Super MetalArc

SYLVANIA GTE

A. Short History of Metal Halide

This Technical Brochure sets out to describe and inform Specifiers and Users about the Sylvania Super MetalArc programme. MetalArc and Super MetalArc are the brands used by Sylvania for their ranges of Metal Halide Gas Discharge Lamps.

Today Metal Halide (M.H.) lamps are the most efficient white light sources available. Whereas the first commercially available M.H. lamps were designed largely for outdoor use, today the latest developments in manufacturing processes and lamp chemistry are enabling compact, low power sources to challenge the traditional Incandescent Display lamp for new projects. It is likely that MetalArc lamps will revolutionize commercial lighting practice in the late 1980's and early 1990's.

Investigations into the effects of adding metal iodides to a Mercury Discharge date back as far as 1911. It was only in 1962 that the lamps were commercially perfected. During this time lapse significant advances in gas-phase chemistry, electrode metallurgy and design and also thermodynamics were needed. Although M.H. lamps look like modified Mercury types they are truly new inventions.

For more than twenty years, until the early 1980's, Metal Halide lamps were used in exterior Floodlighting for large and small stadia and sports grounds of all descriptions. Much of the technical effort (in Europe) was expended in the area of design and manufacture of lamps compatible with the requirements for Colour TV Outside Broadcast. Even today groups of lamps with different additives and colour temperatures are used and compete with each other.

Only recently have Commercial Indoor Metal Halide light sources appeared on the European Lighting scene. The requirements for Indoor work are stringent as for example in the merchandising of clothing. It is only recently that lamps of the right lumen package, colour rendering characteristics and operating stability — perhaps the most important feature — have become available. Among these the Sylvania MetalArc and Super MetalArc stand out. The Sylvania M100 MetalArc for instance offers the highest efficacy of any lamp of comparable power rating.

The Range

Super MetalArc lamps are particularly suited for the general lighting of commercial and industrial interiors. Three wattages are available 175, 250 and 400. Three forms of the product are available in the 175 – 400W types, these are:-

(a) Clear lamps for good optical control.
(b) Coated 4K lamps for reduced glare and improved colour rendering.
(c) 3K coated lamps to create a warm looking environment for commercial interiors. The range in full is set out below:-

B. Principles of the Metal Halide Discharge

A popular method of analysis used to detect the presence of a wide variety of elements is to examine their "resonance emission" spectra. When raised to the gas-phase temperature, most metals give out a characteristic line emission spectrum which can be thought of as the "signature" of that particular metallic element.

A Metal Halide lamp contains a "cocktail" of metals in the form of iodides. The combination of metals has been chosen with a number of specific objectives in mind. Among these are:-

— **Colour**
The dosage of the metals, in order to give an acceptable colour, is so arranged that the dissociated gas-vapour partial pressures favour their optimum emission. Their cold vapour pressures in the iodide form must also enable easy lamp starting. Their spectra must show strong emission in the 400 – 700nm range to give "white" light.

— **Lamp Stability**
Gas discharge lamps operate by means of the "excitation" (or energy exchange process) of the gaseous metallic ion ingredients in the discharge tube by the passage of an electric current in the form of a controlled arc discharge.

An arc discharge may be either "wall" or "arc" stabilized. In the latter case a highly constricted arc is produced which occupies the axis of the arc tube lying between the electrodes. The temperature of the core of the discharge is intense but a high radial temperature gradient to the arc tube wall can produce "dumping-out" of some ingredients causing momentary colour shift. Wall stabilized arcs tend to avoid this problem and the use of sodium iodide helps to produce a wall stabilized arc in addition to its contribution to the lamp spectrum. Lamp stability is further affected by the control gear design concept and its ability to cope with mains voltage variation.

Sylvania Code Number	Ordering Abbreviation	Description	100 hour Lumens	CRI	Pack Quantity
20600	MS175/3K/HOR	175W Coated 3200°K Horizontal burning only	14,000	70	6
20601	MS250/3K/HOR	250W Coated 3200°K Horizontal burning only	21,500	70	6
20602	MS400/3K/HOR	400W Coated 3200°K Horizontal burning only	36,000	70	6
20621	MS250/3K/BU	250W Coated 3200°K Base Up burning only	20,500	70	6
20603	MS400/3K/BU	400W Coated 3200°K Base Up burning only	37,000	70	6
20605	MS250/C/HOR	250W Coated 3700°K Horizontal burning only	23,000	70	6
20606	MS400/C/HOR	400W Coated 3800°K Horizontal burning only	40,000	70	6
20607	MS400/C/BU	400W Coated 3500°K Base Up burning only	40,000	70	6

C. The Super MetalArc System: General Notes

In his authoritative book on the subject, Dr. John Waymouth (Director of Research for Sylvania) mentions that Sylvania began additive experimentation with the iodides of 59 different metals. After considerable work Sylvania opted for an additive system containing mercury and iodides of **sodium** and **scandium.**

Scandium is a strong blue radiator with complementary green and near-red lines. Sodium radiates strongly in the orange-yellow-red and mercury has several lines in the ultra violet and green-blue. Extra red content can be supplied by a lamp phosphor coating.

Although these metals are active in the discharge in dissociated ionic form they are dosed into the arc tube as iodides. In this halide-salt form they have a lower cold vapour pressure to aid starting, they dissociate well at high arc temperatures to liberate metallic ions and reconstitute in the cooler zones near the arc tube wall so preventing arc tube wall blackening. Also the iodides are generally less reactive than the metallic element form with the arc tube materials.

Much has been written about alternative additive systems and their relative defects and merits. Lamp stability and consequent colour stability during life are the only criteria a user will apply to a choice of brand and lamp type. For this reason Sylvania Super MetalArc lamps are manufactured with sodium-scandium iodides.

Mercury also plays an important role. The presence of mercury vapour in the discharge slows the diffusion rate of the metallic ions from the core of the discharge to the wall of the arc tube. When cold the mercury absorbes excess-free iodine which would lead to difficult starting.

The MetalArc lamp has a quartz arc tube which is slightly smaller than that of the same wattage Mercury lamp. The arc tube contains argon gas and mercury plus sodium iodide and scandium iodide as additives. These materials are responsible for the outstanding performance of this remarkable light source. The ends of the arc tube have a heat reflecting coating to control the temperature of these areas during operation. Temperature control is essential to the MetalArc lamp's operation and is discussed in the next section.

The MetalArc lamp uses a split frame support construction. This is necessitated by the high electrochemical activity of the additive system which requires maximum possible isolation of metal parts from the arc tube. The arc tube harness includes spring supports at the neck and dome, which make the mount structure very durable and resistant to rough service and vibration.

