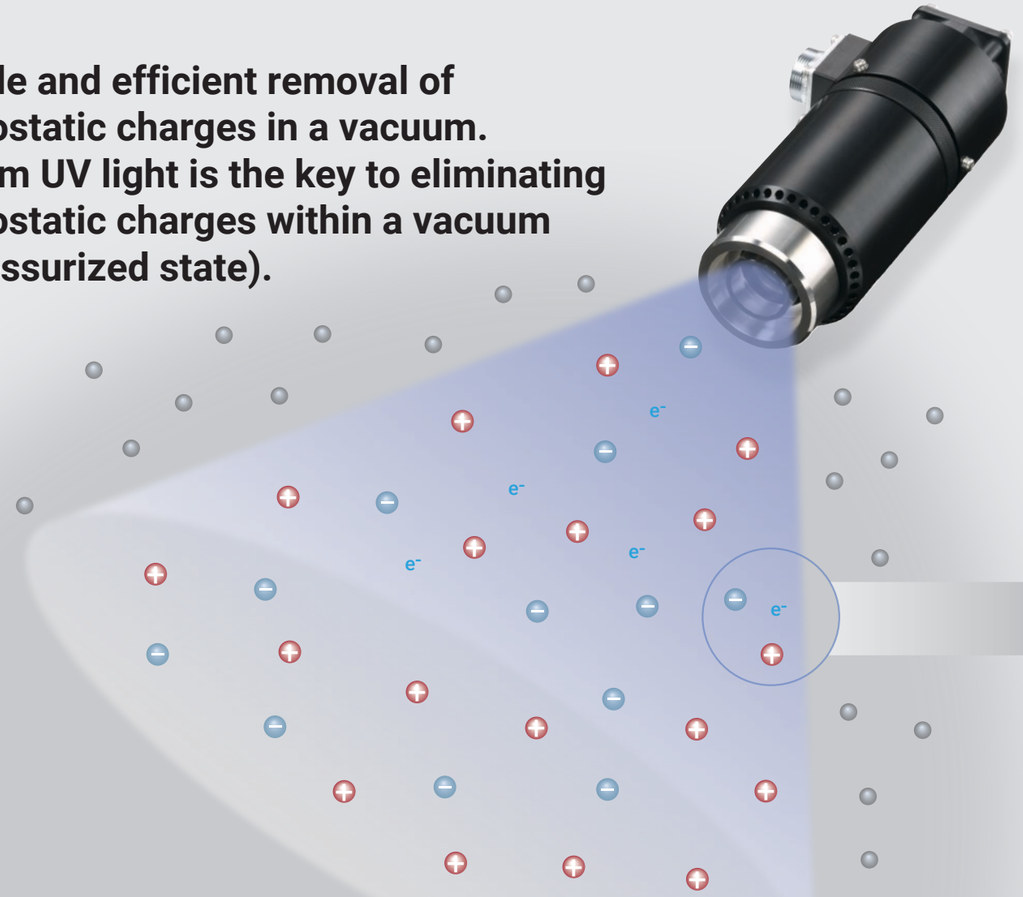
HAMAMATSU

PHOTON IS OUR BUSINESS

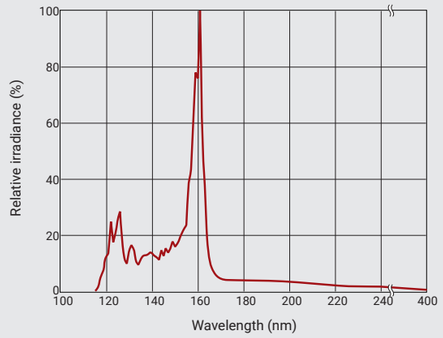
Electrostatic Charge Removers

VUV Ionizer™

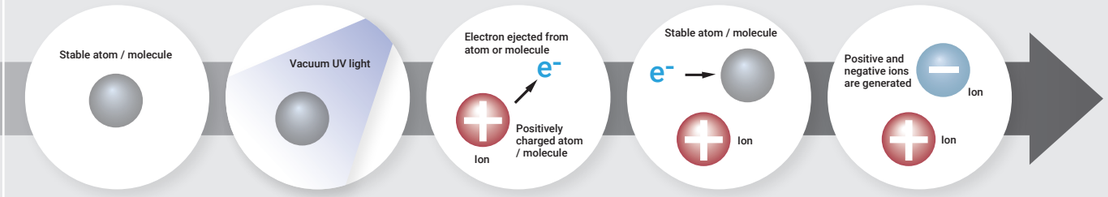
Reliable and efficient removal of electrostatic charges in a vacuum. Vacuum UV light is the key to eliminating electrostatic charges within a vacuum (depressurized state).



VUV Ionizers are electrostatic charge removers that use "photoionization" to apply vacuum UV light to remove static electricity. This innovative ionization method makes use of unique features of vacuum UV light to eliminate unwanted electrostatic charges in a vacuum (depressurized state) which has been impossible up to now.
High-energy vacuum UV light at wavelengths shorter than 160 nm ensures highly efficient removal of electrostatic charges and in this way eliminates all types of static electricity problems that occur on production lines and a broad range of manufacturing processes.



