Osram-GEC

Information & Data

Low Pressure Sodium Lamps

Reference L4/HT

Issue 1 Oct 1969

ALL OSRAM LAMPS CONFORM TO BRITISH STANDARD SPECIFICATIONS WHERE APPLICABLE.

THE INFORMATION CONTAINED IN THIS BOOKLET SUPERSEDES ALL PREVIOUSLY PUBLISHED DATA.

REFERENCE TO A PARTICULAR TYPE OR WATTAGE DOES NOT IMPLY CURRENT AVAILABILITY.

Much information is published in this document concerning lamp performance and characteristics. In all such tables the information provided is typical of the product concerned and must not be interpreted as a guarantee of individual lamp characteristics or performance.

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OSRAM-G.E.C. LOW PRESSURE SODIUM LAMPS

I N D E X

1. SOURCE OF RADIATION.

The low pressure Sodium Lamp derives practically all of its visible radiation from the excitation of sodium atoms. The vapour pressure of the sodium is carefully controlled at $^{1}/_{152,000}$ of an atmosphere. If the pressure is lower then there will be insufficient sodium atoms to carry the current and the lamp will appear red. Likewise if the pressure is too high absorption of the visible radiation by the excess sodium atoms will occur and lead to low lamp efficiency.

II. RANGE.

The range of Osram Low Pressure Sodium Lamps is as follows:-

SO/H — Known as the Dewar Type having a detachable outer vacuum jacket which conserves the heat generated by the inner. The inner, on failure can be replaced without loss of the outer jacket.

SOI/H — Known as the "Integral" lamp, it is similar to the "Dewar" type except that it is a complete entity and it is not possible to replace the arc tube alone on failure. The improved heat conservation results in the increase of lamp efficacy and better striking characteristics.

SUPER SOX — An improved form of the SOI lamp resulting in further increases in lamp efficacy.
The range is designed to replace existing SOI lamps. Although the wattage consumed by a SUPER SOX lamp is much lower than that of the lamp it replaces the light output is higher; it also has the same dimensions.

SLI/H — The "Linear" type. In this lamp the arc tube is not in the 'U' form as with the previous types but is straight and has depressions which effectively divide the tube into chambers so preventing sodium migration.

III. CONTROL GEAR AND CIRCUITRY.

All Sodium lamps require control gear to operate the lamp at the correct current. The most common type of control gear used in conjunction with lamps having a 'U' form of arc tube is a leaky reactance transformer, which has an open circuit voltage sufficient to strike the lamp but has a secondary current which is correct for the lamp. A typical circuit is shown in FIG.I.

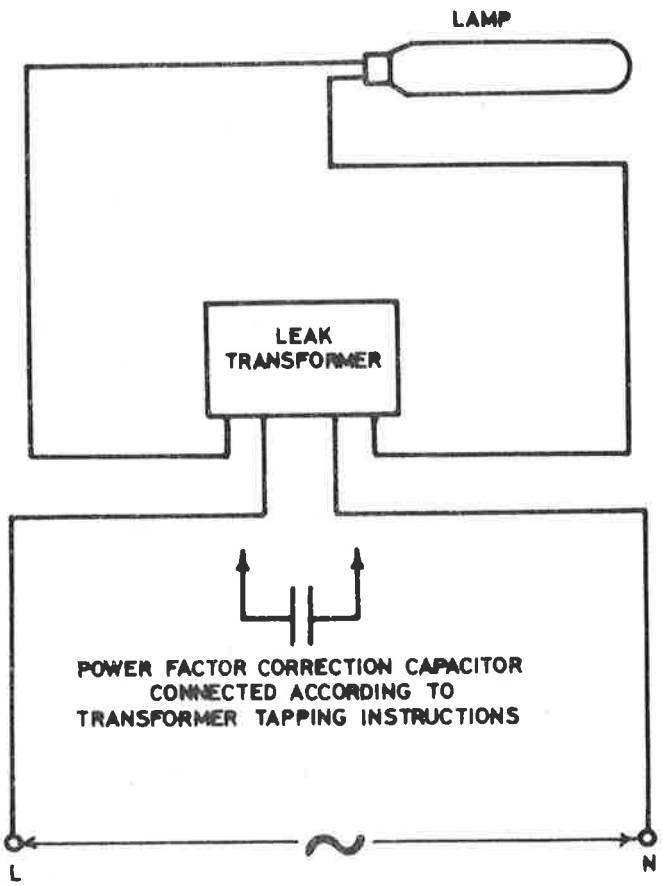


Fig.I Typical circuit for low pressure sodium lamps using leaky reactance transformer.

