



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



4 times longer guaranteed life HOURS

Life Characteristics



than conventional lamps. This is the longest operat-ing life of any deuterium lamp. 4000 hours-4 times longer assure an operating life of The L2-4000 series lamps

Fluctuation: 0.05 %p-p, Drift: ±0.3 %/h 2 TIMES STABLE

TLSOB0050EA

Light Output Stability



output,

as well as a re-

duced drift of only ± 0.3 %/h.

only 0.05 %p-p in the light can be obtained. uniform and optimum tem-perature distribution, which are the most important

factor for stable operation,

This

oped ceramic structure,

മ

By using a newly devel-

TIME (30 s/div.)

EXCELLENT TEMPERATURE HARACTERISTICS

> the presence of ambient temperature variations. stability ensures stable lamp operation even in Use of a ceramic structure with excellent thermal

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





- APPLICATIONS UV-VIS Spectrophotometers HPLC
- CE(Capillary Electrophoresis)
- SOx/NOx Analyzers Atomic Absorption Spectrophotometers

Thin Layer Chromatography

Film Thickness Measurement

NOTE

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



light output than conven-tional lamps. The L2-4000 series lamps even offer light output 1.1 times higher The L2-2000 series lamps produce 1.3 times higher than conventional lamps.



0 190

210

230

250

270 290

330

350

370

390

WAVELENGTH (nm) 310 0.5

SSI

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

ω 5

L2D2 LAMPS

RELATIVE INTENSITY(A.U.)

<u>1</u>.5 N ₽.5

CONVENTIONAL LAMPS

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000 series **2-2000 Series TIMES HIGHER**







SPECIFICATIONS FOR L2D2 LAMPS



SPECIFICATIONS

GENERAL	PURPOSE							
Corios	Type.	Dimen- sional	Window Material	Spectral Disiribution	Aperture Diameter	Required Dis- charge Starting	Anode Current	Tube Drop
Sellec	No.	outline			Ø	Voltage B Min.		Voltage Typ.
				(nm)	(mm)	(V dc)	(mA dc)	(V dc)
10,000	L6565	•		105 100	1.0	350	00-00	0
	L6566	2	Uv ylass		1.0	350	JULTOU	00
	L6301	0		105 100	0.5	400		
	L6302	0	ระยุเกิ ก.ก		1.0	350		
	L7298	6	Synthetic silica	160 to 400	1.0	350		
	L6303	4		105 100	0.5	400		
	L6304	4	confi an		1.0	350		
	L6305	2	IIV alace	195 to 100	0.5	400		
	L6306	2	ccbifi A.C		1.0	350		80
	L6307	٩	I IV alace	195 to 100	0.5	400		
	L6308	ω	confi A.C.		1.0	350		
L2-2000	L7296	0			0.5	400	300±30	
	L7296-50	0	Synthetic silica	160 to 400	0.5	400		
	L7295	Ø			1.0	350		
	L6309	ø		105 100	0.5	400		
	L6310	۵	confi an		1.0	350		
	L6311	g			0.5	400		о Л
	L6311-50	0		105 to 100	0.5	400		ç
	L6312	σ	C v Ulass		1.0	350		
	L6312-50	0			1.0	350		õ
	L7293	9			1.0	350		ç
	L7292	7			1.0	350		

SEE-THROUGH TYPE

L7292

	Г							
	2-2000					Series		
L7174 L7306	L7307	L6999-50	C6999		NO.	2	Type.	
•	•	8	4			outline	sional	Dimen-
	UV glass						Material	Window
	185 to 400			(nm)			Disiribution	Spectral
1.0	1.0	0.5	0.5	(mm)		Ð	Diameter	Aperture
350 350	350	400	400	(V dc)	Min.	Voltage B	charge Starting	Required Dis-
	300±30			(mA dc)			Current	Anode

NOTE (2)Lamps with an aperture of 0.5 mm diameter are high brightness types. These lamps provide 1.6 times higher brightness than standard lamps with an aperture of 1.0 mm diameter. (Refer to page 8.)
(3) The provide the provide of the provide the prov

for further details.

Overage 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).

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.

			±0.3			(%/ h)	Max	Drift	Output S
ended operating vol			0.05			(%)	(p-p)	Fluctuation	stability
tage is $3.5 \text{ V} \pm 0.5 \text{ V}$.			2.5 ± 0.25			(V dc, ac)	Voltage	_	
			4			(A dc, ac)	Current	Narm-up	Filame
		1	20			(S)	Time		nt Rating
	1.7±0.2		1.0-0.1	1 0+0 1		(V dc)	Voltage	Opera	s
	3.3		 0	0		(A dc)	Current	ating	
			2000			(h)		Life D	Guaranteed
	L1886		L1887		Ι			Lamps 🕒	Conventional
	L7306	L7174	L7307	L6999-50	L6999		No.	Type.	

