

# Mazda LAMP DATA SHEET

## Special Service POINTOLITE LAMPS

### General Description

The Pointolite lamp is an arc-incandescent lamp with a negative volt-ampere characteristic, the arc being formed and maintained between refractory conducting electrodes contained within a glass bulb filled with inert gas at a relatively low pressure.

The electrodes are rendered incandescent by the action of the arc, and serve as highly concentrated sources of light, the arc itself being practically non-luminous.

There are two distinct types, viz.

- (1) for d.c. operation.
- (2) for a.c. operation.

which are sub-divided into two groups, viz.

Group A - 2 electrode lamps comprising the 30 c.p. and 100 c.p. ratings for d.c. operation (see Fig. 1 and Fig. 2).

Group B - 3 electrode lamps comprising the 500 c.p. and 1000 c.p. ratings for d.c. operation, and the 150 c.p. rating for a.c. operation (see Fig. 3 and Fig. 4).

### Electrode Systems

The 2-electrode lamp possesses a positive electrode in the form of a Tungsten bead mounted on the extremity of a stalk of the same metal, and a negative electrode (known as the 'Ionizer') in the form of a coil of Tungsten wire, the extended end of which carries a protective sleeve composed of a mixture of oxides (see Fig. 1 and Fig. 2).

The 3-electrode lamp resembles the 2-electrode type, but has in addition to the bead and ionizer a third electrode in the shape of a Tungsten plate in the case of the 500 c.p. and 1000 c.p. lamps (see Fig. 3) and a Tungsten bead in the case of the 150 c.p. lamp (see Fig. 4).

### The Fundamental Circuit

Owing to the voltage required to initiate the arc being considerably in excess of the voltage required to maintain it, a resistor of suitable ohmic value is connected in series with the arc. Similarly, a resistor of suitable ohmic value is connected in series with the ionizer to limit the ionizer current to its correct value.

The circuit by which these conditions are satisfied is shown in Fig. 5.

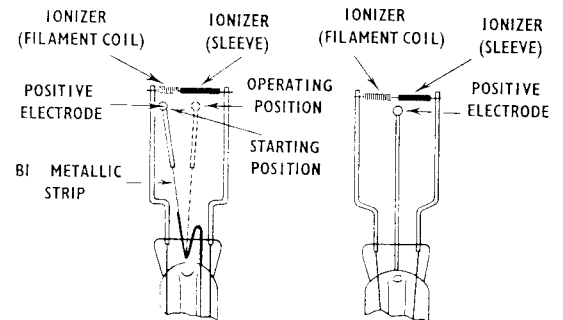
The ohmic values of the resistors required for any supply voltage can be calculated by the following formulae -

- If  $V$  = supply voltage  
 $I_i$  = ionizer current (amps.)  
 $V_i$  = ionizer voltage  
 $I_a$  = arc current (amps.)  
 $V_a$  = arc volts  
 $R_i$  = ionizer series resistor (ohms)  
 $R_a$  = arc series resistor (ohms)

$$\text{Then, } R_i = \frac{V - V_i}{I_i}$$

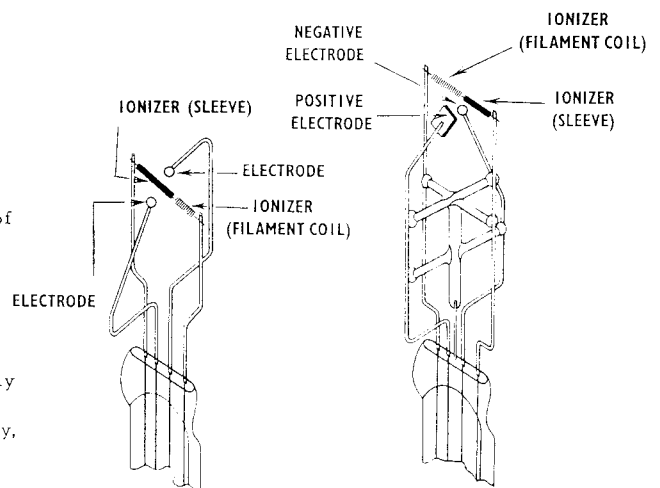
$$\text{and } R_a = \frac{V - V_a}{I_a}$$

The values of  $I_i$ ,  $V_i$ ,  $I_a$  and  $V_a$  will be found in the table of electrical characteristics.