Linear types sometimes use a circuit similar to that employed with fluorescent tubes. A typical circuit is shown in Fig. II.

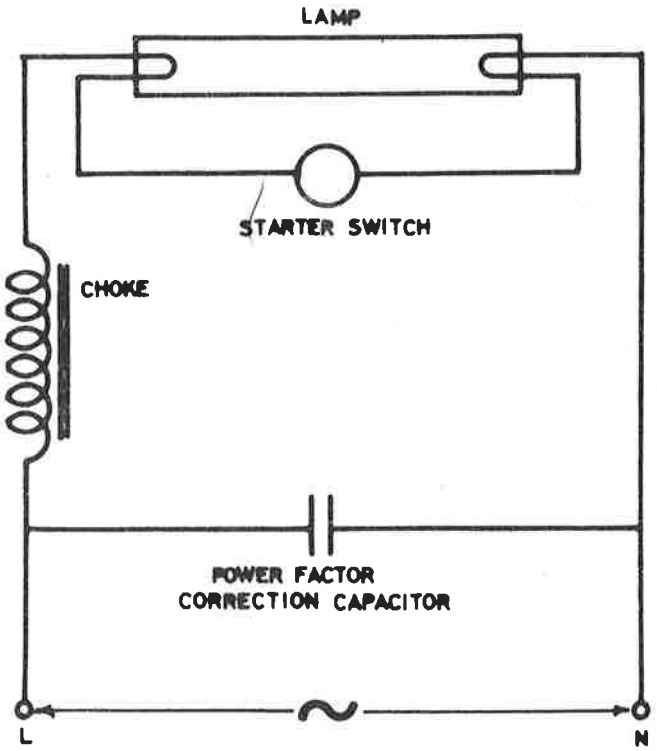


Fig.II Typical circuit for Linear types of low pressure sodium lamps using choke and starter switch.

NOTE: It will be appreciated that the wattage at which the lamp runs is a feature of control gear, circuitry and lamp design.
Lamps of different wattages are often operated from the same piece of control gear with or without circuit modifications made by altering gear tappings.

IV. POWER FACTOR CORRECTION.

Power factor correction capacitors are a requirement by the electrical supply authorities. Usually their inclusion or otherwise has no effect upon the performance or characteristics of the lamp.

With the SO/H and SOI/H types the control gear is designed for a particular wattage and the incorporation of the maker's recommended p.f. correction capacitor usually gives acceptable correction to the order of 0.85 - 0.9 lagging.

The substitution of the lamp with a SOX type at a lower wattage reduces the power factor and extra correction is necessary. Often it is not possible to restore the power factor to its original value.

The SOX and SLI types which were not intended as substitutions are used with control gear designed specifically for the wattage of the lamp and acceptable power factor correction is usually achieved.

V. STRIKING MECHANISM.

The initiation of an arc in a sodium lamp is made in neon/argon gas.

The ionisation of the neon gas follows and later the vaporisation and ionisation of the sodium vapour. Except in a few instances with the SLI lamp there is no pre-heating of the cathodes and some form of starting aid is usually necessary in order that striking may take place with the voltage available. Generally this is provided by extending the connection to one or both lamp cathodes along the side of the arc tube to effectively reduce the impedance of the lamp at starting.

In the SUPER SOX and Linear types advantage is taken of the conductivity of the heat reflecting film to assist starting.

VI. STARTING CHARACTERISTICS.

As the vaporisation of the metallic sodium takes several minutes the lamp is not run up until about 15 minutes after striking.

The characteristics and lumen output of the lamp during this "Warming Up" period are indicated in FIG.III.

It should be noted that there is little change in electrical characteristics during the warm up period.

