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Catalogue HBO

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Super Pressure Mercury Lamps

OSRAM



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HBO-Lamps without Starting Electrode

Lamp (Ordering Abbreviation)			Item No.	HBO 50 W/AC	HBO 50 W/3	HBO 75 W	HBO 100 W/2	HBO 200 W/2	
Type of Current			1	AC	DC	AC	DC	DC	AC [5]
Lamp Supply Voltage		U_V (V)	2	220	> 45	220	> 45	> 105	220
Operating Voltage of Lamp [1]	$\frac{L_1}{L_2}$	U_L (V)	3	39···45 34···39	22 rated value	51 ± 4	20 rated value	65···47	61 ± 4 53 ± 4
Operating Current at operating voltage range	$\frac{L_1}{L_2}$	J_L (A)	4	1,3 1,45	2,3	1,6	5,0 rated value	3,1···4,2	3,6 4,2
Rated Power of Lamp [1]		P_L (W)	5	50	50	75	100	200	
Luminous Flux		Φ (lm)	6	2000	1300	2650	2200	10 000	
Luminous Efficacy		(lm/W)	7	40	26	35	22	50	
Luminous Intensity vertical to lamp axis		I (cd)	8	230	150	270	260	1000	
Average luminance		L (cd/cm²)	9	30 000	90 000	6500	170 000	40 000	
Arc	width b x height h [4]	(mm)	10	0,3x1,0	0,2x0,35	0,7x2,8	0,25x0,25	0,6x2,2	
Average Lamp Life		(hours)	11	100	200	400	200 [3]	400	200
Diameter		d (mm)	12	9,5	9,5	30	10	17	
Length		l max. (mm)	13	53	53	122	90	128	
Distance center of arc to bottom of base		a (mm)	14	22,5 ± 2	22,5 ± 2	55,6 ± 0,5	43 ± 2	41 ± 2	
Width at starting electrode		b (mm)	15	–	–	–	–	–	
Permissible burning position stamped base down			16	vertical ± 45°	vertical ± 45°	vertical ± 15°	vertical ± 90°	vertical ± 45°	
Base			17	sleeve	sleeve	P28s	sleeve	sleeve with knurled nut	
Standard pkg. [2]		qty.	18	10	10	10	10	10	
Price each			19						

[1] Immediately after lamp starting, the operating voltage falls short of the rated value. During warm-up, it gradually rises to the value as mentioned in the table. Only after about 15 minutes, the warm-up of the lamp has finished. When using D. C., operate lamp with nominal wattage (see section "Ballasting Gear" on page 6).

[2] Also available in cartons containing one lamp only.

[3] Valid for a mean operating time of 2 hours per start. In the case of a mean operating time of 20 min. per start the average lamp life is reduced to 50% of the value stated (see section "Lamp Life" page 6).

[4] b = half width of luminance, h = electrode spacing at operating temperature.

[5] When operating a lamp on AC, starting is impeded (see section "Ignition" on page 7).

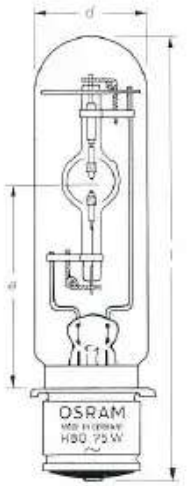
[6] Distance between the bottoms of bases approx. 25 mm shorter.

Sources of supply of auxiliary equipment (power supplies and ignition devices) are furnished upon request.

HBO-Lamps with Starting Electrode

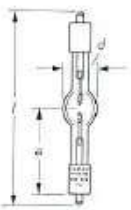
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HBO 200 W/4	HBO 350 W	HBO 500 W/2		HBO 100 W/1	HBO 200 W		HBO 500 W		No. Item
AC	DC	DC	AC	DC	DC	AC	DC	AC	1
220	> 125	> 140	220	> 45	> 105	220	> 140	220	2
61 ± 6 –	60···75	85···67	81 ± 4 73 ± 4	20 rated value	65···47	61 ± 4 53 ± 4	85···67	81 ± 4 73 ± 4	3
3,6 –	4,7···5,9	5,9···7,4	7,1 7,8	5,0 rated value	3,1···4,2	3,6 4,2	5,9···7,4	7,1 7,8	4
200	350	500		100	200		500		5
9500	19 500	30 000		2000	9500		28 500		6
47,5	55,5	60		20	47,5		57		7
950	2000	2850		260	1000		2850		8
33 000	40 000	30 000		170 000	40 000		30 000		9
0,6x2,2	0,6x2,2	1,1x4,1		0,25x0,25	0,6x2,2		1,1x4,1		10
200	400	400	200	100[3]	200		200		11
17	20	26,5		10	18		26,5		12
128	128	170		90	108[6]		170[6]		13
41 ± 2	47,5 ± 2	68 ± 2		43 ± 2	41 ± 2		68 ± 2		14
–	–	–		28	45		53		15
vertical ± 45°	vertical ± 15°	vertical ± 20°		vertical ± 45°	vertical ± 45°		vertical ± 20°		16
sleeve with knurled nut	sleeve with thread 8-32 UNC 3A	sleeve with knurled nut		sleeve	sleeve with knurled nut		sleeve with knurled nut		17
10	10	10		10	10		10		18
									19



