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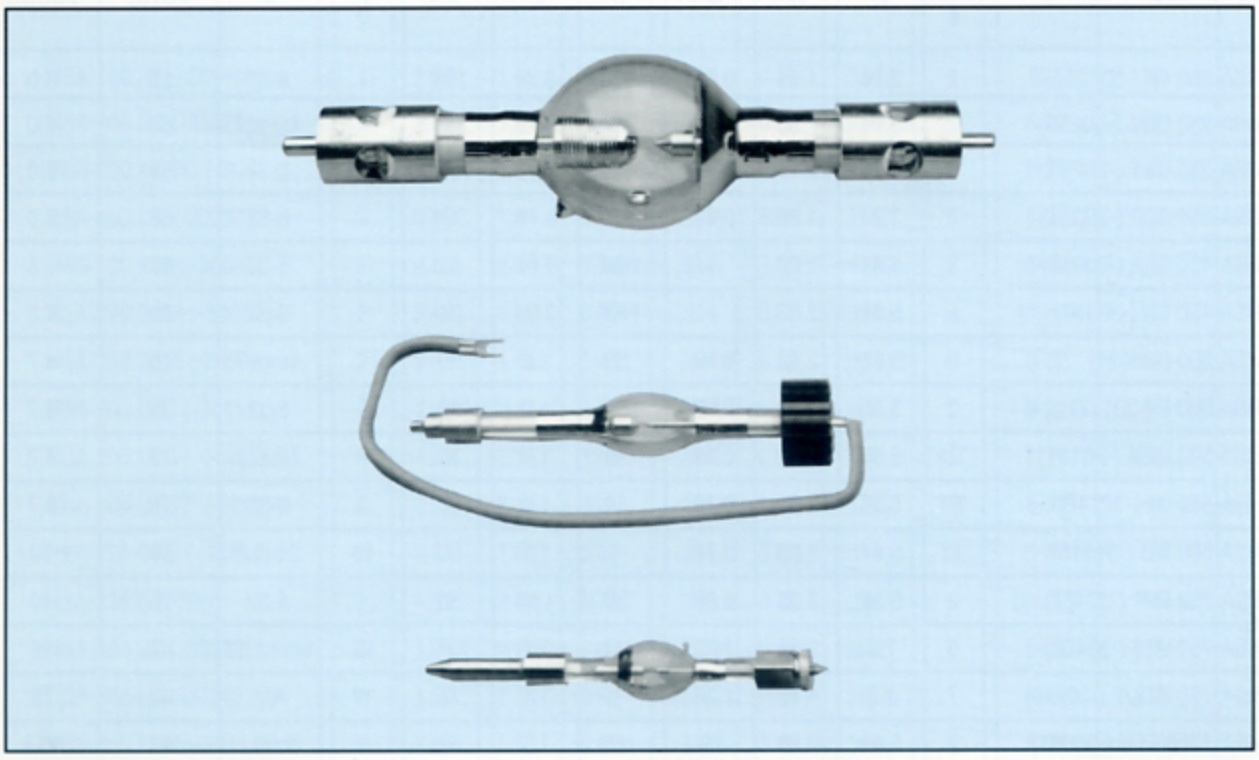
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MERCURY SHORT ARC LAMPS

A Catalog of Ultraviolet Light Sources



Features:

- **Spectral characterization to match photoresist materials**
- **Specially processed electrodes to insure arc stability**
- **Improved processing to extend lamp life and radiation output**
- **New assembly techniques to strengthen construction and increase mechanical reliability**

Advanced Radiation Corporations' series of direct current Mercury Short Arc Lamps represent the state-of-the-art in design, manufacture, and performance of high intensity ultraviolet sources. These lamps provide intense radiation corresponding to the photosensitivity of most presently available photoresist materials; the lamps satisfy the demands of arc stability and long reliable life necessary for economic manufacture of integrated circuitry in today's sophisticated electronics industry.