The bimetal shorting switch in the MetalArc lamp closes during lamp operation, providing a short circuit between the starting electrode and the adjacent main electrode. This prevents voltage drop between the main electrode and the starting electrode which can lead to electrolytic failure of the arc tube seal.

Some MetalArc lamps use a solid state diode and a bimetal switch. The diode augments the bimetal switch during lamp warmup. A Borosilicate (hard) glass bulb protects the inner parts and also absorbs ultra violet from the arc.

A hydrogen getter is incorporated to mop up any hydrogen liberated from the glass bulb or arc tube supports which improves lamp life.

Super MetalArc lamps are a result of detailed studies of the physics of the MetalArc discharge. The characteristics of particular interest are the effects of arc bending in nonvertical operating positions and the effect on cold spot temperature of various orientations. The result of these studies is the Super MetalArc family which are designed for a single specific operating position and offer significantly higher efficacy.

The arc tube geometry developed for the horizontal Super MetalArc lamps necessitates control of the lamp operating position. To achieve this a special base and lamp socket holder have been developed. These are the Position Oriented Base and Position Oriented Socket. The base has a locating pin attached to the shell of the base that positively stops the lamp in the cutout of the base. The tolerances allowed for installation are ±15% in two planes.

The lampholder will accommodate a standard E40 base and Mercury or MetalArc lamps can be used in these sockets. For vertical burning types a standard E40 lampholder is sufficient but again the lamp must be operated within ±15% of the vertical.

The longitudinal axis of the lamp must meet this requirement and the vertical centerline of the body of the arc tube is held to the same limits. These tolerances are allowed in order to account for physical limitations of actual fixtures and installations but the lamp is really a point design and the ideal is to achieve perfect orientation. If the allowed tolerances are exceeded lamp performance will be compromised and life will be shortened.


STA
STATOIL
SuperDiesel
STATOIL
Blyfri
Benzin
Selvbe-
tjening og
Kontomat
Glasrens
20,35
7,60
Vask
Kaffe
Mini kop
Danmarks
mest
avancerede
benzin

THE APPEARANCE OF SOPHISTICATED SELF-SERVICE PETROL STATIONS in Denmark has been greatly enhanced by the use of high quality metal halide lamps supplied by GTE Sylvania.

Statoil wanted to improve the appearance of their stations to make them more 'attractive' to drivers.

3K Super Metalarc lamps with a CRI of 70 not only provide a superior quality of light compared with conventional high pressure sodium lamps which have a CRI of around 25 but are also more economic to use than mercury lamps, because less power is required to produce light of the same quality, leading to major savings in energy.

The basic efficiency of the Sylvania lamps is extremely high at 82 lumens per Watt and since they have been tried and tested in many other applications, the lamps are very reliable and will provide consistently good quality light output.

Super MetalArc Lamp Construction

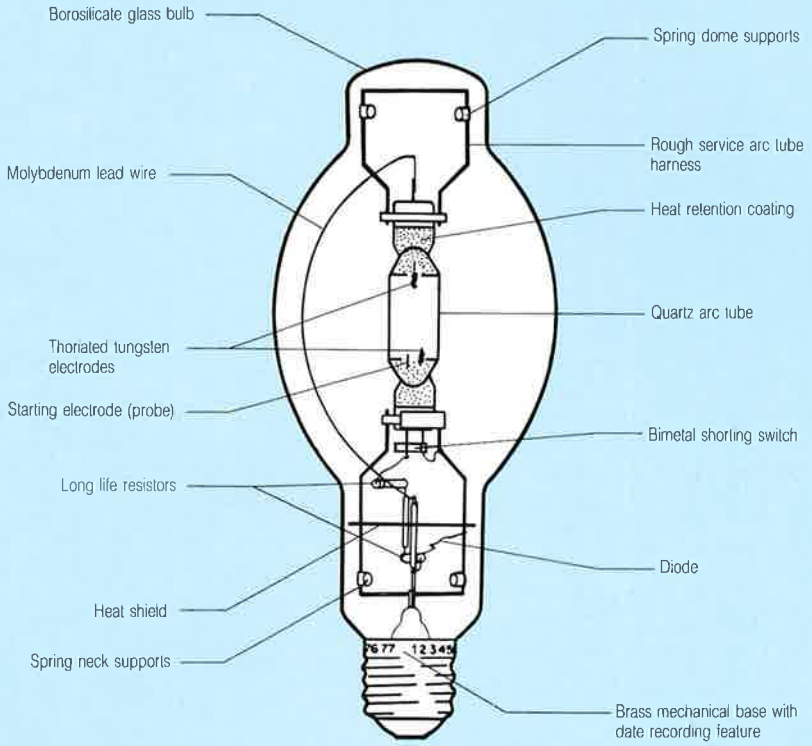


Fig. 1 Construction of 400-Watt, Base Up Burning MetalArc lamp.

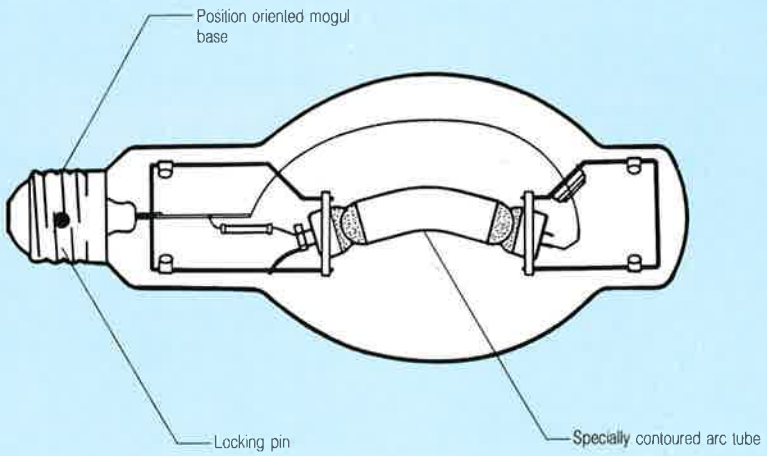


Fig. 2 Construction of 400-Watt, Horizontal Burning MetalArc lamp.

D. Principles of Construction

The lamp construction features several interesting design elements.

Frame Design

Studies have shown that at the high radiant intensities found in Discharge Lamps and arc tube supports become photo-emmisive. The potential difference between arc wall and the arc tube supports induces a current flow which in turn may be complemented by an "ionic" current tending to draw sodium through the seal area. Careful design of the side support system can substantially reduce this phenomenon and for this reason the dome support bulb and split frame have evolved, which thus enable lengthened lamp life.

