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HAMAMATSU

PHOTON IS OUR BUSINESS

SUPER-QUIET XENON LAMP
SUPER-QUIET MERCURY-XENON LAMP

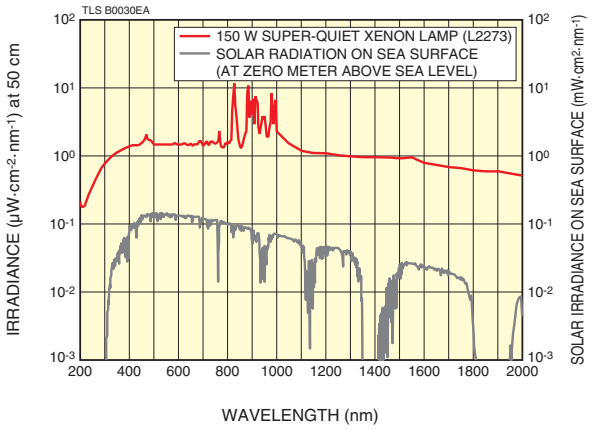


OVERVIEW

●SUPER-QUIET XENON LAMP

These are lamps filled with xenon gas that emits "white light" at a high color temperature of 6000 K, which is close to that of sunlight and covers a broad continuous spectrum (185 nm to 2000 nm) from the UV to infrared region. These xenon lamps are ideal as light sources for various types of photometric instruments such as spectrophotometers.

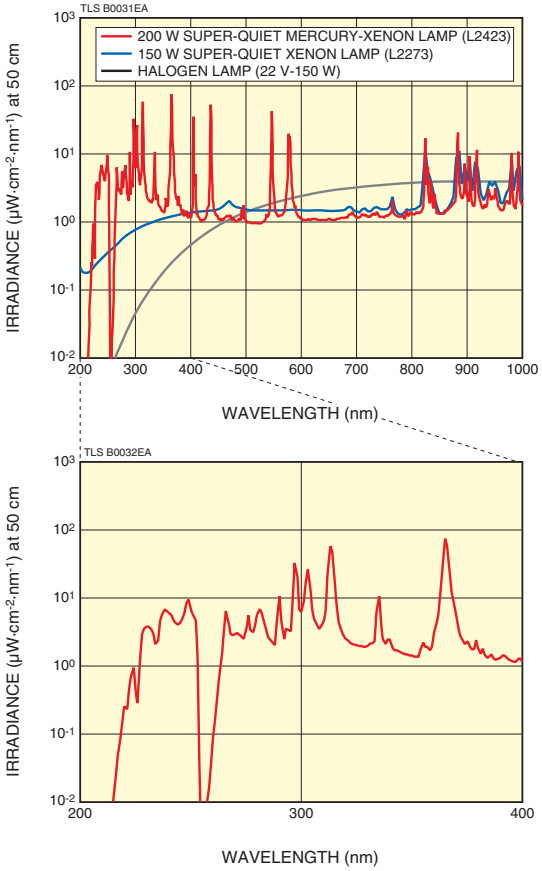
Figure 1: Spectral irradiance



●SUPER-QUIET MERCURY-XENON LAMP

Mercury-xenon lamps produce high radiant energy especially in the UV region due to an optimal mixture of mercury and xenon gas. These lamps possess features of both xenon gas and mercury discharge lamps. The spectral distribution includes a continuous line spectrum ranging from UV to infrared of the xenon gas and strong mercury line spectra in the UV to visible region.
Compared to xenon lamps, the radiant spectrum in the UV region of mercury-xenon lamps is sharper in width and its peak is higher in intensity. These features make mercury-xenon lamps ideal as UV light sources.

Figure 2: Spectral irradiance



FEATURES

- **No arc point shift**
- **High stability**
  - **Super-quiet xenon lamp:**
    - **Fluctuation (p-p) 0.2 % Typ.**
    - **1.0 % Max.**
    - **Drift ±0.5 %/h Typ.**
  - **Super-quiet mercury-xenon lamp:**
    - **Fluctuation (p-p) 0.5 % Typ.**
    - **2.0 % Max.**
    - **Drift ±0.5 %/h Typ.**
- **Long life**
- **Wide lamp lineup starting from low wattage input**
- **High brightness point light source**
- **High color temperature: 6000 K (Super-quiet xenon lamp)**
- **High UV light irradiation intensity (Super-quiet mercury-xenon lamp)**

APPLICATIONS

●SUPER-QUIET XENON LAMP

- **Spectrophotometer**
- **Liquid chromatograph**
- **Fluorospectrophotometer**
- **Microscope light source**
- **Color analyzer, color scanner**
- **Solar simulator, etc.**

●SUPER-QUIET MERCURY-XENON LAMP

- **Wafer inspection system**
- **Semiconductor photolithographic equipment**
- **Fluorescent microscopy**
- **Blood analyzer**
- **UV irradiation equipment, etc.**

ARC POINT "INSTABILITY (FLUCTUATION)" AND "SHIFT"

Light source lamps used for high precision photometry must have good arc emission point stability. However, cathodes used in conventional lamps have two shortcomings in terms of arc stability. One problem is that the arc emission point shifts intermittently due to inadequate electron emission from the cathode. The other problem is that the arc point shifts a little at a time due to the cathode tip wear that occurs with operating time as the lamp ages.

Hamamatsu super-quiet lamps employ a high performance "BI (Barium-Impregnated) cathode" developed totally in-house that eliminates the above problems to deliver extremely high stability.

This durable cathode exhibits no wear at the cathode tip over operating time and the arc point does not shift. So there is no need to realign the optical system until the time finally comes when the lamp must be replaced.

Figure 3: "Light output stability (fluctuation) vs. operating time" measurement block diagram

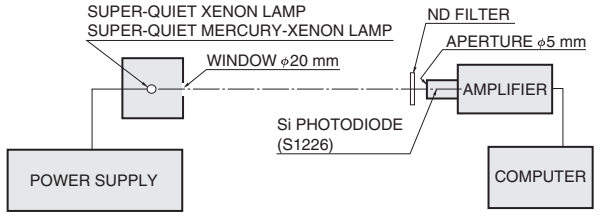


Figure 5: Comparison of cathode tip wear

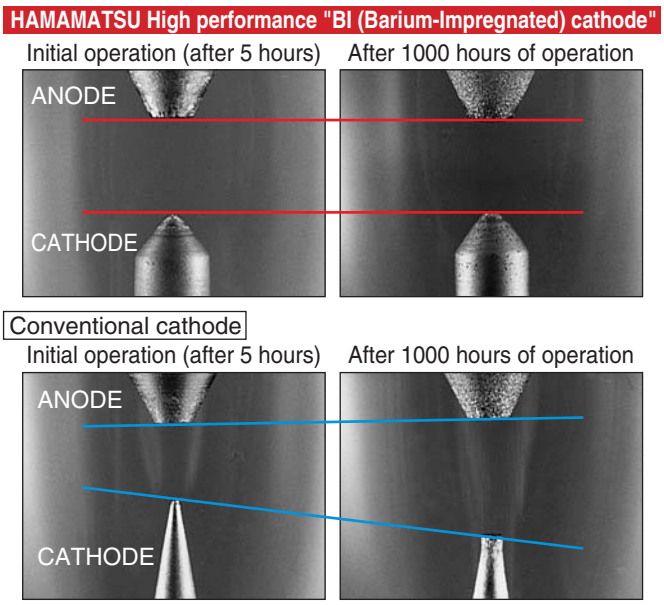
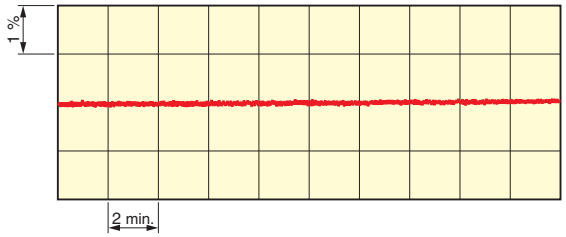


Figure 4: Light output stability (fluctuation) vs. operating time

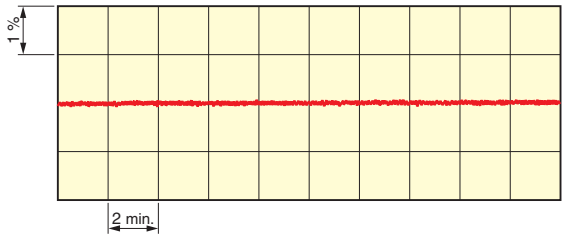
150 W SUPER-QUIET XENON LAMP (L2273)

(Average life: 3000 hours)