Principle of electrostatic charge removal | Photoionization mechanism

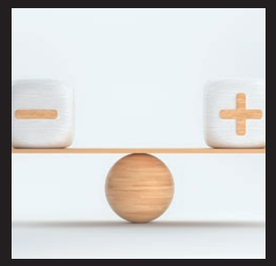


Irradiating vacuum UV light onto residual atoms and molecules in a vacuum (depressurized state) ejects the electrons from the atoms and molecules, leaving positively charged atoms and molecules (positive ions). These ejected electrons then combine with other residual atoms and molecules to produce negative ions. These electrons and ions are generated simultaneously over the entire space irradiated with vacuum UV light, and the electrons and ions generated near a target object are attracted to static electricity to remove electrostatic charges from the target object. Other electrons and ions generated during this process return to their original residual atoms and molecules.

Highly efficient removal of electrostatic charges in low vacuum to high vacuum conditions eliminates the root causes of static electricity problems thought impossible to solve until now.

Completely removes all electrostatic charges

Ions are constantly generated over the entire space irradiated with vacuum UV light to create a high ion density that efficiently removes all electrostatic charges on a target object by neutralizing them to 0 volts.



No worries about "overshoot" *1

Inherently balanced ionization ensures that positive and negative ions are generated in equal amounts and causes no "overshoot" that might charge the target object to an opposite polarity. So there is absolutely no need to adjust the supply of positive and negative ions.

*1: Overshoot is a phenomenon in which a target object is electrostatically charged at an opposite polarity due to generating an unbalanced amount of positive and negative ions.

Needs no air flow that might badly affect target objects *2

Electrons and ions are also generated in the vicinity of a target object and are efficiently attracted to the static electricity on the target object to directly remove electrostatic charges. This means there is no longer any need to blow air to move the generated electrons and ions to the target object. Eliminating this air flow prevents emitting any flying dust particles that might badly affect the target object.

*2: Please check the other data to find how irradiating vacuum UV light affects the target object.

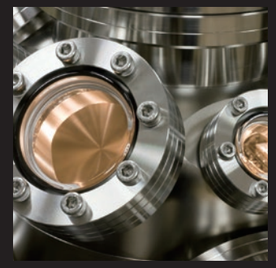
It has been impossible for conventional corona-discharge ionizers to remove electrostatic charge in a vacuum (depressurized state) due to their electrostatic charge removal principle.
VUV Ionizers have a vacuum flange that connects to a vacuum chamber and emits vacuum UV light to ionize the residual atoms and molecules in a vacuum (depressurized state). This allows reliable and efficient removal of electrostatic charges in low vacuum to high vacuum conditions.

Clean design generates no dust

Photoionization or ionization by light is a clean process for removing electrostatic charges since it generates no dust particles or electromagnetic noise. This design eliminates potential problems such as product defects caused by ordinary ionizers due to dust particles and peripheral device malfunctions which might be induced by electromagnetic noise.

Reliable operation over a long life

VUV Ionizers employ a high-quality, high-precision deuterium lamp that we manufacture entirely in-house. This deuterium lamp exhibits high stability and a long lifetime to ensure stable emission of vacuum UV light over long periods of time.



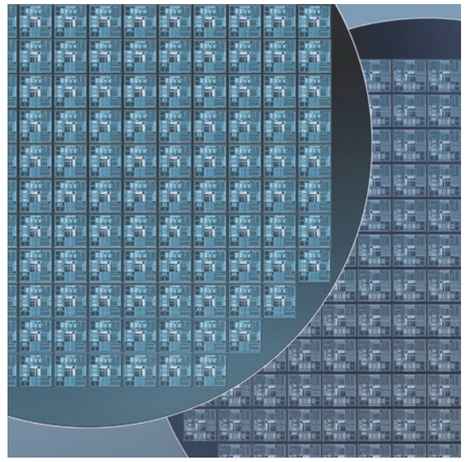
Compatible with low vacuum to high vacuum levels

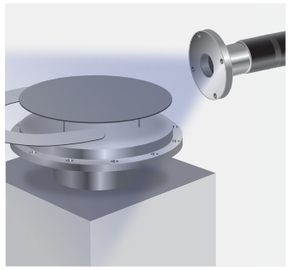
VUV Ionizers ensure efficient removal of electrostatic charges over a wide range of vacuum levels from low-vacuum to high-vacuum conditions. VUV Ionizers are also useful for removing electrostatic charges in special environments such as inert gas atmospheres.

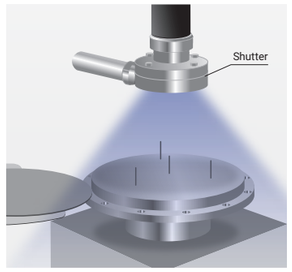
Achieves real improvement in production yields and throughput.
Use is spreading fast to ever more fields and applications due to its effective ionization.

VUV Ionizers help prevent electrostatic destruction and particle adhesion which contributes to significant improvements in manufacturing process yields and throughput. Besides not inducing “overshoot” that may cause opposite polarity charging, VUV Ionizers offer a clean ionization process that does not need to blow air onto the target and generates no electromagnetic noise. Due to this effective ionization, VUV Ionizers are becoming widely used in countless fields and applications where static electricity and dust particle adhesion are a great concern such as in the manufacture of semiconductors, LCD panels, and organic EL displays.