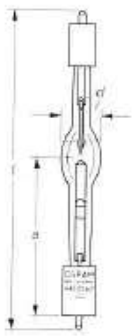
HBO 75 W

Fig. 7



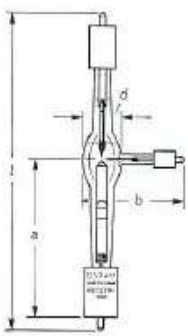
HBO 50 W/AC
HBO 50 W/3

Fig. 1



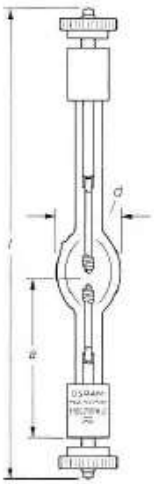
HBO 100 W/2

Fig. 2



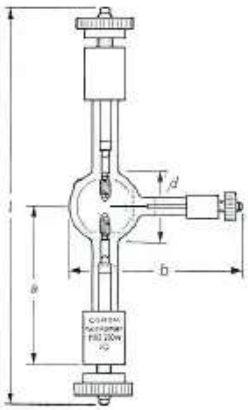
HBO 100 W/1

Fig. 3



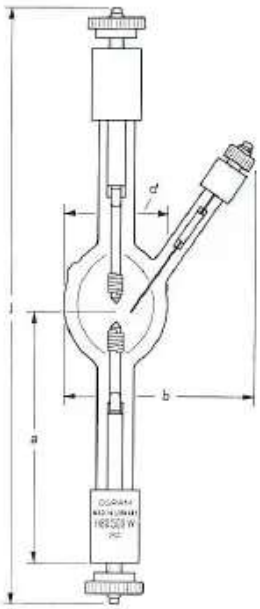
HBO 200 W/2
HBO 200 W/4
HBO 350 W
HBO 500 W/2

Fig. 4



HBO 200 W

Fig. 5



HBO 500 W

Fig. 6

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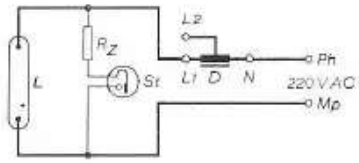


Fig. 8

For HBO 50 W/AC, HBO 75 W, HBO 200 W/4

Wiring Diagrams

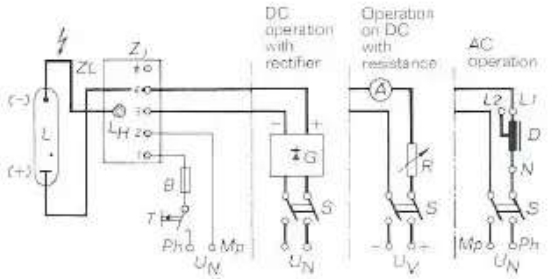


Fig. 9

For lamps with or without starting electrode

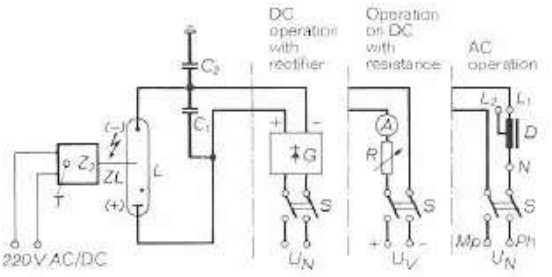


Fig. 10

For lamps with starting electrode

A = ammeter
B = fuse 3 amps
C_1 = coupling condenser c = 2500 pfd
C_2 = earthing condenser c = 2500 pfd
D = choke
G = rectifier
L = lamp
L_H = high voltage terminal
L_1, L_2, N = taps of choke
Mp = neutral lead
Ph = phase lead
R = resistance
R_Z = ignition circuit resistance 1000 Ohm ≧ 15 W
S = switch
St = CENTRA® starter St 192
T = push button
U_N = mains connection 220 V AC
U_V = supply voltage
Z_1 = super imposing ignition device
Z_2 = vibrator ignition device
ZL = ignition lead

To figs. 9 and 10:

Operation on DC:	HBO 50 W/3, HBO 100 W/1, HBO 100 W/2, and HBO 350 W.
Operation on either DC or AC:	HBO 200 W, HBO 200 W/2, HBO 500 W, and HBO 500 W/2.
Operation on AC:	HBO 50 W/AC, HBO 75 W, and HBO 200 W/4.