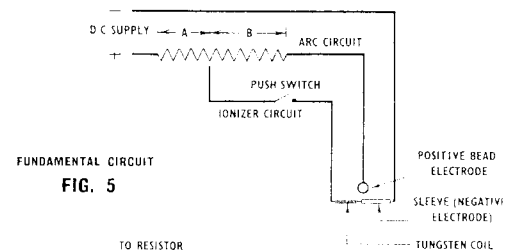
100 CP (MOVING ELECTRODE) FOR DC OPERATION  
FIG. 1

100 CP (FIXED ELECTRODE) FOR DC OPERATION  
FIG. 2

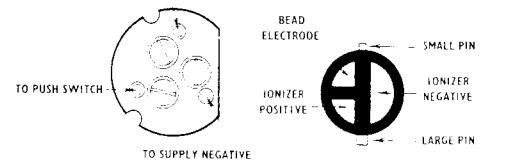


150 CP FOR AC OPERATION  
FIG. 4

500 CP and 1000 CP FOR DC OPERATION  
FIG. 3



FUNDAMENTAL CIRCUIT  
FIG. 5



REAR VIEW OF PORCELAIN INTERIOR OF SPECIAL BC LAMPHOLDER SHOWING WIRING TO CIRCUIT

PLAN OF 3 CONTACT BC CAP SHOWING CONNECTIONS TO ELECTRODES  
FIG. 6

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98-4

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**Standard Ratings and Types**

C. P. Rating	Supply Voltage	Cap	Bulb Shape	For operation on
30	100/120, 200/250	Special 3 contact BC	Tubular	d.c.
100	" "	" " " "	Spherical	d.c.
150	" "	" " " "	"	a.c.
500	" "	Special 4 contact GES	"	d.c.
1000	" "	" " " "	"	d.c.

**Starting and Operating**

30 c. p. and 100 c. p. lamps

The positive electrode of the lamp is electrically connected through a resistor of suitable value (according to the supply voltage) to the positive pole of the supply. One end of the ionizer is electrically connected direct to the negative of the supply, and the other end through a 'normally off' or push switch and a resistor of suitable value (according to the supply voltage) to the positive pole of the supply (see Fig. 5).

Upon temporarily closing the push switch, current flows through the ionizer, causing incandescence of the tungsten coil, thereby ionizing the gas in its vicinity.

On the push switch being released, a condition is obtained favourable for the formation of an arc, namely, a pre-heated negative electrode, a positively charged electrode and an intervening gas path ionized by emission from a hot body.

The arc forms between the ionizer coil and the tungsten bead and then moves over from the coil to the ionizer sleeve. It is important that this effect should be definite and complete in every case, since the coil portion of the ionizer while suitable for starting the arc, is quite unable to withstand the action of the arc for any length of time, while the ionizer sleeve being unsuitable for starting the arc, is most efficient as a negative electrode when the arc functions between it and the bead. This can be effected in two different ways, viz. :

(a) By means of a fixed positive electrode, suitably spaced relative to the junction of the ionizer coil and its protective sleeve (see Fig. 2), or;

(b) By means of a moving positive electrode. In this case, a short length of bimetallic strip is incorporated in the stalk carrying the tungsten bead, and the bead is initially set in position opposite the tungsten coil of the ionizer, where it remains when the lamp is not in operation. Upon striking the arc, the heat conducted from the incandescent bead causes the bimetallic strip to warp, thereby moving the bead (and with it the arc) to a position opposite a part of the protective sleeve of the ionizer, coming to rest approximately in the centre of the bulb (see Fig. 1).

Method (a) is employed in 30 c. p. and 100 c. p. (Fixed Electrode) Lamps.

Method (b) is used only in the case of the 100 c. p. ordinary type.

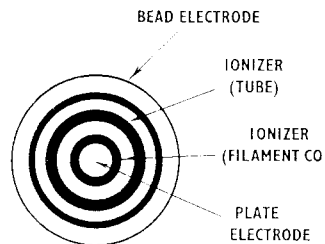
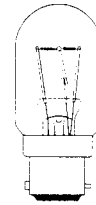
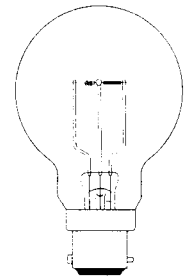