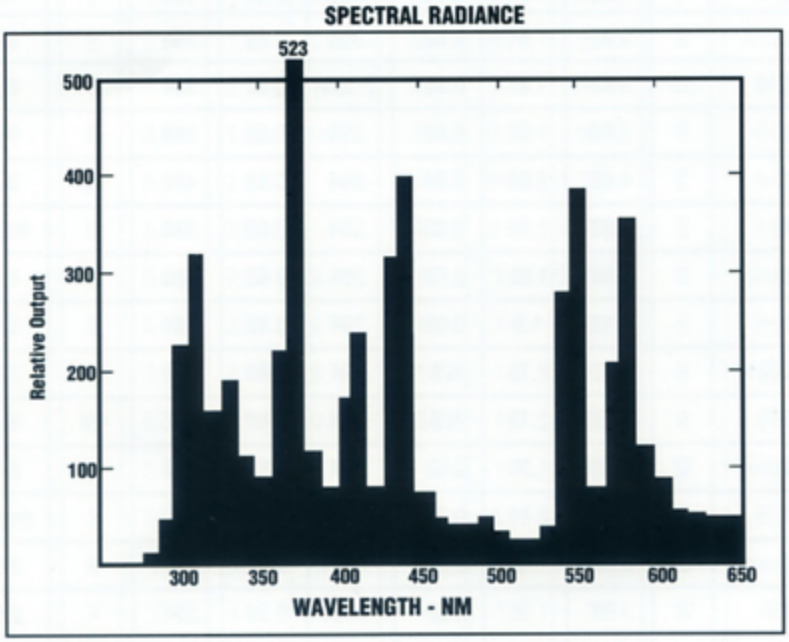
The point source configuration of the short arc lamp makes this series of lamps, ideally suited for photochemistry, fluorescence microscopy, micro-film enlargement, optical instrumentation, and other applications requiring high intensity ultraviolet radiation.

Advanced Radiation Corporation

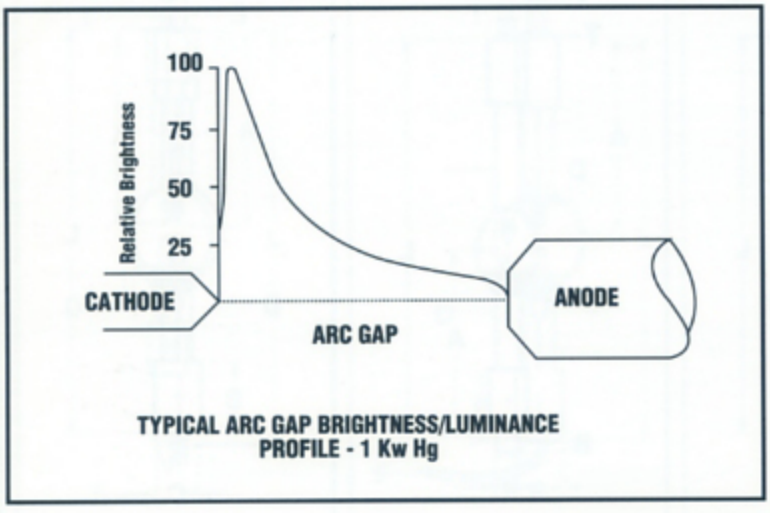
2210 Walsh Ave., Santa Clara, CA 95050 • **Tel** 408-727-9200 • **FAX** 408-727-9255

Mercury Short Arc Lamps are high intensity radiation sources with an ideal optical configuration for collecting the spectral emissions. The short arc lamp consists of a spherical or ellipsoidal quartz bulb in which two tungsten electrodes (anode and cathode) are positioned to provide a very short space between their tips; during operation, this space is filled with a high pressure "plasma" of mercury vapor whose temperature is approximately the same as the surface of the sun (about 6000° Centigrade). This high temperature arc plasma produces an intense radiation characteristic of mercury; a typical spectral radiance distribution for a mercury short arc lamp is shown here.

