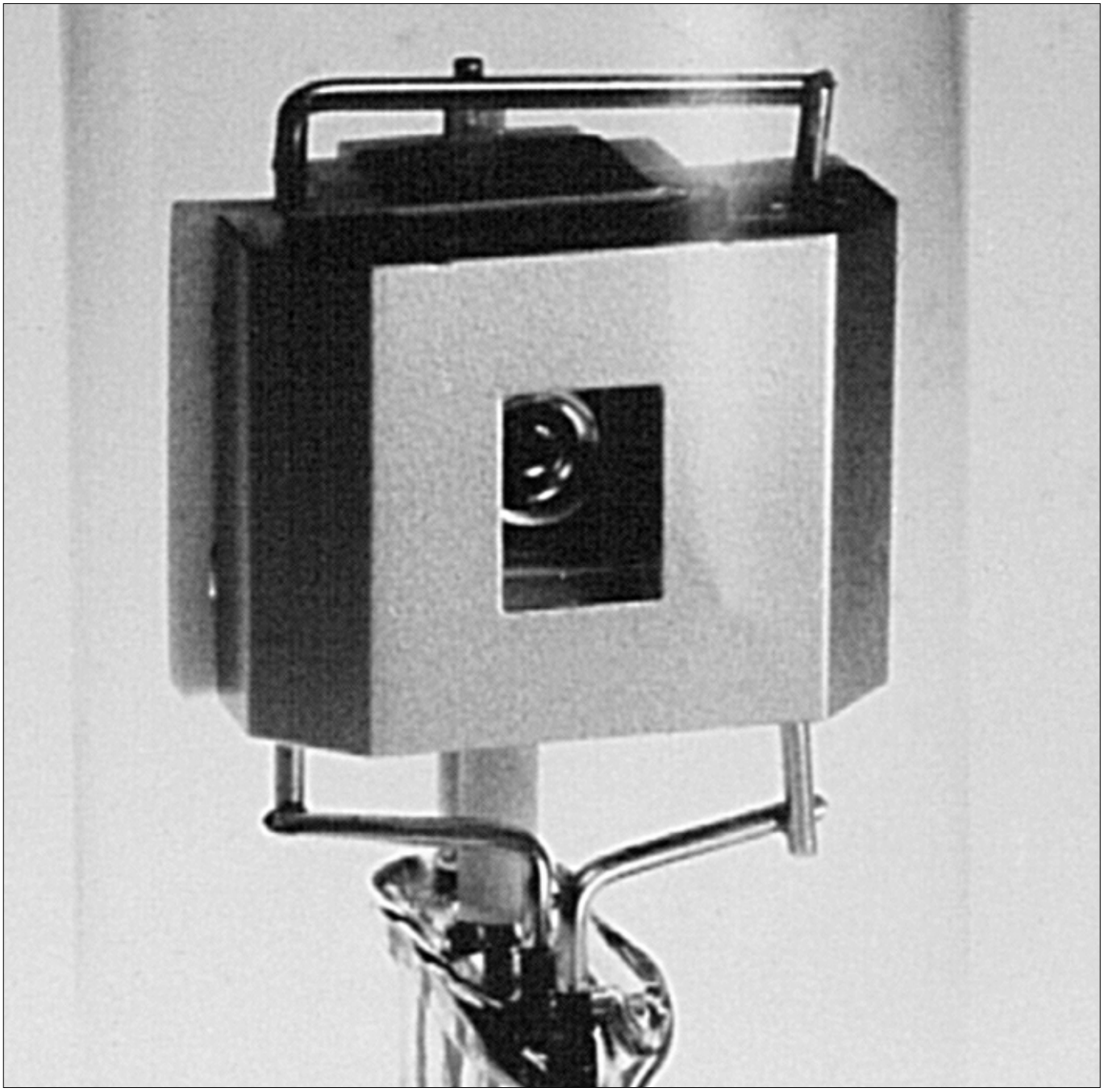
PATENTS

L2D2 LAMPS

DEUTERIUM LAMPS

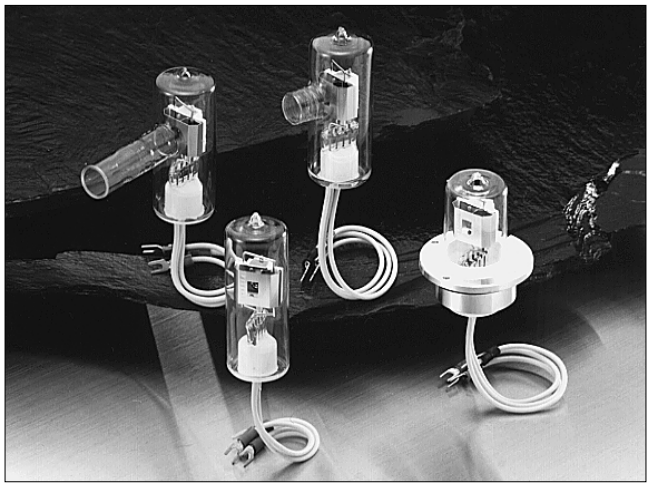
The best light source is supported by the best electrode technology.



HAMAMATSU

Introducing the L2D2 lamps that open up a new generation of Deuterium lamps used in analytical instruments. The Hamamatsu L2D2 lamps deliver high performance in all respects-operating life, stability and light output intensity. You will find significant distinc tions from conventional lamps.

L2D2 LAMPS



TLSOF0138

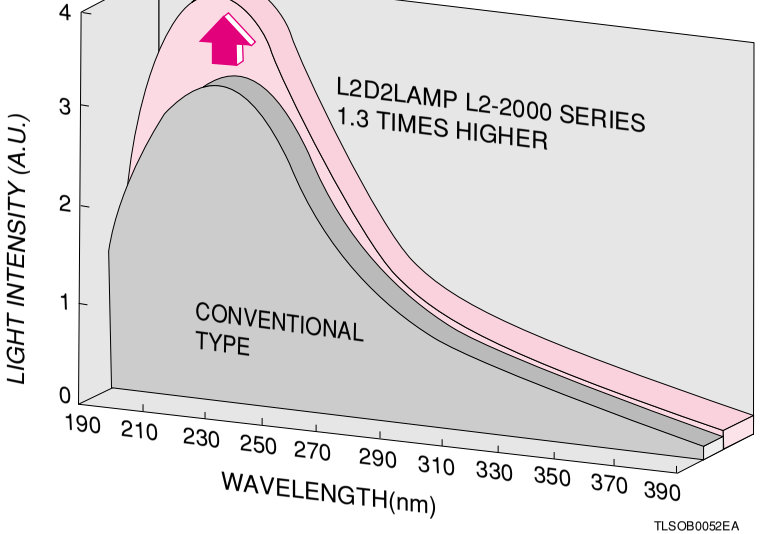
APPLICATIONS

- UV-VIS Spectrophotometers
- CE(Capillary Electrophoresis)
- SOx/NOx Analyzers
- Film Thickness Measurement
- HPLC
- Atomic Absorption Spectrophotometers
- Thin Layer Chromatography

NOTE

All of Hamamatsu deterium la mps will be L2D2 type in future. However, Hamamatsu agrees to provide conventional types before end of December,1998 upon your requests. Comparison table between L2 D2 type and conventional type is shown on page 3 and 4.

series lamps even offer light output 1.1 times higher than conventional lamps.