Semiconductors

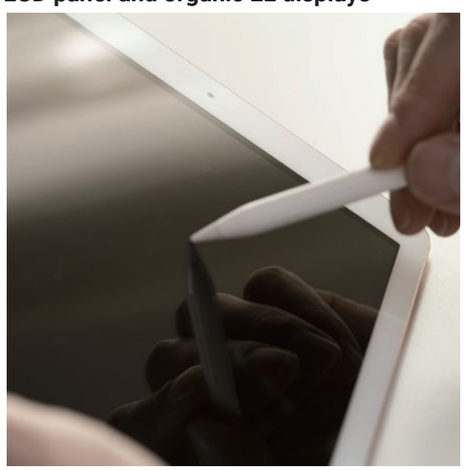


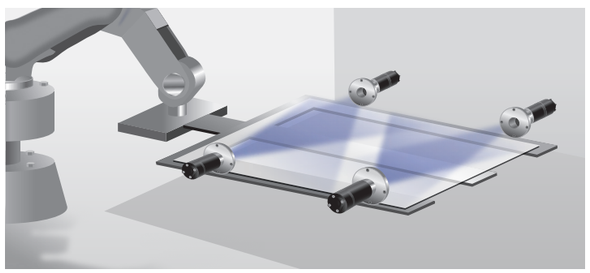




The ever-increasing degree of miniaturization, process-shrinking and circuit integration of semiconductor devices makes them more vulnerable to electrostatic charges. This makes it essential to take measures against electrostatic charges to prevent electrostatic destruction as well as device defects caused by foreign particle adhesion.
When used for an electrostatic chuck, the VUV Ionizer eliminates electrostatic charges that occur at de-chucking to make de-chucking safe and reliable. By irradiating vacuum UV light timed so that no wafer is present, the residual electrostatic charges on the electrostatic chuck can be removed without causing UV damage to semiconductor devices. To perform ON / OFF irradiation control at time intervals ranging from a few seconds to several minutes, we recommend using a shutter to interrupt the vacuum UV light.

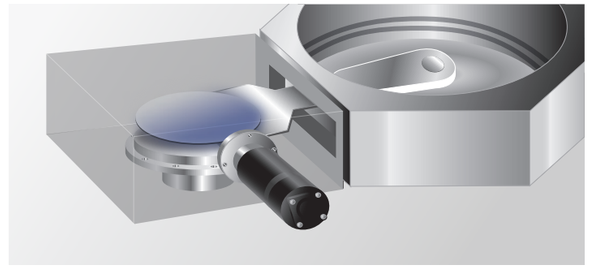
LCD panel and organic EL displays





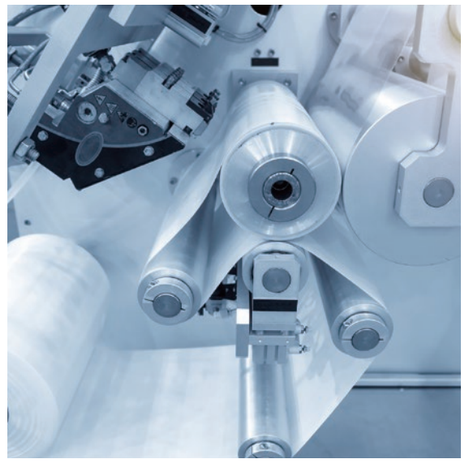
LCD panel and organic EL displays are becoming larger and thinner so efficient and effective measures must be taken to remove electrostatic charges on larger surface areas. VUV Ionizers help prevent electrostatic destruction and product defects caused by foreign particle adhesion and also improve the yield and throughput in manufacturing processes.
In applications where large glass substrates are treated, installing multiple VUV Ionizers will boost the electrostatic charge removal effect.

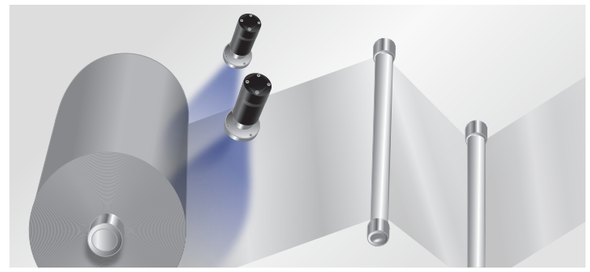
Hard disks



Hard disks must provide ever larger capacity and higher data transfer speeds, thus making effective electrostatic charge prevention measures more essential than ever. Eliminating static electricity that accumulates on components such as magnetic heads vulnerable to static electrical charges and disks onto which foreign particles may adhere will effectively boost the yield and throughput in manufacturing processes.

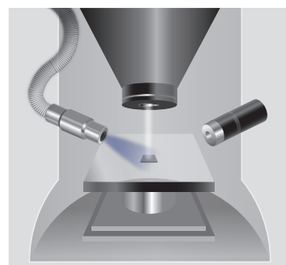
Films

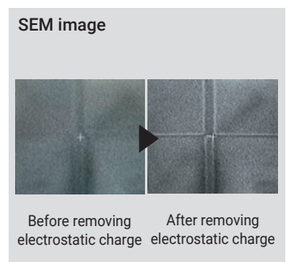




Static electricity is generated on films when repeatedly brought into contact with and peeled away from an object. Large electrostatic charge tend to accumulate in particular on the surface of roll films near the feed and take-up rollers. VUV Ionizers prevent film damage (perforation) caused by electrostatic sparks and defects due to adhering of foreign particles and also help improve conditions in the work environment.
In wide film applications, installing multiple VUV Ionizers will boost the electrostatic charge removal effect.