Arc Tube Design

The concentration of mercury in relation to the other metallic iodide salts (iodides) ensures that the cold lamp can be easily started without resort to high voltages. A ballast open circuit voltage of around 300 Volts applied through a conventional auxilliary electrode system commonly in use with Mercury Vapour lamps is sufficient.

Electrode Design

Electrode design and operating temperature is crucial to sustain through-life performance. Among many relevant design parameters two are vital:- First is the use of thoriated tungsten which is an alloy resistant to the highly reactive dissociated iodides.

Second is electrode tip temperature. It is not only a function of the mass and shape of the electrode but also the ability of its surroundings to retain or disperse the heat developed. In this particular case a high temperature must be maintained, of around 2000°C, and to aid this process a heat retaining silicate coating is applied to the outer surface of the arc tube at each end.

Arc Tube Design — Super MetalArc Horizontal

Convection currents within the arc tube itself in the horizontal burning mode, have been observed to lead to a "bowing" of the arc plasma. Sylvania lamp Engineers therefore designed a lamp with an arched arc tube which if a line-of-sight could be maintained between the electrodes, allowed lamp efficacy to be increased dramatically. This bowing is illustrated in Fig. 2. The result of bowing the arc tube is more even arc tube temperatures.

This change has the following benefits:-

(a) Less halides are condensed on the arc tube wall resulting in more taking part in the discharge giving higher efficiencies and stability.
(b) A higher average temperature produces a higher pressure in the arc tube which improves lumen maintenance.

Convection currents also play a large part in the vertical burning lamp efficacy. The electrical loading on a Metal Halide arc tube is higher than a mercury arc tube. The result is a splitting of the convection currents into 2 or more cells. This has the following effects:-

(a) The top of each convection current cell is a major heat loss as hot gases are transfered from the centre of the arc to the wall.
(b) The top of the arc tube becomes additive deficient as the halides collect at the bottom.

Expanding the arc tube section recombines the convection currents and produce a more efficient and stable lamp.

Ballasting and Starting Requirements

The ballasting requirements for Sylvania MetalArc lamps are to be scrupulously observed if maximum performance is to be obtained consistently through life.

Colour stability is closely related to lamp wattage regulation and it is largely for this reason that Sylvania specifies a constant wattage configuration despite the fact that cheaper choke-ignitor system will, at least in theory, start and operate such lamps.

Rather than employ electronically produced high voltage pulses for lamp starting MetalArc lamps use an autotransformer winding to reach 300 – 400 Volts.

A further requirement of the ballasting system is to continuously provide sufficient ionisation potential to keep all the dissociated metal ions present without re-combination during the "off" time between each half cycle of the alternating current supply.

This can readily be achieved by means of a series-connected capacitor in the output side of the circuit. This allow the correct current crest factor (ratio of peak to RMS value) to be specified at around 1,65.

The effects of using a choke circuit similar to High Pressure Sodium are eminently predictable. At 50Hz mains frequency visible flicker is likely due to assymetric currents and wide variations in colour will be observed because of poor wattage regulation. It is for these reasons that Sylvania specifies **ONLY the lead-peak CWA** (constant wattage autotransformer) configuration.

In order to design a ballast correctly the following design constraints are proposed.

*** CURRENT SLOPE (di/dt - A/s^{-1})
*** OFF TIME (msec)
*** CURRENT CREST FACTOR
*** BALLAST OPEN CIRCUIT VOLTAGE (V).

The significance of each of these parameters is briefly highlighted overleaf.

Super MetalArc

E. Ballast Design Data

The following information is intended to guide ballast designers in the specification of the product.
Sylvania does not guarantee lamp life, performance or safety if lamps are used on non-approved ballasts.
M100 may be operated on 100W High Pressure Sodium chokes.

CRITERIA	CHOKE CCT	CONSTANT WATTAGE AUTOTRANSFORMER CCT		
	M100	**MS/M175**	**MS/M250**	**MS/M400**
Impedance (ohm)	—	102	71.5	45
O.C. Input (V)	220	220	220	220
O.C. Output (V) RMS	—	295	295	295
PEAK	—	540	540	540
Short CCT Current (A)	—	1.5–2.5A	2.1–2.8A	3.2–5.0A
Current Crest Factor (max. running)	1.414	1.65 Max. during starting 1.80 all types	1.65	1.65
Sustaining Data Vss min.	208	195	220	285
Current Offtime max. (m.sec)	—	2.75	2.75	2.75
Current Slope (A/m.sec) nom.	—	1.45	1.45	1.45
max.	—	1.76	1.76	1.76
Peak Current nom.	—	1.5	2.1	3.2
max.	—	2.5	2.8	5.0
Watt Loss Target (W)	20	36	50	65
Lamp Data Nom.				
Wattage (W)	100	175	250	400
Current (A)	1.1	1.5	2.1	3.2
Voltage (V)	100	130	130	133
Min. RMS Volts for stability	208	250	250	250
Minimum starting voltage for 90% probability of starting at 0°C with Lead Peak Ballast:				
V_{RMS}/V_{Peak}	See below	382/540	382/540	382/540
App. Series Capacitance (mfd) +/−5%	P.F.C. Capacitance 12 (300V)	12	18	25

Starting Requirements* — M100 only — External Ignitor.

A. Peak Voltage
1. Minimum volts: 3300
2. Maximum volts: 3500

B. Minimum Pulse width at 70% of peak volts in microseconds: 2

C. Pulse Repetition Rate, per alternation, minimum: 3

D. Pulse Positions

1. One Pulse within ±10° of peak open circuit voltage
2. A second pulse from −40° to peak open circuit voltage
3. A third pulse from −40° to +30° of peak open circuit voltage

*** We encourage the submission of all newly designed started for evaluation by Sylvania whether or not they meet these requirements.**

Data specified under reference conditions at 25°C.

Current Slope
The conventional relationship between rate of change of current and voltage developed by an inductance holds true ($V = L.di/dt$). The current slope effectively determines the ability of the ballast to reach an adequate value of sustaining voltage to maintain the discharge. Both the absolute value of the voltage and the ramp time taken are critical to avoiding flicker.

Off Time
This is connected with the current slope in that the time which lapses between the extinction and re-ignition of the arc (as each current half-cycle passes through zero) is a function of the speed at which the voltage rises on the alternate cycle. Thus the discharge re-ignites in a time delay which is sufficient short so ensuring that visible flicker and colour shift is minimised.

Off time is defined as the time during which the arc is effectively extinguished, between half-cycles, measured in milliseconds.

Current Crest Factor
This parameter was defined earlier. Its significance lies in the fact that the secondary circuit capacitor develops an additional peak on top of the sinusoidal ballast current output curve thus better enabling the ionisation of the iodides, in particular Scandium which has a relatively high ionisation requirement.

