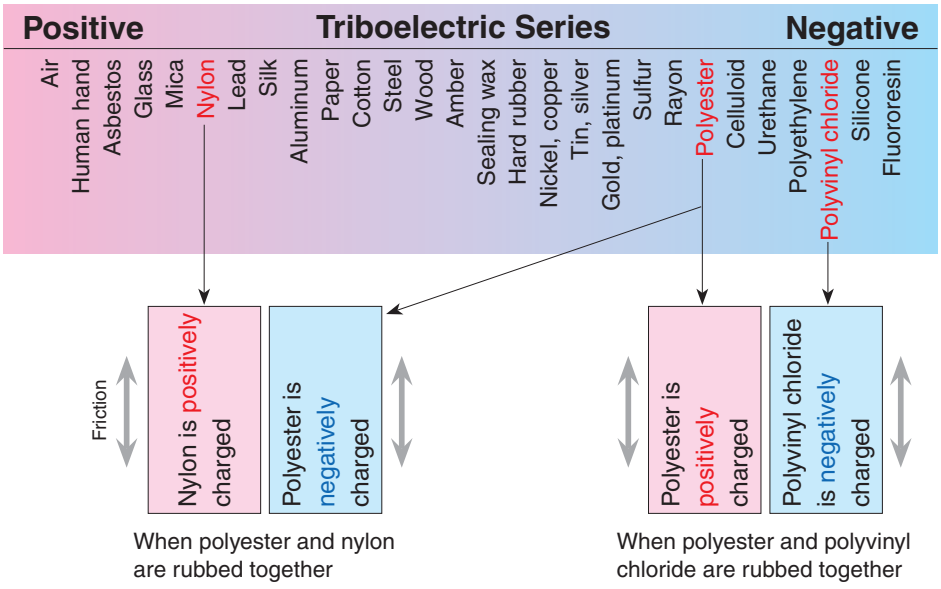


Q What is a triboelectric series?

A

It is a relative positioning of positively and negatively charged materials undergoing friction. When two materials are rubbed against each other, the one on the left becomes positively charged, and the one on the right becomes negatively charged. In general, the magnitude of friction-induced charge is larger for materials whose positional relationship is distant than for those that are close together.
In addition, if two of the same materials are rubbed together, one will be positively charged and the other negatively charged.

In reality, of course, variations in temperature, humidity, surface shape, etc., may prevent the following series from appearing. View this as a general example of what a series could look like.



The same material can become either positively or negatively charged depending on the material against which it rubs.

Q What is electrostatic damage?

A

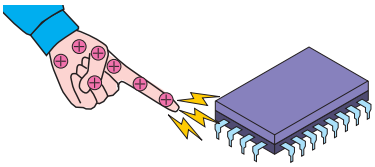
With increasingly compact parts and greater semiconductor densities, electrostatic damage to circuits and devices due to electrostatic discharge (ESD) has become a major problem.
In general, MOS-configuration ICs and field-effect transistors (FETs), high-frequency devices, and other similar types of equipment are extremely sensitive to static electricity, and easily susceptible to be damaged.

Electrostatic Damage Model of Semiconductor Devices

The electrostatic damage model of semiconductor devices can be broadly classified into the Human Body Model (HBM), Machine Model (MM), and Charged Device Model (CDM).

■ Human Body Model (HBM)

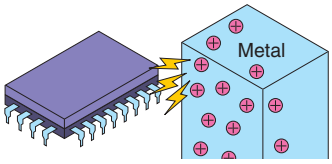
Model when the body's static charge is discharged to a device pin when touched.



Causes (example)
- Wrist strap or conductive shoes not worn
- Hand touches a pin directly

■ Machine Model (MM)

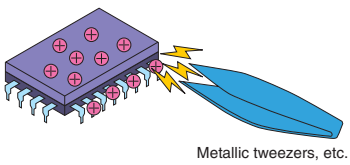
Model when the static charge on a metallic device is discharged to a device pin when touched.



Causes (example)
- Insufficient grounding for electrification of equipment or robot
- Power leak from soldering tool, etc.

■ Charged Device Model (CDM)

Model when static charge on a device conductor part (chip, wire, lead frame, etc.) is discharged when the device pin touches equipment or tools.



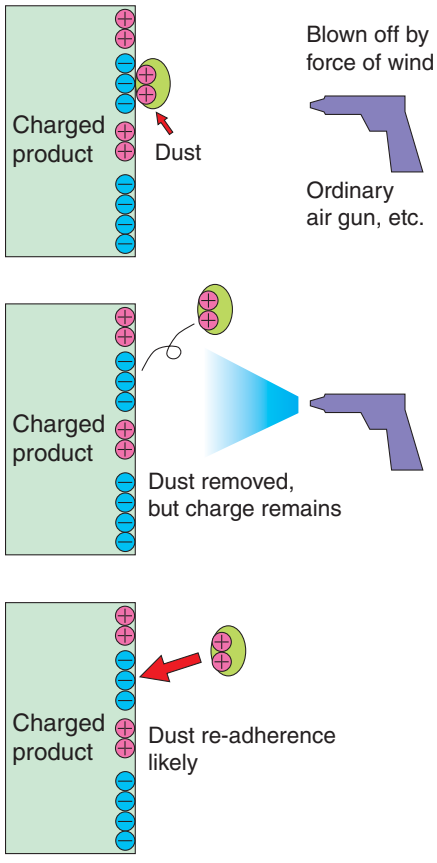
Causes (example)
- Triboelectric charging on an automated IC conveyer system, etc.

Q What points should we be careful about during dust removal?

A

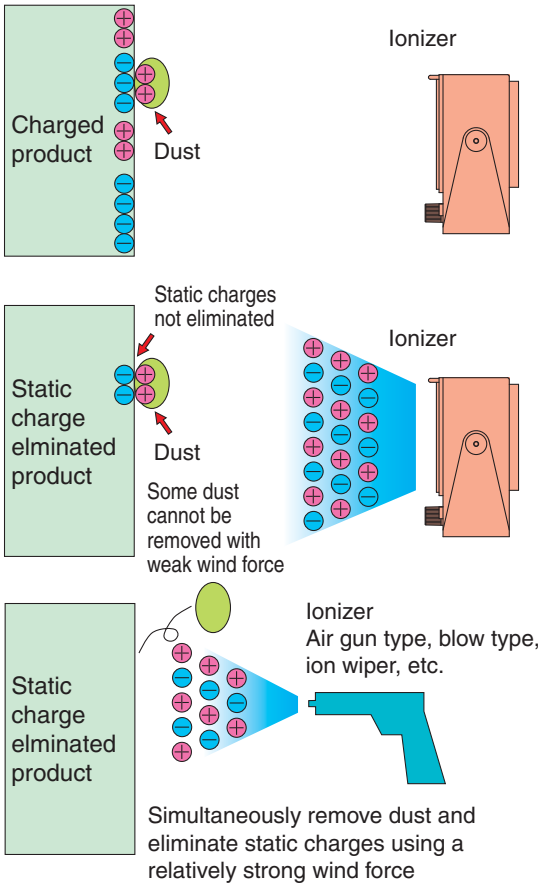
Dust Removal Omissions (1)

Even after wind force has been used to blow off dust, the charged state continues unchanged.



Dust Removal Omissions (2)

Attracted dust may not be removed when the method of static charge elimination is not appropriate.



Dust Removal Points

1. Blow dust off
2. Static charge elimination from the product
3. Collect the dust (with a dust collector, etc.)

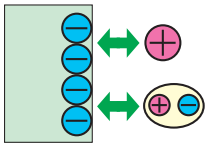
Q What is the mechanism for static electricity attracting dust?

A

When two charged materials are brought close together, the Coulomb force is activated.
As with the North and South poles of a magnet, materials with the same polarity are repulsed, while materials with opposite polarity attract each other. It is this Coulomb force that causes the problem of dust adhering to the product.

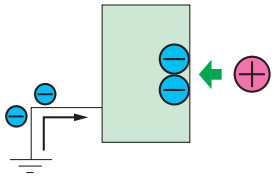
The larger the amount of charge, and the oloser the distance, the greater the attracting force between two objects.

When workpiece is an insulator



Since the magnitude of the charge on the workpiece is large, charged dust adheres to it. Even non-charged dust can become internally polarized and adhere to it.

When workpiece is a conductor



When dust becomes charged, electrostatic induction causes the dust to adhere to the product. Since grounding alone will not change the situation, the static charges must be removed from dust.

Q What kind of static electricity countermeasures are taken at manufacturing sites?