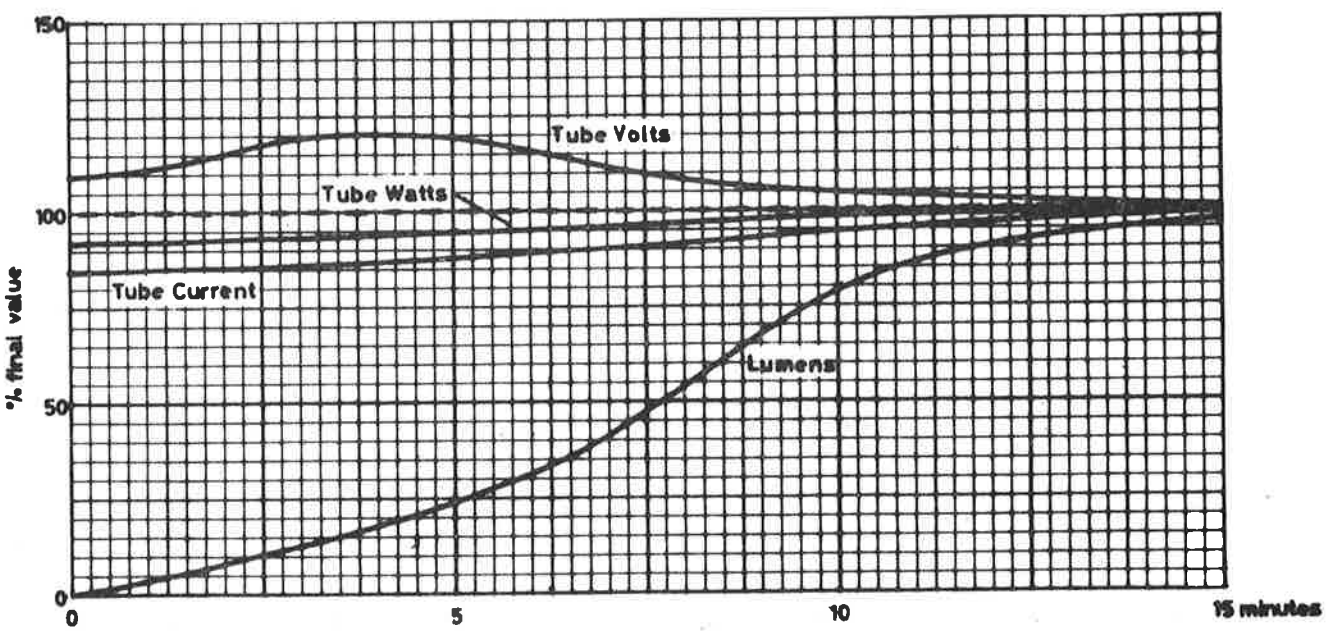


Fig.III Typical "run-up" characteristics of low pressure sodium lamps.

VII. MAINS FUSING.

As stated in Para. VI, due to the absence of any current surges immediately after striking (unlike high pressure mercury vapour lamps) it is not necessary to cater for any currents beyond the normal mains starting current.

VIII. RE-STRIKING.

One of the essential requirements of a low pressure sodium lamp is that the vapour pressure must be kept low in order that there is the minimum amount of visible radiation absorbed by neutral sodium atoms.

With such a low pressure, re-switching a lamp within one minute after switching off is usually possible. Only in extreme conditions where the ambient temperature in the immediate vicinity of the lamp is high is it likely that a waiting time for the lamp to cool will be necessary.

IX. OPERATING CONDITIONS.

(a) Effect of temperature.

(i) Starting - usually there is sufficient voltage at striking to overcome the affect of high or low temperature. Only under conditions of extreme temperature variations is it likely that low pressure sodium lamps will fail to strike. Such conditions will not be encountered in other than very special circumstances.

(ii) Lumen output - the performance of arc tube itself is very sensitive to variations in temperature but the surrounding vacuum provides reasonable protection against such variations. At very low temperatures the lamp will appear red due to insufficient vaporisation of the sodium. At very high temperatures the light output will be reduced due to absorption by neutral atoms.

(b) Effect of voltage variations.

Variations in mains voltage affect the characteristics and performance of a low pressure sodium lamp in accordance with the typical curves shown in Fig. IV. Only very high voltages are likely to cause damage to the lamp and reduce its life.

(c) Burning Positions.

See under individual lamp types the permitted burning positions.