Open Circuit Voltage
By definition, the current crest factor of a sinusoid is 1.414 ($\sqrt{2}$). This allows us to say that the peak of the output of a sine wave is approximately 40% higher than the **root mean square value.** For example a 220 volt mains supply actually provides a peak of just over 310 Volts.

In the case of a current crest factor of 1.80 which can be obtained from a CWA lead peak configuration, the available peak volts based on a nominal 220 Volt supply are tabulated on page 8. The open circuit voltages specified enable both starting and sustaining conditions to be met.

In summary the use of CWA gear over conventional circuits has the following benefits:-

(a) It operates the lamp correctly at ±10% of supply level.
(b) Withstands higher voltage dips without extinguishing the lamp.
(c) Long life, good lumen maintenance and reduced flicker due to the series capacitor.
(d) High power factor typically 0.95.
(e) No electronic ignitor required. The gear can be located remote from the lamp.
(f) Lamp starting current is less than operating current.

Temperature Sensitivity and Starting
Operated with correctly designed control gear Super MetalArc lamps start with 90% probability down to MINUS 25 celsius.

Temperature Effects During Operation
During operation MetalArc lamps are relatively insensitive to ambient temperature.

On the other hand, however, local temperatures of the lamp parts are critical and must be carefully observed during the fixture design. Among these are a 210°C maximum on the cap and 400°C on the bulb wall. A major source of problems is re-focusing or concentration of energy as a result of a poorly adapted fixture reflector.

Stroboscopic Effect
From previous comments on the "OFF TIME" it can easily be seen that the discharge modulates at the rate of 100 times per second on a 50Hz supply. Normally speaking, apart from peripheral vision effects and use on choke reactors, visible flicker is **NOT EVIDENT.**

In the presence of rotating machinery there can be a danger to operators due to the "stroboscopic effect", i.e. the interaction of the rotation speed and the 100Hz modulation and its harmonics. A three phase electric motor is typically designed to run at 1500rpm and multiples of the 100Hz modulation can interfere causing the rotating part to appear to be stationary, sometimes with a dangerous outcome. Three options are available:

— each alternate fixture is wired to a different phase of the mains supply.
— a local incandescent lamp is used (safety light).
— coated Super MetalArc lamps are used, where the phosphor afterglow provides some partial offsetting of the modulation of the arc.

M100 CIRCUIT

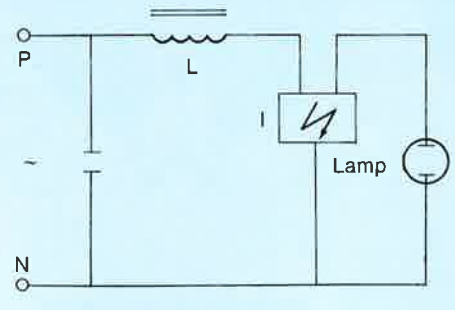


Fig. 3

M/MS 175, 250, 400 W CIRCUIT

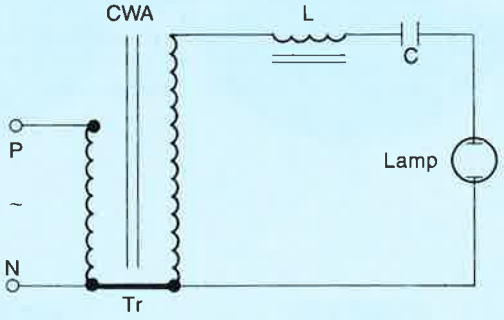


Fig. 4

Please consult Sylvania for information on approved ballast suppliers.

F. Colour Parameters

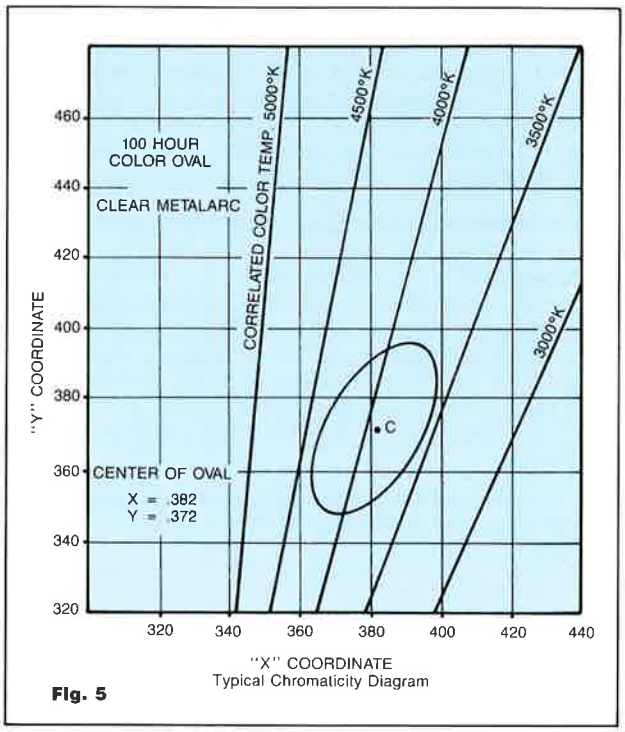
A chromaticity diagram as shown in Fig. 5 is useful in discussing the effects to be expected.

IT IS WORTH REPEATING THAT THE CHIEF SOURCE OF COLOUR VARIATION IS POOR OR INAPPROPRIATE BALLAST DESIGN LEADING TO A LACK OF LAMP REGULATION.

The colour of a lamp is specified using a system of X and Y coordinates — CIE CHROMATICITY CHART — and Correlated Colour Temperature. Like all specifications a certain amount of tolerance is to be expected and so an X,Y coordinate is surrounded by elliptical tolerance areas which statistically designate the "sigmas" of permitted deviation. A further term, the MPCD (mean perceptible colour difference) is often used to describe the sized of the ellipse where c.5 units of MPCD is just discernable and 10 MPCD is the size of oval used.

The colour performance of a Metal Halide lamp can vary substantially during the first 100 hours after which the installation becomes stabilized. It may be convenient to think of this similarly to the running-in period of a motor car. In certain cases some tuning is necessary and in the case of MetalArc lamps either some re-grouping of lamps of similar colour could be made or lamps swopped for other similar pre-aged ones. In any case close cooperation with the Sylvania Field Technical Service will ensure good results.