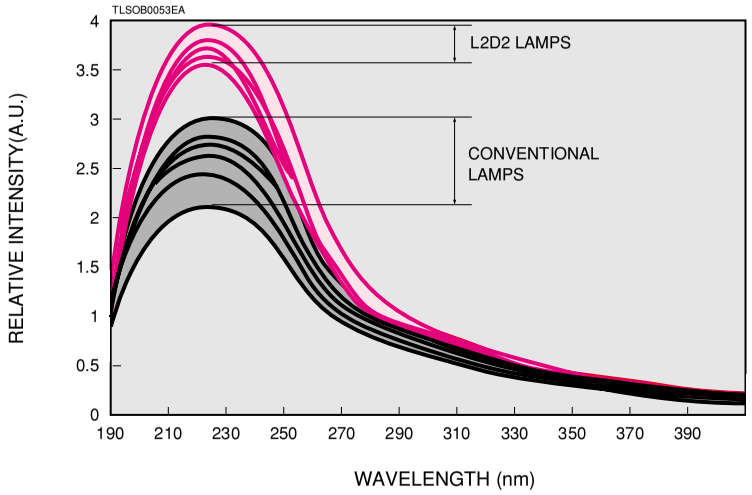
TLSOB0052EA

SMALL INTENSITY VARIATIONS : 1/2

Compared to our conventional lamps

The spacing between electrodes is kept fixed by a molded ceramic spacer. This reduces the lamp to lamp variations in the light output to one half of that obtained with our lamps having a conventional all metal structure.

■ **Intensity Variation**

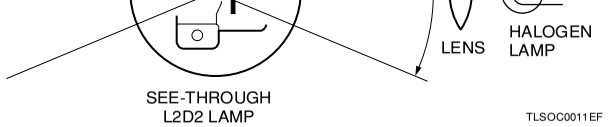


LESS MOVEMENT OF ARC EMISSION POINT

Since the ceramic structure has a small thermal expansion coefficient, there is virtually no movement of the arc emission point during operation.

10 V/2.5 V to 6.0 V
10 V/7.0 V
12 V to 15 V/0 V
2.5 V/1.0 V
2.5 V/1.7 V

eliminates "loss of light amount caused by the hall mirror."



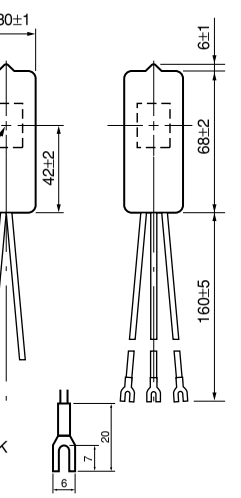
Dis-arting Ⓑ	Anode Current (mA dc)	Tube Drop Voltage Typ. (V dc)	Output Stability Drift Max. (%/ h)	Output Stability Fluctuation (p-p) Max. (%)	Filament Ratings Warm-up Voltage Ⓒ (V dc, ac)	Filament Ratings Warm-up Current Typ. (A dc, ac)	Filament Ratings Warm-up Time Min. (s)	Filament Ratings Operating Voltage (V dc)	Filament Ratings Operating Current Typ. (A dc)	Guaranteed Life Ⓓ (h)	Conventional Lamps Ⓔ	Type. No.
	300±30	80	±0.3	0.05	2.5±0.25	4	20	1.0±0.1	1.8	4000	L613,L613-04	L6565
					3.0±0.3	5		0 to 1	0 to1.8		L3382-01	L6566
	300±30	80	±0.3	0.05	2.5±0.25	4	20	1.0±0.1	1.8	2000	—	L6301
											L613,L613-04	L6302
								1.7±0.2	3.3		L1636	L7298
											—	L6303
											L1729	L6304
					3.0±0.3	5		0 to 1	0 to1.8		L3381-01	L6305
											L3382-01	L6306
					10±1	0.8		2.5 to 6.0 Ⓕ	0.3 to 0.6		—	L6307
											L591	L6308
					10±1	1.2		7.0±0.5	1		L2196	L7296
											—	L7296-50
											L1626	L7295
											L2541	L6309
											L2526	L6310
		85			12 to 15	0.5 to 0.55		0 Ⓖ	0 Ⓖ		L4505	L6311
											L4505-50	L6311-50
		80									L4510	L6312
											L4510-50	L6312-50
			—	—	2.5±0.25	4		1.0±0.1	1.8	2000 Ⓗ	L879-01	L7293
					10±1	0.8		2.5 to 6.0 Ⓕ	0.3 to 0.6		L879	L7292