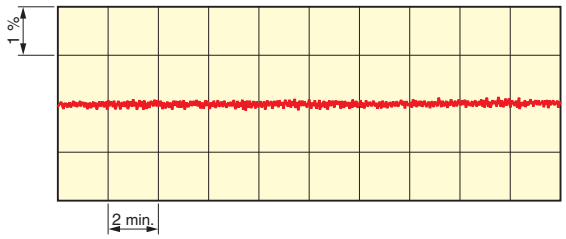
a) Initial operation (after 5 hours)



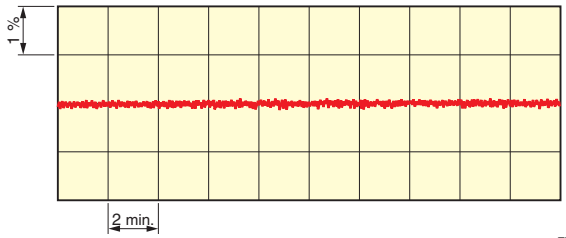
b)After 1000 hours of operation



c) After 2000 hours of operation



d) After 3000 hours of operation

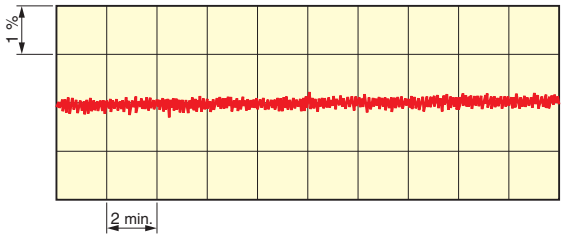


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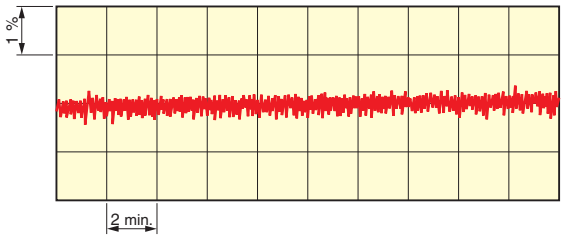
200 W SUPER-QUIET MERCURY-XENON LAMP (L2423)

(Average life: 2000 hours)

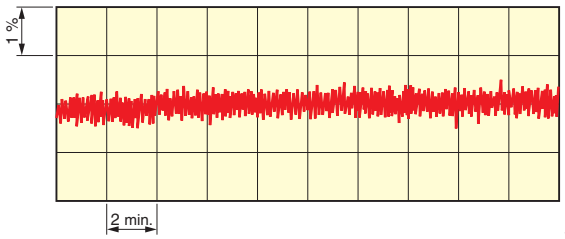
a) Initial operation (after 5 hours)



b)After 1000 hours of operation



c) After 2000 hours of operation

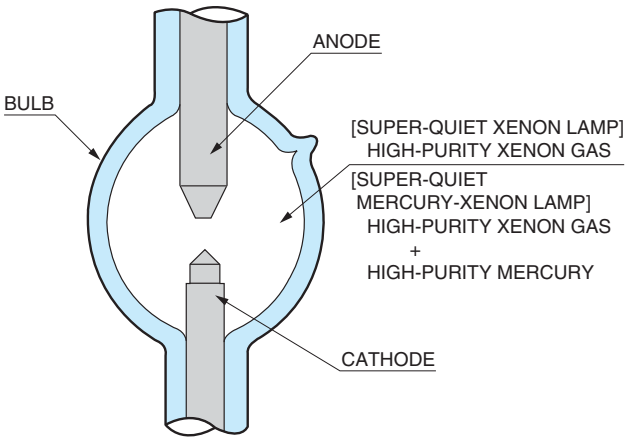


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STRUCTURE AND OPERATION

These lamps have an oval bulb in which a cathode and an anode face each other. The bulb for super-quiet xenon lamps is filled with high-purity, high-pressure xenon gas. The bulb for super-quiet mercury-xenon lamps is filled with a mixture of high-purity, high-pressure xenon gas and high-purity mercury.
The lamps emit light by arc discharge. The lamps are installed vertically or horizontally with the anode at the upper side (some types of lamps are only installed vertically) and operate on DC (when the specified voltage is supplied across the anode and cathode, the lamp forms an arc discharge).
After the lamp lights up, the light output intensity varies until the gas pressure inside the bulb reaches thermal equilibrium. It takes several minutes to reach the maximum light output intensity.
During lamp operation, the bulb wall temperature rises above 500 °C and the gas pressure inside the bulb increases to approximately 4 MPa which is 4 times higher than when the lamp is not operating.

Figure 6: Lamp structure



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CHARACTERISTICS

●SPECTRAL IRRADIANCE

SUPER-QUIET XENON LAMP

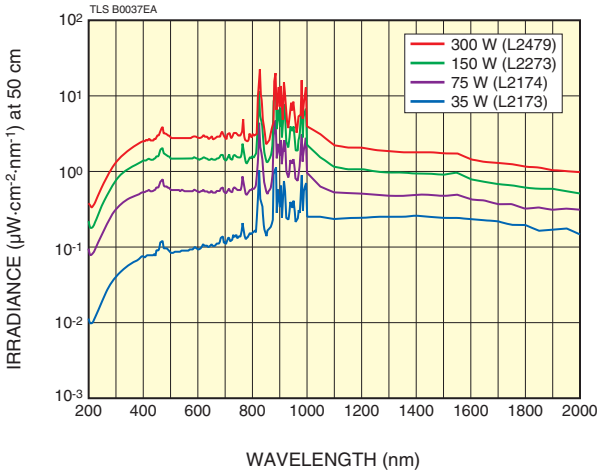
Xenon lamps emit a continuous spectrum in a broad range from the UV through visible to infrared regions. Some line spectra are emitted in the visible to infrared regions.

SUPER-QUIET MERCURY-XENON LAMP

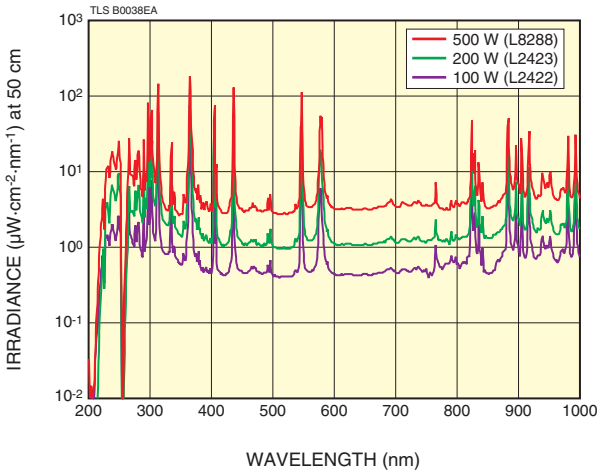
Mercury-xenon lamps emit a spectrum containing strong line spectra in the UV and visible regions. This radiation spectrum includes both the continuous spectrum of super-quiet xenon lamps and mercury line spectra.

Figure 7: Spectral irradiance

SUPER-QUIET XENON LAMP



SUPER-QUIET MERCURY-XENON LAMP

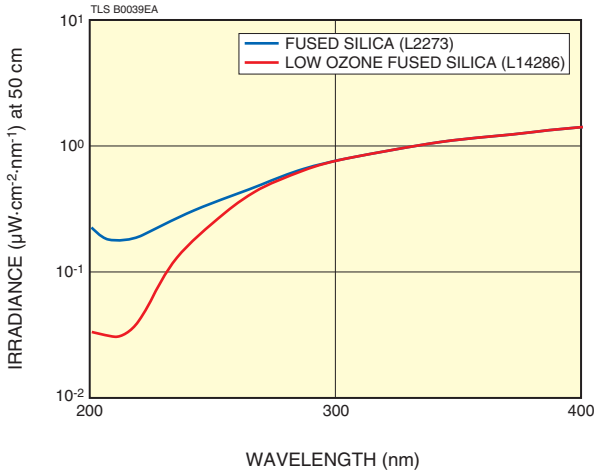


●DIFFERENCE IN IRRADIANCE BY BULB MATERIAL

The irradiance slightly differs between fused silica and low ozone fused silica used as the window materials for lamps. So select the window material that matches your application.