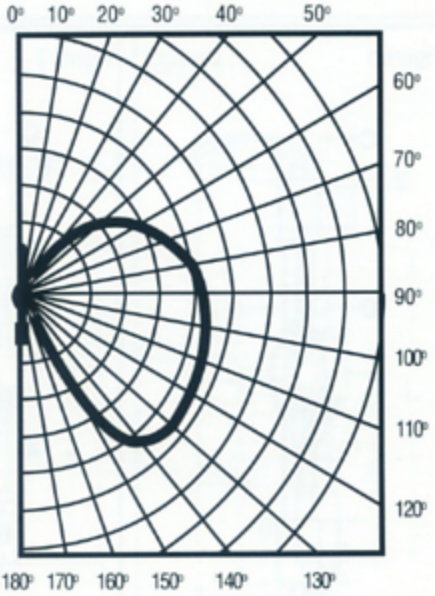
MERCURY SHORT ARC LAMP Model HSA-1000 FC



The intensity of the arc plasma is not uniform across the arc space or electrode separation, but is more concentrated at the tip of the cathode (negative electrode) and decreases across the arc space to a value of only about 10 to 15% of is maximum at the anode (positive electrode) tip. The figure on the left illustrates a typical intensity distribution across the "arc space".



TYPICAL ARC GAP BRIGHTNESS/LUMINANCE PROFILE - 1 Kw Hg



The shadow effect of the electrodes and the construction of the lamp limits the output to about 10 steradians as is illustrated in the polar distribution.

Model	Figure	Dimensions - Inches							Base Thread	Electrical	
		L	A	B	C	D	E	F	T	Volts	Amps
HSA-100 HP (-30019)	1	3.50	1.70	0.50	.295	0.42	.354	-	N/A	20	5
HSA-200 DC (-30020)	2	3.82	1.61	0.62	.394	0.62	.394	-	8-32	57	3.5
HSA-200 AC/DC (-30021)	2	3.82	1.61	0.62	0.394	0.62	.394	-	8-32	57	3.5
HSA-200 CB (-30037)	2	3.88	1.54	0.62	.394	0.62	.394	-	8-32	57	3.5
HSA-200 KLA (-30042)	3	4.62	2.04	0.34	.394	0.62	.433	-	8-32	30	6.7
HSA-200 DCM (-30094)	2	3.82	1.61	0.62	.394	0.62	.394	-	4mm.7	57	3.5
HSA-200 TAM (-30095)	2	3.82	1.61	0.62	.394	0.62	.394	-	8-32	57	3.5
HSA-200 UTS (-30144)	2	4.12	1.9	0.62	.394	0.62	.394	-	8-32	60	3.3
HSA-200 UTS/L (-30200)	6	4.25	2.15	N/A	.394	0.62	N/A	4.7	8-32	60	3.3
HSA-200 UTS/P (-30277)	6	4.25	2.15	N/A	.394	0.62	N/A	4.4	8-32	60	3.3
HSA-200 OPG (-30154)	2	3.88	1.58	0.62	.394	0.62	.394	-	8-32	57	3.5
HSA-250 (-30096)	2	4.92	2.44	0.79	.50	0.79	.50	-	5mm.9	40	5.6
HSA-350 SB (-30023)	2	3.94	1.85	0.62	.394	0.75	.394	-	8-32	58	6.0
HSA-350 LB (-30116)	2	3.94	1.85	0.62	.394	0.79	.394	-	8-32	58	6.0
HSA-350 TAM (-30114)	2	4.57	2.48	0.62	.394	0.75	.394	-	8-32	58	6.0
HSA-350 OPT (-30115)	4	3.85	2.13	0.62	.394	0.79	.187	-	8-32	58	6.0