Dis-arting Ⓑ	Anode Current (mA dc)	Tube Drop Voltage Typ. (V dc)	Output Stability Drift Max. (%/ h)	Output Stability Fluctuation (p-p) Max. (%)	Filament Ratings Warm-up Voltage (V dc, ac)	Filament Ratings Warm-up Current Max. (A dc, ac)	Filament Ratings Warm-up Time Min. (s)	Filament Ratings Operating Voltage (V dc)	Filament Ratings Operating Current Max. (A dc)	Guaranteed Life Ⓓ (h)	Conventional Lamps Ⓔ	Type. No.
	300±30	80	±0.3	0.05	2.5±0.25	4	20	1.0±0.1	1.8	2000	—	L6999
											—	L6999-50
											L1887	L7307
											—	L7174
								1.7±0.2	3.3		L1886	L7306

an aperture of 1.0 mm diameter. (Refer to page 8.)
maximum rated voltage that can be applied is 650 V.
p and the power supply is long because

6. Please consult with our sales offices

NOTE Ⓕ Recommended operating voltage is 3.5 V ± 0.5 V.
Ⓖ In these lamps, discharge current is allowed to flow into the filament during operation so that cathode temperature is maintained at an optimum level. So there is no need for input of external power to keep the filament heated.
Ⓗ Average operating life : Operating life depends on environmental conditions (vacuum atmosphere). It is recommended that these lamps be used in an oil-free environment.
*We recommend using Hamamatsu deuterium lamp power supplies in order to obtain the full performance from our lamps (Refer to page 7 and 9).



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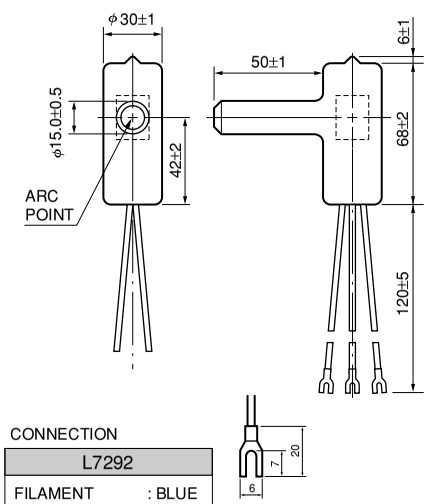
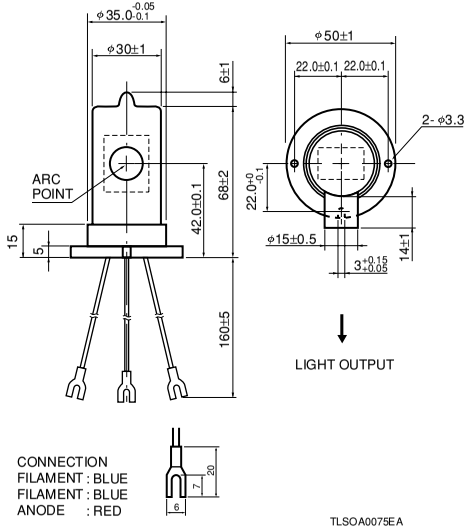


TLSOA0011EC

CONNECTION

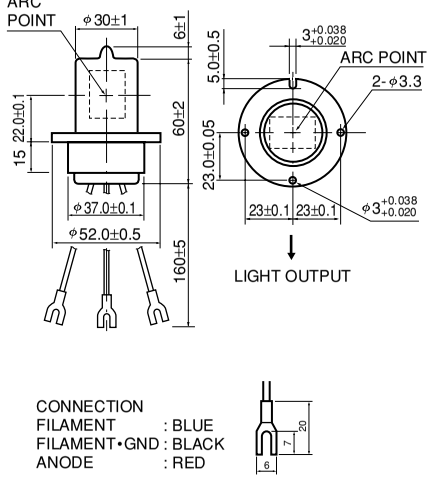
L7292	
FILAMENT	: BLUE
FILAMENT·GND	: BLACK
ANODE	: RED