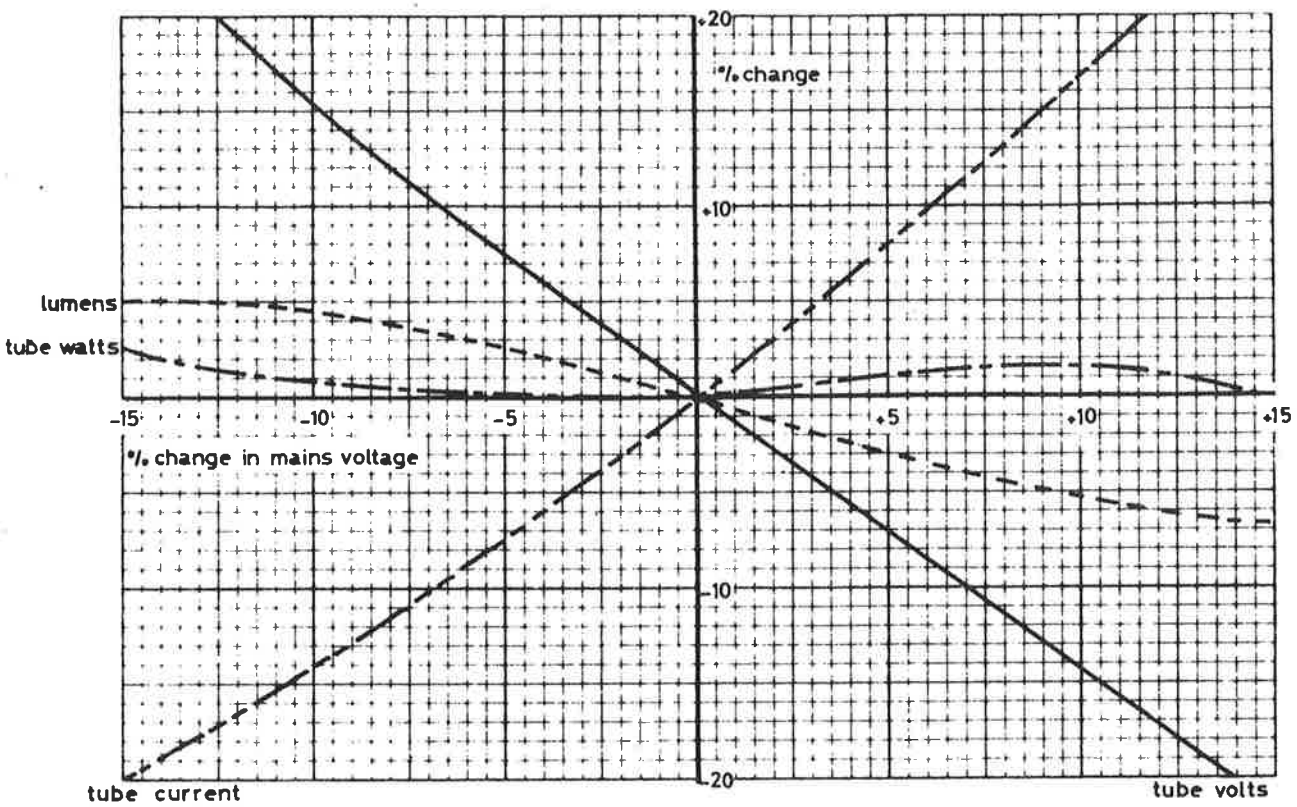


Fig. IV Typical effect of mains voltage variation on lamp characteristics.

(d) Vibration.

Mechanically the low pressure sodium lamp is strong and is not affected by normal vibration. The sodium is however in molten form when the lamp is running and is sensitive to vibration. It is important that the sodium is not dislodged from its position. Generally, sodium lamps should not be used in conditions of vibration (except the SUPER SOX type) in a vertical cap-up position.

(e) Unprotected lamps.

The wattage loading of sodium lamps being low the temperature of the bulb is low and is therefore unaffected by rain. Although desirable protection of low pressure sodium lamps against the weather is not essential.

(f) d.c. Operation.

Whilst control gear can be designed to run sodium lamps on d.c. supplies, such a use is not recommended. Gas separation and sodium migration to one cathode will result. If the use of d.c. is unavoidable consult your local Osram Sales Office.

(g) Stroboscopic effect.

Although low pressure sodium lamps are not usually employed in situations where stroboscopic effects are likely to be embarrassing, such effects are present and precautions such as mixed phases should be taken if necessary.

(h) High Frequency Operation.