The 3K range of Super MetalArc is unique in that it has a very warm colour temperature of initially 3200°K declining to 2800°K through life giving an average of 3000°K, hence the name. Additionally, the colour appearance between lamps of the same and different wattages is very closely controlled. This is achieved by matching the light emission of the arc tube to the thickness and composition of the phosphor coating. The result is that control is within a 5 MPCD oval has shown in which is a good deal better than the standard 10 MPCD oval.



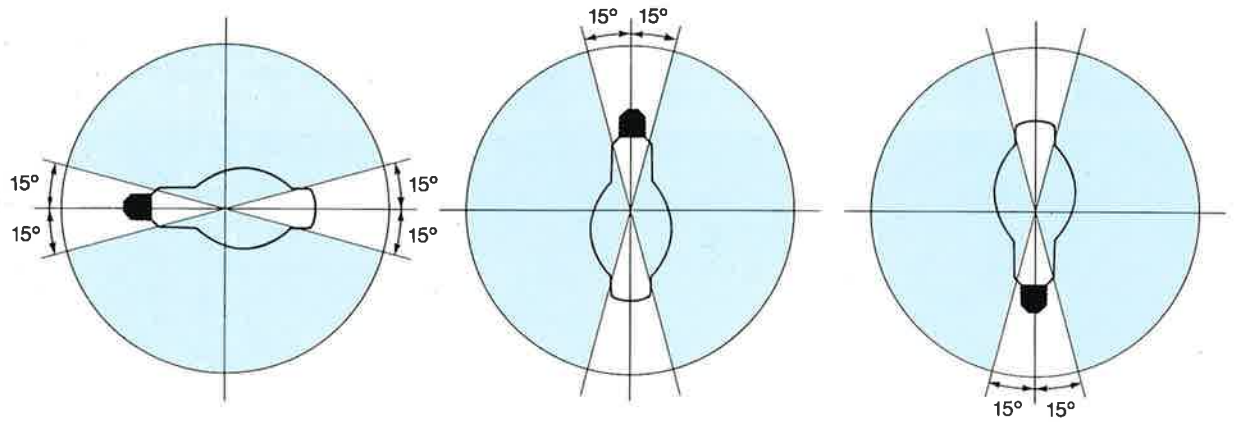
Typical Chromaticity Diagram

Fig. 5

As previously mentioned, the colour appearance of all Super MetalArc lamps change during life. They get warmer in colour and they all change together. Spot replacement of lamps is not therefore recommended as large colour differences can result.

Burning Position

The diagram gives the relevant information:



HORIZONTAL (HOR)

VERTICAL BASE UP ±15°

VERTICAL BASE DOWN ±15°

Fig. 6

G. Applications — General

Sylvania Super MetalArc lamps have been designed particularly with the requirements of Commercial and Industrial Lighting in mind. In terms of general product attributes, the following features are therefore important:

COLOUR RENDITION — CRI 70
EFFICACY — 86 lumens/Watt
IDEAL BURNING POSITION
AVAILABILITY IN MANY WATTAGES.

Since the lamps are designed primarily for Indoor non-Floodlighting use they are specified for use in dedicated burning positions. The horizontal +/−15 degrees configuration being specified for:-

LOW BAY INDUSTRIAL LIGHTING
UPLIGHTERS IN OFFICES ...

where the horizontal positioning of the lamp can keep the total height of the fixture low. The vertical burning lamps are specialised for:-

HIGH BAY INDUSTRIAL LIGHTING

where the maximum reflector and appropriate beam distribution can be obtained in the vertical. In conjunction with this requirement several types are available in the clear bulb alternative type.

Applications — 3K Super MetalArc

New Sylvania warm colour Super MetalArc 3K lamps provide excellent colour rendering plus proven high lumen-per-watt efficacy. This new family of 3200°K colour temperature lamps provides an outstanding opportunity for retail stores, offices and schools — virtually any commercial user — to have the most efficient warm-colour H.I.D. light source available today. Super MetalArc 3K is an improved colour rendering light source with distinctive advantages for interior design emphasizing warm colour with minimum power consumption.

These new Super MetalArc 3K lamps are available in ratings 100W, 175W, 250W and 400W. The horizontal types are designed to be installed in low profile luminaires which are the most popular method of H.I.D. lighting in retail and commercial interiors. These new lamps must be used in fixtures equipped with position-oriented sockets designed to accommodate the Sylvania line of horizontal burning Super MetalArc lamps. For new construction and lighting renovations, the Sylvania Super MetalArc 3K lamps could be considered in place of fluorescent, mercury, and incandescent lighting systems to achieve substantial energy savings.

This new highly efficient lamp family with its incandescent-like colour offers a new opportunity for the use of H.I.D. sources in interior lighting design.

Enclosure Requirements

The notes are intended to ensure that Super MetalArc lamps are used in complete safety. Please read them carefully.

It should be remembered always that Metal Halide lamps of all descriptions run at greater than atmospheric pressure and the risk of non-containment, though small, is always present. For this reason Sylvania advises that the lamps **are only used in protected fixtures.**

The following notes are intended to guide fixture designers and specifiers:-

All Metal Halide lamps are subject to a type of failure in which the arc tube, operating at a pressure of approximately 4 atmospheres, bursts and shatters the outer jacket. If the outer jacket shatters, the hot quartz arc tube particles (as high as 1000°C) and the outer jacket glass particles will be discharged against the fixture's enclosure or into the environment if the fixture is open. In the event of such failure, THERE IS A RISK OF PERSONAL INJURY AND PROPERTY DAMAGE FROM HOT QUARTZ ARC TUBE PARTICLES, SHATTERED GLASS, BURNS AND FIRE, unless the precautions recommended below are taken.

This warning applies to all Sylvania Metal Halide lamps with the letters "M", "MM", or "MST" regardless of operating position (horizontal or vertical), wattage (100, 250, 400, 750, 1000 or 1500), or date of manufacture.