Figure 1

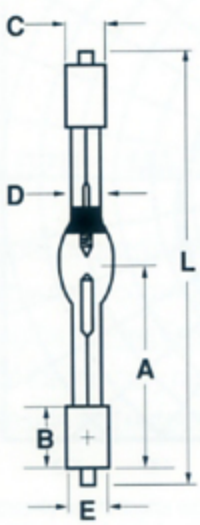


Figure 2

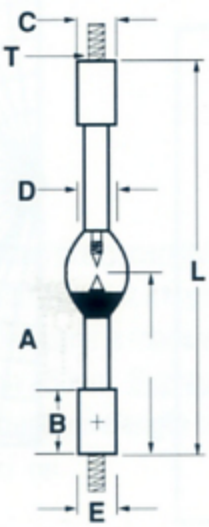


Figure 3

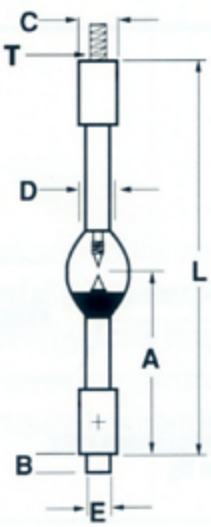
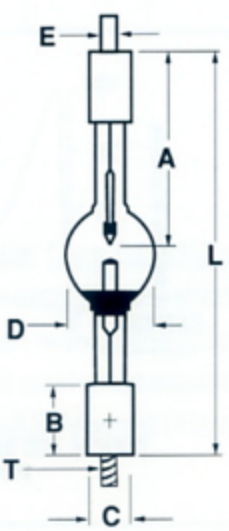


Figure 4



Model	Figure	Dimensions - Inches							Base Thread	Electrical	
		L	A	B	C	D	E	F	T	Volts	Amps
HSA-350 OF (-30125)	2	3.94	1.85	0.62	.394	0.79	.394	-	8-32	58	6.0
HSA-350 OFM (-30210)	2	3.94	1.85	0.62	.394	0.79	.394	-	4mm.7	58	6.0
HSA-350 QNT (-30273)	6	4.15	2.17	N/A	.394	0.73	N/A	4.0	8-32	58	6.0
HSA-350 GCA (-30356)	2	3.94	1.85	0.62	.394	0.79	.394	-	8-32	58	6.0
HSA-450 GCA (-30059)	5	5.51	2.07	-	HEX	0.91	.31	-	8-32	60	7.5
HSA-450 GS (-30339)	5	5.51	2.07	-	HEX	0.91	.31	-	8-32	60	7.5
HSA-500 (-30024)	2	5.55	2.68	0.79	.50	1.0	.50	-	4mm.7	75	6.7
HSA-500 E (-30117)	2	5.55	2.68	0.79	.50	1.0	.50	-	8-32	75	6.7
HSA-500 OFM (-30135)	2	5.55	2.68	0.79	.50	1.0	.50	-	4mm.7	75	6.7
HSA-500 OF (-30146)	2	5.55	2.68	0.79	.50	1.0	.50	-	8-32	75	6.7
HSA-500 MB (-30313)	11	5.91	2.83	0.77	-	1.1	.50	14	5mm.8	50	10
HSA-750 OPT (-30168)	2	6.26	3.05	0.80	.50	1.18	.50	-	8-32	75	10
HSA-750 UTS (-30406)	6	7.2	3.65	N/A	.75	1.1	N/A	16	8mm1.25	47	16
HSA-750 UTS/P (-30440)	7	7.6	4.15	1.25	-	1.1	.75	17	N/A	47	16
HSA-1000 CEN (-30061)	2	5.90	2.88	.79	.55	1.1	.63	-	4mm.7	63	15.8
HSA-1000 BMO (-30269)	2	9.80	4.5	1.90	.63	1.5	.63	-	6mm1.0	80	12.5