Figure 8: Irradiance Comparison of Different Bulb Materials

150 W SUPER-QUIET XENON LAMP

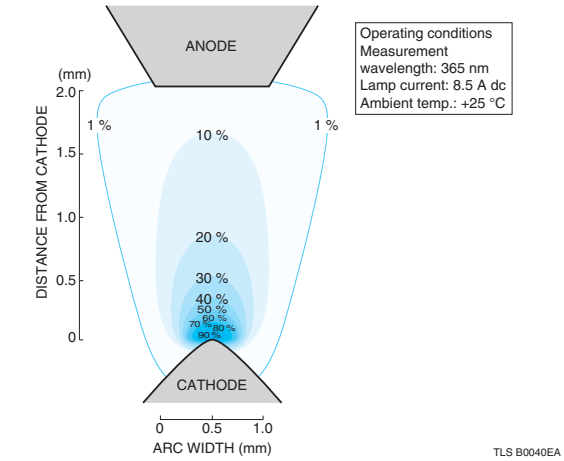


●LIGHT OUTPUT DISTRIBUTION

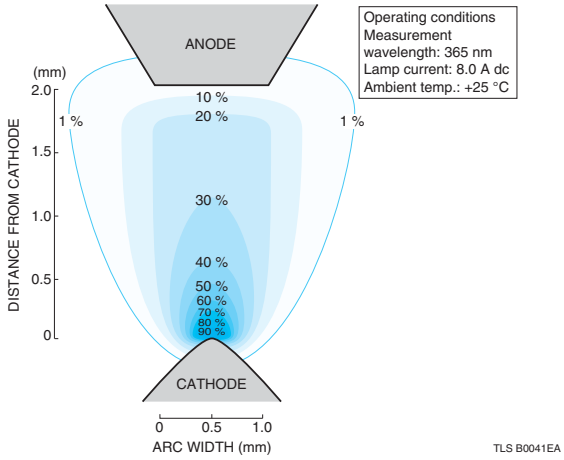
Maximum light output intensity is more intense around the cathode, and decreases towards the anode.

Figure 9: Light output distribution (vertical installation)

150 W SUPER-QUIET XENON LAMP (L2273)



200 W SUPER-QUIET MERCURY-XENON LAMP (L2423)

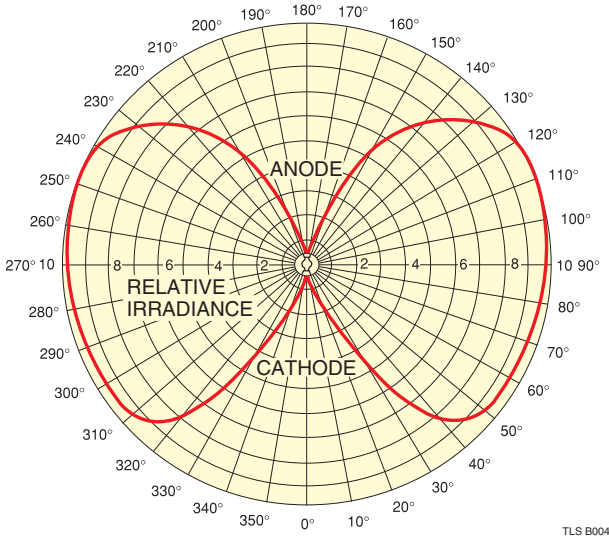


●DIRECTIVITY (LIGHT DISTRIBUTION)

The lamps emit a directivity uniformly along the horizontal direction.

Figure 10: Directivity (light distribution) (vertical installation)

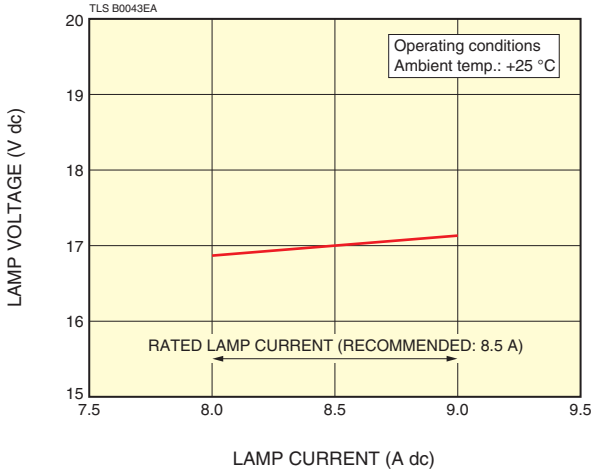
150 W SUPER-QUIET XENON LAMP (L2273)
200 W SUPER-QUIET MERCURY-XENON LAMP (L2423)



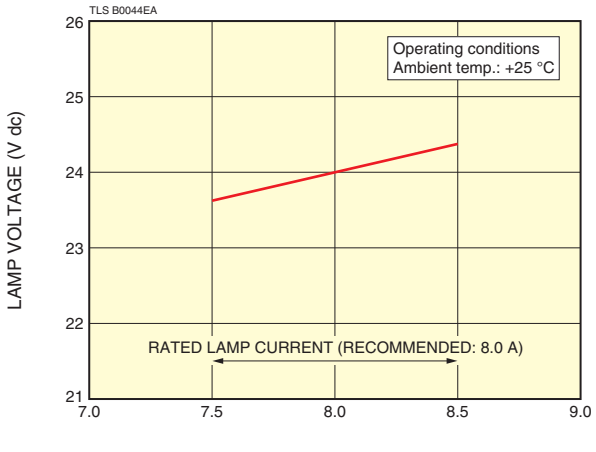
●LAMP VOLTAGE AND LAMP CURRENT

Figure 11: Lamp voltage vs. lamp current

150 W SUPER-QUIET XENON LAMP (L2273)



200 W SUPER-QUIET MERCURY-XENON LAMP (L2423)

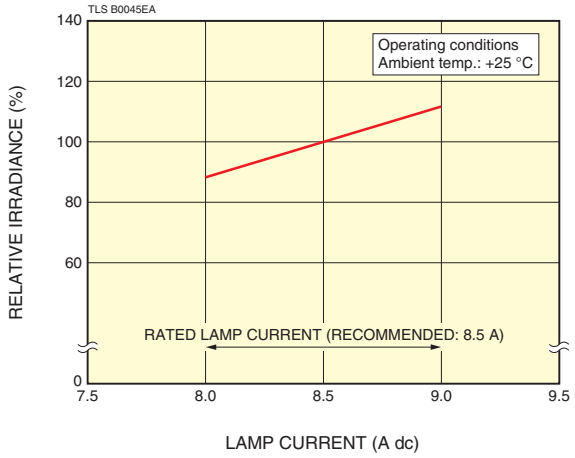


●LIGHT OUTPUT INTENSITY AND LAMP CURRENT

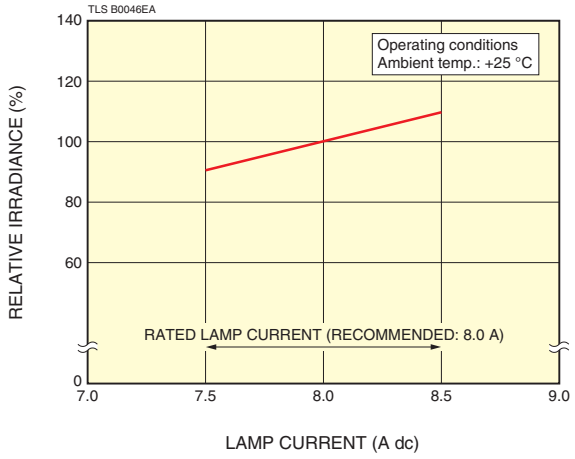
The light output intensity of a lamp is proportional to the lamp current.

Figure 12: Light output intensity vs. lamp current

150 W SUPER-QUIET XENON LAMP (L2273)



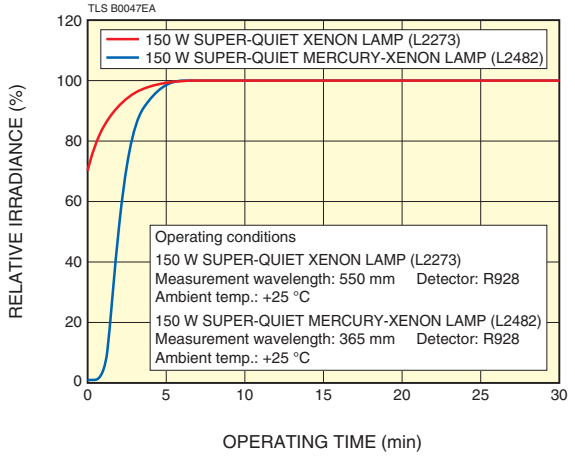
200 W SUPER-QUIET MERCURY-XENON LAMP (L2423)



●INITIAL STABILITY OF LIGHT OUTPUT INTENSITY

After the lamp lights up, the light output intensity varies until the gas pressure inside the bulb reaches thermal equilibrium. It takes several minutes to reach the maximum light output intensity.