A

For equipment, people, and other conductors

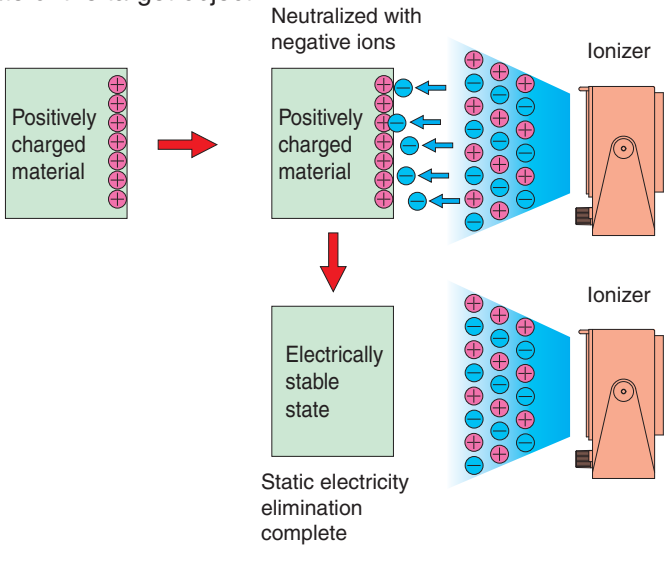
Grounding, wrist straps, conductive shoes, etc., are effective. In addition, conductive mats are used for static electricity elimination from workbenches, etc.

For insulators in which grounding is not effective

Antistatic sprays, humidity controls, and ionizers that utilize ions to neutralize static electricity are used.

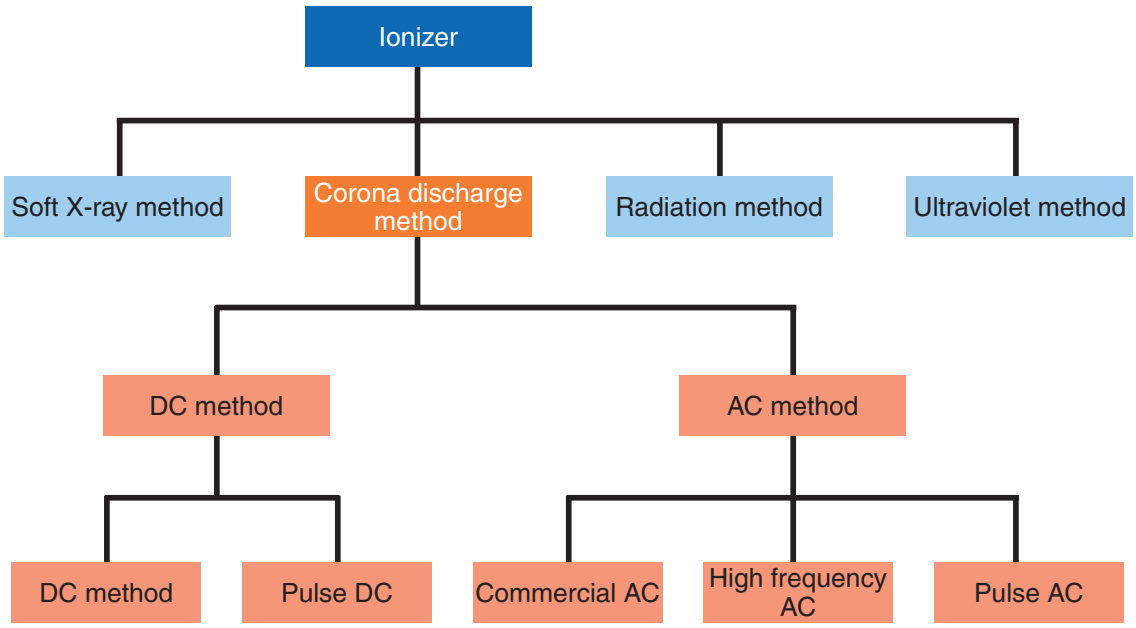
Static electricity removal using ionizers

Ionizers are devices that direct positive and negative ion air against the target object to neutralize the electrification state of the target object.



Q What kind of ionizer types exist?

A



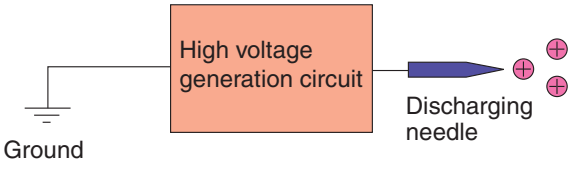
There are four types of ionizers, including the corona discharge method, radiation method, soft X-ray method, and ultraviolet method.

Q How does corona discharge generate ions?

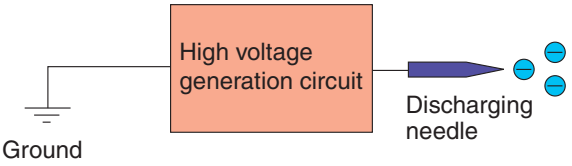
A

Corona discharge occurs when high voltage is locally generated between two conductors, causing a breakdown in air insulation and generating blue-violet light. In a corona discharge ionizer, high voltage is applied to the discharging needle to generate the corona discharge.
The corona discharge causes the air near the discharging needle to electrically break down, generating ions.

●Applying a positive high voltage to the discharging needle generates positive ions.



●Applying a negative high voltage to the discharging needle generates negative ions.

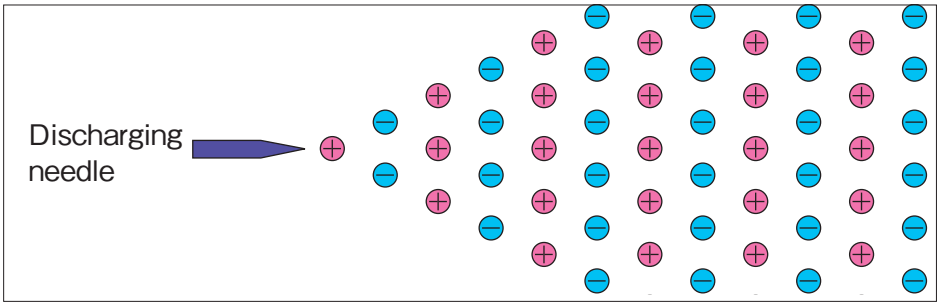


Q What is the difference between the AC and DC methods?

A

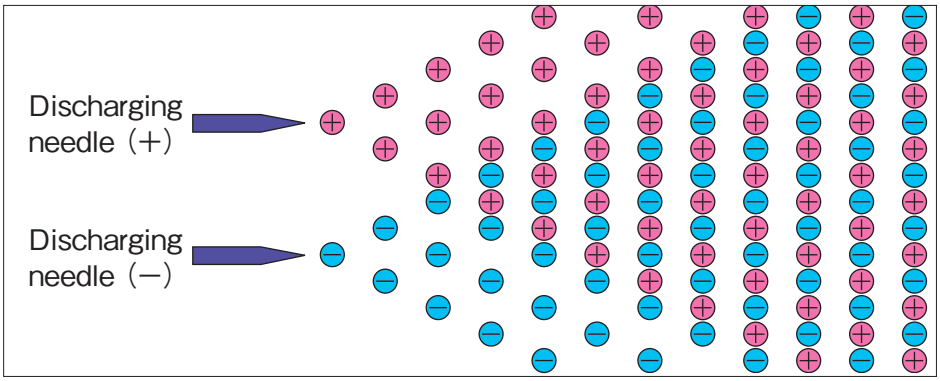
The corona discharge type ionizer can be broadly divided into AC and DC methods, depending on the method of applying voltage.

AC method : Generates positive and negative ions in alternating sequence from a single discharging needle



- Provides a good ion balance.
- Generates fewer ions than DC method.

DC method : Generates ions from dedicated positive-only or negative-only discharging needle