Electron beam applications



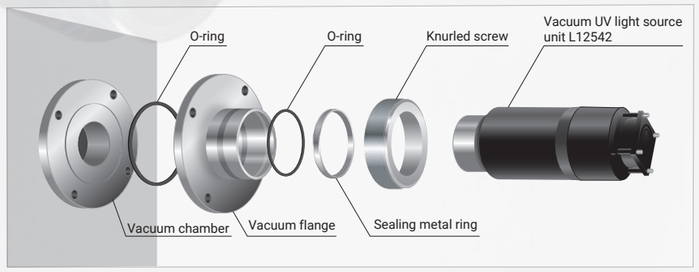


On equipment utilizing electron beams, VUV Ionizers can eliminate charges that occur when a sample is irradiated with an electron beam. For example, in the case of scanning electron microscopes (or SEM) applications, clear images are obtained after pinpoint removal of charges on a sample that were caused by irradiating the sample with an electron beam.

Vacuum UV light source unit L12542

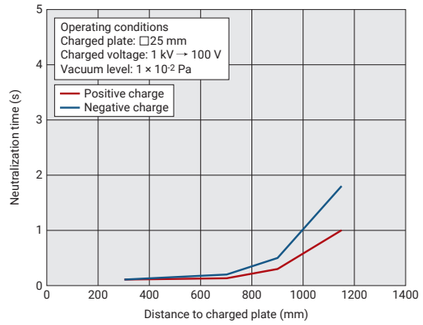
Large-area irradiation model with a wide directivity (light distribution)

The L12542 is a large-area irradiation model that boasts a wide directivity (light distribution) as well as high stability and a long life. Among our VUV Ionizer product line-up, the L12542 offers high versatility and has a strong track record from being used in a wide range of fields. The L12542 is effective in rapid removal of electrostatic charges even on large objects or multiple objects.

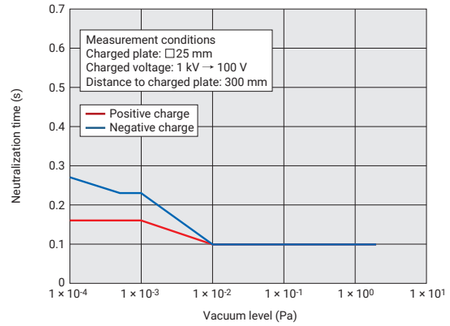


Neutralization performance (Typ.)

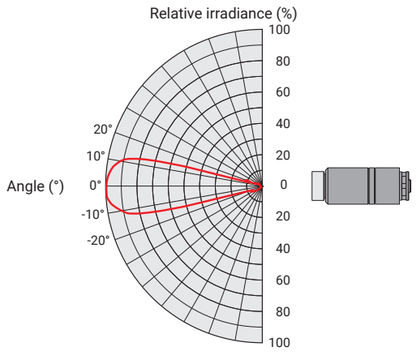
Neutralization time vs. distance



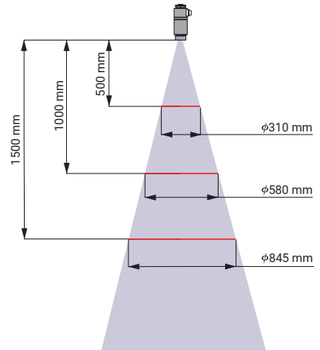
Neutralization time vs. vacuum level



Directivity (light distribution) (Typ.)



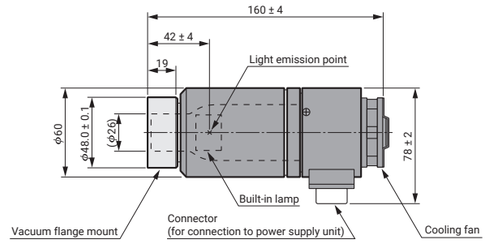
Light irradiation range (Typ.)



Dimensional outlines (Unit: mm)

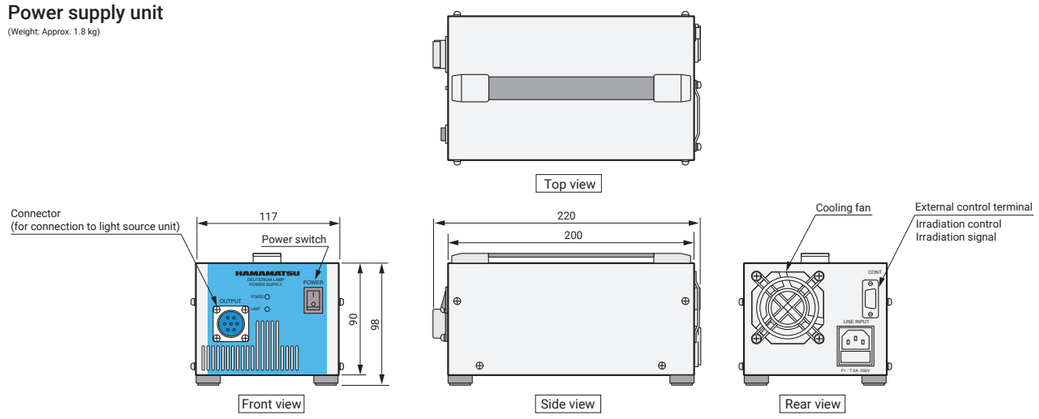
Light source unit

(Weight: Approx. 530 g)