										±0.3										د.⊥0	ר ב ב	(%/ h)	Max	Drift	Output	
										0.05										0.03	о Оп	(%)	(d-d)	Fluctuation	Stability	
10±1	2.5±0.25			10 to 15				10±1			1011	10+1	ა.U±U.ა	3 0+0 3			2.5±0.25			3.0±0.3	2.5 ± 0.25	(V dc, ac)	Voltage G			
0.8	4							1.2			0.0	0	c	л			4			ъ	4	(A dc, ac)	Current	Warm-up	Filame	
										20										20	2	(S)	Time		ent Rating	
2.5 to 6.0	1.0±0.1		c	- (Ð			7.0±0.5			2.0 0.0		0	⊃ •		1.7±0.2		1.0±0.1		0 to 1	1.0±0.1	(V dc)	Voltage	Oper	s	
0.3 to 0.6	1.8		c	- (Ð			-					0.01.0			3.3		1.0		0 to1.8	1.8	(A dc)	Current	ating		
										2000										4000	1000	(h)		Life D	Guaranteed	
L879	L879-01	L4510-50	L4510	L4505-50	L4505	L2526	L2541	L1626	I	L2196	L591		L3382-01	L3381-01	L1729	I	L1636	L613,L613-04	I	L3382-01	L613,L613-04			Lamps 🕒	Conventional	
L7292	L7293	L6312-50	L6312	L6311-50	L6311	L6310	L6309	L7295	L7296-50	L7296	L6308	L6307	L6306	L6305	L6304	L6303	L7298	L6302	L6301	L6566	L6565		No.	Type.		

SEE-THROUGH TYPE

The see-through type electrode structure enables straight-line arrangement of the halogen lamp, deuterium lamp, optical system and optical passage. This simplifies optical design of UV-VIS spectrophotometer etc., and eliminates loss of light amount caused by the half mirror.





4

DIMENSIONAL OUTLINES (Unit : mm)













FILAMENT FILAMENT ANODE

: BLUE RED

L6999/L7307

FILAMENT : BLUE FILAMENT · GND : BLACK ANODE : RED

L6303/L6304/L7306

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TLS OA0020EC

017ED

TLSOA0051EA

TLSOC0010EA

TLSOA0052E







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POWER SUPPLY

a constant-voltage circuit in the filament power supply section to assure a reliable operation. Hamamatsu's power supply for deuterium lamps uses a constant-current circuit in the main power supply section and Therefore, use of a power supply designed to drive the lamps with stable operation is recommended. Extremely high stability of intensity is required for deuterium lamps because of their applications.

types according to the operation mode of various lamps. Hamamatsu offers not only OEM power supplies specially designed for your applications, as well as the following

SPECIFICATIONS

	Pa	arameter		C1518	C7860	M7628	Unit
Control Me	thode			Dropper Type	Switching Type	Switching Type	
Input	<u>-</u>	ıput Voltage		(AC) 100/118/230 ±10 %	(AC) 90 to 115/180 to 250 (Automatic)	(DC) 24 ± 2.4	<
	п	iput Wattage		100	60	48	VA Max.
	2	internet Vieltage	With Load	(DC) 80	(DC) 80	(DC) 80	V Typ.
	0	uput voitage	Without Load	(DC) 160	(DC) 160	(DC) 160	V Typ.
2	0	utput Current		300	300	300	mA
Ţ		rigger Voltage		600 ± 50	600 ± 50	600 ± 50	V peak
Output	ш	luctuation (p-p))	0.1	0.5	0.5	% Max.
	D	rift		±0.1	±0.1	±0.1	%/h Max.
	0	utput Voltage		See below	See below	See below	1
H	eater O	utput Current		See below	See below	See below	1
	5	/arm-up Time		20	25	25	s Typ.
Ambient Te	emperatu	lre		0 to +40	0 to +40	0 to +40	റ്
Cooling				Not required	Not required	20 CMF of forced air	1
Dimension	$W \times W$	×D)		$200 \times 107 \times 240$	$113 \times 122 \times 220$	$100 \times 118 \times 36.2$	mm
Weight				6.7	2.7	0.17	кġ
Certificatio				1		UL/CE	