Figure 13: Initial stability of light output intensity



●LIGHT OUTPUT INTENSITY AND AMBIENT TEMPERATURE

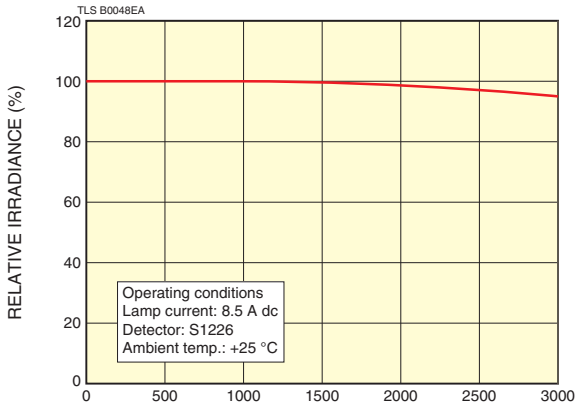
The light output intensity of a lamp also varies with ambient temperature. This is due to the change in light output intensity resulting from the change in gas pressure in the bulb with temperature.
The ambient temperature must be kept constant to ensure stable lamp operation.

●LIGHT OUTPUT INTENSITY AND OPERATING TIME

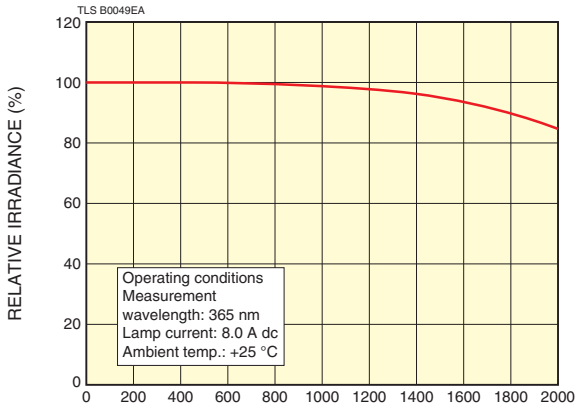
The light output intensity decreases over operating time.
This is because of a loss of glass transmittance caused by blacking of the bulb wall due to evaporation of the cathode materials and solarization effect of UV radiation.

Figure 14: Light output intensity vs. operating time

150 W SUPER-QUIET XENON LAMP (L2273)



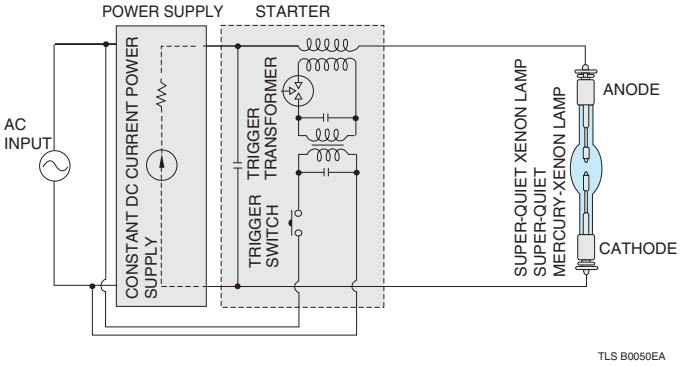
200 W SUPER-QUIET MERCURY-XENON LAMP (L2423)



POWER SUPPLY

Lamps used as a light source for photometric applications must provide stable light output. To ensure stable lamp operation, the power supply must also provide high stability equal to or better than that of the lamp.

Figure 15: Block diagram of power supply



●POWER SUPPLY

Besides supplying the lamp with stable DC power, the power supply gives the cathode an optimal operating temperature.
The cathode temperature is very important for lamp operation. A cathode temperature that is too high speeds up the evaporation of cathode materials. Too low of a temperature will increase the load on the cathode, causing unstable electron emission and greatly reducing the lamp service life.
The lamp current value and its range are specified for each lamp type to operate the lamp stably over long periods of time.

●STARTER

The starter is for starting lamp discharge. It applies a high-frequency pulse to the lamp load by inductive coupling. (See Figure 15.)
In the initial stage of lamp operation, the discharge starts at approximately 10 kV. However, this characteristic varies according to the drop in electron emission capability of the cathode or variations in the gas pressure in the bulb.
In actual equipment operation, a trigger voltage of 20 kV to 30 kV should be applied to the lamp, while taking an ample safety margin into account.

SPECIFICATIONS

SUPER-QUIET XENON LAMP

Type No.	Lamp rating (W)	Arc length (mm)	Lamp current (A dc)	Lamp voltage (V dc)	Window material (Spectral distribution) (nm)	Light output stability	
						Drift Typ. (%/h)	Fluctuation (p-p) Max. (%)
L2173	35	1.0	3.5 ± 0.2	11	Fused silica (185 to 2000)	±0.5	1.0
L14284					Low ozone fused silica (185 to 2000)		
L2174	75	1.3	5.4 ± 0.5	15	Fused silica (185 to 2000)	±0.5	1.0
L2174-01							
L2174-02							
L14285-01					Low ozone fused silica (185 to 2000)		
L14285-02							
L10725		1.0	5.7 ± 0.3	13.5	Fused silica (185 to 2000)		
L10725-01							
L10725-02							
L11307	100	1.3	7.0 ± 0.5	15	Fused silica (185 to 2000)	±0.5	1.0
L2175	150	2.5	7.5 ± 0.5	19	Fused silica (185 to 2000)	±0.5	1.0
L2273		2.0	8.5 ± 0.5	17			
L14286					Low ozone fused silica (185 to 2000)		
L11033					Fused silica (185 to 2000)		
L14287					Low ozone fused silica (185 to 2000)		
L2479	300	3.0	15.0 ± 1.0	20	Fused silica (185 to 2000)	±0.5	1.0

SUPER-QUIET MERCURY-XENON LAMP

Type No.	Lamp rating (W)	Arc length (mm)	Lamp current (A dc)	Lamp voltage (V dc)	Window material (Spectral distribution) (nm)	Light output stability	
						Drift Typ. (%/h)	Fluctuation (p-p) Max. (%)
L2421	50	1.0	3.5 ± 0.2	14	Fused silica (185 to 2000)	±0.5	2.0
L2481	75	1.0	5.4 ± 0.5	14	Fused silica (185 to 2000)	±0.5	2.0
L2481-01							
L2481-02							
L2422	100	1.3	5.5 ± 0.5	18	Fused silica (185 to 2000)	±0.5	2.0
L2422-01							
L2422-02							
L8029		0.8					
L8029-01							
L2482	150	1.7	7.5 ± 0.5	20	Fused silica (185 to 2000)	±0.5	2.0
L2423	200	2.0	8.0 ± 0.5	24	Fused silica (185 to 2000)	±0.5	2.0
L8706	250	1.8	8.5 ± 0.5	27	Fused silica (185 to 2000)	±0.5	3.0
L2483	350	2.5	14.0 ± 1.0	25	Fused silica (185 to 2000)	±0.5	2.0
L8288	500	3.0	20.0 ± 1.0	25	Fused silica (185 to 2000)	±0.5	2.0

NOTE: Ⓐ The life end is defined as the time when the light output intensity falls to 50 % of its initial value or when the fluctuation (p-p) exceeds 1.0 % for super-quiet xenon lamps and 2.0 % for super-quiet mercury-xenon lamps (3.0 % for 250 W type L8706).
Ⓑ Open-circuit voltage necessary for certain lighting of lamps. Ⓒ See "DIMENTIONAL OUTLINES" on pages 10 and 11.