Power supply unit

(Weight: Approx. 1.8 kg)

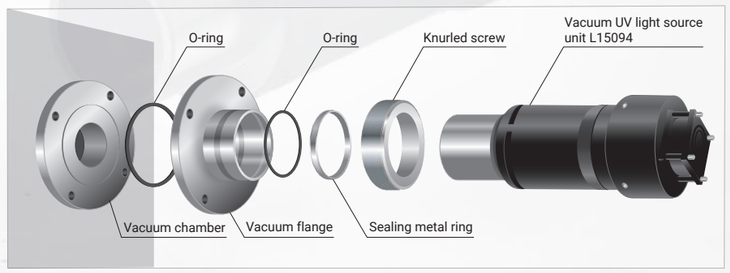


Accessories: Output cable (2 m), AC cable (2 m)

Vacuum UV light source unit L15094

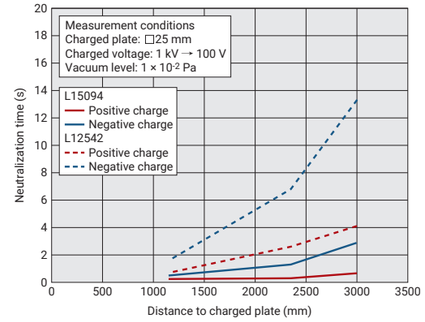
High output model with high neutralization performance

The L15094 is a high output model using a high power deuterium lamp we manufacture in-house. In addition to high stability and a long life, the L15094 delivers performance maximized for electrostatic charge elimination, making it effective in removing static electricity from objects having large electrostatic charges or objects moving at high speed. The L15094 also helps shorten the time required for electrostatic charge removal to improve the throughput. The L15094 efficiently ionizes residual atoms and molecules in a vacuum (depressurized state) to create an ion-rich environment.

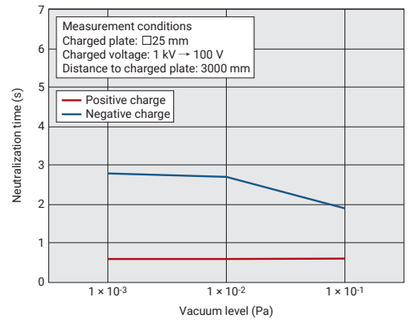


Neutralization performance (Typ.)

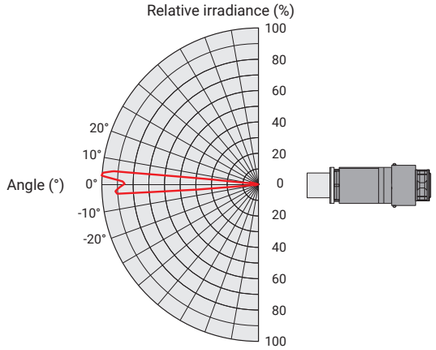
Neutralization time vs. distance



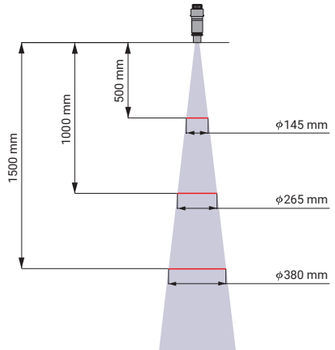
Neutralization time vs. vacuum level



Directivity (light distribution) (Typ.)



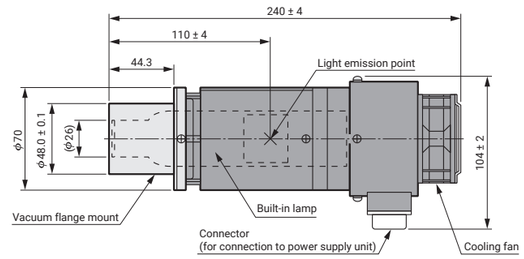
Light irradiation range (Typ.)



Dimensional outlines (Unit: mm)

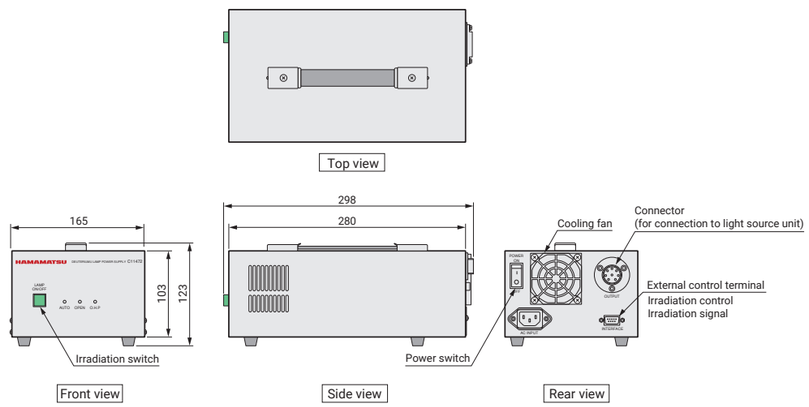
Light source unit

(Weight: Approx. 1.3 kg)