L7293	
FILAMENT	: BLUE
FILAMENT	: BLUE
ANODE	: RED



TLSOA0075EA

CONNECTION
FILAMENT : BLUE
FILAMENT : BLUE
ANODE : RED



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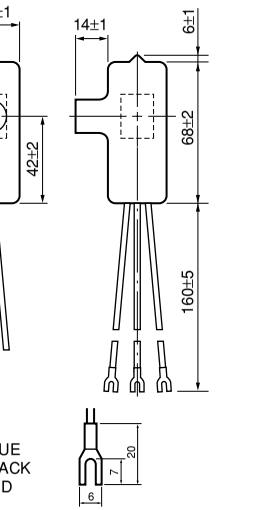
CONNECTION
FILAMENT : BLUE
FILAMENT·GND : BLACK
ANODE : RED

7296, L7298



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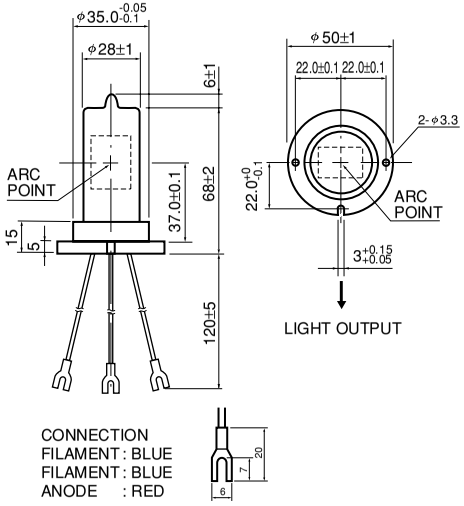
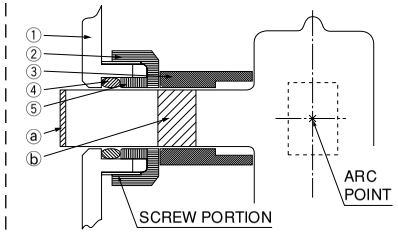
⑩ L6999-50, L7174



TLSOA0051EA

CONNECTION
FILAMENT : BLUE
FILAMENT : BLUE
ANODE : RED

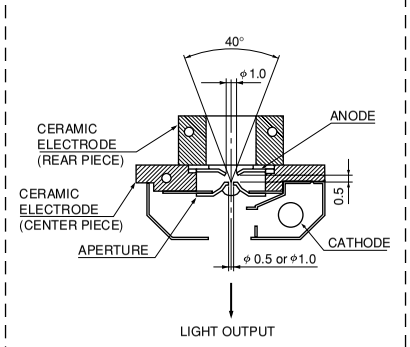
L7292, L7293 mounting example on the vacuum system



①VACUUM SIDE FLANGE
②TIGHTENING SXREW
③STORRER
④ORING (JIS B2401)
CALL No. V15
(15 mm I.D.
4 mm WIDTH)
⑤SPACER
ⓐMgF_2 WINDOW
ⓑGRADED SEAL

TLSOC0010EA

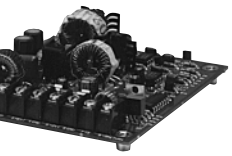
Cross section of see-through type



TLSOA0052EA

M7628	Unit
tching Type	—
C) 24 ± 2.4	V
48	VA Max.
(DC) 80	V Typ.
DC) 160	V Typ.
300	mA
600 ± 50	V peak
0.5	% Max.
±0.1	%/h Max.
ee below	—
ee below	—
25	s Typ.
0 to +40	°C
F of forced air	—
× 118 × 36.2	mm
0.17	kg
UL/CE	—

Applicable Lamps
, L7293, L6999, L6999-50
, L7174, L6301, L6302
, L6308, L7292
, L6303, L6304, L7306
, L7295, L6309, L6310, L7296-50
, L7293, L6999, L6999-50
, L7174, L6301, L6302
, L6303, L6304, L7306
, L6305, L6306
, L6308, L7292
, L7295, L6309, L6310, L7296-50
, L6311-50, L6312, L6312-50