Relative Spectral Radiance Distribution of Super Pressure Mercury Lamps HBO

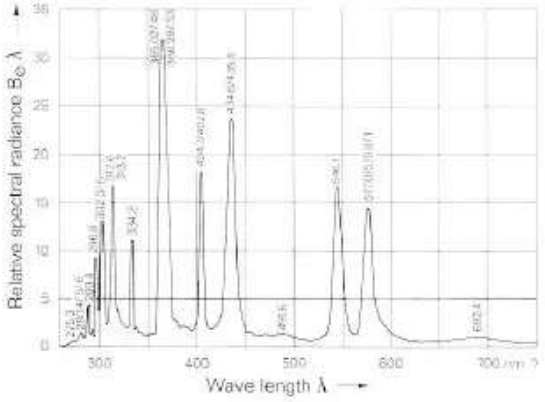


Fig. 11

1) 1 nm (nanometre) = 10 Angstroms = 10^{-9} metres.

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Super Pressure Mercury Lamps HBO are the result of research work and continuous further development carried out for many years. The most outstanding features of these lamps are: simple structure, very small dimensions, ease of handling, permanent readiness for operation; and by compressing the high powered discharge into a minimum space, an **exceptionally high radiance and luminance** could be achieved.

Special mention should be made of the intensity of radiation in the medium and long wave ultraviolet regions, and the ease of modulating the luminous flux up to 10^4 cps. Despite the high concentration of power in a very small envelope, HBO lamps will operate continuously without forced ventilation.

Among the DC/AC lamps, the HBO 200 W/2 and HBO 500 W/2 lamps are exceptionally well suited for operation on direct current. Besides the optical and constructional advantages for the installation of these lamps, operation on direct current offers further advantages as compared with AC-operation:

double lamp life, improved performance during starting and warming-up, better arc stability.

Application

Super Pressure Mercury Lamps HBO are of special importance wherever a source of radiation having a high luminance (visible region) or a high radiance in the medium and long wave ultraviolet regions is needed. Due to their small dimensions, the lamps can be used at short distance from any optical system with the result that an optimum utilization of the luminous or radiant flux is achieved. The various lamp models and wattages contained in the program of HBO lamps offer, therefore, a considerable selection for a wide field of application, e.g.

luminous recording instruments, light scanning devices
fluorescence microscopy
production of integrated semi-conductor circuits
micro and striae photography
interferometry and refractometry tasks
examination of fast moving processes
optical-electrical monitoring of production processes
testing of optical systems
micro film enlarging devices
and other special applications.

Technical Information

Description

HBO lamps have a spherical or ellipsoidal envelope made of fused quartz which contains a basic gas and an accurately dosed quantity of mercury. Basic gas and mercury vapour are under high pressure only when the lamp is operated.

The overall length of the lamp is mainly determined by the necessary temperature gradient between the electrodes and the lamp bases which governs the length of the foils.

The current-carrying foils are designed for the maximum lamp current existing during the warming-up period after starting (see section "Operation" on page 8).

The shape of the diametrically opposed electrodes is determined by the type of current for which the particular lamp type is suitable. For thermal emission reasons the HBO 100 W/1 and HBO 100 W/2 lamps have a very small cathode (negative electrode), whereas the anode is large to make possible a dissipation of heat.

The electrodes of lamps also suitable for AC operation have identical shapes as both of them are subjected to the same load.

The bases of HBO lamps serve as support and as current connection to the lamps. HBO lamps are equipped with sleeve bases. Types with higher wattages are additionally provided with a threaded pin with knurled nut for current connection.

The earlier lamp types HBO 100 W/1, HBO 200 W, and HBO 500 W have a starting electrode at the side of the envelope. These lamps can be started with a vibrator ignition device (see section "Ingition" on page 7).

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Light Intensity and Luminance

The light intensity has been measured vertically to the lamp axis at the level of the luminous arc. The values can be seen from line 8 of the table. The light intensity distribution of HBO lamps is almost spherically symmetrical with the exception of those segments of solid angle which are shadowed off by the main electrodes, or by the starting electrode in lamps of older design. Consequently, also the luminous flux, the luminous efficacy (lines 6 and 7 of table), and the radiant power of lamps without starting electrode are considerably greater than those of lamps with starting electrodes.