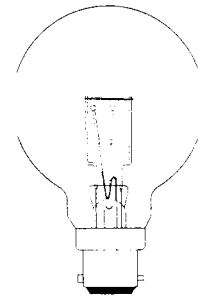
FIG. 7



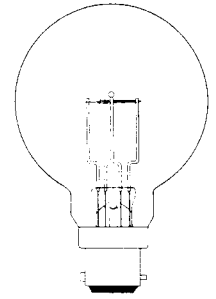
30 CP



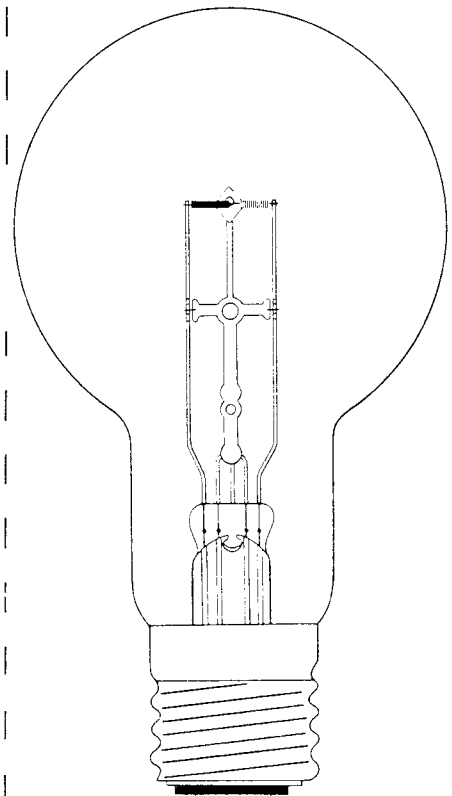
100 CP  
(FIXED ELECTRODE)



100 CP  
(MOVING ELECTRODE)



150 CP



500 CP  
1000 CP

### 500 c.p. and 1000 c.p. lamps

At first, an arc is formed between the ionizer as negative and the bead as positive electrode - the plate electrode being dead. Then, by means of a rotary rapid action switch, the ionizer is made dead, the incandescent bead is made negative and the plate the new positive electrode, the arc being formed between these. The plate electrode then becomes the main source of light.

All electrodes in the 3-electrode lamps are fixed, the motion of the arc from the ionizer coil to ionizer sleeve in the 'starting' stage of the Pointolite operation being effected in a manner similar to that employed in the 2-electrode Pointolite with fixed electrodes.

### 150 c.p. lamp

The Alternating Current type of Pointolite Lamp is similar to the 3-electrode direct current type, except that, instead of the plate electrode, the lamp has a second bead electrode which is of the same dimensions as the first (see Fig. 4).

The method of operation of the alternating current type Pointolite is the same as that employed in the 3-electrode direct current type.

Both beads are equally bright and either or both may be used as the source of light. All electrodes are fixed.

### Special Caps

The 30 c.p. and 100 c.p. lamps are usually fitted with a special 3-contact bayonet cap (see Fig. 6) having one large diameter and one small diameter pin. A special bayonet holder suitable for accepting this cap and having slots of dissimilar width and 3 plungers is necessary, in order to ensure the correct connection of the lamp to the circuit.

The 500 c.p. and 1000 c.p. lamps are fitted with a special 4-contact G.E.S. cap (see Fig. 7), the centre contact of which is connected to the plate electrode, the shell to the bead and the two concentric rings to the two ends of the ionizer.

The a.c. type of Pointolite (150 c.p.) is fitted with a 3-contact B.C. cap, the shell being used as an ionizer connection on starting the lamp. The alternating current Pointolite is quite satisfactory on all normal frequencies.

### General Applications

The Pointolite lamp has been successfully used for many years in most scientific and industrial laboratories. Its numerous applications include microscopy, metrology, mineralogy, pathology, etc.

It is particularly valuable for use with optical systems where a light source of high intensity and small magnitude is required.

As no adjustment of the arc is necessary, the lamp can be left unattended for any required length of time.