HEATER VOLTAGE AND CURRENT

Tuno No	Wai	m-up	Ope	ation	A splitching Lampa
i ype ino.	Voltage (V dc)	Current (A dc typ.)	Voltage (V dc)	Current (A dc typ.)	
	o π + o o	A	10101	- 0	L6565, L7293, L6999, L6999-50
	r.u ⊢ u.r	4	o - o	c	L7307, L7174, L6301, L6302
C1518 (10 V)	10 ± 1	0.8	3.5 ± 0.5	0.3	L6307, L6308, L7292
C1518 (SQ2.5 V)	2.5 ± 0.2	4	1.7 ± 0.2	3.3	L7298, L6303, L6304, L7306
C1518 (SQ10 V)	10 ± 1	1.2	7.0 ± 0.5	1	L7296, L7295, L6309, L6310, L7296-50
C7860/M/08820	ол+о1л	Δ	л + с 1 + с	a r	L6565, L7293, L6999, L6999-50
	P.U - U. TU	4	- - - - -	a	L7307, L7174, L6301, L6302
C7860/M7628-2517 A	2.5 ± 0.15	4	1.7 ± 0.1	3.3	L7298, L6303, L6304, L7306
C7860/M7628-3000 A	3 ± 0.15	ъ	0	0	L6566, L6305, L6306
C7860/M7628-1035 A	10 ± 0.5	0.8	3.5 ± 0.2	0.3	L6307, L6308, L7292
C7860/M7628-1070	10 ± 0.5	1.2	7 ± 0.35	1	L7296, L7295, L6309, L6310, L7296-50
C7860/M7628-1555 A	15 ± 0.75	0.5	5.5 ± 0.3	0.3	L6311, L6311-50, L6312, L6312-50
NOTE A CTREN Socias and	manufactured only wh	on the order is placed			

* Characteristics are measured at 23±1 °C after 30 min of warming up.







TECHNICAL INFORM

Spectral Distribution

Deuterium lamps emit high intensity light in the UV range at wavelengths shorter than 400 nm. Light intensity on the short wavelength side is determined by the window material used.

Figure 1: Spectral Distribution



Window Material

The following 4 types of window material are available for deuterium lamps. (1) UV glass (2) Synthetic silica (1) UV glass (3) MgF2

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 trans-mittance, 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

WAVELENGTH (nm)

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

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 %.

MgF2 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.

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HAMAMATSU

ATION

Light Distribution

to a projection on the bulb. The projecting type has a uniformed transmittance due to the plane glass. emission window, whilst the projecting type uses a plane glass attached The non-projecting type uses the side of the cylindrical glass bulb as the

space and has a wider directivity since there is no projection, enabling effective use of emitted light. The long-nose projecting type uses an MgF2 window and is suitable for vacuum ultraviolet applications. This Since the window is located far from the discharge position, the amou of dirt produced by spattering from the electrodes is reduced resulting the amount ⊒.





TECHNICAL INFORMATION

Construction

Since a deuterium lamp uses the positive column flash of arc discharge, the cathode is shifted sideways and an aperture is located immediately in lamp. The anode has a unique structure covered with ceramic to prevent abnormal discharge, and the cathode has a highly durable electrode. trode for lamps designed for low voltage lighting. placed between anode and cathode may be used as an auxiliary elecfront of the anode so that high intensity is obtained. The Figure 6 shows the external view and internal construction of a deuterium aperture plate

Figure 6: External View and Electrode Construction



(1)Solarization Terminology

in short wavelength region. This phenomenon is hardly ened. This is called solarization, and transmittance drops, particularly over a long period. This is caused by a drop in transparency of the glass resulting from dirt on the glass and the influences of ultraviolet rays. In the worst case, the glass becomes cloudy and its life is shortsynthetic silica. ransmittance of UV glass and fused silica drops when they are used ever seen with

2Discharge starting voltage

3Output stability pulse trigger voltage is applied between anode and cathode, and discharge starts. The discharge starting voltage of 30 W deuterium lamps charge. (The maximum applied voltage for trigger is 650 V.) The dis-charge starting voltage varies depending on the trigger method and ommended that a voltage of approx. 500 V be applied to assure disvoltage rises according to the prolongation of operation time, it is recis approx. 350 V (400 V max.). However, since the discharge starting When the cathode is sufficiently heated and ready for arc discharge, a

(1) Drift Drift refers to variation of output over a long period caused as a result of the change in thermoelectron discharge characteristic of the cathode, change in gas pressure or dirt on the window. It is expressed in variation per hour. In the case of deuterium lamps, it equilibrium after start of discharge, so a warm-up period of 20 to takes 10 to 15 minutes until the inside of the lamp reaches thermal equilibrium after start of discharge, so a warm-up period of 20 to 30 minutes is required.

(2) Fluctuation

4Life the cathode or fluctuation of discharge position. Light output fluctuates approx. 0.05 % at intervals between a few minutes and a few Fluctuation refers to variation of output caused by deterioration of hours. In addition, the position of the arc point also fluctuates.