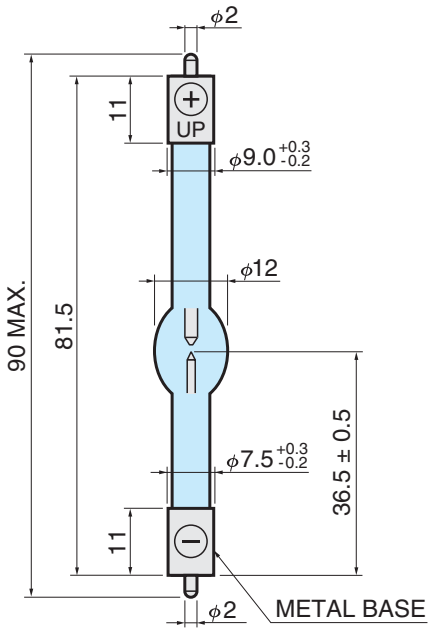
Ⓐ Guaranteed life (h)	Average life (h)	Orientation (degree)	Cooling method	Ⓑ Supply voltage Min. (V dc)	Trigger voltage (kV)	Ⓒ Dimen-sional outline	Weight (g)	Ⓓ Power supply + Starter + Lamp housing	Type No.
1000	2000	Vertical ±15 or horizontal ±15	Not required	50	15	❷	12	① ③	L2173
									L14284
1000	2000	Vertical ±15 or horizontal ±15	Not required	50	15	❷	14	① ③	L2174
						❸	13		L2174-01
						❹	19		L2174-02
						❸	13		L14285-01
						❹	19		L14285-02
2000	3000					❷	15		L10725
						❸	13		L10725-01
						❹	19		L10725-02
1500	2500	Vertical ±15 or horizontal ±15	Not required	50	15	❷	15	① ③	L11307
1200	2500	Vertical ±15 or horizontal ±15	Not required	65	20	❺	44	② ④ ⑤	L2175
1800	3000								L2273
									L14286
3000	4000								L11033
									L14287
1000	2000	Vertical ±15 or horizontal ±15	Forced air cooling	80	25	❼	69	—Ⓔ	L2479

Ⓐ Guaranteed life (h)	Average life (h)	Orientation (degree)	Cooling method	Ⓑ Supply voltage Min. (V dc)	Trigger voltage (kV)	Ⓒ Dimen-sional outline	Weight (g)	Ⓓ Power supply + Starter + Lamp housing	Type No.
500	1000	Vertical ±15 or horizontal ±15	Not required	50	15	❶	9	—Ⓔ	L2421
500	1000	Vertical ±15 or horizontal ±15	Not required	50	15	❷	14	① ③	L2481
						❸	13		L2481-01
						❹	18		L2481-02
500	1000	Vertical ±15 or horizontal ±15	Not required	50	15	❷	14	① ③	L2422
						❸	13		L2422-01
						❹	19		L2422-02
		Vertical ±15				❸	13		L8029
1000	2000								L8029-01
1000	2000	Vertical ±15 or horizontal ±15	Not required	65	20	❺	43	② ④ ⑤	L2482
1000	2000	Vertical ±15 or horizontal ±15	Not required	65	20	❺	44	② ④ ⑤	L2423
2000	3000	Vertical ±15	Forced air cooling	65	20	❻	62	—Ⓔ	L8706
500	1000	Vertical ±15	Forced air cooling	70	25	❼	69	—Ⓔ	L2483
1000	2000	Vertical ±15	Forced air cooling	80	30	❼	78	—Ⓔ	L8288

ⒹPower supplies should be used in combination with a starter or lamp housing (See "POWER SUPPLY + STARTER + LAMP HOUSING COMBINATIONS" and "STRUCTURES" on page 11.).
ⒺPlease consult us.

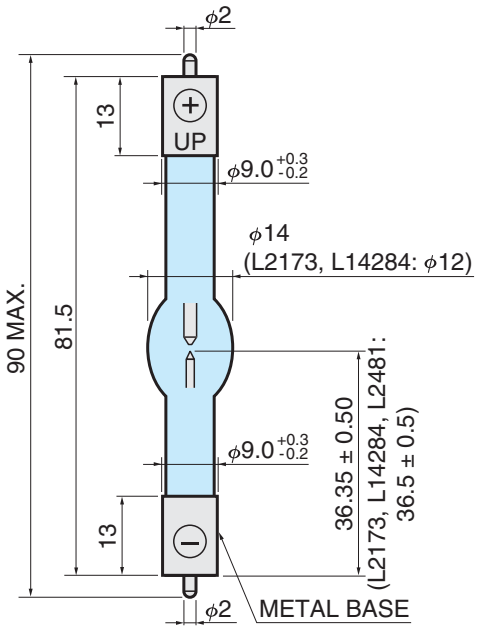
DIMENSIONAL OUTLINES (Unit: mm)

❶ SUPER-QUIET MERCURY-XENON LAMP: L2421



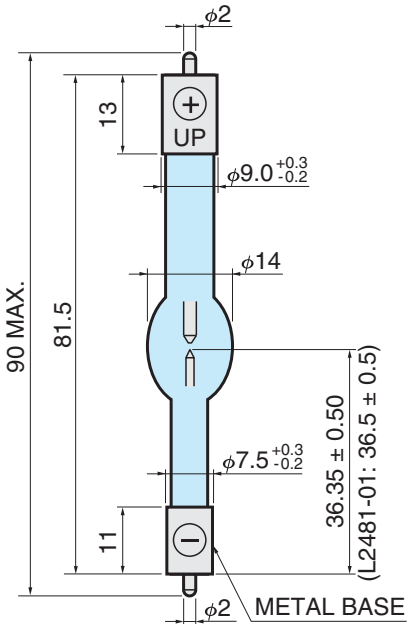
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❷ SUPER-QUIET XENON LAMP: L2173, L14284, L2174, L10725, L11307
SUPER-QUIET MERCURY-XENON LAMP: L2481, L2422



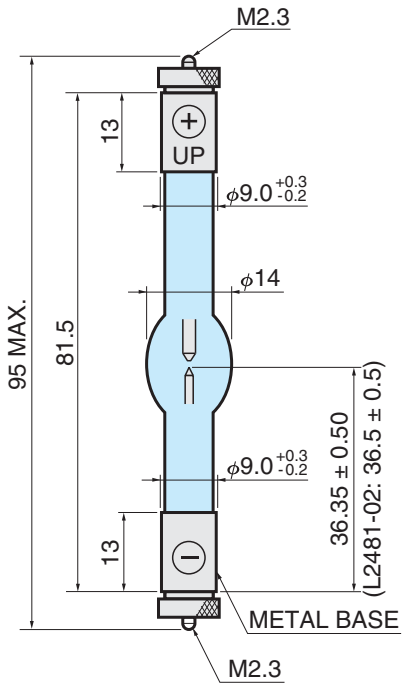
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❸ SUPER-QUIET XENON LAMP: L2174-01, L14285-01, L10725-01
SUPER-QUIET MERCURY-XENON LAMP: L2481-01, L2422-01, L8029/-01



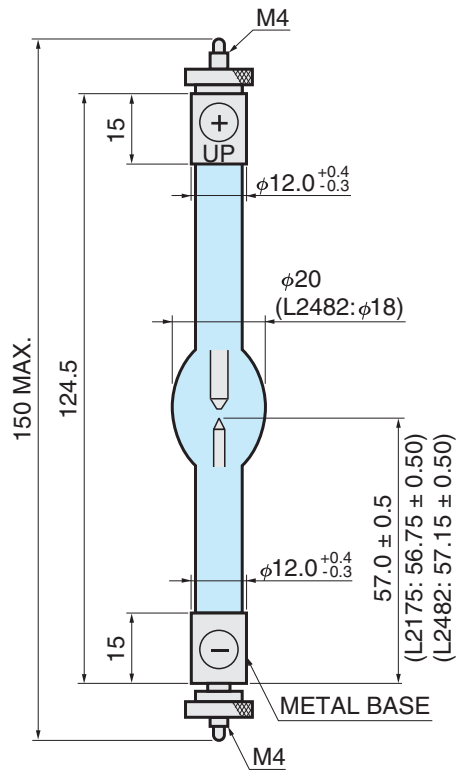
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❹ SUPER-QUIET XENON LAMP: L2174-02, L14285-02, L10725-02
SUPER-QUIET MERCURY-XENON LAMP: L2481-02, L2422-02



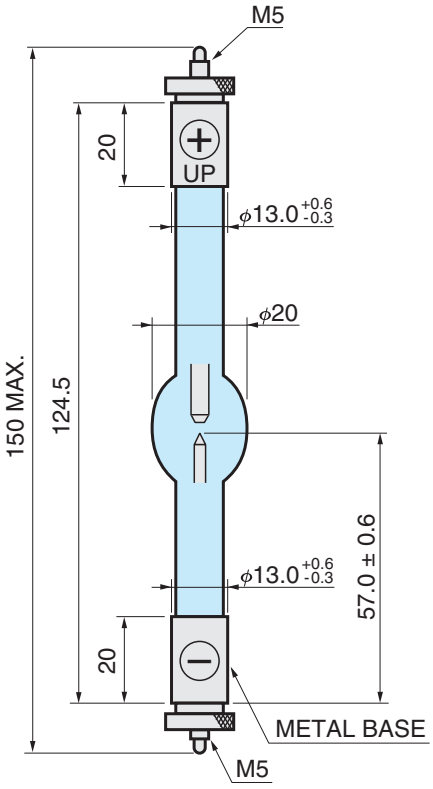
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❺ SUPER-QUIET XENON LAMP: L2175, L2273, L11033
SUPER-QUIET MERCURY-XENON LAMP: L2482, L2423