Figure 5

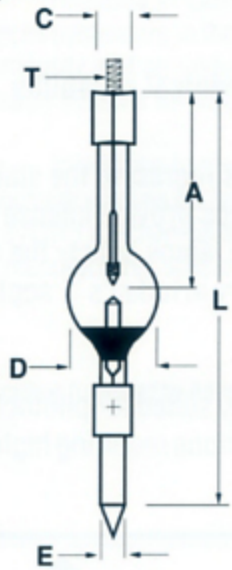


Figure 6

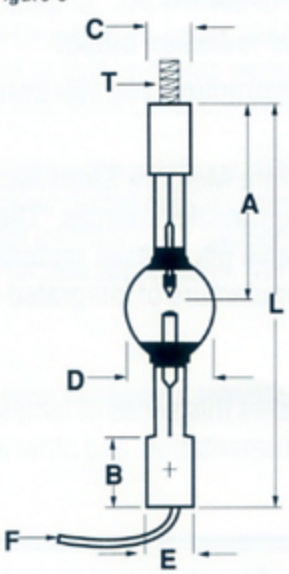


Figure 7

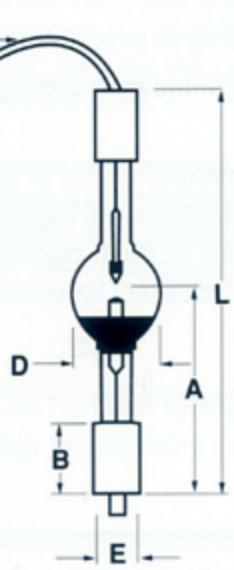
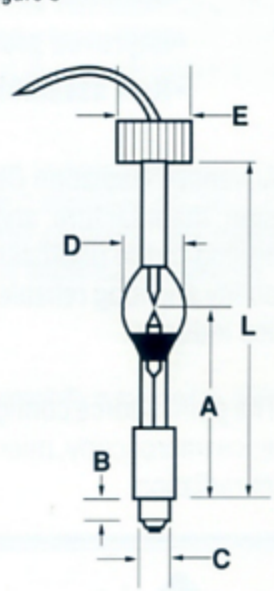


Figure 8



Model	Figure	Dimensions - Inches							Base Thread	Electrical	
		L	A	B	C	D	E	F	T	Volts	Amps
HSA-1000 FN (-30281)	8	6.52	3.44	0.30	.44	1.1	1.43	13.5	N/A	44*	16
HSA-1000 FC (-30336)	2	6.10	2.83	0.79	.59	1.1	HEX	-	6mm1.	44*	16
HSA-1002 FN (-30372)	6	6.52	3.10	1.0	.59	1.1	.55	3.6	6mm1.	44*	16
HSA-1002 FC (-30378)	2	6.10	3.11	1.0	.59	1.1	HEX	-	6mm1.	44*	16
HSA-1000 FG (-30381)	2	6.60	3.16	.79	.59	1.1	.59	-	8-32	44*	16
HSA-1000 KS (-30428)	2	8.12	3.51	1.90	.63	1.5	.63	-	6mm1.	38	26.3
HSA-1000 MC (-30438)	2	5.9	2.88	.79	.55	1.1	.63	-	6mm1.	53	19
BMO-1000 DF (-30122)	2	9.8	4.5	1.9	.60	1.5	.60	-	6mm1.	80	12.5
HSA-2002 TAM (-30341)	2	10.0	5.35	1.5	.75	1.77	.86	-	8mml.25	66	30
HSA-3500 TAM(-30436)	9	11.25	5.37	1.5	N/A	2.8	.30	12.0	N/A	55	64
HSA-5000 TAM (-30358)	10	12.0	5.74	2.25	.375	3.4	.25	-	N/A	58	86
HSA-5000 SC (-30424)	10	12.0	5.74	2.25	.375	3.4	.25	10	N/A	58	86
HSA-5000 LC (-30431)	10	12.0	5.74	2.25	.375	3.4	.25	16	N/A	58	86
HSA-7000 TAM (-30430)**	10	12.0	5.74	2.25	.375	3.4	.25	-	N/A	72	97
HSA-8000 TAM (-30450)**	10	12.0	5.74	2.25	--	3.4	--	-	N/A	--	--

* The operating voltage and current for these lamps is given for the 700 watt simmer mode; the lamps are pulsed to a maximum of 1000 watts for wafer exposure.
**Under development.