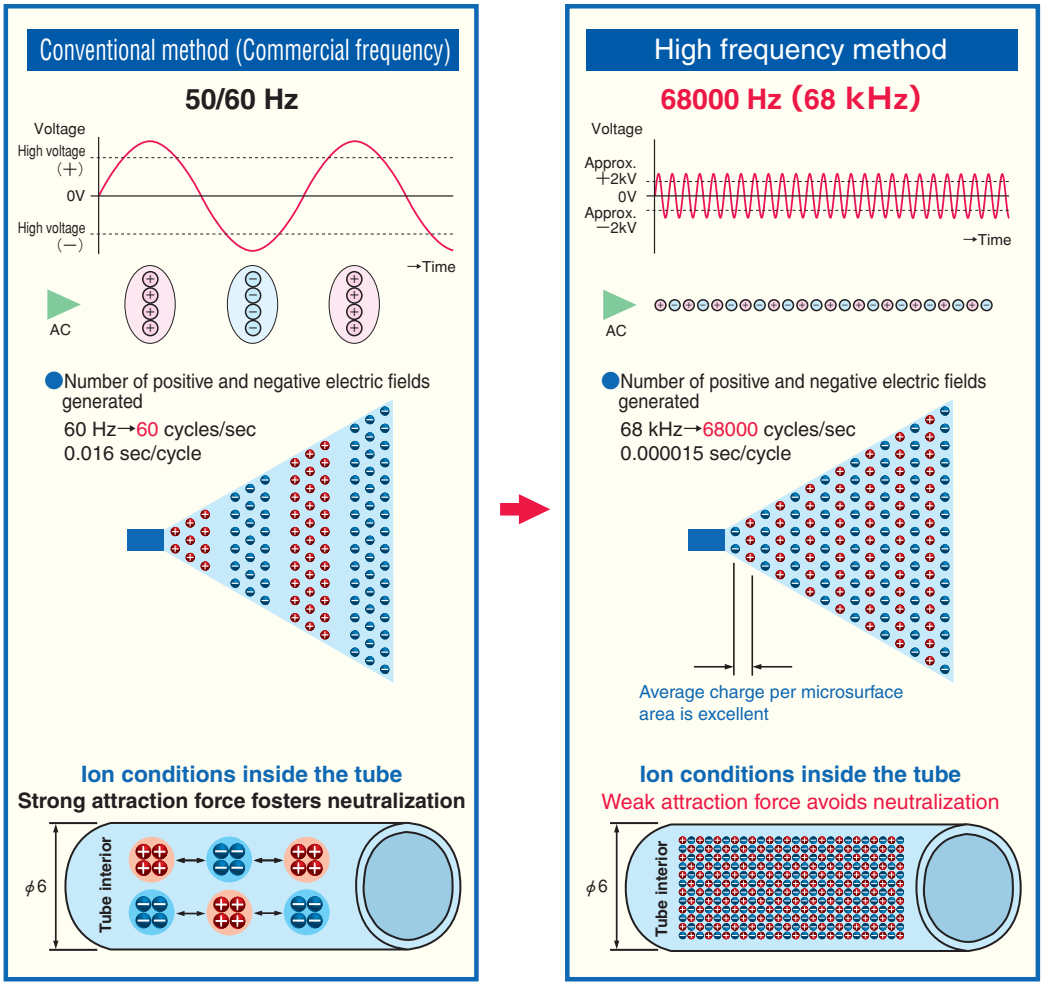


- Poor ion balance at close distances.
- Generates more ions than AC method.

Q How is it possible that the Koganei high frequency method can carry ions through a tube or pipe?

A

In commercial frequency ionizers, the frequency for generating ions is a low 50/60 Hz that results in a poor ion balance over short periods of time. This causes ions within the tube to be extinguished, making carrying ions through the tube impossible. The Koganei ionizer, on the other hand, uses a high frequency of 68000 Hz to achieve an excellent ion balance that avoids ion neutralization within the tube, thereby enabling ions to be carried through the tube.



Q Please explain about static charge removing time and ion balance.

A

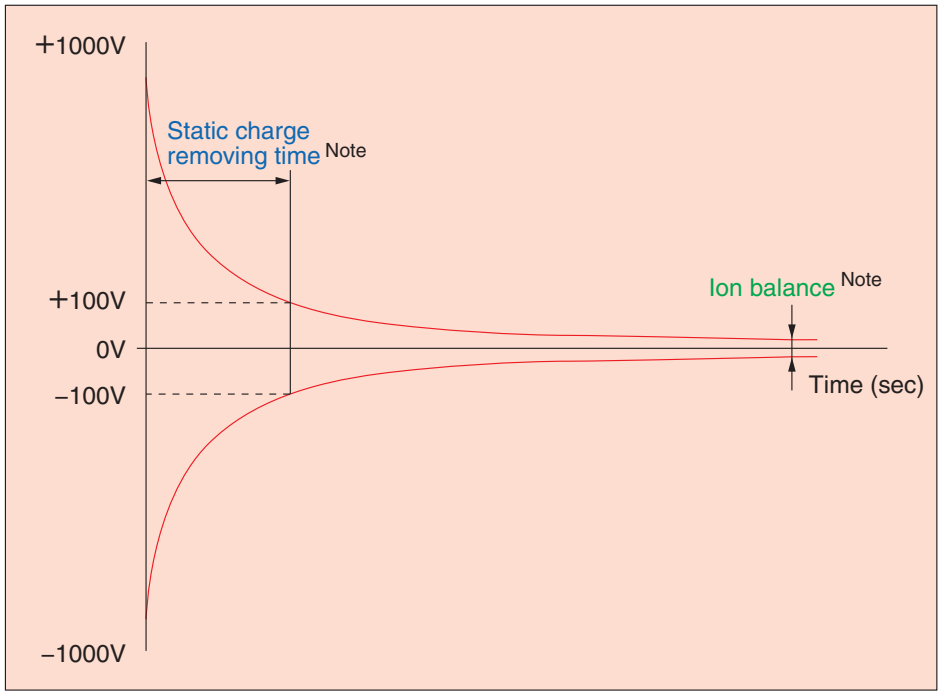
Static charge removing time (elimination speed) and ion balance are two measures for evaluating ionizer performance.

Static charge removing time

The time required for objects charged to ±1000V to decay down to ±100V.

Ion balance

Measures how close an object approaches 0V when it is continuously delivered with positive and negative ions. A value closer to 0V represents an excellent ion balance. In addition, a poor ion balance means that the target object is susceptible to becoming charged.

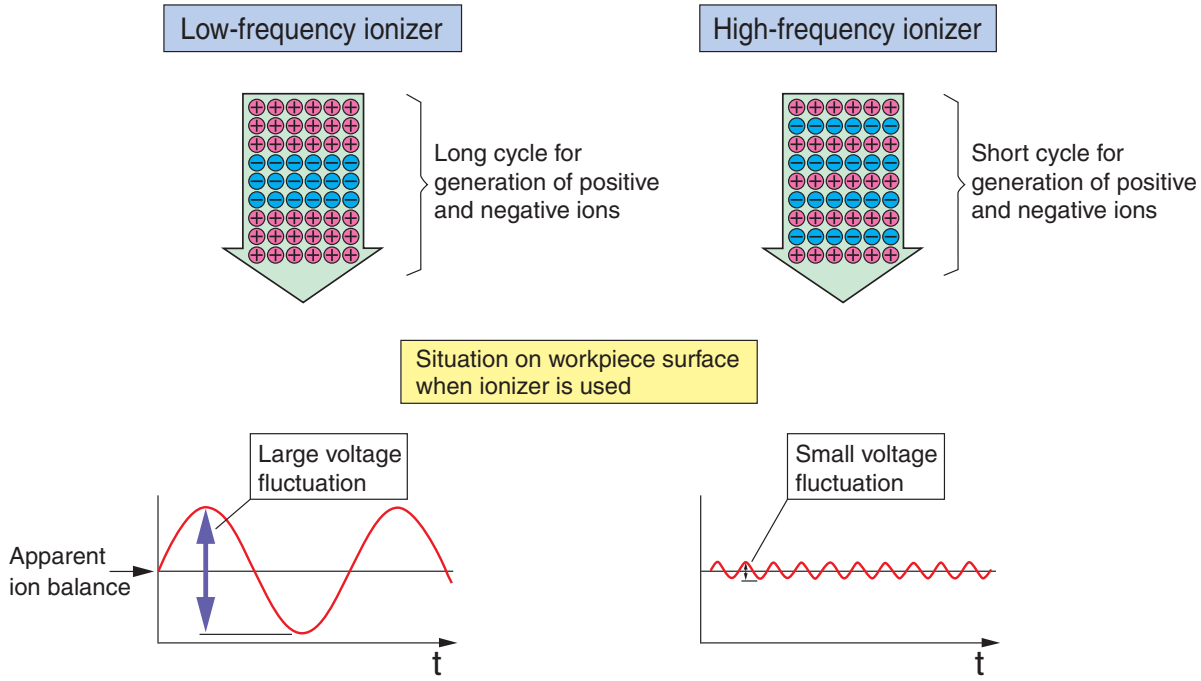


Note: Measurement of static dharge removing time and ion balance is performed in accordance with IEC61340-5-1.

Q Does the frequency make a difference even if the ion balance is equivalent?

A

At a low frequency, the rate that ions are carried to the workpiece is uneven. Since the ion balance constitutes an average value, the actual voltage fluctuation known as over-voltage has an effect on the workpiece.



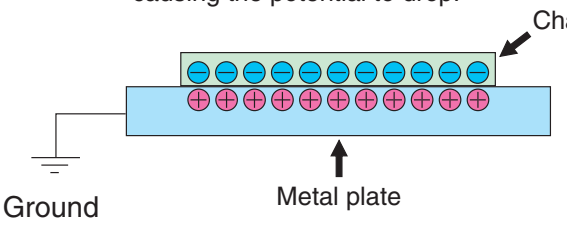
Q To be effective, in which process should the ionizer be installed?

A

As shown in Figure 1, when a charged plastic panel is placed on top of a grounded metal plate, the charge on the plastic panel surface is apparently neutralized by the differing charge induced from the adjacent metal plate surface. In addition, the potential in the plastic panel becomes virtually equal to the ground surface.
The situation when the plastic panel is lifted away from the metal plate is shown in Figure 2. When the plastic panel is separated from the metal plate, its potential rises sharply. If an ionizer was being used to perform efficient static charge removal, where the static charge is being eliminated is the key point.