The values for the average luminance are stated on line 9 of the table. The reference area for determining the light intensity in order to establish the average luminance for each individual lamp type consists of a rectangular section of the arc formed by the height h (electrode spacing of a lamp in operation) and the half width of luminance b of the luminous arc. The size of the luminous area can be found on line 10 of the table.

The values for light intensity as stated on line 8 of the table are valid for the entire arc and are, therefore, higher than the light intensity derived from luminance and reference area.

The spatial distribution of luminance depends primarily on the type of current. When direct current is used, the spot of highest luminance is formed adjacent to the negative electrode whereas a maximum is formed adjacent to each electrode when the lamp is operated on alternating current.

Spectral Distribution of Radiation

The spectrum of radiation of the super pressure mercury discharge is – besides of its broad mercury line – practically continuous and extends from the ultraviolet through the visible into the infrared with more or less the same intensity. The visible proportion of the radiation produces a bluish-white light. The relative spectral distribution of the radiation of HBO lamps is shown in fig. 11.

Lamp Life

The values for the average lamp life as stated in the table (line 11) are based on a mean operating time of 2 hours per start; it is important that the minimum operating time is not less than 15 minutes (finished warming-up period).

If the number of starts is greater, or if with DC-operation the pulsation of current p_i exceeds the upper limit of 25%, the life of HBO lamps will be shortened.

In the course of lamp life, a thin layer of evaporated electrode material deposits on the inner wall of the envelope and causes a drop in the useful radiation. This gradual process can be slowed down by a lower number of starts, resp. – in the case of DC-operation – by a lower pulsation of current p_i.

Installation in Devices

Please, follow the Instructions for Use which accompany each lamp

The danger of glare ultraviolet radiation, and the high vapour pressure (only when the lamp is operated) necessitates the installation of lamps in housings provided with protected ventilating vents.

HBO lamps do not require forced cooling provided care is taken that with a proper supply and exhaust of cooling air the temperature of the bases does not exceed 230 °C during operation. If a cooling by blower is provided, care should be taken that the envelope is not touched by the forced air flow during warming-up and subsequent operation.

HBO lamps must be fixed at one end only in order to prevent the occurrence of stresses in the quartz body due to the different thermal expansion of the lamp and its metal parts. The current lead to the free base and possibly the starting electrode must be flexible and free of tensile stress.

Further information about lamp housings and installation of HBO lamps is contained in a paper titled "Guide for the Design of Equipment for Super Pressure Mercury Lamps HBO". Interested parties may apply for a copy. Upon request, housings or equipment can be tested and declared as suitable for operation with HBO lamps by the lamp manufacturer.

Ballasting Gear

Please note: The lamps are covered by a warranty only when the auxiliary equipment used provides proper operating conditions for the lamp type concerned.

Besides an ignition device (see section "Ignition"), also a ballast is necessary for operating HBO lamps.

When feeding the lamp from a direct current source with fixed output voltage (for instance a battery), a resistance must be inserted into the circuit. If the current is supplied across

a rectifier, the lamp current may either be limited with a resistance or inductively. The value of the particular ohmic resistance can be calculated from the difference between the existing supply voltage and the lamp operating voltage.

The operating voltage of HBO 50 W/3, HBO 100 W/1 and HBO 100 W/2 increases in the course of lamp life and makes necessary a reduction of the lamp current. Mains operating sets approved by the lamp manufacturer stabilize the lamp power within the determined limits.

When using AC, the ballasting gear consists of a choke specifically adapted to the lamp concerned. In view of the unavoidable deviations in operating voltage, a simple, permanently set choke cannot be used for HBO 50 W/AC, HBO 200 W, HBO 200 W/2, HBO 500 W, HBO 500 W/2. The chokes are, therefore, provided with two taps (marked L_1 or L_2) for the two operating voltage ranges of the lamps (see line 3 of table). According to its operating voltage (marking L_1 or L_2 on one of the knurled nuts and on the lower base; with HBO 50 W/AC on the upper base) the lamp shall be connected with the corresponding tap of the choke.

In order not to endanger the lamp if and when a short circuit to earth occurs, the choke should be wired into the phase lead and not into the neutral lead (see figs. 9 and 10).

Manufacturers of power supplies for HBO lamps are requested to apply for detailed information.

The lamp manufacturer is prepared to test auxiliary equipment and give its approval if all requirements for such equipment are met.