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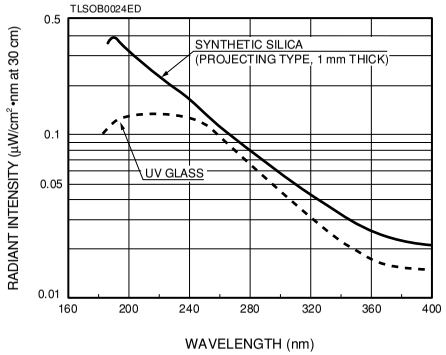
M7628

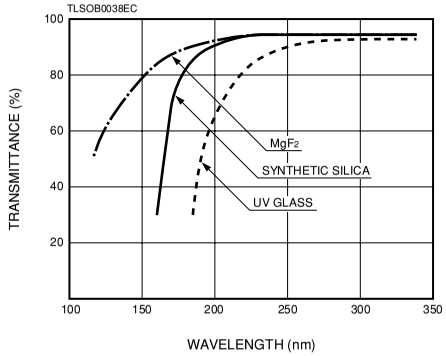
Figure 1: Spectral Distribution



■ Window Material

The following 4 types of window material are available for deuterium lamps.
(1) UV glass (2) Synthetic silica
(3) MgF_2
Figure 2 shows the transmittance of various window materials.
UV light at wavelengths shorter than 190 nm attenuates greatly due to its absorption by oxygen. To obtain the fullest performance in window transmittance, it is recommended that the inside of the equipment be filled with nitrogen or vacuum-evacuated to eliminate this absorption effect.

Figure 2: Typical Transmittance of Various Window Materials



●UV glass

UV glass has a higher ultraviolet transmittance than normal optical glass (borosilicate glass). It has the longest cut off wavelength of 185 nm among the four types. However the generation of ozone is lower than other window material types, it is not necessary to have special anti-ozone treatments.

●Synthetic silica

Synthetic silica is obtained by fusing a silica crystal that is artificially grown. Although its cut off wavelength is 160 nm, it contains less impurities than fused silica, and transmittance at 200 nm has been improved by approx. 50 %.

●MgF_2

MgF_2 is a crystallized form of alkali metal halide that has an excellent ultraviolet transmittance, a low deliquescence and is used as window material for vacuum ultraviolet applications. Its cut off wavelength is 115 nm.

Since the window is located far from the discharge position, the amount of dirt produced by spattering from the electrodes is reduced resulting in low deterioration of light output. The non-projecting type requires less space and has a wider directivity since there is no projection, enabling effective use of emitted light. The long-nose projecting type uses an MgF_2 window and is suitable for vacuum ultraviolet applications. This type is used with the tip of the nose inserted into the vacuum equipment.

Figure 3: External View

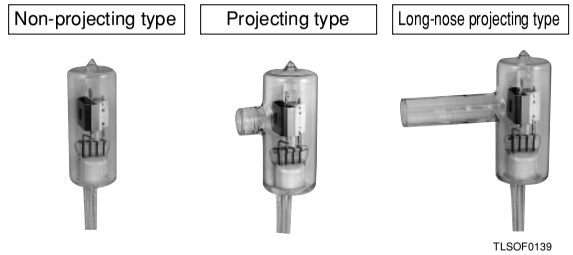
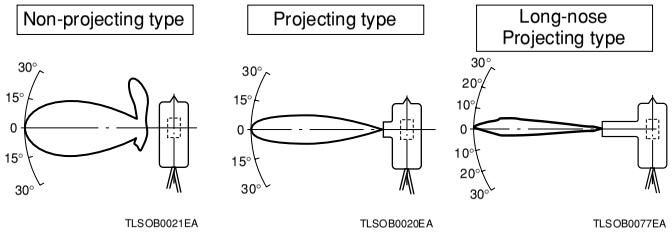