(1)Fluctuation of light output

fluctuation and shift exceeds 0.05 %p-p. _ife is determined by the point at which fluctuation combining

(2)Drop of light output Life is determined by the point at which the total emitted energy

light output is caused mainly by solarization and dirt inside the window. The life specified is 2000 hours for L2-2000 series, and drops to 50 % of the initial level. As described earlier, decrease 4000 hours for L2-4000 series. ∍

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Discharging the L2D2 Lamps

In deuterium lamps, an aperture electrode is placed between cathode and anode to compress the discharge, so that high light intensity is obtained. This required, a high voltage trigger discharge across cathode and anode. In general, a typical power supply for deuterium lamps consists of the follow-

- ing three power supplies. Constant current power supply of 300 mA
- (open voltage about 150 V)
- Trigger power supply of 500 to 600 V peak
- Power supply for the heater (about 10 W)

charge. However, because this trigger discharge occurs only at a restricted (main power supply) is stored in a trigger capacitor and then is discharged between lamp shield box and cathode. This generates ions and momentarily electrical energy from a constant current power supply of 150 V/300 mA ply. One of these is the use of an auxiliary electrode. In this approach, point near the cathode, it is a less reliable triggering method reduces the impedance between anode and cathode, leading to the main dismanufactures are evaluating methods that eliminate the trigger power However, in view of the need for cost reduction, safety and downsizing, lamp -dns the

supply charge can be guided to the aperture, allowing operation at a voltage 40 to 50 V lower than that of a conventional lamp. This also results in higher relion the below, resulting both a cost reduction and downsizing of the power In the L2D2 lamp, ceramic insulators are used as part of the electrode sup-port, so that the aperture potential is isolated from the shield box potential. ary electrode is that no trigger power supply is necessary. The circuit shown ability of the triggering operation. Thus, the greatest advantage of the auxili-Since this aperture electrode is used as an auxiliary electrode, the trigger dis-

Figure 7: Example Circuit Diagram Auxiliary electrode operation





SUPPLY (500 to 600 V dc) RT (1 to5 kΩ) -////-

0.2 to 0.

POWER SUPPLY

Conventional circuit

ignition. When the L2D2 lamp series with an aperture size of 0.5 mm diameter will be operated by the circuit as shown above, it is recommended to employ be constant as $R_{T}=1$ k Ω and $C_{T}=0.5$ μ F to obtain the reliable lamp inclusion.

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OPERATING TEMPERATUR

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Optimum Operating Temperature

trode is constructed. (Bulb wall temperature (Tb) also differs depending on the lamp type and heater voltage as well as lamp housing.) Although the operating tem-perature of Hamamatsu L2D2 lamps has been designed based on lamps operated under normal temly 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 tem-perature of the L2D2 lamps rises even further by +50 Although the lamp's bulb wall temperature (Tb) rises as the ambient temperature (Ta) rises, the bulb wall temperature of conventional deuterium lamps normal-Io obtain high stability and long operating life, ade-quate care must be paid to operating conditions includa long period of time with high stability. perature, the temperature range given in the table below is recommended as the allowable operating temperature range enabling the use of the lamps over ing the operating temperature of the lamp. temperature range enabling the use of the lamps ov $^\circ\mathrm{C}$ reaching +280 $^\circ\mathrm{C}$ due to the way in which the elec-

Table1: Allowable Operating Temperature Range for Deuterium Lamps

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



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







PRECAUTION AND WARRANTY

Precautions When Using Deuterium Lamps

- goggles and clothing when operating the lamps. into contact with your skin. Always wear protective harmful to your eyes and skin. Never look directly at Deuterium lamps emit ultraviolet rays which can be the emitted lights, nor should you allow it to come
- Ņ Since the bulb wall reaches a very high temperature (over +200 °C) when the lamp is on, do not near it. touch it with bare hands or bring flammable objects
- ω lamp, otherwise the stability will deteriorate. Do not exert mechanical vibration or shock on the
- 4 Silica glass graded sealing. mechanical strength of these seams is low, the bulb ing slightly different expansion rates. Since the is formed by connecting different glass sections hav-In the case of bulbs using silica glass, the window tion. is exerted on these seams during fixing or operafixing method should be so arranged that no force
- ςī Before turning on the lamp, wipe the bulb and winso always wear gloves when handling the lamp. dow will cause deterioration of the UV transmission, dow gently with alcohol or acetone. Dirt on the win-
- ი High voltage is used to operate the lamp. extreme caution to prevent electric shocks. Use

Warranty

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

shortening the operating life.

wall temperature (Tb) does not exceed +290 $^\circ$ C.

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 MgF2(L1835) are available.

The MgF2 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.

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.

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.

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.

*PATENTS: USA 6, PATENTS PENDING: JAPAN 7, USA 1, EUROPE 7

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