Ignition

The voltage required for starting HBO lamps is by far exceeding the supply voltage. The magnitude of the starting voltage depends on the starting conditions, i.e. whether a lamp shall be started only as long as it has a low internal pressure (in cold state) or also shortly after switching off when the internal pressure is very high (in hot state). Decisive for selecting a suitable ignition device or starter are:

type of lamp, design with or without starting electrode, length of ignition lead when using superimposing igniters.

The frequency and surge voltage of superimposing ignition devices (Z_1) are so high that at any time, i.e. also in a hot state, reliable starting is possible. The surge circuit is designed for a maximum length of the ignition lead of 0.5 meters. The spark gaps incorporated in such ignition devices are subject to wear, depending on number and duration of starts. Therefore, a spare spark gap should always be kept on hand. Further information is contained in the Instructions for Use supplied with the igniter.

Vibrator ignition devices (Z_2) serve to strike lamps with a starting electrode and may be connected on the low voltage end to either 220 V AC or DC. The high voltage terminal shall be connected with the starting electrode (see fig. 10). By briefly pressing down the push button (T), the ignition device (Z_2) is activated, and the lamp will start regardless of whether it is in a hot or cold state. Sufficient insulation of the ignition lead must be provided for (starting voltage about 15 kV) in order to prevent flashovers to grounded metal parts which generally will destroy the lamp. With ungrounded mains systems, the use of a protective circuit with two condensers C_1 and C_2 as shown in fig. 10 (page 4) is recommended also on that side of the igniter connected to the mains. To start HBO 100 W/1 in a cold state, it is sufficient to place the ignition device near the base of the starting electrode and to press down the push button.

Lamps without starting electrode HBO 50 W/3, HBO 100 W/2, HBO 200 W/2, HBO 350 W, and HBO 500 W/2 may be started either hot or cold by means of a superimposing ignition device. When operating HBO 200 W/2 on AC, starting is impeded. In order not to overload the ignition device, more than three attempts to strike the lamp with a duration of 5–6 seconds each in intervals of 1 minute each should not be made. These superimposing ignition devices are connected to 220 V AC by pressing down a push button (see fig. 9 on page 4). The lamp current flows through the output transformer whereby the upper lamp end should be connected with the high voltage terminal. Superimposing igniters are also suitable for starting lamps with a starting electrode, whereby the circuit needs not to be changed. Care should be taken however, when using this circuit that the free base of the starting electrode has sufficient distance from grounded metal parts.

CENTRA® starter St 192 serves to strike HBO 50 W/AC, HBO 75 W, and HBO 200 W/4 (see fig. 8). If the lamp should not start at the first attempt, the starter St 192 will switch-off automatically after a while. In order to get it ready for operation again, its push button must be pressed down. A hot lamp cannot be restarted with CENTRA® starter St 192; it must cool off first.

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Electrical Connection

Please note also section "Installation in Devices" on page 6.

Further important information about handling HBO lamps is given in the "Instructions for Use" supplied with each lamp.

HBO lamp models 50 W and 100 W are fitted with sleeve bases without threaded pin; it is advisable to fix one base by means of current-carrying clamping jaws. The current lead to the other base must be flexible. The higher wattage HBO models are provided with sleeve bases with threaded pin on which the electric leads (preferably cable lugs) are screwed on by means of the knurled nut.

The starting electrode of HBO 200 W and HBO 500 W is likewise fitted with sleeve bases and knurled nut.

At DC operation, the positive pole of the lamp supply voltage must always be connected with the stamped base which has to be positioned at the lower end.

When operating HBO 50 W/3, HBO 100 W/1, and HBO 100 W/2, the (thicker) electrode marked + must be positioned at the lower end (imprint on base to be upright). Reversed polarity will render these lamps useless instantaneously.

The starting electrode of HBO 100 W/1, HBO 200 W, and HBO 500 W must never be located above the luminous arc when the lamp is operated in an inclined position.

Operation
Warming-up Period

The housing must be closed before the lamp is put into operation.

After ignition, an arc discharge takes place in the basic gas. Because of the heating effect of the discharge, the accurately dosed quantity of mercury completely vapourizes within a few minutes (warming-up period). During this process, the discharge which was wider at the beginning will contract to a narrow luminous arc of high luminance. At the same time, the internal vapour pressure increases. The initial discharge operates at a voltage of about 15 V which gradually increases to a constant value (see line 3 on table). The rising voltage of the lamp reduces the lamp current from a higher initial value to its normal operating value. This warming up period is completely finished after an operating time of 15 minutes (minimum operating time per start).

General Information

Sales and delivery are subject to our Terms of Delivery and Payment valid on the day the sales contract was effected.

Operating data and dimensions are subject to the usual insignificant tolerances.

Technical modifications and possibility of delivery are reserved.

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