Power supply unit

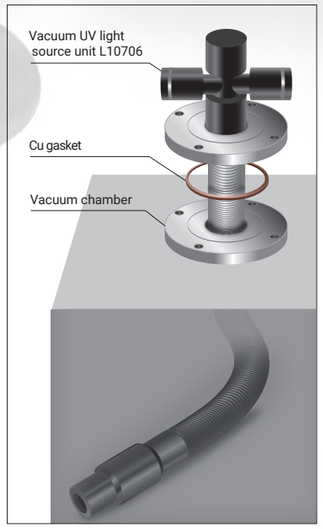
(Weight: Approx. 2.8 kg)



Accessories: Output cable (2 m), AC cable (2 m)

Vacuum UV light source unit L10706

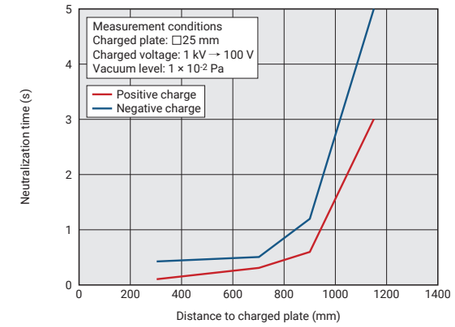
Proximity irradiation model with flexible design that does spot charge removal



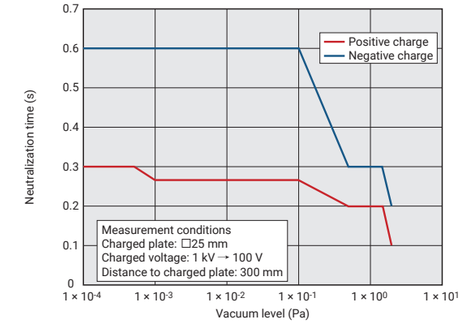
The L10706 is a proximity irradiation model equipped with a stainless steel flexible tube and unique cooling mechanism specifically designed for installation into vacuum chambers. Its compact design and easy routing of the flexible tube within equipment make the L10706 ideal for applications requiring pinpoint removal of electrostatic charges.

Neutralization performance (Typ.)

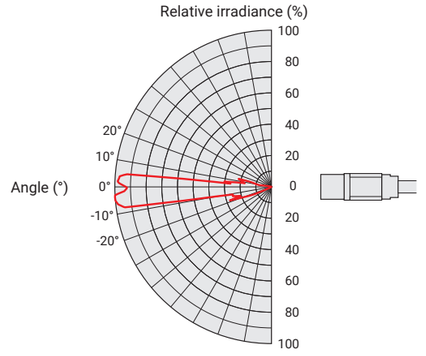
Neutralization time vs. distance



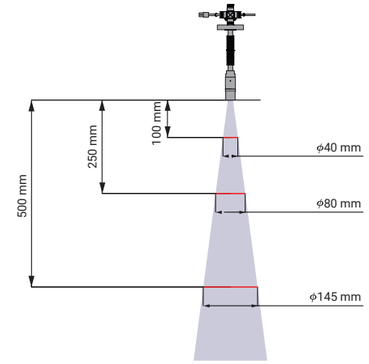
Neutralization time vs. vacuum level



Directivity (light distribution) (Typ.)

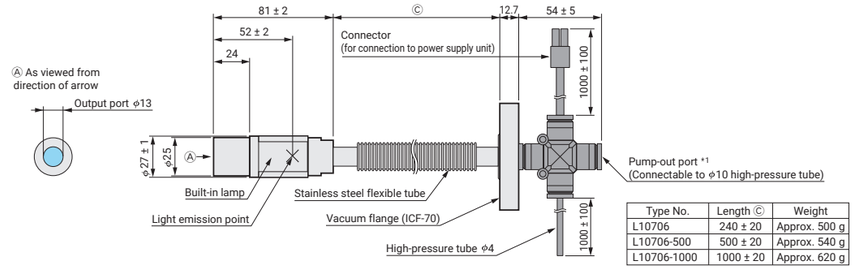


Light irradiation range (Typ.)



Dimensional outlines (Unit: mm)

Light source unit

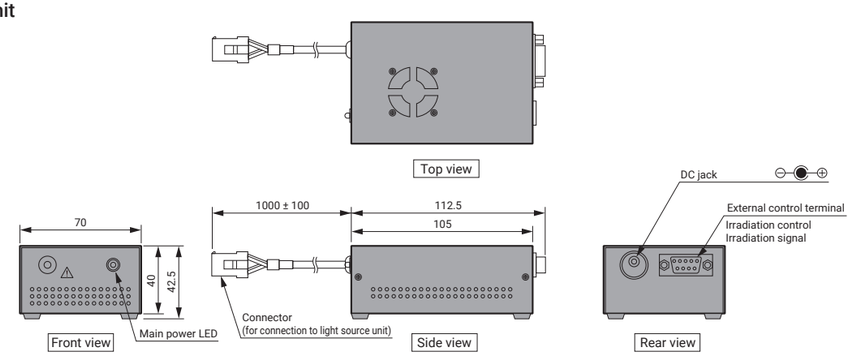


Type No.	Length Ⓒ	Weight
L10706	240 ± 20	Approx. 500 g
L10706-500	500 ± 20	Approx. 540 g
L10706-1000	1000 ± 20	Approx. 620 g

*1: High-pressure air (compressed air) is required for using the L10706.