Sodium lamps can be run on high frequency supplies; but the design and manufacture of suitable control gear is likely to be so expensive that it may be preferable to convert the supply to the more usual 50 Hz and to use standard gear.

(i) Radio Interference.

The usual distance between sodium lamps and radio or television receivers is such that it is rare that there is interference by radiation from the lamp. On such occasions a lamp nearing the end of its life is generally the cause. The remedy being to replace the lamp.

Mains borne interference is attenuated by the use of standard symmetrically wound transformers.

X. PRECAUTIONS.

(a) Disposal of Lamps.

Sodium reacts very violently with water. The chemical action generates so much heat that great care must be exercised when dealing with sodium.

When disposing of failed lamps it is strongly recommended that the sodium is made innocuous. This is affected by breaking the lamp in a receptacle and adding water at a slow rate to produce a controlled reaction. The operator should be protected and position himself some distance from the lamp.

(b) Effect on foliage.

Often low pressure sodium lamps are positioned in close proximity to foliage of trees and shrubs. It should be noted that the illumination from the lamps during autumn can promote extra growth which could be killed off by frosts.

XI. COLOUR.

Nearly all of the visible radiation from a low pressure sodium lamp is in two spectral lines 5890 Å and 5896 Å. Although the radiation is very close to the point of maximum response of the eye and therefore the efficacy is high the radiation is nevertheless nearly monochromatic and colour rendition is poor. Only colours in the yellow-orange region being reproduced with any similarity to that under natural light.

XII. LIFE.

(a) Failure Rate.

The percentage survivor rate of Osram low pressure sodium lamps is indicated in Fig. V. The average life, being where there is 50% survivors is in excess of 6000 hours.

All Osram low pressure sodium lamps are guaranteed to give 4000 hours of life. Any lamp which does not give this life will be replaced free of charge with a lamp carrying a similar guarantee.

This guarantee is subject to the use of lamp with control gear that ensures the lamp runs at the correct electrical characteristics, operation within the permitted burning positions and normal operating conditions.

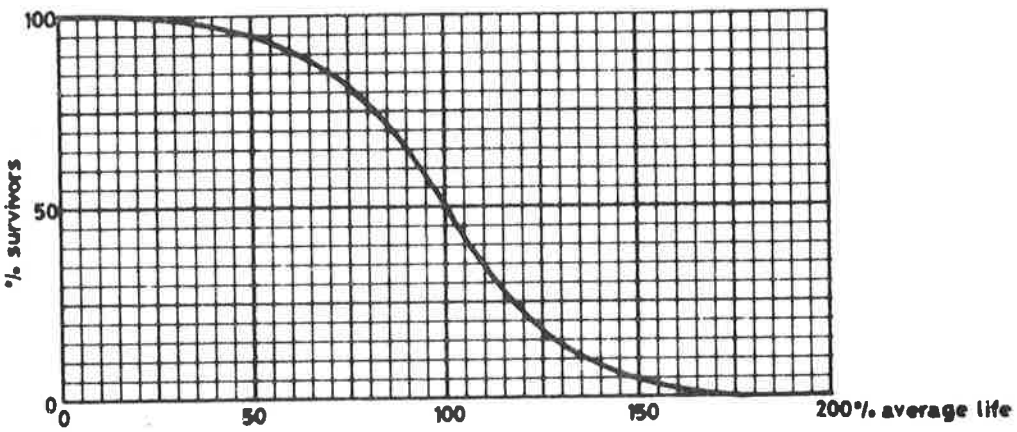


Fig. V. Typical survivor curve for Osram Low Pressure Sodium lamps.

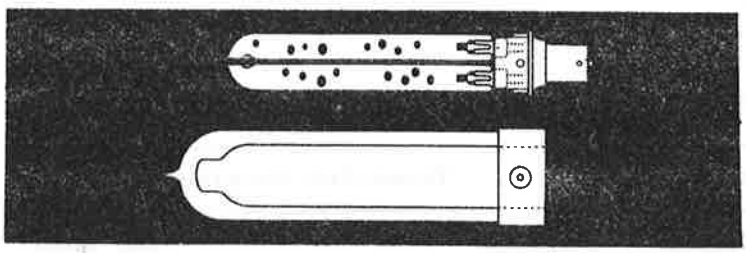
(b) Electrical Characteristics.