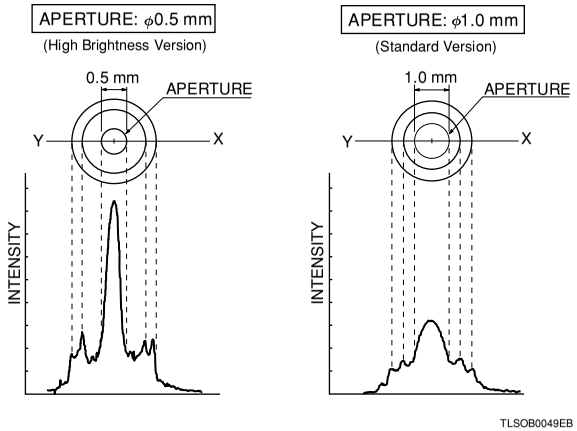
Figure 4: Directivity (Light Distribution)



■ Arc Distribution

Arc intensity is determined by the aperture (light exit) size. Figure 5 shows typical spectral distributions for lamps with different aperture sizes. At the same input current and voltage, lamps with an aperture of 0.5 mm diameter (high brightness type) provide 1.6 times higher brightness than lamps with an aperture of 1.0 mm diameter (standard type). The half width of spectral distribution also becomes narrower with a reduced aperture size. When higher intensity is required or the object to be irradiated is very small, the high brightness type is recommended.

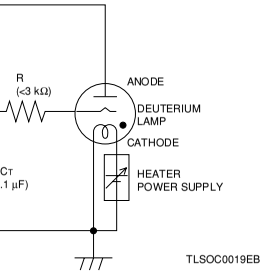
Figure 5: Arc Distribution

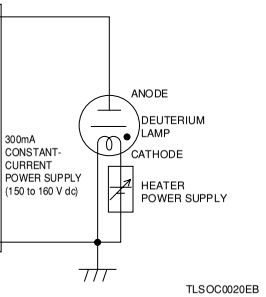


mA

peak
W)
uction, safety and downsizing, lamp
at eliminate the trigger power sup-
ry electrode. In this approach, the
t power supply of 150 V/300 mA
r capacitor and then is discharged
is generates ions and momentarily
nd cathode, leading to the main dis-
scharge occurs only at a restricted
triggering method.
used as part of the electrode sup-
ated from the shield box potential.
auxiliary electrode, the trigger dis-
owing operation at a voltage 40 to
mp. This also results in higher reli-
e greatest advantage of the auxili-
ly is necessary. The circuit shown
ction and downsizing of the power

n





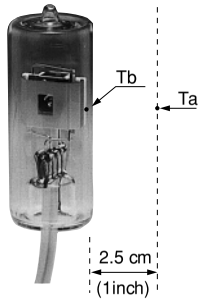
perture size of 0.5 mm diameter will
bove, it is recommended to employ
.5 µF to obtain the reliable lamp

Although the lamp's bulb wall temperature (Tb) rises as the ambient temperature (Ta) rises, the bulb wall temperature of conventional deuterium lamps normally rises to approx. +200 °C (direct-heated cathode type) to 240 °C (SQ cathode type) when the ambient temperature is +25 °C. Moreover, the bulb wall temperature of the L2D2 lamps rises even further by +50 °C reaching +280 °C due to the way in which the electrode is constructed. (Bulb wall temperature (Tb) also differs depending on the lamp type and heater voltage as well as lamp housing.) Although the operating temperature of Hamamatsu L2D2 lamps has been designed based on lamps operated under normal temperature, the temperature range given in the table below is recommended as the allowable operating temperature range enabling the use of the lamps over a long period of time with high stability.

Table1: Allowable Operating Temperature Range for Deuterium Lamps

Lamp Type	L2D2 Lamp
Cathode Type	All Cathode type
Ambient temperature: Ta	+10 °C to +50 °C (+20 °C to +30 °C)*
Bulb wall temperature: Tb	+245 °C to +280 °C
Maximum allowable bulb wall temperature: Tb Max.	+290 °C Max.

*Temperature enclosed by ( ) indicates the optimum ambient temperature.