Figure 9

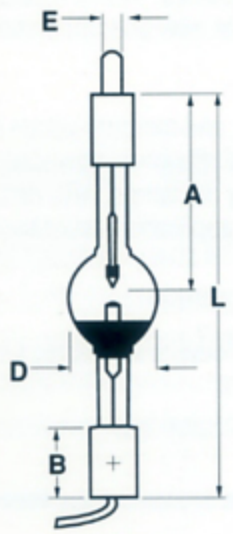


Figure 10

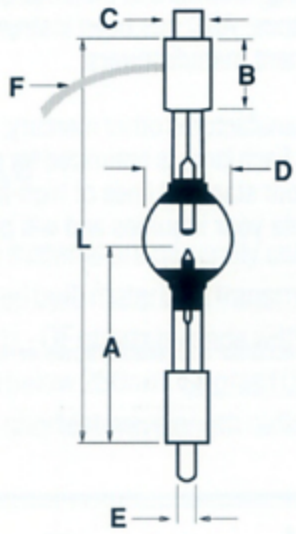


Figure 11

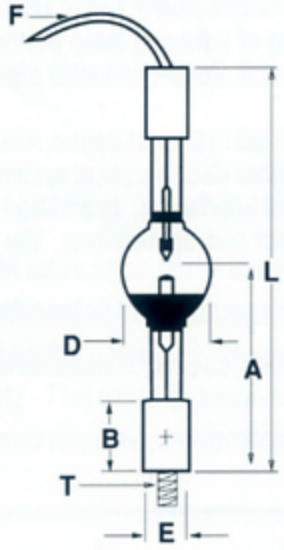
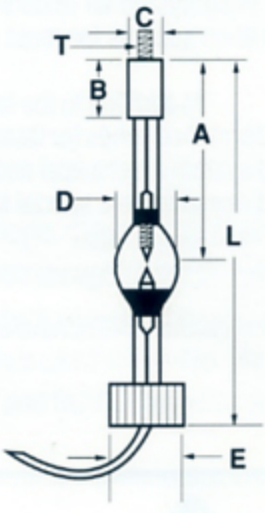


Figure 12



Product Designations

HSA Series: These lamps are standard mercury short arc lamps; i.e., during operation the spectral characteristic is representive of the mercury emission line structure plus weak continuum radiation due to the high temperature mercury plasma. The most important mercury lines are: G-line (436 nm), H-line (405 nm), and I-line(365 nm).

HXSA Series: These lamps differ from the HSA lamps due to the addition of a quantity of xenon gas in the lamp envelope. The xenon enhances the continuum radiation and has an altering effect on the mercury line emissions.

DUV Series: The DUV series of lamps are also mercury-xenon filled, but have a very carefully controlled partial pressure fill ratio to maximize the radiation between 220 nm and 240 nm.