### Physical Characteristics

C.P. Rating	Dimensions (mm)			Positive Electrode shape and size	Average life (hours)
	Diam.	Overall length	Light centre length		
30	32+1	75 +5	60+5	Spherical 0.075" diam.	500
100	75+1	112.5±5	75+2	" 0.10" "	500
100	65+1	104.5+5	75+2	" 0.10" "	500
150	75+1	112.5+5	75+2	" 0.10" "	300
500	100+2	180 +5	134+5	Rectangular 0.25" x 0.25"	500
1000	150+2	230 +10	165+5	" 0.355" x 0.355"	500

### Electrical Characteristics

C.P. Rating	Volt drop across			Current (amps.)		
	Ionizer	1st arc	2nd arc	Ionizer	1st arc	2nd arc
30	7.0	45	-	4.5	0.45	-
100	7.0	45	-	7.0	1.35	-
150	7.0	50	50	7.0	2.0	2.0
500	7.0	45	50	7.0	2.0	5.0
1000	7.0	45	50	7.0	3.5	8.0

C. P. Rating	Cap	Nominal Bulb Diameter (mm)	A. E. I. L. L. No.	
			100/120V	200/250V
30	Spec. BC	32	98-3001	98-3002
100	" "	65	98-3011	98-3012
100	" "	75	98-3021	98-3022
150	" "	75	98-3031	98-3032
500	Spec. GES	100	98-3041	98-3042
1000	" "	150	98-3051	98-3052

### Spectrum

The Spectrum is continuous and approximates to that of a Tungsten Filament Lamp operating at a colour temperature of 2600/2700°K.

### Position of Operating

All Pointolite lamps are designed to operate in the vertical position with cap below. If operated in any other position, the internal structure of the lamp may become deformed, resulting in premature failure, accompanied by early bulb discoloration.

### Characteristics of Ultimate Failure

During the life of the lamp, tungsten particles are thrown off the positive electrode and adhere to the negative electrode. The positive (light giving) electrode thus becomes smaller and the light output falls to a point where it becomes economic to install a new lamp; also during life, bulb discoloration occurs, due to tungsten evaporation, but as this takes place in the upper hemisphere of the lamp, it does not interfere appreciably with its useful light output.

### Polarity

D.C. Pointolite Lamps will only operate when the correct polarity is applied.

If the arc does not readily strike during the normal ionizing period, it is an indication that it is incorrectly connected to the mains. In such cases, the connections of the resistance to the supply should be reversed.

### Periodicity of A.C. Supply

The 150 c.p. Pointolite is designed to operate on 50 cycle supply, but normal variation of periodicity above and below 50 cycles will not affect satisfactory operation.

### Control equipment

As control equipment for Pointolite lamps is not now manufactured by the A.E.I. Lamp and Lighting Co., circuit diagrams and resistor values are shown to enable potential users to construct control units.

The circuit diagrams show the connections to the resistors, rotary switches and lamp holders for all lamp ratings.

### Source of supply of components

Component	Source of Supply
3-plunger BC lampholder for 30 c.p. and 100 c.p. lamps Shrouded 3-plunger BC lampholder for 150 c.p. lamp 4-contact GES lampholder for 500 c.p. and 1000 c.p. lamps	A.E.I. Lamp and Lighting Co. Ltd., 44 Fitzroy Rd., London, N.W.1. or nearest Branch Office.
Spring loaded push switch for 30 c.p. and 100 c.p. lamps	Any manufacturer of electrical accessories.
6-contact rapid action Rotary switch for 150 c.p. lamp	Santon Ltd., Newport, Mon. Cat. No. 104.
9-contact rapid action Rotary switch for 500 c.p. and 1000 c.p. lamps	Santon Ltd., Newport, Mon. Cat. No. 105.
Resistors of the required ohmic value and current carrying capacity.	From any manufacturer of this class of material.

### Directions for starting and operating Pointolite Lamps

#### 30 c.p. and 100 c.p. lamps

Assuming that the control gear has been connected as shown in the appropriate circuit diagram:

- (1) Insert Pointolite lamp in lampholder and connect circuit to supply.
- (2) Depress push switch for about 3 seconds.
- (3) Release push switch. The arc should now be established between the Ionizer and the Tungsten bead, when the latter will increase in brightness until full light output is attained. The lamp will now operate continuously without attention.

#### 150 c.p. lamp

Assuming that the control gear has been connected as shown in the appropriate circuit diagram:

- (1) Insert Pointolite lamp in lampholder and connect circuit to supply, with the Rotary switch set at position marked 'OFF'.
- (2) Turn Rotary switch to position 1 to heat Ionizer.
- (3) After 3 to 4 seconds, switch to position 2 when an arc will be established between the Ionizer and one of the Tungsten beads.
- (4) After 10 to 15 seconds, switch to position 3 when the arc will be transferred to between the two Tungsten beads. The lamp will increase in brightness until full light output is reached, after which it will operate continuously without attention.
- (5) To extinguish the lamp, turn switch to 'off' position.