Recommended Precautions to Reduce Risk of Danger

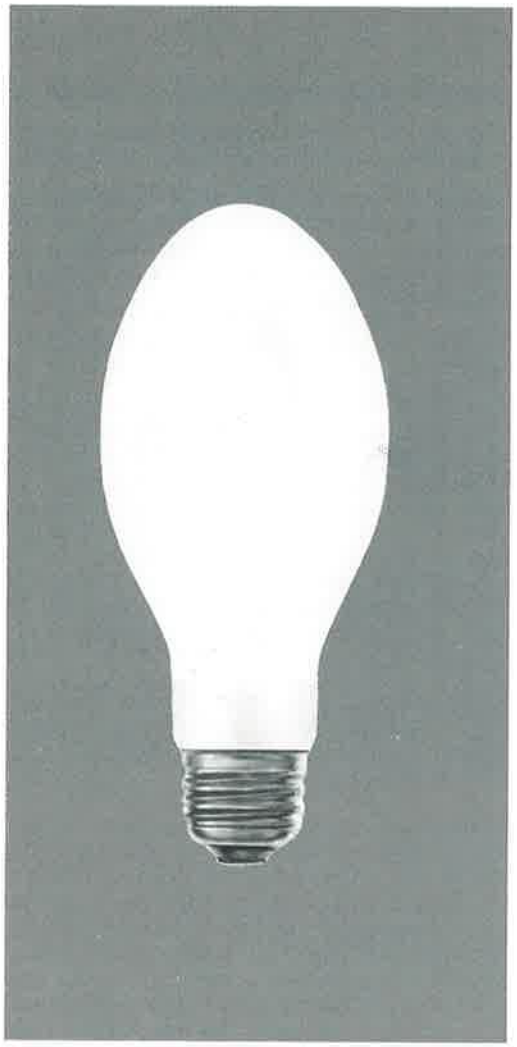
1. **All fixtures must be enclosed:** This requirement for enclosing open fixtures applies to **all** fixtures containing Sylvania MetalArc and Super MetalArc.
2. **Enclosures must be made of suitable materials:** Enclosures containing Sylvania MetalArc lamps must be capable of withstanding the discharge of hot quartz arc tube particles described above. GTE Sylvania had identified only tempered glass as a suitable lens or diffuser material but end users should contact their fixture manufacturer to determine if other suitable enclosures are available.
3. GTE Sylvania continues to recommend that all Metal Halide lamps be cycled (turned on and off weekly) and group relamped at the end of the rated life.

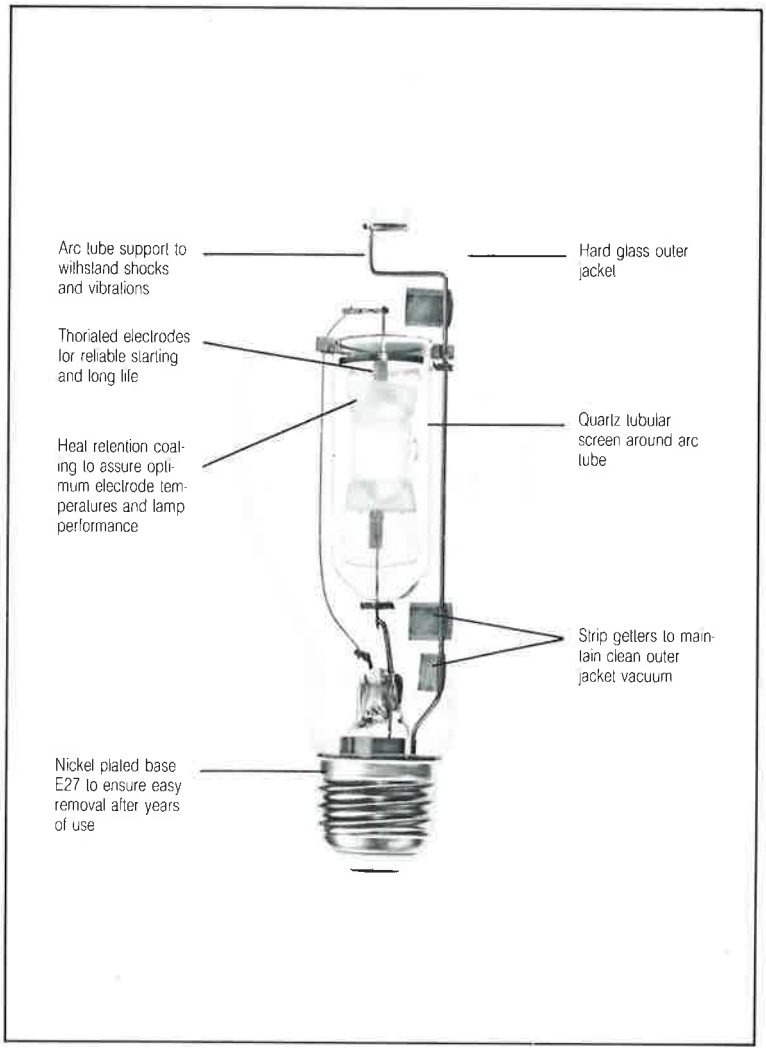
Discharge Lamp Product Information

Description

100 Watt Single-Ended MetalArc Lamps

MetalArc M100





Mechanical Data and Illumination Characteristics

General Information								
Lamp Rating	100 W	100 W						
Type Description	M100/CL	M100/CO						
Mechanical Data								
Bulb Shape	ED17	ED17						
Bulb Finish	Clear Ellipsoid	Coated Ellipsoid						
Bulb Diameter mm	54	54						
Overall Length mm	138	138						
Arc Length mm	15	—						
Light Centre Length mm	85	—						
Cap	E27	E27						
Illumination Characteristics								
Light Output lm	8500	8000						
Efficacy lm/W	85	80						

Features

- Compact dimensions and single-ended E27 design allow maximum freedom to fixture designer
- Warm light colour appropriate for commercial interiors
- Clear bulb version for "sparkle" and critical optical design. Low glare coated bulb version for "ambience" requirements
- 85 Lumen per watt efficacy
- Operates on 100W SHP ballasts

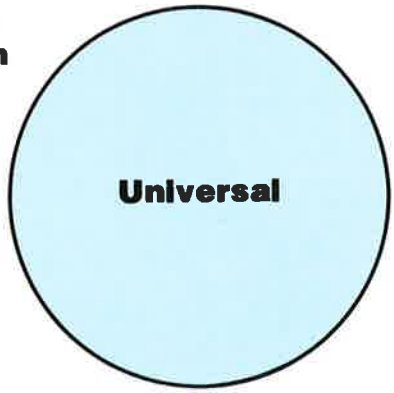
SYLVANIA GTE

MetalArc M100

Applications

- Retail store merchandising
- Public Areas
  - — Lobbies
  - — Banking halls
  - — Airport Terminal Areas
- Offices, especially in VDU areas combined with "uplighter" fixtures