Ta: Temperature measured at a position 2.5 cm (1 inch) away from the bulb wall

Tb: Temperature on the bulb wall (cathode side)

As the ambient temperature (Ta) rises, cathode temperature increases, resulting in evaporation of the cathode. If the ambient temperature (Ta) drops, the gas pressure inside the bulb is reduced increasing the kinetic energy of the gas and ions causing sputtering of the cathodes thermionic coating. In both cases, the gas inside the bulb is rapidly consumed. This deteriorates the stability and intensity. Thereby drastically shortening the operating life.
For stable operation of deuterium lamps, care should be paid to the installation of the lamps so that the bulb wall temperature (Tb) does not exceed +290 °C.

2. Since the bulb wall reaches a very high temperature (over +200 °C) when the lamp is on, do not touch it with bare hands or bring flammable objects near it.
3. Do not exert mechanical vibration or shock on the lamp, otherwise the stability will deteriorate.
4. Silica glass graded sealing.
   In the case of bulbs using silica glass, the window is formed by connecting different glass sections having slightly different expansion rates. Since the mechanical strength of these seams is low, the bulb fixing method should be so arranged that no force is exerted on these seams during fixing or operation.
5. Before turning on the lamp, wipe the bulb and window gently with alcohol or acetone. Dirt on the window will cause deterioration of the UV transmission, so always wear gloves when handling the lamp.
6. High voltage is used to operate the lamp. Use extreme caution to prevent electric shocks.

Warranty

The warranty period will be one year after our shipment to original purchaser or guaranteed life time whichever comes first. The warranty is limited to replacement of the faulty lamp. Faults resulting from natural disasters and incorrect usage will also be excluded from warranty.

Related Products

Water-Cooled 150W VUV Deuterium Lamps

These water-cooled 150W lamps provide a radiant output 3 to 4 times higher than 30W lamps and are chiefly used as excitation light sources. Two window materials, synthetic silica(L1314) and MgF_2(L1835) are available.
The MgF_2 window type is widely used as a VUV light source in photo CVD, solar simulator(in space) and other VUV applications. A vacuum flange E3444 series are provided as an option allowing simple connection to a vacuum instrument.

TLSOF0140

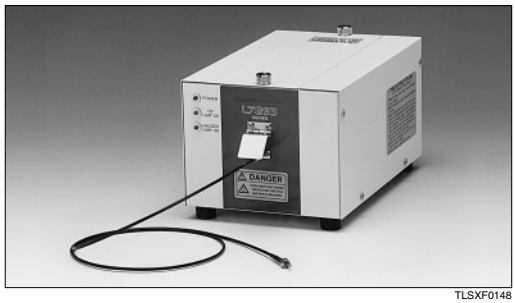
Calibrated Deuterium Light Source L7820

The L7820 is the calibrated light source consisting of L2D2 featuring high stability and good repeatability, which are required for calibrated light source.
In order for anybody to achieve stable light, not only the lamp design but also power supply and lamp housing design are optimized. It delivers high stable light in the long and the short term operation especially in the calibrated range of 250 nm to 400 nm.
The L7820 is suitable for quality control of light source, light detector and so on.
The certificate with JCSS logo mark is attached.

TLSXF0159

UV-VIS Fiber Light Source L7893 Series

This light source L7893 series incorporates a highly stable L2D2 lamp and a Tungsten lamp into a single compact housing with an optical fiber light guide. The combination of these two lamps covers a wide spectral range from 200 nm to 1100 nm, yet offers highly stable light output and long service life. This light source L7893 series is ideal for a compact analytical equipment such as miniature grating units, portable spectrophotometers and reflection meters.



TLSXF0148

Lamp Housing E8039

This lamp housing was designed to allow easy operation of deuterium lamps such as L2D2 lamps and provide full lamp performance. It accommodates a lamp with a flange so that no optical alignment is required. The built-in interlock and forced-air cooling functions ensure high safety. Collimating lenses and fiber guide adaptors are also available as easy-to-replace options, which easily attach to the light exit and allow obtaining the desired light beam.

For details, please refer to the catalogs which are available from our sales office.

CE Marking

This catalog contains products which are subject to CE Marking of European Union Directives. For further details, please consult Hamamatsu sales office.

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