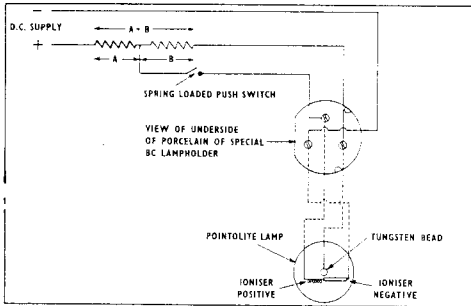
#### 500 c.p. and 1000 c.p. lamps

The instructions for starting and operating are the same as for the 150 c.p. lamp.

When the Rotary switch is in position 3, the arc operates between the Tungsten bead and the Tungsten plate.

Warning. 150 c.p., 500 c.p. and 1000 c.p. lamps must not, in any circumstance, be left in circuit except when the Rotary switch is in position 3.

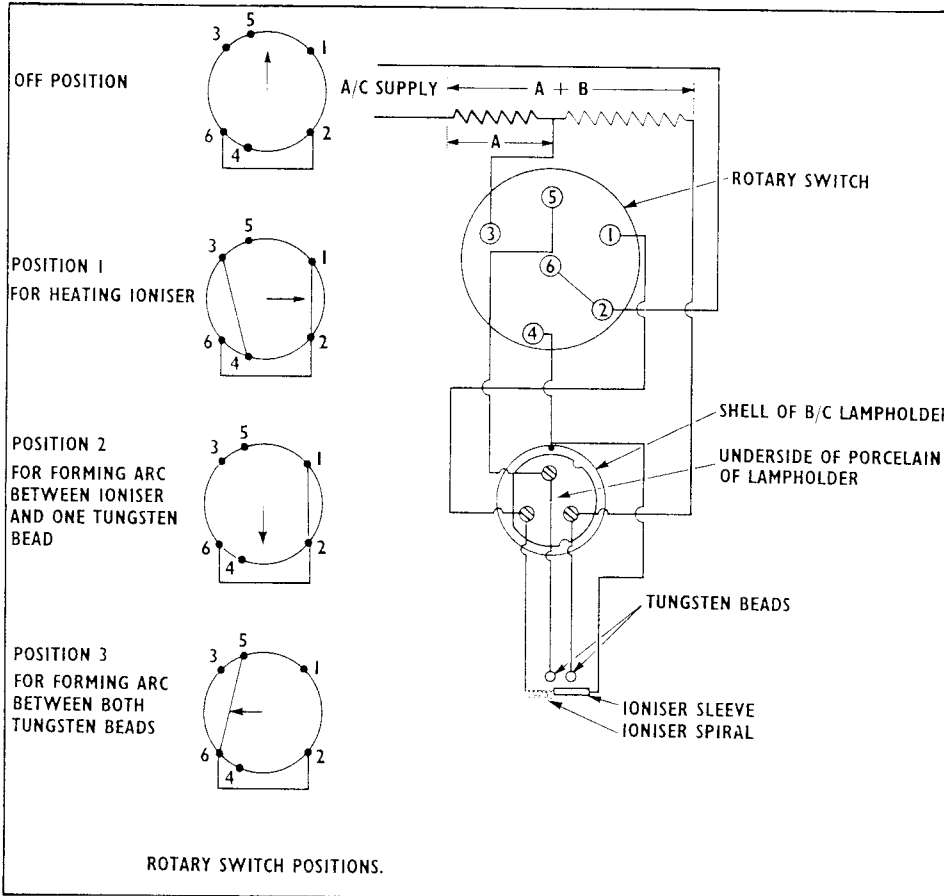
Note. In the case of 30 c.p., 100 c.p., 500 c.p. and 1000 c.p. lamps, all of which are designed for d.c. operation only, if the arc does not readily strike it is an indication that the polarity is incorrect and the connections to the supply should be reversed.



CIRCUIT DIAGRAM FOR  
30 CP and 100 CP LAMPS

RESISTOR VALUES FOR 30 C.P. AND 100 C.P. LAMP CIRCUIT.