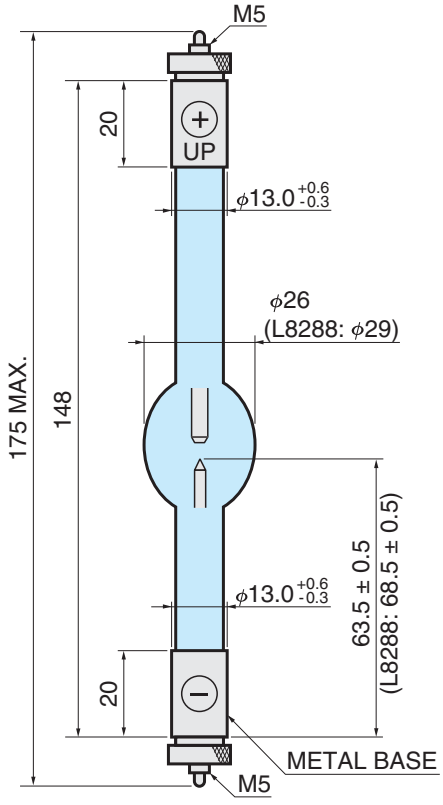
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❻ SUPER-QUIET MERCURY-XENON LAMP: L8706



TLS A0027EA

❼ SUPER-QUIET XENON LAMP: L2479
SUPER-QUIET MERCURY-XENON LAMP: L2483, L8288



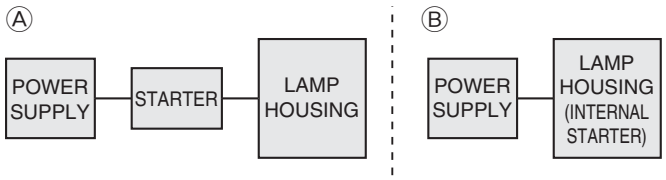
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POWER SUPPLY + STARTER + LAMP HOUSING COMBINATIONS

	Power supply	Starter	Lamp housing	Structure
①	C11522 series Ⓐ		E2419 / -01	Ⓐ
②	C11522 series Ⓐ		E2420	Ⓐ
③	C12122 series	C14632	E2419 / -01	Ⓐ
④	C12122 series	C14632	E2420	Ⓐ
⑤	C12122 series	E7536 / -01 Ⓑ		Ⓑ

NOTE: ⒶStarter is supplied as an necessary.
ⒷHas an internal starter.
See also pages 9, 12 and 13.

STRUCTURES



POWER SUPPLY

Lamps used as the light source for high precision photometry must provide stable light output intensity. We recommend using Hamamatsu dedicated power supplies, which produce the maximum lamp performance, for lamp operation.
We also provide OEM power supplies according to your application, so please feel free to consult us.



▲Left: C12122
Right: Starter C14632 (sold separately)

●SPECIFICATIONS

Power supply / Starter		C11522 series	C12122 series / C14632	Unit
Power supply type		Board type	Enclosure type	—
Circuit method		Switching	Switching	—
Start method ①		Manual / Auto		—
Input voltage (AC)		100 V to 240 V single phase 50 Hz / 60 Hz		—
Output current (DC)		3.5 / 5.4 / 5.5 / 5.7 / 7.0 / 7.5 / 8.0 / 8.5 ②		A
Ripplenoise (p-p) (Max.) ③		0.2		%
Drift (Max.)		±0.1		%/h
Applicable standards	EMC standards	IEC60326-01: 2013 Group 1 Class A		—
	Safery standards	IEC61010-01: 2010		—
Dimensions (W × H × D)	Power supply	132 × 60 × 190	144 × 90 × 282	mm
	Starter	82 × 40 × 51	89 × 60 × 100	mm
Weight	Power supply	Approx. 1.0	Approx. 2.7	kg
	Starter	Approx. 0.2	Approx. 0.6	kg

NOTE: ①Manual: When the power switch is ON, pressing the lamp switch lights the lamp. mode is suitable for laboratory experiments.
Auto: The lamp automatically lights up at the same time the power switch is turned on. This mode is suitable for production lines or installation into equipment.
②The is set at the factory prior to sipment.
③At the rated input and output. Ripplenoise (p-p)(Max) is 0.3 % when the output current (DC) 3.5 A of the C12122 series.

∗ Specifications are determined at an ambient operating temperature of 23 °C ± 5 °C after 30 minute preheating.
∗ Please contact us for details.
CAUTION: These power supplies use a trigger mode in which a positive high voltage is supplied. Use extreme caution concerning the insulation.

●SUITABLE LAMPS

Parameter		Description / Value								Unit
Output current (DC)		3.5	5.4	5.5	5.7	7.0	7.5	8.0	8.5	A
Suitable lamp rating	Super-quiet xenon lamp	35	75	—	75 (Long life type)	100	150	—	150 (GS type⑤)	W
	Super-quiet mercury-xenon lamp	50	75	100	—	—	150	200	250	

NOTE: ⑤Short gap type

LAMP HOUSING

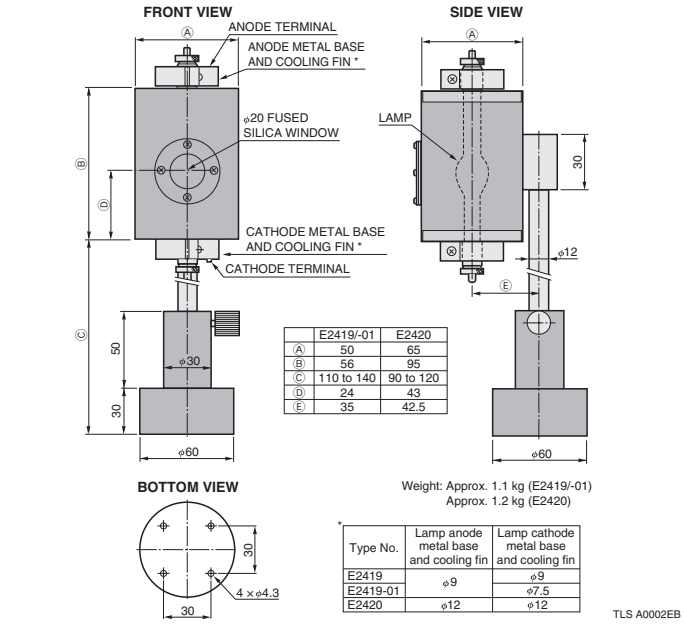
Hamamatsu provides various lamp housings to make our lamps easier to use. Besides using a stable power supply, it is also essential to use a proper lamp housing to extract full performance from the lamps and obtain stable light output.
Four models of lamp housings are currently available. Among these, the E7536 and E10180 are designed for high accuracy yet easier handling, while the E2419, E2420 and E5421 feature simplified designs.
The E7536 and E10180 have an internal reflecting mirror and light output lens to provide high intensity. The built-in interlock function, starter and cooling fan enhance safety, for example, the surface temperature on the housing is kept below +40 °C during operation. The optical axis can be easily aligned with the adjuster screws from the outside of the housing.



▲E7536

●DIMENSIONAL OUTLINES (Unit: mm)

E2419/-01 (For 35 W, 50 W, 75 W and 100 W lamps) E2420 (For 150 W and 200 W lamps)



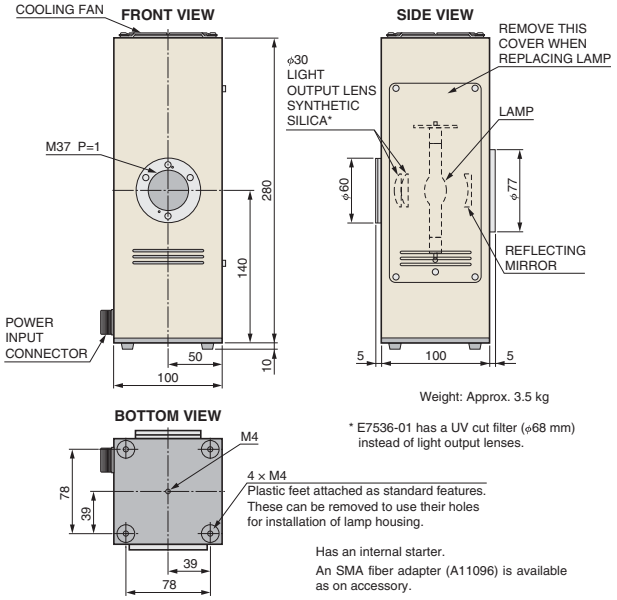
	E2419/-01	E2420
Ⓐ	50	65
Ⓑ	56	95
Ⓒ	110 to 140	90 to 120
Ⓓ	24	43
Ⓔ	35	42.5