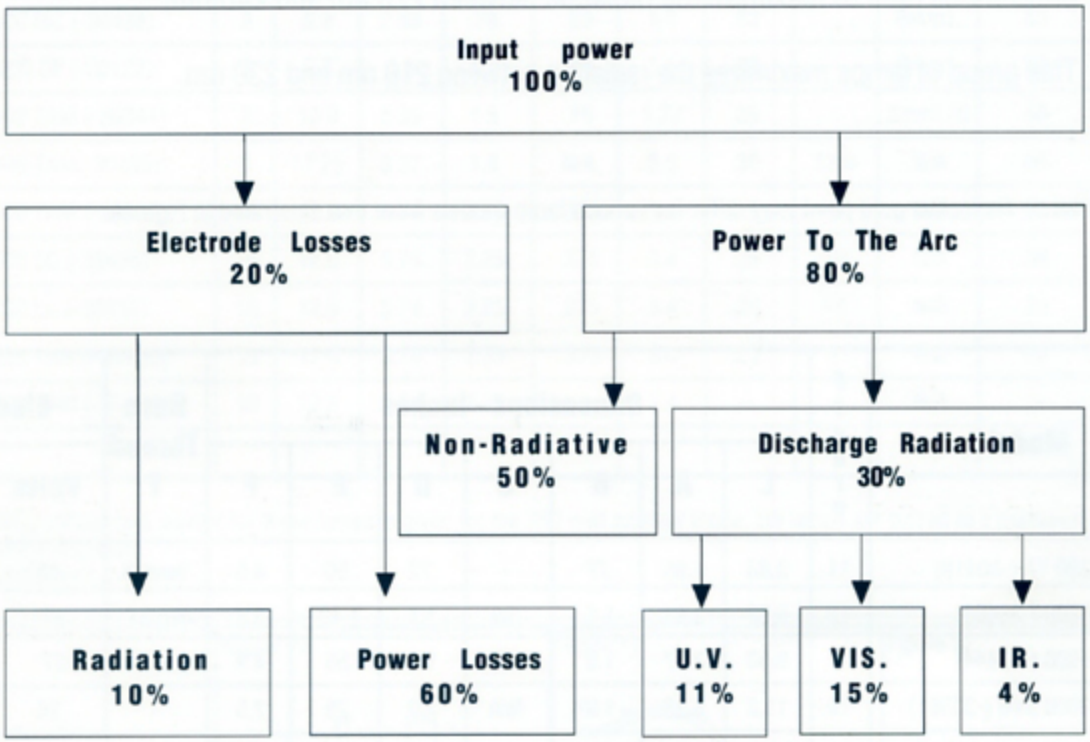
SUV Series: This group of lamps maximizes the radiation between 210 nm and 230 nm.

Note: Reflective gold paint may differ for various lamp models from that illustrated in Figures.

Model	Figure	Dimensions - Inches							Base Thread T	Electrical	
		L	A	B	C	D	E	F		Volts	Amps
HXSA-200 YA (-30419)	11	3.88	1.95	.77	-	.72	.50	4.5	5mm.8	18	11
HXSA-1000 (-30408)	12	6.62	3.41	1.0	.59	1.1	1.43	9.5	6mm1.	27*	26
HXSA-1000 (-30444)	6	6.50	3.07	1.0	.59	1.1	.55	4.2	1/4-20	27*	26
HXSA-1600 SVG (-30361)	10	11.8	6.28	1.9	N/A	2.0	.25	7.5	-	25	64
DUV-350 HTG (-30047)	2	5.2	2.59	.79	.50	.90	.50	-	8-32	35	10
DUV-350 OAI (-30118)	2	4.2	2.18	.79	.50	.90	.50	-	8-32	35	10
DUV-500 HTG (-30046)	2	6.2	3.29	.79	.50	1.0	.50	-	8-32	35	14.3
DUV-500 OAI (-30036)	2	5.8	3.18	.79	.50	.90	.50	-	8-32	36	13.9
DUV-500 MA (-30055)	2	5.9	2.98	.79	.51	1.0	.51	-	5mm.9	25	20
DUV-500 (-30056)	2	5.9	2.98	.79	.51	1.0	.51	-	5mm.9	35	10
DUV-1000 (-30119)	2	9.80	5.16	1.9	.63	1.5	.63	-	6mm1.	30	33
DUV-1000 (-30192)	2	10.0	4.65	1.5	1.05	1.77	1.05	-	5/16-18	38	53
SUV-1000 (-30195)	1	9.63	4.40	1.5	.75	1.5	.75	-	88mm1.25	25	40
SUV-2000 (-30191)	2	10.0	4.65	1.5	1.05	1.77	1.05	-	5/16	33	60

Very complicated mechanisms govern high pressure arc operation and performance. The high temperature characteristic of the arc discharge establishes a critical power balance of the total input power (operating volts times amperes) of the arc. Of the total input power only about 30 percent is emitted as arc radiation; the remaining power is lost as a by-product of the arc regime mechanisms or lamp component radiation. A power partition for a typical 500 watt mercury short arc lamp is presented below.