There is little change in electrical characteristics - including wattage - with Osram SO/H, SOI/H, SUPER SOX and SLI/H types.

Generally if there is a change, the tendancy is for the wattage to fall during life.

XIII. OSRAM LAMP TYPE SO/H (DETACHABLE JACKET)

Range 45W
60W
85W
140W



XIII. LAMP TYPE SO/H (DETACHABLE JACKET)

(a) Dimensions (in millimetres)

Wattage	Overall Length	Diameter (Nominal)	Light Centre Length (Nominal)
45	238 ± 10	50	140
60	300 ± 10	50	170
85	415 ± 10	50	230
140	518 ± 10	65	280

(b) Capping

All Osram SO/H (detachable jacket) lamps have a Ceramic Bayonet Cap.

(c) Electrical Characteristics

Wattage	Mains		Lamp	
	Volts	Current	Volts	Current
45	240	0.32	80	0.6
60	240	0.41	110	0.6
85	240	0.51	165	0.58
140	240	0.82	165	0.9

The measurements given above are with p.f. correction capacitor in circuit on lamps fully run-up. The difference between starting and running characteristics is indicated in Fig IV.

(d) Lumen Output

Lamp Wattage	Initial	Lighting Design
45	2,950	2500
60	4,450	3750
85	7,000	5950
140	11,500	9800

The final lumen output at objective life is of the order of 70% of initial.

(e) Burning Position

Lamp Wattage	Permitted Burning Position
45	20^{o} from horizontal (cap down) to vertical (cap up)
60	" " "
85	20^{o} from horizontal (cap up or down)
140	" " "

(f) Life

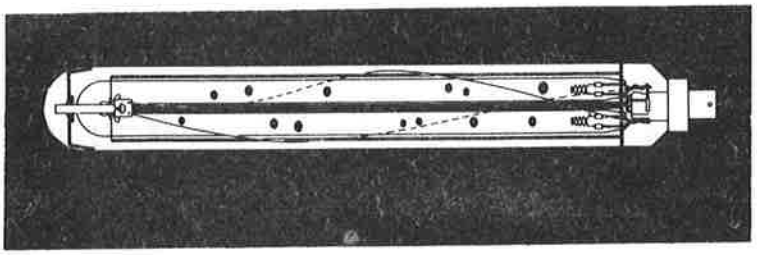
See Para. XI.

(g) Colour

See Para X.

XIV. OSRAM LAMP TYPE SOI/H (INTEGRAL)

Range 45W
60W
85W
140W



XIII. LAMP TYPE - SOI/H (INTEGRAL TYPE)

(a) Dimensions (in millimetres)

Wattage	Overall Length	Diameter (Nominal)	Light Centre Length (Nominal)
45	238 ± 10	50	140
60	300 ± 10	50	170
85	415 ± 10	50	230
140	518 ± 10	65	280

(b) Capping

All Osram SOI/H (Integral) lamps have "Micalex" Bayonet Caps (B.C.).

(c) Electrical Characteristics

Lamp Wattage	Mains		Lamp	
	Volts	Current	Volts	Current
45	240	0.32	80	0.6
60	240	0.41	105	0.6
85	240	0.51	144	0.68
140	240	0.82	160	0.9

The measurements given above are with p.f. correction capacitors in circuit on fully run-up lamps.

The difference between starting and running characteristics is indicated in Fig.II.

(d) Lumen Output

Lamp Wattage	Initial	Lighting Design
45	3300	2800
60	4600	3900
85	7500	6400
140	12400	10600

The final lumen output at objective life is of the order of 70% of initial.

(e) Burning Position

Lamp Wattage	Permitted Burning Position Limits
45	20^{o} from horizontal (cap down) to vertical (cap up)
60	" " "
85	20^{o} from horizontal (cap up or down)
140	" " "

(f) Life

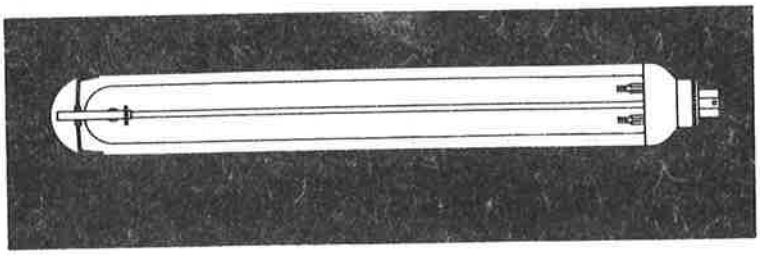
See Para XI.