Weight: Approx. 1.1 kg (E2419/-01)
Approx. 1.2 kg (E2420)

Type No.	Lamp anode metal base and cooling fin	Lamp cathode metal base and cooling fin
E2419	φ9	φ9
E2419-01		φ7.5
E2420	φ12	φ12

TLS A0002EB

E7536/-01 (For 150 W and 200 W lamps)



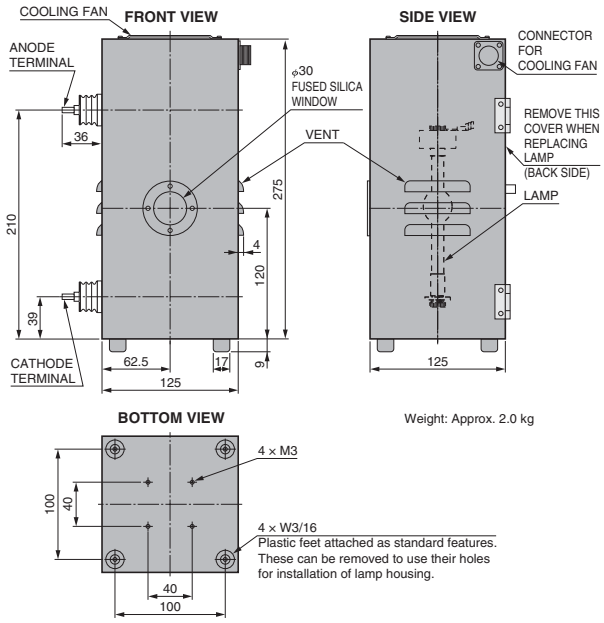
Weight: Approx. 3.5 kg

* E7536-01 has a UV cut filter (φ68 mm) instead of light output lenses.

Has an internal starter.
An SMA fiber adapter (A11096) is available as on accessory.

TLSXA0083EE

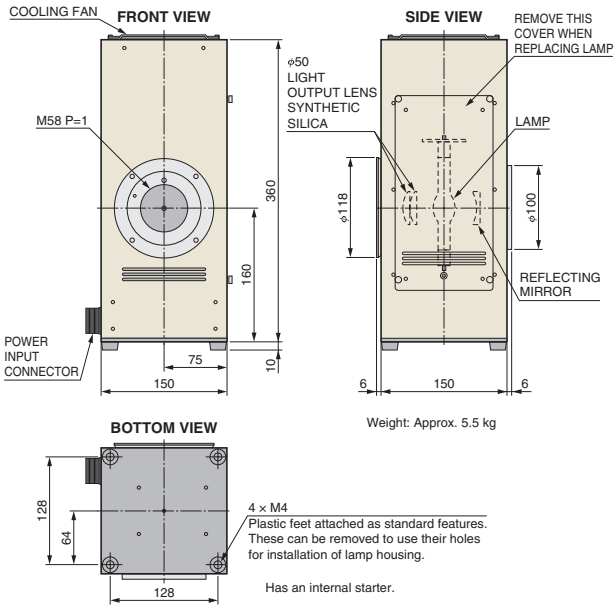
E5421 (For 300 W, 350 W and 500 W lamps)



Weight: Approx. 2.0 kg

TLSXA0105ED

E10180 (For 300 W, 350 W and 500 W lamps)



Weight: Approx. 5.5 kg

Has an internal starter.

TLS A0001EC

HANDLING PRECAUTION (Be sure to read before using lamp)

●INSTALLATION PRECAUTIONS

1. Always handle the lamp very carefully.

The bulb is filled with high pressure gas (approx. 1 MPa at room temperature and approx. 4 MPa during operation). Subjecting the lamp to strong shocks or scratching the surface of the bulb might rupture the bulb, causing hazards from flying glass fragments.
When handling the lamp, always wear a protective mask, long-sleeved shirt and gloves for safety.
Keep the specified package that came supplied with the lamp, because it will be used for lamp replacement.

2. Never touch the bulb with bare hands.

Operating the lamp with dust or grime still on the bulb causes it to thermally stick on the bulb and cuts the light transmittance. This results in low light output intensity and also lowers the mechanical strength of the glass bulb. If dust or grime adheres to the bulb, gently wipe it off the bulb using absorbent cotton or gauze moistened with high-quality alcohol and thoroughly wrung out. In such cases, use a proper protective mask, shirt and gloves mentioned above and take care not to apply any strong shocks to the lamp.

3. Install the lamp in a correct direction and polarity. (See Figure 16.)

Operating the lamp while installed in the wrong direction or polarity will damage the cathode, leading to permanent lamp defects.
[Vertical lighting]
To install the lamp in an upright position, make sure that the "UP" or "+" mark (anode mark) scribed on the metal base is positioned facing upwards.
[Horizontal lighting]
To install the lamp in a horizontal position, make sure that the sealed-off tip is positioned parallel to ground (horizontal plane). Use a magnet to make adjustments so that the arc discharge stays along the center line of both electrodes. To obtain adequate performance from the lamp, it is essential to set the arc point at the correct position by using a proper magnet. (See Figure 17.).

Figure 16: Lamp installation direction and polarity

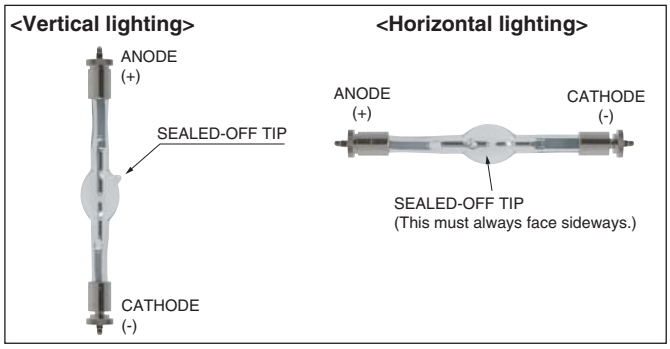


Figure 17-1

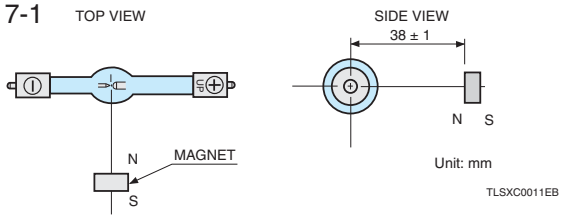
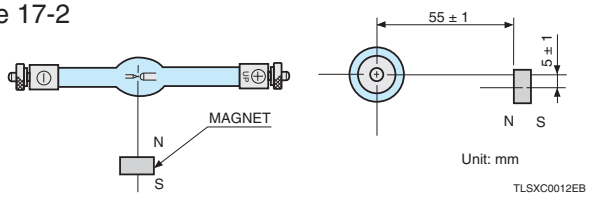


Figure 17-2



Power consumption	Residual magnetic flux density (mT)	Distance*1 (mm)	Magnet example*2	Position (direction)
35 W to 100 W	380 to 420	38 ± 1	E5203 (ϕ10 mm 5 mm thickness)	See Figure 17-1
150 W to 300 W	360 to 390	55 ± 1	E5203-01 (ϕ15 mm 7 mm thickness)	See Figure 17-2

*1 Distance from the center of arc to the surface of magnet.
*2 The minimum lot size is 10.

●OPERATING PRECAUTIONS

4. Observe high voltage and high temperature precautions.

Lamps discharge starts by application of a high trigger voltage of 15 kV to 30 kV. Sufficient insulation must be installed to prevent electrical shocks.
When the lamp is used near equipment such as a PC (personal computer) which is vulnerable to noise, start the computer operation after the lamp has already been turned on.
The lamp is extremely hot during operation and also immediately afterwards, so do not touch the lamp with bare hands and do not let the lamp get close to flammable materials.
Never open the cover of the lamp housing during operation since the lamp is at an extremely high temperature.
If you have to open the cover, always use protective gear. (Refer to item 1.).

5. Observe UV radiation precautions.

These lamps emit UV radiation which is harmful to the eyes and skin. Avoid looking directly at an operating lamp or exposing the skin directly to it since there is danger of burns to the skin or eyes.
Always wear a light-shielding protector (ISO 4849 or equivalent standard) during lamp operation.