(Figure 1)

The plastic panel is apparently neutralized, causing the potential to drop!

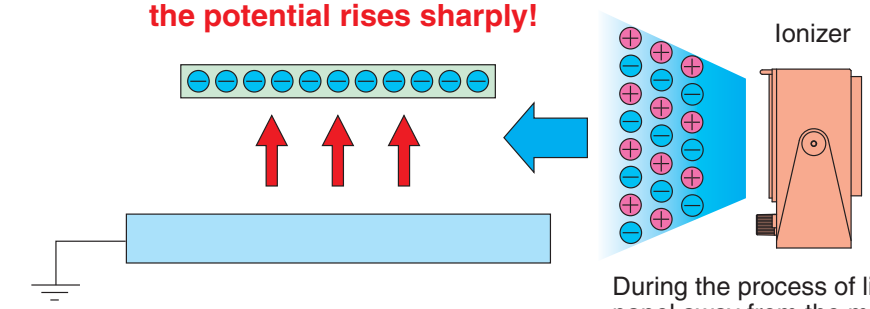


In this situation, the charges on the plastic panel cannot be effectively eliminated, even when an ionizer is used.

(Figure 2)

When it is lifted from the metal plate,
the potential rises sharply!

Static charges should be eliminated during the process of lifted away from the metal plate!



During the process of lifting the plastic panel away from the metal plate, ionized air is delivered to the charged surface of the plastic panel.

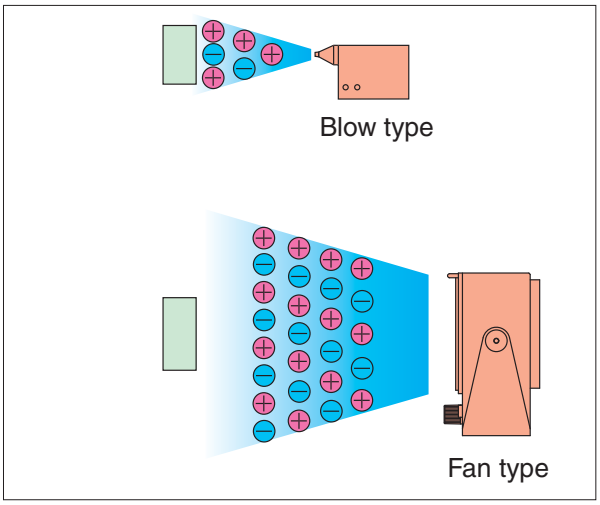
When using an ionizer for eliminating static charges, the key point is choosing which elimination process to use.

Q Is there a discernible trend in static charge elimination capability due to differences in charge elimination surface area and distance?

A

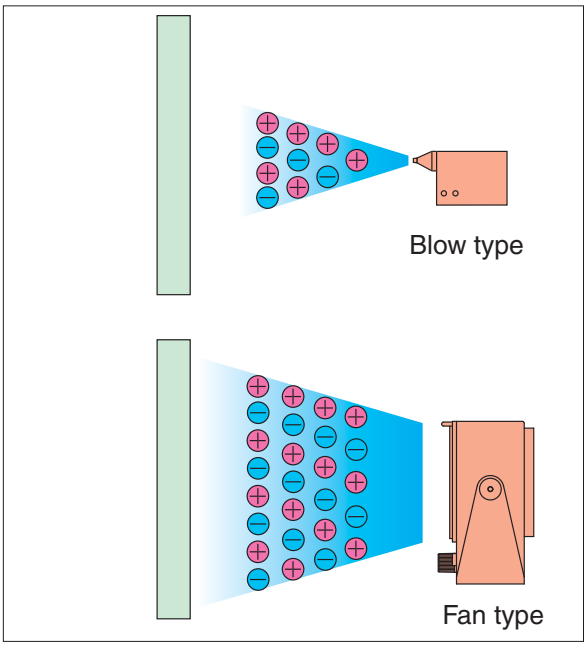
When various kinds of ionizers are used, differences in the size and distance of the charged object show discernible trends in static charge elimination capability.

When eliminating charges of a small charged object



The blow type can bring the nozzle closer to the charged object.
If the charged object is compact and the objective is pinpoint static charge removal, charge elimination effects are better than for the fan type.

When eliminating charges of a large charged object



When the targeted workpiece is large in size, and the ionizer must be set at a certain distance away, the fan type shows better charge elimination effectiveness than the blow type.

Q Please explain about maintenance of the discharging needle.

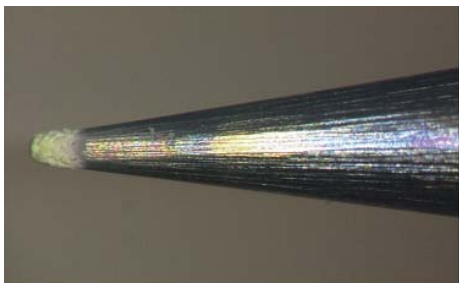
A

To ensure optimal ionizer performance, maintenance of the discharging needle is needed.(For details, see pp. 9-10.)

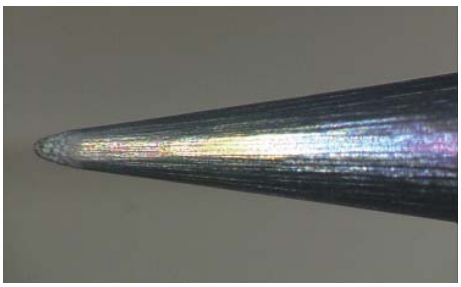
Discharging Needle Contamination

The tip of the discharging needle used in the ionizer can become dirty after repeated use. If this discharging needle contamination becomes severe enough, the amount of ions generated will deteriorate, resulting in reduced static charge elimination capability. It can also lead to poor ion balance. Accordingly, perform periodic cleaning.

Photos of discharging needle (reference)



Before cleaning



After cleaning

Remark: Comparative photos using the blow type. (Contamination and wear state may vary depending on application conditions.)

Discharging Needle Cleaning Method

If there is black or white residue on the tip of the discharging needle, use a cotton swab soaked in alcohol, or the brush provided with the fan type, to clean it off.

Operating Life of Discharging Needle

Repeated use of corona discharge can cause wear on the tip of the discharging needle after a long period of use. Since discharging needle wear can cause deterioration of performance, periodic maintenance is required. While the operating life of the discharging needle depends on the material used for the needle and on application conditions, in general a tungsten needle is recommended to be replaced at around 10000 hours.

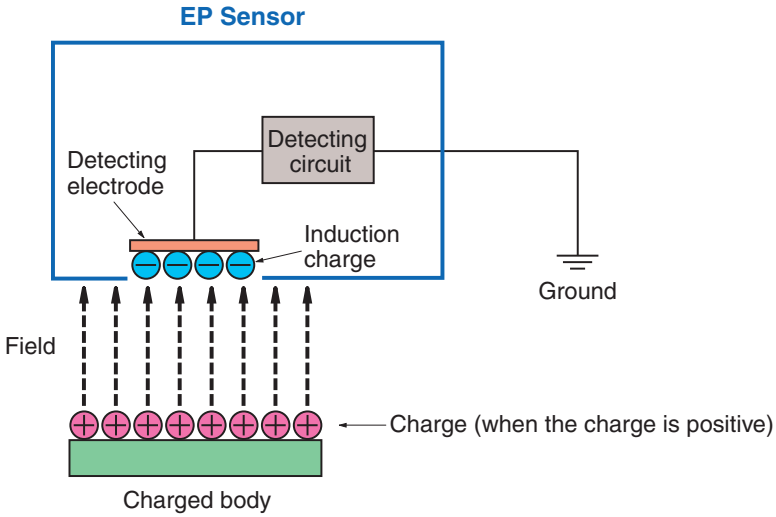
Cleaning, replacement, and other maintenance is required for the ionizer discharging needle.

Q Please explain the measurement principles for the electrostatic potential sensor EP Sensor.

A

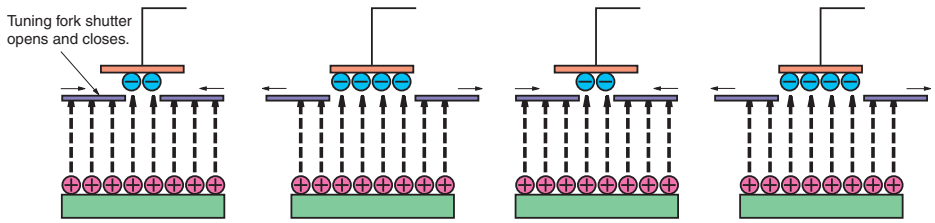
The electrostatic potential sensor EP Sensor uses the electrostatic induction phenomenon that arises between the charged body and detection electrodes. The electric field from the charged body generates an induction charge in the detection electrode surface. This induction charge is then calculated and displayed as the potential of the charged body.