Power supply unit

(Weight: Approx. 120 g)



Accessories: Output cable (2 m), AC cable (2 m)

Specifications

Parameter			L12542	L15094	L10706	Unit
Relative light intensity			10	40	1	–
Window material			MgF_2			–
Spectral distribution			115 to 400			nm
Preheating time			25 ± 5			s
Light output stability	Fluctuation (p-p)	Max.	0.05			%
	Drift	Max.	±0.3			%/h
Guaranteed lamp life *1			2000	1000	1000	h
Replacement lamp			L12565	L15294	L10706D	–
Vacuum flange			– *2		ICF70	–
	Sealing method		O-ring		Cu gasket	–
	Leakage amount		1×10^{-10} Pa m^3/s *3			–
Input voltage (AC)			100 V to 240 V , single phase 50 Hz / 60 Hz		100 V to 240 V , single phase 50 Hz / 60 Hz *4	–
Power consumption		Max.	90	200	40	VA
Light source unit cooling method			Forced air cooling by fan		Forced air cooling by high-pressure air *5	–
Operating temperature range			+10 to +40		+10 to +35	°C
Storage temperature range			0 to +60		-10 to +60	°C
Operating humidity range			Below 80 % (no condensation)		Below 80 % (no condensation)	–
Storage humidity range			Below 85 % (no condensation)		Below 80 % (no condensation)	–
External control			Irradiation control, irradiation signal, various error signals			–

*1: The life end is defined as the time when light output at 230 nm falls below 50 % of its initial value or when light output fluctuation exceeds the maximum specification value.
Note that light output attenuation is highly dependent on the condition of the vacuum equipment.
*2: The L12542 and L15094 can be used with vacuum flanges listed below as related products.
Please contact us for information on how to install a VUV Ionizer onto vacuum equipment.
*3: Result measured with helium leak detector.
*4: Input to the DC jack on the L10706 (power supply unit) should be 12 V DC (10.8 V to 13.2 V DC and less than 17 W).
*5: Using a high-pressure tube, supply compressed air at a flow rate of 20 to 30 liters per minute.

Related products

Vacuum flanges

We provide E3444 series vacuum flanges that are designed for our VUV Ionizers.

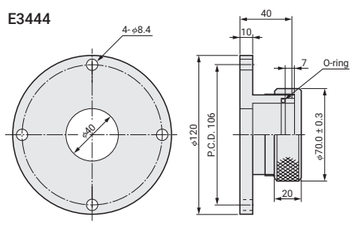
Specifications

Parameter	E3444 (General purpose specifications)	E3444-01 (JIS VF50)	E3444-02 (ICF114)	Unit
Flanges	– *1	JIS VG50	ICF114	–
Sealing method	O-ring		Cu gasket	–
Leak amount	1×10^{-10} Pa m^3/s *2			–

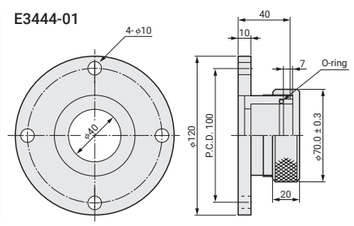
*1: Prepare a flange that matches the E3444 contour.
*2: Result measured with helium leak detector.

Dimensional outlines

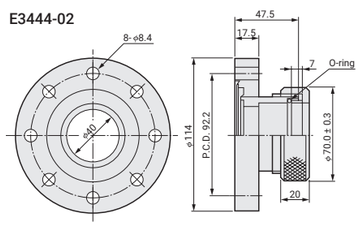
E3444



E3444-01



E3444-02



Warranty period

Products listed in this catalog are warranted to the original purchaser for a period of one year after delivery. Even if within the warranty period, this warranty shall not apply to failures due to misuse or mishandling by the customer or accidents such as natural and man-made disasters.

FAQ

Q01. Do VUV Ionizers emit vacuum UV light immediately after power-on?

A01. No, this is because the deuterium lamp incorporated in VUV Ionizers uses a thermal cathode that requires a warm-up time (filament preheating time) of about 20 seconds after power-on. Vacuum UV light is not emitted during this warm-up time.

Q02. Does vacuum UV light have any effects on target objects?

A02. Vacuum UV light energy is high and might damage target objects exposed to vacuum UV light for extended periods of time.
The extent of damage depends on the type of object so we recommend confirming that the target objects are not damaged under the same irradiation conditions as during actual usage. If you send us a target object sample we will confirm effects from vacuum UV irradiation on the target object. Please feel free to consult us about this.
If you do not want to directly irradiate the target objects with vacuum UV light, we suggest indirect irradiation to remove electrostatic charges. In this case, however, the electrostatic charge removal effect will be lower than when using direct irradiation so please consult us about this.

Q03. What are the residual atoms and molecules that contribute to photoionization by vacuum UV light?

A03. The residual atoms and molecules in the vacuum chamber originate from atmospheric components or namely components in the air.

Q04. In which area can electrostatic charges be most efficiently removed?

A04. Electrons and ions are generated by irradiation of vacuum UV light, so electrostatic charges will be most efficiently removed in the entire area irradiated by vacuum UV light. If an even higher electrostatic charge removal effect is needed, we recommend irradiating vacuum UV light directly onto the target object.

Q05. How do the characteristics change depending on the irradiation distance?