6. Always observe the specified values.

The current is specified for each lamp type. (See "SPECIFICATIONS" on pages 8 and 9.) If used outside the specified range, operation will become unstable and the service life will be shortened drastically. Forced air cooling by fan is necessary for lamps of 250 W or more.

7. We recommend replacing the lamp by the guaranteed life. If using the lamp for longer than this period, replace it when the total operating time exceeds the average life plus 500 hours (plus 300 hours for 500 W super-quiet mercury-xenon lamps), or when the inner wall of the bulb becomes extremely dark.

When the total operating time exceeds the average life plus 500 hours (plus 300 hours for 500 W mercury-xenon lamps), vaporization and spattering from the electrodes will adhere to the inner wall of the bulb, and speed up blackening of the bulb as well as disturbing heat dissipation. If this lamp is used continuously, the temperature (gas pressure) inside the lamp bulb increases abnormally, possibly causing the lamp to rupture or break.

8. Observe ozone precautions.

As ozone is generated when the lamp is turned on, provide adequate ventilation.

●PRECAUTIONS WHEN REMOVING

9. Place the used lamp in the specified package that came supplied with the lamp.

When removing a used lamp from the lamp housing, be sure to wait until the lamp cools to room temperature and wear a protective mask, long-sleeved shirt and gloves for safety.

High pressure gas remains inside a bulb even in a used lamp. Subjecting the lamp to strong shocks or scratching the surface of the bulb may cause the bulb to rupture, so handle the used lamp as carefully as you would a new lamp.

10. Disposal of lamps.

Bulbs are filled with high pressure (approx. 1 MPa at room temperature) xenon gas (xenon gas and mercury in mercury-xenon lamps).

When disposing of the used lamp, take appropriate measures in compliance with applicable regulations regarding waste disposal and correctly dispose of it yourself, or entrust disposal to a licensed industrial waste disposal company.

In any case, be sure to comply with the regulations in your country, state, region or province to ensure the used lamp is disposed of legally and correctly.

●BE SURE TO OBSERVE THE FOLLOWING PRECAUTIONS WHEN USING LAMPS

A. The lamp housing must have a sturdy cover.

The bulb is filled with high pressure gas (approx. 1 MPa at room temperature and approx. 4 MPa during operation). Lamp housings must have a sturdy cover (enclosure) to avoid possible breakage.

B. Clamp the lamp only at one end of the lamp. Leave the other end unclamped.

(See Figure 18.)

The bulb expands from heat during operation. So if both metal base electrodes of the lamp are clamped by holders made of a hard material or having a rigid, inflexible frame, the glass bulb may eventually rupture. Always clamp the lamp at one end to permit the lamp to absorb thermal expansion. Leave the other end of the lamp unclamped. When designing the lamp housing, also be sure to note the operating temperature at the metal bases of the lamp. (Refer to item F.).

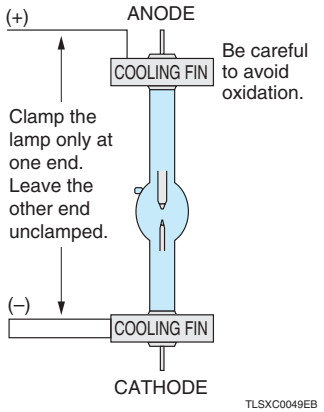
C. Do not connect the starter output cable directly to the metal base of lamp.

Hamamatsu starter output cables are designed to connect to a cooling fin for lamp. Connecting the starter output cable directly to the metal base of lamp may lead to defects such as oxidation or disconnection. As the materials for lamp cooling fins and screws for securing them, use nickel or nickel alloys that are resistant to oxidation and have very low resistance.

D. Be careful to avoid damaging the starter output cable.

The starter output cable may be damaged and unusable in a short period of time if it comes in contact with high-temperature parts of lamp or is exposed directly to intense light from lamp.

Figure 18



E. Use caution when focusing the light, so that the lamp operating temperature will not rise abnormally.

When focusing the light from the lamp with a mirror or other means, be sure not to focus it onto the bulb wall or electrodes. Doing so increases the lamp operating temperature excessively.

Always be careful with the lamp operating temperature when using a condenser mirror. (See Item F.).

F. Use caution to avoid excessive temperature rise during operation. (See Figure 18.)

The lamp should be operated at less than 750 °C on the bulb surface and at less than 200 °C on the metal base surface.

If the lamp operating temperature exceeds these upper limits, "oxidation of electrode leads" and "excessive wear on electrodes or consumption of enclosed gas" may occur, leading to a significant reduction in lamp life. In addition, the gas pressure inside the bulb may rise abnormally, possibly causing cracks or breakage in the glass portion around the leads. Allow for a safety margin for thermal heat emitted from the lamp housing and provide a structure or use materials that efficiently dissipate or conduct away heat. Do this, for example, by attaching a heatsink to the anode metal base.

If the lamp holder makes poor contact with the metal base or contact resistance increases due to an oxidized contact piece, the lamp operating temperature will rise abnormally. Take sufficient precautions to avoid this.

Forced air cooling by fan is necessary for lamps of 250 W or more. The cooling fan must be designed to continue operation for 3 minutes to 5 minutes even after the lamp is turned off so that the fan will not stop during lamp operation.

G. Maintain adequate insulation to avoid trigger voltage leakage.

Use high quality insulation materials and maintain sufficient insulation gaps since an extremely high trigger voltage of 20 kV to 30 kV is applied to the lamp for start-up. (An insulation gap of 1 cm will withstand only about 10 kV, though this also depends on relative humidity. We recommend an insulation gap of at least 3 cm.)

Use a power supply cable capable of withstanding high voltages more than 30 kV. To avoid electrical leakage from the cable surface, do not bundle it up during wiring. The power cable layout should be as short as possible, and should not be passed through a metal opening (or should not be in contact with a metal surface) of the chassis or enclosure.

If such a cable layout is not practical, use high-quality silicon insulating tube to cover the power cable, or install insulating material around the metal opening (or metal surface).

WARNING

- ●Lamps emit UV radiation. Never stare directly into the operating lamp.
  - • UV radiation will irritate the eyes and might impair eyesight.
- ●Do not allow skin to be exposed to UV radiation.
  - • UV radiation may cause skin inflammation.
- ●Do not bring the lamp close to any flammable materials such as cloth or paper.
  - • Doing so might cause fires.
- ●The lamp remains at high temperatures during and shortly after operation. Never let any part of the heated lamp come in contact with your hands or skin.
  - • The heated lamp will cause burns.
- ●Be careful not to drop the lamp, subject it to impacts, apply excessive force or scratch it, because the gas pressure inside the bulb is very high and might cause it to rupture.
  - • Injury may result if the lamp is broken.
- ●Always operate the lamp after installing it in the lamp housing.
  - • Injury may result if the lamp is broken.
- ●Always turn off the power supply when installing or removing the lamp, or when cleaning the lamp or housing.
  - • Failure to do this may result in electrical shocks, pain in the eyes, damage to eyesight or skin burns.

CAUTION

- ●As ozone is generated when the lamp is turned on, provide adequate ventilation.
  - • Ozone can cause respiratory disorders and the like.
- ●Install the lamp in the correct direction and polarity.
  - • Incorrect installation might damage the lamp.
- ●Be sure to use a power supply that provides an optimal current value for the lamp.
  - • Using the wrong power supply might cause overheating and damage the lamp.
- ●Do not use the lamp in damp locations subject to raindrops or water droplets, high humidity, etc.
  - • Operating the lamp in high humidity may result in electrical shocks or damage the lamp.
- ●Always wear a protective mask and garment when installing or removing the lamp.
  - • If broken, exploding glass fragments may cause injury.

WARRANTY

Lamps are warranted for a period of one year from the date of delivery. If a lamp is found to be defective within this warranty period, Hamamatsu will replace the defective lamp without charge. (This warranty is limited to replacement of the defective lamp.) Even if within the warranty period (one year), the warranty shall not apply to cases where the lamp operation time has exceeded the guaranteed life (e.g. 1000 h, please refer to data sheet for guaranteed life for each product.), or the trouble was caused by incorrect operation or natural or man-made disasters.

RELATED PRODUCTS

SUPER-QUIET XENON FLASH LAMP

Compared to ordinary xenon lamps, xenon flash lamps are compact and lightweight, generate less heat, and emit an intense, continuous spectrum with instantaneously high peaks in a broad range from UV through visible to infrared light. Due to improvements to the electrode structures and materials, Hamamatsu xenon flash lamps exhibit both high stability and long life, making them ideal as light sources for high-precision photometry. Our lineup also includes easy-to-use modules that integrate a xenon flash lamp, power supply and trigger socket into a compact case.



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