(g) Colour

See Para X.

XV. OSRAM LAMP TYPE SUPER SOX

Range 35W
55W
90W
135W
180W



XV. LAMP TYPE - SUPER SOX

(a) Dimensions (in millimetres)

Wattage	Overall length	Diameter (Nominal)	Light Centre Length (Nominal)
35	300 ± 10	50	170
55	415 ± 10	50	230
90	518 ± 10	65	280
135	765 ± 10	65	405
180	1110 ± 10	65	575

(b) Capping

All Osram Super SOX lamps have Ceramic or "Micalex" Bayonet Caps (B.C.)

(c) Control Gear

Some control gear is interchangeable with different wattages and types of Sodium Lamps. An indication of the lamps that can be used with various types of control gear is given in the following table.

Wattage and type of lamp for which control gear was designed	Wattages and types of lamps that can be used with particular control gear
45W SO/H / SOI/H	45W SO/H & SOI/H
60W SO/H / SOI/H	60W SO/H & SOI/H, 35W SOX & SUPER SOX
85W SO/H / SOI/H	85W SO/H & SOI/H, 55W SOX & SUPER SOX
140W SO/H / SOI/H	140W SO/H & SOI/H, 90W SOX & SUPER SOX

(d) Electrical Characteristics

Lamp Wattage	Mains		Lamp	
	Volts	Current	Volts	Current
35	240	0.32	70	0.6
55	240	0.40	109	0.6
90	240	0.64	112	0.95
135	240	0.84	164	0.95
180	240	1.3	240	0.91

The measurements given above are with p.f. correction capacitors in circuit on full run-up lamps.

The difference between starting and running characteristics is indicated in Fig. II.

(e) Lumen Output

Lamp Wattage	Initial	Lighting Design
35	4600	4500
55	7650	7500
90	12750	12500
135	22000	21500
180	30600	30000

The final lumen output at objective life is 94% of initial.

(f) Burning Position

All ratings can be operated between 20° above horizontal (cap down(to vertical (cap up)

(g) Life

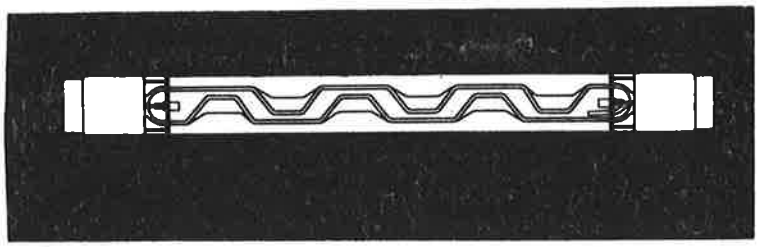
See Para XI.

(h) Colour

See Para X

XV1. OSRAM LAMP TYPE SLI/H (LINEAR)

Range 60W
160W
200W



XVI. LAMP TYPE SLI/H - LINEAR

(a) Dimensions (in millimetres)

Wattage	Overall Length (Max)	Diameter (nominal)
60	419	38.0
160	901.7	38.0
200	901.7	38.0

Note The overall length of a linear solium lamp is measured from one cap face to extreme end of pins on other cap.

(b) Capping

All Osram SLI/H lamps have Bi-pin caps with "non-tracking" insulators.

(c) Electrical Characteristics

Lamp Wattage	Mains		Lamp	
	Volts	Current	Volts	Current
60	240	0.4	82	0.83
160	240	0.9	195	0.94
200	240	1.3	135	1.6

(d) Lumen Output

Lamp Wattage	Initial	Lighting Design
60	6000	5700
160	18500	18000
200	20500	20000

The final lumen output at objective life is 90% of initial.

(e) Life

See Para. XI.

(f) Colour

See Para X.

XVII. APPLICATIONS.

The low pressure sodium lamp is one of the most efficient light sources, but at the same time has very poor colour rendition.

The application of this lamp is therefore limited to those situations where light has to be produced as economically as possible and where colour rendition is not important.

The lamp is eminently suitable for road and area lighting.

The preference for a particular type depends essentially on economic grounds bearing in mind energy charges and lantern and lamp costs to obtain the desired level of illumination.