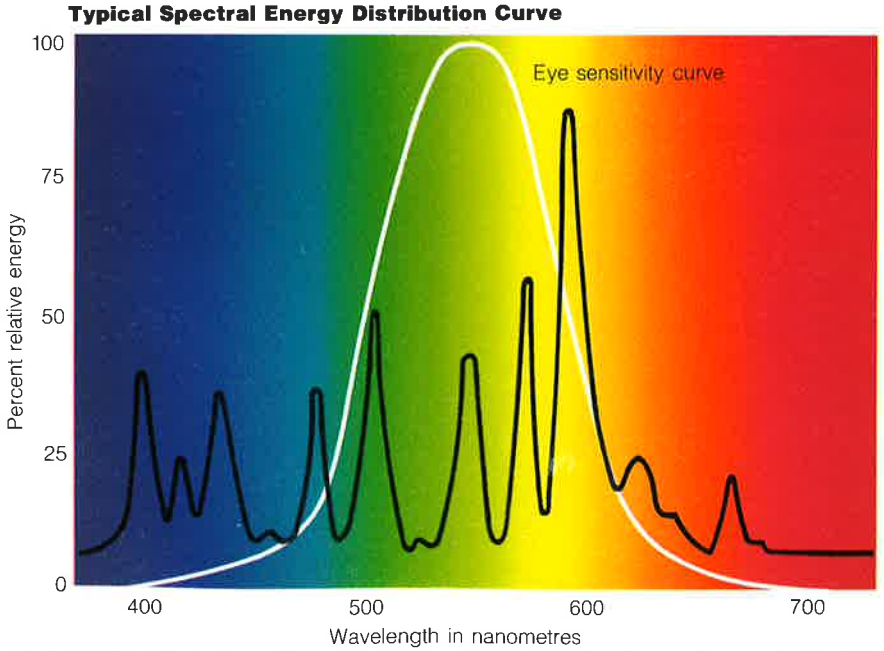
Burning Position



Electrical Data									
Lamp Rating	100 W	100 W							
Arc Tube Voltage V	100	100							
Arc Current A	1,1	1,1							
Starter Type (1)	E	E							
Peak Starting Voltage	3,3 kV	3,3 kV							
PF Capacitor mfd	12 (300 V)	12 (300 V)							
Min. Supply Voltage (V)	208	208							

Ordering Data - Lamps								
Code No	20637	20638						
Type Description	M100/CL	M100/CO						
Packing Qty	10	10						

Typical Spectral Energy Distribution Curve



Reference Colour Data

	CL/CO
Tc (Kelvin) :	3200
x :	0,420
y :	0,395
Colour Rendering Index (ra8):	65/>70

Special Notes

(1) Starter type - Sylvania M100-I or similar.
(2) Lamps may only be used in fixtures provided with tempered glass enclosures.
(3) Continuous burning is inadvisable. Switch off at least once per week for 15 minutes.
(4) Should the outer jacket break, switch off immediately as there is a grave risk of eye and skin damage.
(5) Only a 3,5 kV pulse rated E27 socket may be used - Sylvania M100-SK or similar.
(6) M100 lamps may be used on 100W High Pressure Sodium ballasts.

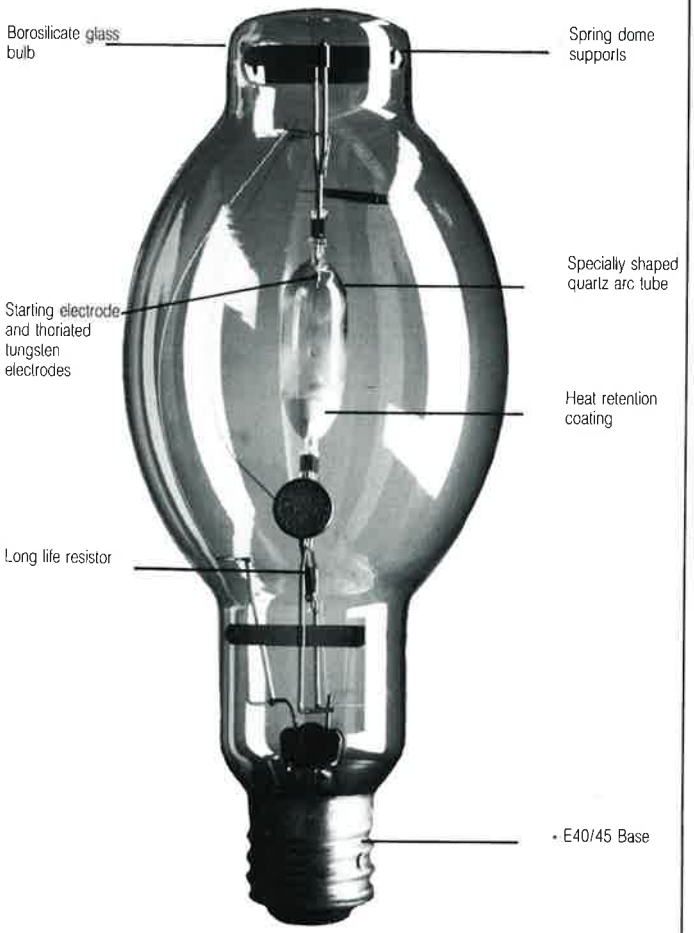
Sylvania reserves the right to change data and specifications without notice. Data for guidance only.

Discharge Lamp Product Information

Description

Super MetalArc Coated Lamps

Super MetalArc MS-Coated



Physical and Photometric Characteristics

Ordering Abbreviation	MS175/3K/HOR	MS250/3K/HOR	MS400/3K/HOR	MS250/3K/BU	MS400/3K/BU	MS250/C/HOR	MS400/C/BU	MS400/C/HOR
Bulb Designation	BT-28	BT-28	BT-37	BT-28	BT-37	BT-28	BT-37	BT-37
Bulb Diameter mm	89	89	117.5	89	117.5	89	117.5	117.5
Base Type	P.O. E40	P.O. E40	P.O. E40	E40	E40	P.O. E40	E40	P.O. E40
Light Centre Length mm	—	—	—	—	—	—	—	—
Arc Length mm	—	—	—	—	—	—	—	—
Max. Overall Length mm	211	211	292	211	292	211	292	292
Max. Bulb Temp. °C	350	350	400	350	400	350	400	400
Max. Base Temp. °C	210	210	210	210	210	210	210	210
100 Hr. Lumens	14,000	21,500	36,000	20,500	37,000	23,000	40,000	40,000
Colour Temperature K	3200°	3200°	3200°	3200°	3200°	3700°	3500°	4500°
Chromaticity Co-ord x	0.425	0.425	0.425	0.425	0.425	0.380	0.410	0.360
y	0.410	0.410	0.410	0.410	0.410	0.380	0.380	0.370
CRI	70	70	70	70	70	70	70	65
Warm Up Time mins	2	2	2	2	2	2	2	2
Hot Restrike Time mins	10	10	10	10	10	10	10	10

Features
- Highest efficiencies available
- Diffuse light source giving good visual comfort
- Excellent colour rendering