	Supply Voltage	100	110	120	200	210	220	230	240	250
		Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms
30 C.P. Lamp	Ionizer Resistor A. To carry 4.5 amps	20.6	22.7	25.1	42.9	45.2	47.4	49.6	51.8	54.0
	Operating Resistor A+B To carry 9.15 amp	120.0	134.5	150.5	314.5	327.0	340.0	353.0	366.0	380.0
100 C.P. Lamp	Ionizer Resistor A To carry 7 amps	13.3	14.7	16.1	27.6	29.0	30.4	31.8	33.3	34.7
	Operating Resistor A+B To carry 14.35 amp	30.0	38.1	55.5	114.5	122.0	130.0	137.0	144.5	150.0

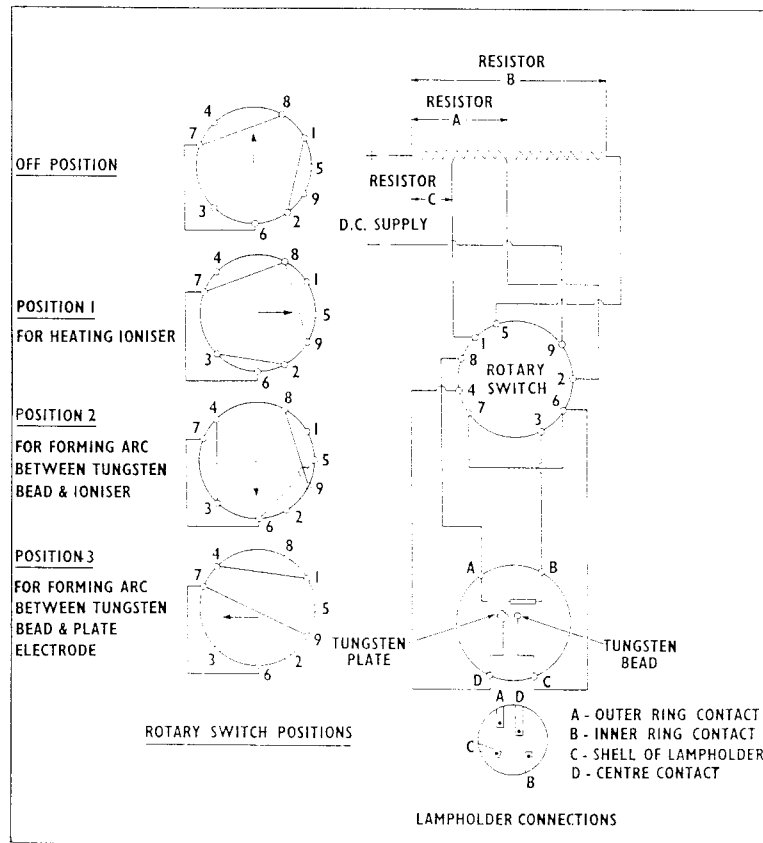


CIRCUIT DIAGRAM FOR  
150 CP POINTOLITE LAMP.

WITH RESISTOR VALUES FOR 150 C.P. LAMP CIRCUIT.

Supply Voltage	100	110	120	200	210	220	230	240	250
	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms
Ionizer Resistor A. To carry 7 amps	13.3	14.7	16.1	27.6	29.0	30.4	31.8	33.3	34.7
Operating Resistor A+B. To carry 2 amps	25.0	30.0	35.0	75.0	80.0	85.0	90.0	95.0	100

**CIRCUIT DIAGRAM FOR 500 CP  
and  
1000 CP POINTOLITE LAMPS**



**RESISTANCE VALUES FOR 500 CP LAMP CIRCUIT**

Supply Voltage	100	110	120	200	210	220	230	240	250
	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms
Ionizer Resistor A. To carry 7 amps	13.3	14.7	16.1	27.6	29.0	30.4	31.8	33.4	34.7
First Arc Resistor B. To carry 2 amps	27.5	32.5	37.5	77.5	82.5	87.5	92.5	97.5	102.5
Second Arc Resistor C. To carry 5 amps	10.0	12.0	14.0	30.0	32.0	34.0	36.0	38.0	40.0

**RESISTANCE VALUES FOR 1000 CP LAMP CIRCUIT**

Supply Voltage	100	110	120	200	210	220	230	240	250
	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms
Ionizer Resistor A. To carry 7 amps	13.3	14.7	16.1	27.6	29.0	30.4	31.8	33.4	34.7
First Arc Resistor B. To carry 3.5 amps	15.7	18.5	21.4	44.3	47.2	50.0	53.0	55.7	58.6
Second Arc Resistor C. To carry 8 amps	6.3	7.5	8.7	18.7	20.0	21.2	22.5	23.8	25.0