Basic Principles



Charge Q (induction charge) is proportional to the voltage V (charge voltage).

A high-speed tuning fork shutter is incorporated in the front of an actual detecting electrode. An alternating current signal proportional to the charge is obtained, depending on the amount of shutter opening and closing, and that signal is used to measure the potential of the charged body.



The EP Sensor uses the tuning fork shutter method to perform measurement.

Frequently Asked Questions

Item	Question	Response
Common to every ionizer	In what kind of situation is the a-contact (NO) and b-contact (NC) switching function used?	The a-contact outputs only when an ionizer alarm occurs. The b-contact outputs at normal times, and output is cut off when an alarm occurs. Output is also cut off when the power cable is disconnected. As a result, select the contact to suit customer's application conditions. Contact activation modes are noted in the user's manuals provided for each product. See the manuals for details.
	What is the method for switching between the a-contact (NO) and b-contact (NC)?	A selector switch is used to switch between the contacts. To turn the switch, use a precision screwdriver or similar tool. After switching, cover the switch with the protective seal provided to prevent operators from touching it by mistake.
	What is the method for measuring the static charge removal time?	The □150 mm [5.91 in.], 20 pF charged plate monitor is used to measure the decay time from ±1000V→±100V. (Measured using Koganei measurement conditions. The measuring instrument conforms to IEC61340.)
	Are you in compliance with the RoHS directive?	All Koganei brand products are in compliance with the RoHS directive. There are no model changes required to achieve RoHS compliance.
	Is ionizer performance related to humidity?	Since the blow type performance is affected by the supplied compressed air, the environment has little effect on it. The fan type, however, is susceptible to the effects of the ambient environment, so environmental humidity must be carefully maintained for its use.
	In the connector pin configuration, should the output contact point be connected to #1 or #2?	Since there is no polarity, the connection may be linked to either one. (However, caution is required for products DTRY-ELB0✻ models of not CE compliant, since they do have polarity.)
	Are connector pin #4 (power GND) and the ground terminal shared?	They are shared, and are internally connected by circuits.
	Can nitrogen be used for ion carrying media?	Since the nitrogen ion balance tends to tilt heavily toward positive, the performance is unstable.
	Is a power cable longer than 2 m [6.56 ft.] available?	No longer-power-cable is available. Please use your own for extension.
	What is the operating life for the discharging needle?	While it depends on the operating conditions and environment, a rough guide for use is 10000 hours.
	What is the method for cleaning the discharging needle?	If black or white contamination has accumulated on the tip of the discharging needle, use a cotton swab soaked in alcohol or the brush provided with the fan type to wipe it away. (See pp. 9-10.)
	What are the foreign particles that accumulate on the tip of the discharging needle?	Discharging on the tip of the discharging needle attracts nearby foreign particles and incinerates them, resulting in accumulation of carbon, silica, or other substances.
	If maintenance is performed on the discharging needle, can the operating life of the ionizer be extended?	Maintenance of the discharging needle and the area around the discharging needle is performed to restore them following deterioration of performance. It does not serve to extend the operating life of the ionizer itself.
	Can the ionizer be used in explosive atmospheres?	Corona discharges are induced when ions are generated, and since it could ignite in a flammable gas atmosphere, the ionizer cannot be used in such locations.
	When positive ions are used to elimenate charges on a negatively charged workpiece, what happens to the negative ions?	Negative ions are repelled by the negative charge in the workpiece, and dissipate into the air. After that they are neutralized as they link up with ions in the air.
	Can the AC adaptor (DTRY-ELC04) be used overseas?	The 100V—240VAC can. Be sure to have an outlet conversion adaptor available.
	Can the AC adaptor (DTRY-ELC04) be used with all ionizers?	The DTRY-ELC04 can be used with all ionizers other than the air gun type (DTRY-ELG01). For the DTRY-ELG01, Koganei has the DTRY-ELC04-140W available as an AC adaptor.

Item	Question	Response
Fan type	What material is the cleaning brush made of?	Nylon.
	How long should the filter maintenance period be?	If dust appears to be clogging the filter, it is time to replace it.
	When the power switch is left ON, can ON/OFF control be performed on the +24V side?	It can. Always perform this control on the +24V side. There will be cases where ON/OFF control cannot be performed on the 0V side.
Blow type	Is there a problem with leaving the power supply continually ON?	Do not use the equipment in this way, since plasma concentrations caused by discharges can build up around the discharging needle, increasing the risk of ozone degradation and equipment corrosion.
	Can the DTRY-ELB nozzle be used with the DTRY-ELL?	The DTRY-ELL nozzle uses a different thread size than the DTRY-ELB nozzle for connecting to the main body. Please purchase the nozzle specially made for each model.
	What is the nozzle made of?	The connection part (cone-shaped part) to the ionizer main body is made of aluminum alloy, while the tips are made of stainless steel.
	In what sort of situations can abnormalities occur?	Abnormalities can occur in such cases as when the cap is loose, when the nozzle comes into contact with a ground, or when the discharging needle is exceptionally dirty. When abnormal output is detected, a red lamp lights up.
	DTRY-ELL01 does not have a ground terminal. Is a ground not needed?	Since the mounting holes on the side of the main body (the rear side) share ground terminals, the unit is grounded when brackets are installed on a ground body. If installed on an insulator, however, be sure to provide a separate ground.
	What is the minimum bending radius for each tube?	Conductive urethane tube: R15 mm [0.59 in.]; Teflon tube: R50 mm [1.97 in.]; silicone tube: R10 mm [0.39 in.]; and bender nozzle: R40 mm [1.57 in.].
	Will bending the tube have an effect on static charge removal performance?	It has virtually no effect. However, it is conceivable that bending it at minimum bending radius at several places could affect performance.
	Is a set screw for the mounting bracket DTRY-ELQ02 provided? Also, what are the hexagon socket head screws and set screw made of?	A set screw is provided with the product. Both items are made of stainless steel.
	Can the bender nozzle be chopped short and still function properly?	No, it would become unusable.
	Can the tube holder DTRY-NZR31 be used with all tubes, including Teflon, silicone, and urethane?	Since the DTRY-NZR31 is compatible with tubes of outer diameter ϕ6 [0.236 in.], it is specially made for the urethane tube (DTRY-ADN-U). If using this holder to secure other tubes in place, secure in an insulator.
	What is the tube holder made of?	The holder portion is made of POM, and the screws are made of stainless steel. Everything else is made of aluminum alloy.
	Can we manufacture and use our own nozzle?	Always use Koganei nozzles. For nozzles with special shapes, consult with Koganei.
Filter	Can the Mini Line Filter DTRY-LF080 be connected to the ionizer body? (Same for blow type)	The blow type tube diameter is for Rc1/8, while the LF080 is for R1/4. The LF080 cannot be directly connected together.
	How long should the period be for replacing the Mini Line Filter?	It is impossible to tell from outward appearance. While replacement should be performed when the flow rate declines, Koganei recommends replacement at around once per year.
Air gun type	Is a power cable provided?	No cable is provided. Moreover, for power, 24VDC (750 mA or more) should be provided by the customer. For the air gun type, the DTRY-ELC04-140W special AC adaptor is available.
	Isn't a ground needed?	The structure does not require a ground.
	Can the discharging needle be replaced?	The customer cannot perform this replacement. Consult with Koganei.