Power Partition of a 500 Watt Mercury Short Arc Lamp



ENVELOPE MATERIALS

Three types of quartz envelope material are generally used in fabrication of the lamp envelope: Clear Fused Quartz - This is the most commonly used bulb material; it transmits almost all the discharge radiation except for the shortest wavelengths. Ozone Free Quartz - OF quartz is made with an additive (typically titanium) which reduces the spectral output of the mercury radiation below 250nm. Suprasil Quartz - This more expensive quarts is used when maximum transmission and output of the shortest wavelength radiation is required, as from the DUV and SUV series of lamps.

Mercury lamps operate with an internal pressure that approaches 30 atmospheres and the erythemal flux is extremely high. A shielded enclosure should therefore be used for protection. When cold, the HSA lamp series is at a reduced pressure and is safe to handle. For the HXSA, DUV and SUV lamp type, protective eye glasses and gloves should be worn when handling the lamps.

Before operating the lamp, clean the quartz surfaces of all foreign matter including oil from the fingers.

Direct Current Mercury Short Arc Lamps are designed to be operated vertically. An operating base temperature above 200° C will cause deterioration of the molybdenum ribbon hermetic seal and short life of the lamp.

Reverse polarity to the electrodes will cause immediate destruction of the cathode thermal balance; subsequent correct polarity operation will produce an unstable arc and may cause violent lamp failure.

There will be a slight difference in spectral radiation from lamp to lamp; this is due to small differences in operating pressure, arc spacing, and operating current. Major output differences will only be observed when a lamp is operated at power levels other than the design rated power of the lamp.

The operating voltage of a mercury short arc lamp may vary by a volt or two in your equipment when compared to factory reading specified on the lamp container. This difference is due to different thermal conditions and will have no noticeable effect on operation or performance of the lamp. It is important, however, that excessive forced air cooling to limit base temperatures does not cause mercury condensation inside the lamp bulb. Condensed mercury results in lower operating pressure and decreased lamp output; continued operation at low operating pressure will severely shorten lamp life due to cathode sputtering and more rapid transport of anode tungsten vapors to the lamp envelope.

ABOUT A.R.C.

Advanced Radiation Corporation is a "lamp" company; our expertise are based on many years of design and fabrication of advanced light sources for the government, industry, and educational institutions. Since its inception in 1971, ARC has been a "leader" in developing and manufacturing high quality, high reliability, and fairly priced lamps and ultraviolet radiation sources.

Founded in Campbell, California, ARC moved to Santa Clara in 1977. Today Advanced Radiation Corporation services customers in the Printed Circuit Board, Laser, UV-Curing, Medical and the Electronic Industries. With a reputation for integrity and an understanding of light and lamp performance, ARC has been instrumental in new and imporved UV radiation sources for most of the U.S. Semi-conductor equipment manufacturers.

In addition to the lamps listed in this catalogue, ARC manufactures other mercury, xenon, and mercury-xenon high performance lamps for laser and other electro-optical systems. Each lamp is optimized for spectral efficiency, operating life, and system mechanical and optical interfacing. In addition to our standard lines of high-intensity arc lamps, ARC designs and manufactures special lamps for new applications. We invite your inquiries and will provide application assistance.

Information furnished by Advanced Radiation Corporation is believed to be accurate and reliable; however, no responsiblity is assumed by ARC for its use.

Advanced Radiation Corporation

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