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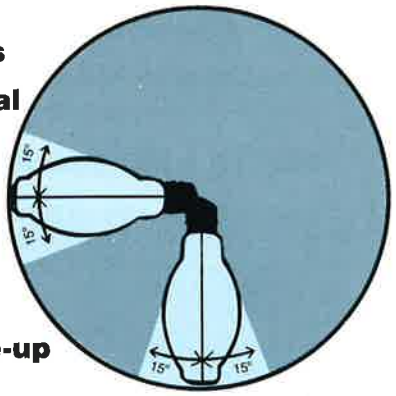
Super MetalArc MS-Coated

Applications

- Where high efficiency, high colour rendering and diffuse lighting is required.
  - — Factories
  - — Warehouses
  - — Sports Halls
  - — Retail Stores
  - — Commercial Offices

Burning Positions

Horizontal "HOR"

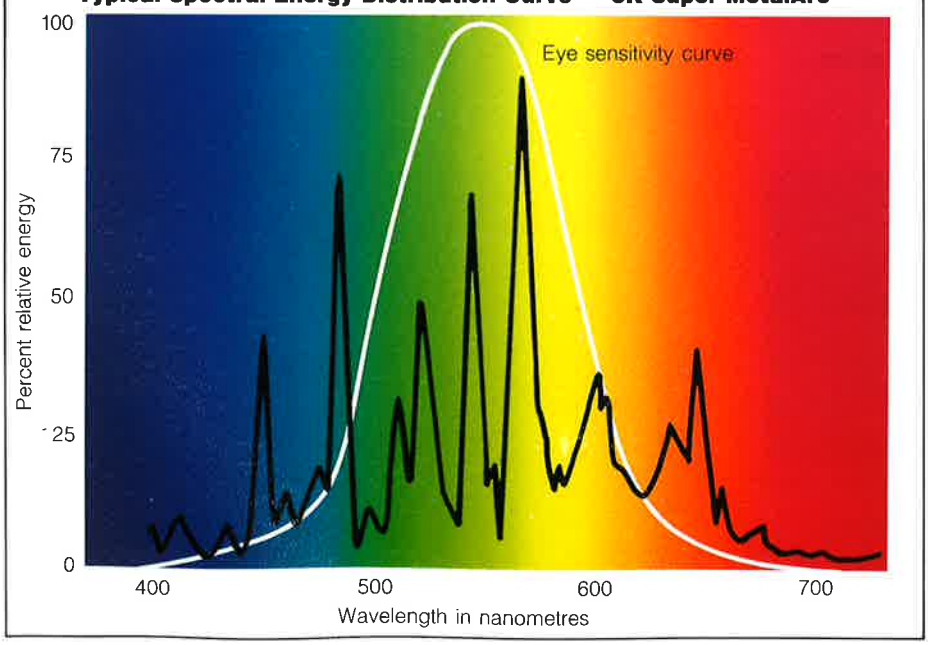


Base-up BU

Electrical Characteristics

Sylvania Code No	20600		20601		20621		20602		20603		20605		20606		20607	
Ordering Abbreviation	MS175/3K/HOR		MS250/3K/HOR		MS250/3K/BU		MS400/3K/HOR		MS400/3K/BU		MS250/C/HOR		MS400/C/HOR		MS400/C/BU	
Burning Position	HOR ±15°		HOR ±15°		BU ±15°		HOR ±15°		BU ±15°		HOR ±15°		HOR ±15°		BU ±15°	
Nominal Lamp Watts	175		250		250		400		400		250		400		400	
Nominal Lamp Volts	130		130		130		133		133		130		133		133	
Nominal Lamp Amps	1.55		2.10		2.10		3.20		3.20		2.10		3.20		3.20	
Min. RMS for Lamp Stability	250		250		250		250		250		250		250		250	
Min. Starting Volts Req.	**RMS**	**Peak**	**RMS**	**Peak**	**RMS**	**Peak**	**RMS**	**Peak**	**RMS**	**Peak**	**RMS**	**Peak**	**RMS**	**Peak**	**RMS**	**Peak**
98% Probability at −18°C or above	382	540	382	540	382	540	382	540	382	540	382	540	382	540	382	540
90% Probability down to −30°C with Lead Peak	382	540	382	540	382	540	382	540	382	540	382	540	382	540	382	540

Typical Spectral Energy Distribution Curve — 3K Super MetalArc



Reference Colour Data

Tc (Kelvin) : —

x : —

y : —

Colour Rendering Index (ra8): 70

Special Notes:
- Super MetalArc lamps only to be operated on approved lead-peak control gear.
- Lamps should only be used in suitably enclosed luminaires as there is a small risk of the arc tube shattering at end of life.
- For continuous operation, it is recommended that all Super MetalArc lamps be turned off once per week to reduce the risk of arc tube rupture.
- As with all mercury and metal halide lamps, switch off and remove lamp immediately if outer bulb is broken as skin burn and eye inflammation from short wave UV may occur.
- Do not operate vertical BU and BD types within 60° of horizontal as they may shatter.

Sylvania reserves the right to change data and specifications without notice. Data for guidance only.

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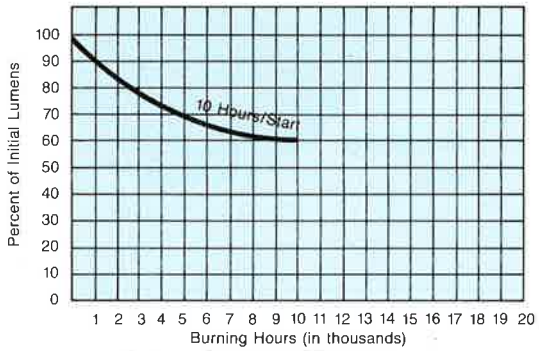
Super MetalArc

Typical life expectancy or mortality curves for Super MetalArc lamps at various burning cycles. All curves apply to operation on single lamp ballast.

MS175 AND 250 HORIZONTAL



Lamp Lumen Maintenance

Lamp Survival

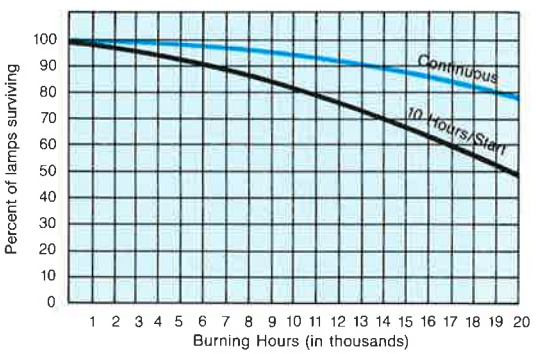
MS400 HORIZONTAL

Lamp Lumen Maintenance

Lamp Survival

MS400 BASE UP

Lamp Lumen Maintenance



Lamp Survival

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