Frequently Asked Questions

Item	Question	Response
Ion wiper	Can the DTRY-ELL01 be replaced?	It can. Consult with Koganei.
	What is the flow rate for the dust collector blower fan?	Approx. 1600 ℓ/min [56.5 ft.^{3}/min.].
	In addition to the body being equipped with a dust collector blower fan, are any other items required?	Use a duct and filter, for exhaust air processing. In addition, prepare a compressed air source, and a power supply (100VAC), regardless of whether a dust collector blower fan is used or not.
	Is there a recommended duct manufacturer?	Koganei makes no particular designation. Select a duct with a nominal diameter of ϕ75 [2.95 in.].
EP sensor, EP monitor	How is it grounded?	The ground can be created from either the main body or the power cable.
	How does the use of the “actual measurement data output mode” and “averaged data output mode” differ?	Use “actual measurement data output mode” when you want to know the instantaneous value of the charged object. When the charge variation is so large that the measured value is difficult to read, use the “averaged data output mode” to average and display the measured potential so that the measured value will be easier to read.
	What is the threshold voltage setting?	This sets the maximum and minimum voltages, and when a charge exceeding the range defined by these two values is detected, outputs an alarm.
	What is the difference between the input-output response time and data output cycle?	“Input-output response time” refers to the time required in “averaged data output mode” for outputting measurement data equivalent to the actual charge amount. “Data output cycle” refers to the timing for outputting the measured data.
	What is the meaning of the red LED display on the body?	The LED lights up when the sensor is abnormal, and blinks when the setting threshold voltage is exceeded.
	What is the method for resetting abnormal output in the EP sensor?	There is no reset function for abnormal output in the EP sensor. A sensor abnormality is treated as a malfunction, and should be either repaired (consult with Koganei) or replaced with a new sensor.
	In what sort of situations do sensor abnormalities occur?	When the sensor (detector) stops transmitting, this is output as a sensor abnormality. Since subjecting the EP sensor to a strong shock can result in an abnormality, be careful when operating.
	When should zero calibration be used?	Use the zero calibration function switch when setting the reference value (zero adjustment) before charged object measurement.
	What is the relationship between detection range and installation distance?	See the EP Sensor Catalog No.BK-R0002.
	In the measurement precision display method, what is the difference between “±○rdg, ±○digit” and “±○FS”?	The precision display method uses two kinds of expressions: “rdg (reading)” and “FS (full scale).” “rdg” expresses the error in relation to the read value, and “FS” expresses the error over the entire measurement range. In addition, “digit” is the minimum unit of display.
	What sort of things in the surrounding environment should we be concerned about for sensor installation?	Since the sensor is affected by temperature, humidity, electric field, ground status, and noise, use the sensor in an environment that minimizes fluctuation.
	Can calibration be performed?	Since the EP sensor is not a measuring instrument, calibration cannot be performed. However, Koganei is ready to perform inspections and adjustments at customer request. Customers desiring this service are requested to consult with Koganei.
	The measurement target objects are moving at high speed. How fast can detection be performed?	Since the data output cycle can be as short as 100 ms, measurements can be obtained so long as the workpiece does not completely pass by within the cycle period.
	Can this be used in an explosive atmosphere?	No, it cannot be used.
	Please give some details about the support software.	The support software can display and save the various settings and measurement data. It can be downloaded free of charge from the Koganei website.

Item	Question	Response
EP sensor, EP monitor	Can the set parameters be saved in the support software?	No, they cannot be saved.
	Can the continuous measurement data be saved in the support software?	Yes. Use Log → Start, Save to save the continuous measurement data.
	How long is the processing time for sampling data?	In “averaged data output mode,” it is approx. 100 ms, including averaging time, while in “actual measurement data output mode,” it is approx. 30 ms.
	In setting the sensor measurement distance, what part of the body is the distance measured from?	It is the distance from the plastic surface of the body.
	What is the electrostatic capacity of the ion balance monitor plate?	It is 10 pF.
CC monitor	What does the CC monitor do?	The CC monitor checks the cleanliness level in clean booths, etc., using simple detection of particles to display the cleanliness level.
	How does it differ from a particle counter?	The particle counter is an instrument for measuring particles. By contrast, the CC monitor is an instrument for simple detection of particles.
	Can it serve as a substitute for a particle counter?	It is not a substitute. The counter is for periodic (short-term) measurement, while the monitor is for continuous monitoring. Used in combination, they can facilitate the early detection of causes when contamination troubles occur.
	What is the role of the LD monitor in the support software?	It shows the operating life status of the detection laser.
	Can it be used in downflow environments?	Since measurement can be affected in environments with wind speeds of 0.2 m/s [0.66 ft./sec.] or higher, use only in environments with wind speeds below that level.
	What is the air flow rate for sampling?	100 mℓ/min [6.1 $in.^3$/min.].
	Can it output the number of particles?	No. It can only display the level of cleanliness.
	What is the measurement precision?	Check the output characteristics graph in the CC Montor Catalog No. BK-P017.
	What are the specifications for the communication LAN cable?	For a network connection, use a straight cable, and for a one-to-one connection with a personal computer, use a cross cable.
	Can calibration be performed?	Since the CC monitor is not a measuring instrument, calibration cannot be performed. However, Koganei is ready to perform inspections and adjustments at customer request. Customers desiring this service are requested to consult with Koganei.

Troubleshooting

No.	Category ①	Category ②	Symptom of problem	Probable cause	Solution
1	Ionizer	Common	LED fails to light even after power is switched on. Or it lights momentarily and then goes out again.	① No power being supplied.	・Check that the DC power switch is turned ON. If using an AC adaptor, check that it is firmly plugged into the electrical outlet. ・Check that the voltage applied is within product specifications range. ・Check whether the power and signal cables have breaks. ・Check that the power and signal cable wiring is correct.
2			Red LED (alarm) lights up.	① Discharging needle dirty or damaged.	・Check the tips of all of the discharging needles, and clean the dirty tips, or replace the damaged ones.
				② Discharging needle not firmly attached.	・Check that the discharging needle (discharging needle unit) is firmly attached.
3			Ion balance collapses.	① Discharging needle dirty.	・Check whether the discharging needle is dirty.
				② Ground not connected.	・Check that the ground wire is firmly connected to the ground terminal on the main body. ・Check that the ground wire is firmly connected to the ground.
4		Blow type	Red LED (alarm) lights up.	① Loose metal cap.	・Check whether the metal cap is loose.
				② Nozzle in contact with the grounding body.	・Check whether the metal cap, nozzle, or pipe is in contact with the grounding body.
			No air is being delivered.	① Ionizer throttle valve too tightly squeezed, or a piping error.	・Check whether the air is throttled too much. ・Check whether air is being supplied to the ionizer. ・Check the pneumatic circuit.
5		Fan type	LED fails to light even after power is switched on. Or it lights momentarily and then goes out again.	① Power switch OFF.	・Check that the switch is ON.
				② Safety circuit activated.	・Check that the louver (DTRY-ELF series) and discharging needle unit (DTRY-ELW series) are both firmly set.
6	Electrostatic potential sensor	EP sensor	Measurement of GND does not approach 0V.	① Ground not connected.	・Check that the ground wire is firmly connected to the ground terminal on the main body. ・Check that the ground wire is firmly connected to the ground.
				② Ground being affected by nearby charged objects.	・Check whether there are charged objects nearby.
7			LED (red) is lit up.	① EP sensor abnormality.	・Repairs required. Consult with Koganei.
8			EP monitor and support software display values differ from the actual charge amounts.	① EP sensor or EP monitor measurement distance settings different from the actual measurement distance.	・Check the measurement distance settings and actual measurement distance.
9			LED (red) fails to blink even when threshold value is exceeded.	① Voltage comparison output valid/invalid setting invalid.	The check methods are as follows. ・In the support software, check that the Enabling voltage setting range was selected in the checkbox. ・Check that the EP monitor EP sensor setting (SET2) is set to CPE0.
10			LED (red) blinking cannot be reset.	① Electric potential in excess of the set threshold value detected.	・Check that the electric potential is lower than the threshold value, and then reset.
				② Reset cannot be performed from EP monitor and support software.	・Check that the communication cable is connected.
11			Nothing happens even after setting the EP sensor (SET2).	① “SEnd” not sent after setting input value.	・After inputting the setting value, send “SEnd”.
12			“PEr” display appears on the monitor.	① EP sensor abnormality.	・Check the EP sensor’s alarm LED. If it is lit, it means an EP sensor abnormality, and that the EP sensor requires repairs. Consult with Koganei.
				② Wiring error.	・Check that the wiring is correct.
13	Cleanliness monitor	CC monitor (main unit)	Power does not switch on.	① Power cable disconnected. No power being supplied.	・Check that the AC adaptor is firmly plugged into the electrical outlet. ・Check that the voltage applied is within product specifications range. ・Check that the AC adaptor plug is firmly inserted into the power supply jack.
14			Power is switched on and display appears, but then the LEDs also light up one by one.	① Measurement preparation time.	・This is a normal operation. Since the sampling time for this product is 5 minutes, the first 5 minutes after switching on the power is required as preparation time. During the preparation time, the level display bar lights up in the sequence of red blinking → orange blinking → green blinking → red lit up → orange lit up → green lit up, to show that preparation time is in progress. After 5 minutes have elapsed, measurement starts.