A05. Vacuum UV light from the deuterium lamp contained in VUV Ionizers spreads with a light distribution angle starting from the light emission point. This means the longer the irradiation distance, the wider the irradiated area. However, as the distance to the target object increases, the light output attenuates or weakens, which causes the amount of generated ions to decrease and degrade the electrostatic charge removal effect.

Q06. What is the reason for the difference between positive charging and negative charging in electrostatic charge removal effect?

A06. Electrons and negative ions work to neutralize positive charges, while positive ions help to neutralize negative charges. This process and the moving speed of the ions and electrons likely cause different electrostatic charge removal effects.

Q07. Is it possible to obtain a electrostatic charge removal effect in an atmospheric environment?

A07. No, a electrostatic charge removal cannot be obtained in an atmospheric environment or namely in the air.
Since vacuum UV light emitted from VUV Ionizers is absorbed by oxygen, a electrostatic charge removal effect can only be obtained in a vacuum or in an environment where oxygen was sufficiently replaced with an inert gas such as nitrogen.
If electrostatic charge removal is required in an atmospheric environment, then please use our PhotoIonizers.

Q08. Does the electrostatic charge removal effect differ depending on the degree of vacuum?

A08. As the degree of vacuum increases, the number of the residual atoms and molecules decreases and the electrostatic charge removal effect also weakens slightly. However, we have verified that there is no significant decrease in the electrostatic charge removal effect until the vacuum level reaches about 10^{-6} Pa.

Q09. When using VUV Ionizers in a gaseous environment, is there any gas that might cause adverse effects?

A09. The window material of the deuterium lamp in VUV Ionizers uses an MgF_2 crystal that is not adversely affected by the following gases.
- Rare gases
- Gases originating from atmospheric air
- Halogen-based gases (HCL, HF)
- Freon-based gases (CF_4, CCl_2F_2, etc.)

Please consult us when using VUV Ionizers in other environments.

Q10. Can I perform ON / OFF irradiation control at short time intervals?

A10. Intermittent lighting ranging from a few seconds to several minutes will shorten the lamp operating life. To perform ON / OFF irradiation control at time intervals within a few seconds to several minutes, we recommend using a shutter to interrupt the vacuum UV light.
In the case of the L12542, the guaranteed life is 2000 hours and the expected operating life during continuous lighting is 6000 hours or more. However, when operated intermittently at time intervals from a few seconds to several minutes, the actual operating life may be shorter than the guaranteed life in some cases.

Q11. How should I maintain the light source unit?

A11. When cleaning the window for the deuterium lamp in the VUV Ionizer, wipe the window surface with a soft cloth moistened with a volatile solvent such as acetone and then wipe it with dry cloth so that no volatile solvent remains on the window surface. If dirt or contaminants adhere to the window surface, these may cause burn-in (partial opacity) when the lamp is lit up, leading to poor electrostatic charge removal (light output attenuates or weakens due to premature loss of window transmittance).

Q12. How do I decide when to replace the light source unit?

A12. We recommend replacing the light source unit before the guaranteed life has expired or after a certain specified operating time has elapsed. The operating time can be calculated from the lamp status signal of the external control terminal on the power supply unit.
Basically, the electrostatic charge removal effect continues as long as the lamp still lights up. Please consult us if concerned about the correct lamp replacement period.

Q13. Is baking of a vacuum chamber possible while a VUV Ionizer is still installed to it?

A13. In the case of the L12542 and L15094 which are designed to be installed outside a vacuum chamber, baking of the vacuum chamber is possible unless the temperature of the vacuum chamber surface (vacuum flange mount) exceeds 140 °C. But do not emit vacuum UV light (do not turn on the light source) during baking.
Please consult us if the temperature of the vacuum chamber surface will be higher than 140 °C or you want to emit vacuum UV light during baking.
When using the L10706 whose main unit is designed to be installed inside a vacuum chamber, do not bake the vacuum chamber at a temperature higher than the storage temperature specified for the L10706.

Q14. Can you customize VUV Ionizers?

A14. Yes, we will customize VUV Ionizers and vacuum flanges to match your applications and usage conditions so please feel free to consult us about this.
Besides designing and manufacturing vacuum flanges, we also provide technical support for design issues.

Q15. Is pre-evaluation possible?

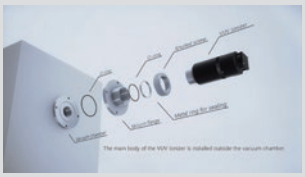
A15. We do simulations and also have demo units available for leasing. Please feel free to contact us about this.

Q16. Are there any laws and regulations that need to be followed when installing and using VUV Ionizers?

A16. There are no specific laws or regulations that need to be followed at this time.
However, if you are concerned about the effects of ultraviolet light on the human body, please take necessary action after referring to the following points.
- Be sure to wear protective equipment when handling a VUV Ionizer.
- Shield the viewing port by sticking a color film or similar item on it.

Operating a VUV Ionizer in the air even just temporarily will generate ozone, so be sure to ventilate the room.

You can watch our product intro videos on our website. Access our website via the QR code or URL.



❍**Video contents**
- Principle of electrostatic charge removal
- Features
- Product line-up
- Installation example
- Operation example

https://www.hamamatsu.com/jp/en/product/manufacturing-support-systems/electrostatic-remover/vuv-ionizer/principle_features/index.html

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