No.	Category ①	Category ②	Symptom of problem	Probable cause	Solution
15	Cleanliness monitor	CC monitor (main unit)	No display appears, even though the object is dirty. Or even though it is clean, the red display does not go out.	① Main unit installation direction upside-down.	・Check that the main unit up and down direction is correct.
				② Ventilation inlet blocked.	・Check whether the upper and lower ventilation inlets are blocked.
				③ Affected by noise.	・Check whether there are strong sources of noise adjacent to the measurement location.
				④ Affected by outside air flows.	・Check that the air flow around the main unit is at a wind speed of 0.2 m/s [0.66 ft./sec.] or less.
16			Nothing happens when attempting to change alarm setting using rotary switch.	① SET button not pressed.	・After changing the setting, press the SET button.
17			Alarm buzzer does not shut off.	① RESET button not pressed.	・The alarm cancel operation can vary depending on the timing of pressing the RESET button. ① After an alarm occurs, if RESET is pressed before the particle density falls below the setting value: If the RESET button is pressed when the particle density is at the setting value or higher, only the buzzer is cancelled. All other alarm LEDs and external outputs are maintained. The alarm LEDs and external outputs are cancelled when the particle density falls below the setting value. ② After an alarm occurs, if the particle density falls below the setting value without RESET being pressed: If RESET is not pressed even though the particle density is below the setting value, all alarm outputs are maintained. In this state, pressing the RESET button cancels all alarm outputs. For details about alarm operations, see the Owner's Manual.
18			Even though RESET button was pressed, alarm LED does not turn off.	① Particle density not lower than setting value.	
19		CC monitor (communication-related)	Communication fails.	① LAN cable specifications incorrect.	・Check the LAN cable specifications. For a network connection → Straight cable. For direct connection to a personal computer → Cross cable.
				② Hardware and software configurations necessary for Ethernet communication not set up.	・Personal computer operating Microsoft WindowsNT/2000/XP. ・Ensure network card compatible with the above computer. ・Check that TCP/IP is installed as network protocol, and is operating correctly.
20			DeviceInstaller does not recognize CC monitor when implementing IP address settings.	① Network configuration and PC settings.	・Problem could be due to any of various factors. For details, consult with Koganei.
21			Could not install DeviceInstaller.	① Restrictions due to PC security.	・Ask the administrator of your company's personal computer network.
				② NET Framework not installed in PC.	・Download and install NET Framework Ver1.1 from the Microsoft Website.
22			In the support software window for state of communication, "The sensor is not connected!" is displayed.	① IP address not set.	・In the support software window for the IP address allocated in DeviceInstaller, go to **Setting** and select **Condition**, and in **Setting IP address of Sensor** input the IP address allocated in DeviceInstaller for implementing the support software settings.

＊ If the product fails to operate correctly even after the above measures are adopted, there may be a problem with the product itself. Consult with Koganei.

Glossary

	Term	Definition
A	a-contact	A normally open contact that closes when a signal (switch input or sensor input) is given. Also called NO (Normally Open) contact ⇔ See b-contact.
	Alternating current type ionizer (AC method)	A type of high-voltage application in corona discharge method ionizers. Devices using alternating high voltage (AC) are called alternating current method devices.
	Antistatic agent (process)	An agent usually consisting of a surfactant. Coating or blending with an insulation object makes the surface of the insulation object more hydrophilic, increasing its hygroscopicity and granting it ionic properties, which increase its surface conductivity and prevent charging.
	Atom	A particle that cannot chemically be further divided. The atom consists of a nucleus carrying a positive charge and surrounding electrons carrying a negative charge. The electrons revolve around the nucleus like satellites.
B	b-contact	A normally closed contact that opens when a signal (switch input or sensor input) is given. Also called NC (Normally Closed) contact. ⇔ See a-contact.
C	Carrying ions through a tube	A method where ions generated by the ionizer are carried through a tube to remove charges from an electrified area. In ionizers with a low frequency of 50/60 Hz, carring ions through a tube is impossible because the ions are extinguished inside the tube. The DTRY-ELB series and DTRY-ELL series manufactured by Koganei use a high frequency of 68000 Hz, to achieve an excellent ion balance and ensure that ions can be carried through a tube with relatively little extinguishing inside the tube.
	CE marking	A safety mark required to be affixed on designated products sold in the European Union (EU) area. The CE marking is issued as a directive from the European Community Council of Ministers (EC Directive), and certifies that the product is in compliance with the requisite safety regulations. Koganei products generally come under the EMC, Low Voltage, and Machinery Directives.
	Charge	The amount of electricity in a substance or its atoms, electrons, etc., which determines the size of an electromagnetic interaction. The unit is the Coulomb (C). Charge exists in two states, positive and negative, which are called positive charge and negative charge, respectively.
	Charged device model (CDM or CPM)	A model for when device package leads (terminals) become charged due to friction, etc., causing a break when the charge is discharged via the device terminal. (CPM: charged package model).
	Charging series (triboelectric series)	A list of materials that produce a charge when rubbed together arranged in order depending on whether they have positive or negative charges. In general, rubbing-induced electrification is larger for materials whose positional relationship is distant than for those that are close together. Even rubbing between substances of the same material will result in a positive charge on one side and negative charge on the other.
	Charged plate monitor	Used for measurement of ionizer performance. High voltage is applied to a □150 mm [5.91 in.], 20 pF metal plate, to measure the time required for an ionizer to decay the voltage (decay time), and the difference in the amount of ions generated by the ionizer (ion balance).
	Clean room	A space where particles and micro-organisms floating in the air are controlled to be at or below a certain level of cleanliness, with temperature, humidity, pressure, and other environmental conditions also controlled as necessary.
	Cleanliness	An amount showing the state of cleanliness in a target object, expressed in the size or number of contamination substances incorporated into a certain surface or volume. In addition, the degree of cleanliness ranked by the amount of contaminated substances or size of particles existing in a specified location or volume is called the cleanliness level, and the arrangement of cleanliness level by class is called the cleanliness class. While standards for clean room cleanliness are independently set in each country, in general, ISO146441-1 and Fed.Std. 209E are most widely used. Note that the clean room evaluation method JIS B9920 regulated under the Japanese Industrial Standards (JIS) is based on ISO146441-1.
	Conductor	Substance that easily passes electricity. Gold, silver, copper, iron, aluminum, etc.
	Contact charging	Charging caused by contact.
	Contamination	Contaminated by dirt or other foreign material. Particles adhering to semiconductor wafers are also called contamination.
	Corona discharge method ionizer	Application of high voltage to a needle-tipped electrode forms an unbalanced electric field adjacent to the electrode, and the discharge that occurs when that electric field locally exceeds the dielectric breakdown electric field strength is called a corona discharge. In a dark room, this discharge is visible as a blue-white light near the electrode. The corona discharge method ionizer utilizes this principle to intentionally induce a corona discharge on the discharging needle, to generate ions.
	Coulomb force	The force exerted according to Coulomb's Law, which is defined as one coulomb being equal to the amount of charge carried by one ampere of current for a period of one second.

	Term	Definition
C	Coulomb's Law	The size of the force exerting between two small charged objects is inversely proportional to the square of the distance between the two objects, and proportional to the product of the two charges. Charges with the same sign repel each other, while differing charges attract. This relationship is called Coulomb's Law.
D	Direct current type ionizer (DC method)	A type of high-voltage application method in corona discharge method ionizers. Devices using direct current high voltage (DC) are called direct current type ionizers.
	Discharging needle	A needle-shaped electrode attached to the interior of a corona discharge method ionizer. A corona discharge is generated from its tip, to generate ions.
	Dust generation	Generation of dust or particles.
E	Electric field	The gradient of a potential induced by existence of a charge. The force acting on an electric field is expressed by Coulomb's Law.
	Electrification	Phenomenon where electric charge accumulates on an object. Discharge occurs when the intensity of an electric field induced in a charged object reaches the dielectric breakdown electric field strength of media, causing multiple problems.
	Electron	Tiny particles with negative charges revolving around the atomic nucleus like satellites.
	Electrostatic breakdown	Phenomenon where discharge of static electricity causes fusion, etc., of circuits in electronic parts.
	Electrostatic capacity	Amount of charge per unit of voltage built up in a capacitor or other insulated conductor. Unit is F (Farad).
	Electrostatic discharge (ESD)	Movement of electrostatic charges between objects of different potential.
	Electrostatic induction	Phenomenon where electrons inside a conductive object move when the conductive object is brought close to a charged object, causing the surface facing the charged body to become charged with opposite polarity of the charged object.
	Electrostatic spark	Phenomenon in which a certain amount of charge builds up and induces a discharge to an adjacent conductive object.
	EPA	ESD Protected Area. An area, space, or room designed to avoid risk to operators, and minimize the risk of damage due to static electricity as a condition for handling ESDS or equipment.
	ESA	Electrostatic Attraction. Attraction of particles to workpieces due to static electricity.
	ESDS	Electrostatic Discharge Sensitive Devices. Stand-alone devices, integrated circuits, or mounted parts with the possibility of damage due to encounters with electric fields or electrostatic discharge during normal handling, testing, or transportation.
	Ethernet	A computer network standard. In LANs (Local Area Networks), a combination of Ethernet and the TCP/IP protocol is common.
F	Farad (F)	Farad (unit: F) is an SI unit of electrostatic capacity. When 1V is applied to a capacitor, and 1 C of electrical quantity has accumulated, the electrostatic capacity of that capacitor is defined as 1 F.
	Feedback-type ionizer	A method involving sensing the amount of charge in workpieces targeted for charge removal, and controlling the amount of discharging ions. Failure to accurately measure the amount of charge in the workpiece could result in emission of ions of the opposite polarity, leading to a reverse charge.
	Flushing	When assembling parts, pressurized air is blown to prevent dust or particles from being attracted to the parts.
	Frequency	Number showing how many times per second a phenomenon of periodic change occurs in electricity, radio waves, sound waves, etc. The unit is Hz (hertz).
	Frictional charging	Charging induced by friction. The friction state can generate a large amount of charge due to pressure application, heat generation, surface distortion, or rupture occurrence.
G	Ground	Refers mainly to the use of grounding wires for electrical connection between a charged object and the earth to prevent conductor charging, and generally includes the meaning that a state of equivalence is achieved when grounded.
H	High-frequency AC method ionizer	High-voltage frequencies type in AC voltage type static charge removal devices (AC method ionizers), for the generation of ions. The high-frequency AC method ionizer manufactured by Koganei operates at 68000 Hz, to achieve an ion balance that is superior to other methods. The ordinary alternating current (AC) method is 50/60 Hz.
	Human body model (HBM)	A model for when a person with a build-up of static electricity touches a device, causing a break when the charge is discharged via the device.
I	IEC standard	International standard set by the International Electrotechnical Commission (IEC), a body for standardizing technologies related to electrical engineering and electronic engineering. Standards for static electricity removal devices (ionizers) are also stipulated in the IEC regulations.

Glossary

	Term	Definition
I	Induction charging	Phenomenon where charging occurs when a charged object is brought close to another object and then pulled away again, causing electrostatic induction from the charged object. Charging can occur even if the two objects do not actually touch each other.
	Insulator, non-conductor	Substances that let virtually no electricity pass through (glass, paper, air, etc.)
	Ion	A particle carrying a + (positive) or − (negative) charge. An atom or molecule that has lost electrons is called a positive ion, while an atom or molecule that has added electrons is called a negative ion. Since electrons are much lighter than protons, it is the electrons that usually move.
	Ion balance	The difference between positive ions and negative ions generated by an ionizer. Also called offset voltage. Measurement is performed using a charged plate monitor (CPM), and the result appears as a potential on a charged plate monitor that has been exposed to ionized air for a specific period.
	Ionizer	A device for eliminating (neutralizing) static charges through ionization of the air, etc.
L	Light scattering method	A measurement principle used for particle counters and other particle measurement. The measurement principle involves radiating a laser or intense light into air containing particles, and using the intensity of the light scattered off particles to measure the particle diameters and numbers of particles.
M	Machine model (MM)	A model for when metal with a build-up of static electricity touches a device, causing a break when the charge is discharged via the device.
	Minimum bending radius	Shows how much bending a tube, pipe, or cable can tolerate when used. Expresses the radius of the inner side of the curve.
	Molecule	The minimum particles possessing the properties of a substance. A number of atoms bond together to form a molecule, and an accumulation of an extremely large number of molecules form the substances that surround us.
O	Ozone (density)	O_3, an allotrope of oxygen. It gives off a distinctive odor. Often used for disinfection, bleaching, or oxidation. While ozone has a strong oxidation action, and can be toxic at high concentrations, it even exists in the natural world at 0.005 ppm to 0.05 ppm (depending on the environment). The allowed ozone density in Japan's labor environment is an average of 0.1 ppm or less over an 8-hour period (Japan Society for Occupational Health).
P	Particle	Refers to particles with extremely tiny diameters, and generally to particles of 10 μm or less that rarely precipitate out when suspended in a gas.
	Peeling charging	Charging that is induced when an object once contacted is peeled off a surface.
	Potential	Positional energy per unit of charge in an electric field. The unit is V(volt). Also, the difference between a certain potential and another potential is called the potential difference or voltage.
	ppm	A unit of density, expressed in parts per million. Used for expressing in ultramicroscopic concentration and ratios. There are also units of concentration expressed in pphm (parts per hundred million) and ppb (parts per billion).
	Pulse AC method ionizer	A method for applying high voltage to the discharging needle in the corona discharge method ionizer. A feature is its ability to use sensing to control the amount of positive and negative ions. Positive ions and negative ions can be discharged from a single discharging needle.
	Pulse DC method ionizer	A method for applying high voltage to the discharging needle in the corona discharge method ionizer. A feature is its ability to use sensing to control the amount of positive and negative ions. Positive ions and negative ions are discharged from separate discharging needles.
R	Radiation method ionizer	An ionizer utilizing the ionizing radiation effect of alpha rays emitted from radioisotopes.
	Relative humidity	Amount of water vapor in the air, divided by the saturated amount of water vapor at a given temperature (unit: %). When the relative humidity in the ambient atmosphere is high, leakage of charge from the insulator surface suppresses generation of static electricity. A relative humidity level of 65% or more demonstrates particular effectiveness as a charge prevention measure.
	Removal of charge	Removal (neutralization) of charge built up on the surface of an object.
	Reverse charge	A phenomenon where the ionizer fails to eliminate charges on a charged object, but instead actually charges the object.
	RoHS directive	The restriction of the use of certain hazardous substances in electrical and electronic equipment. In principle, use of 4 heavy metals, lead, mercury, cadmium, and hexavalent chrome, and the brominated flame retardants PBB and PBDE must be eliminated or curtailed in electrical and electronic equipment by July 2006. All Koganei-brand products shipped by Koganei since July 2006 are in conformance with the RoHS directive.

	Term	Definition
S	Sampling time	The time targeted for measurement.
	Self-discharge	Electrostatic energy discharged from a charged object through a conductive object in close proximity. Discharging brushes utilize this principle.
	Soft X-ray method ionizer	A type of light irradiation ionizer. The ionizer uses soft X-rays, a type of electromagnetic wave with an extremely short wavelength.
	Static charge removing brush (ribbon)	Brush-shaped self-discharging devices commonly equipped with OA equipment (such as at the paper outlet on copy machines). These do not require power supplies, as they remove charges by grounded conductive fiber as electrodes. Although low-priced and simple to attach, their theoretical charge removal capacity is greatly affected by the potential of the charged object and they therefore cannot perform charge removal when the amount of charge is low (approx. 3 kV or less).
	Static charge removing characteristics	In ionizers, such characteristics as static charge removing time, static charge removing range, ion balance, etc.
	Static charge removing time	The time required for reduction from a certain voltage down to a specified voltage. Also called electrostatic decay time.
	Static electricity	Electricity where the charge's spatial movement is very small.
	Static electricity removal device	An ionizer. Also called a static charge removal device. (See Ionizer.)
T	Tungsten	A metallic element, with the element symbol W. It has the highest melting point of the metals, and because it possesses an electrical resistance that is relatively high for a metal, it is used as a filament for incandescent bulbs, etc. It is often used for ionizer discharging needles.
U	Ultraviolet method ionizer	A type of light irradiation ionizer. It features ultraviolet, a type of electromagnetic wave with a wavelength longer than soft X-rays, and uses the optoelectric effect to ionize the atmosphere.

MEMO

Limited Warranty

KOGANEI CORP. warrants its products to be free from defects in material and workmanship subject to the following provisions.

Warranty Period The warranty period is 180 days from the date of delivery.

Koganei Responsibility If a defect in material or workmanship is found during the warranty period, KOGANEI CORP. will replace any part proved defective under normal use free of charge and will provide the service necessary to replace such a part.

Limitations

- This warranty is in lieu of all other warranties, expressed or implied, and is limited to the original cost of the product and shall not include any transportation fee, the cost of installation or any liability for direct, indirect or consequential damage or delay resulting from the defects.
- KOGANEI CORP. shall in no way be liable or responsible for injuries or damage to persons or property arising out of the use or operation of the manufacturer's product.
- This warranty shall be void if the engineered safety devices are removed, made inoperative or not periodically checked for proper functioning.
- Any operation beyond the rated capacity, any improper use or application, or any improper installation of the product, or any substitution upon it with parts not furnished or approved by KOGANEI CORP., shall void this warranty.
- This warranty covers only such items supplied by KOGANEI CORP. The products of other manufacturers are covered only by such warranties made by those original manufacturers, even though such items may have been included as the components.

The specifications are subject to change without notice.

ISO9001
ISO14001

- ISO 9001 certified offices are Main Office, Tokyo Plant, Komagane Plant and Sales Offices.
- ISO 14001 certified offices are Main Office, Tokyo Plant and Komagane Plant.

URL http://www.koganei.co.jp

E-mail: overseas@koganei.co.jp

KOGANEI CORPORATION

OVERSEAS DEPARTMENT
3-11-28, Midori-cho, Koganei City, Tokyo 184-8533, Japan
Tel: 042-383-7271 Fax: 042-383-7276

SHANGHAI KOGANEI INTERNATIONAL TRADING CORPORATION
Room 2606-2607, Tongda Venture Building No.1, Lane 600, Tianshan Road, Shanghai, 200051, China
Tel: 021-6145-7313 Fax: 021-6145-7323

KOGANEI-PORNCHAI CO., LTD.
89/174 Moo 3, Vibhavadee Rangsit Road, Talad Bangkhen, Laksi, Bangkok, 10210, Thailand
Tel: 02-551-4025 Fax: 02-551-4015

3/'09 30 BPBP