

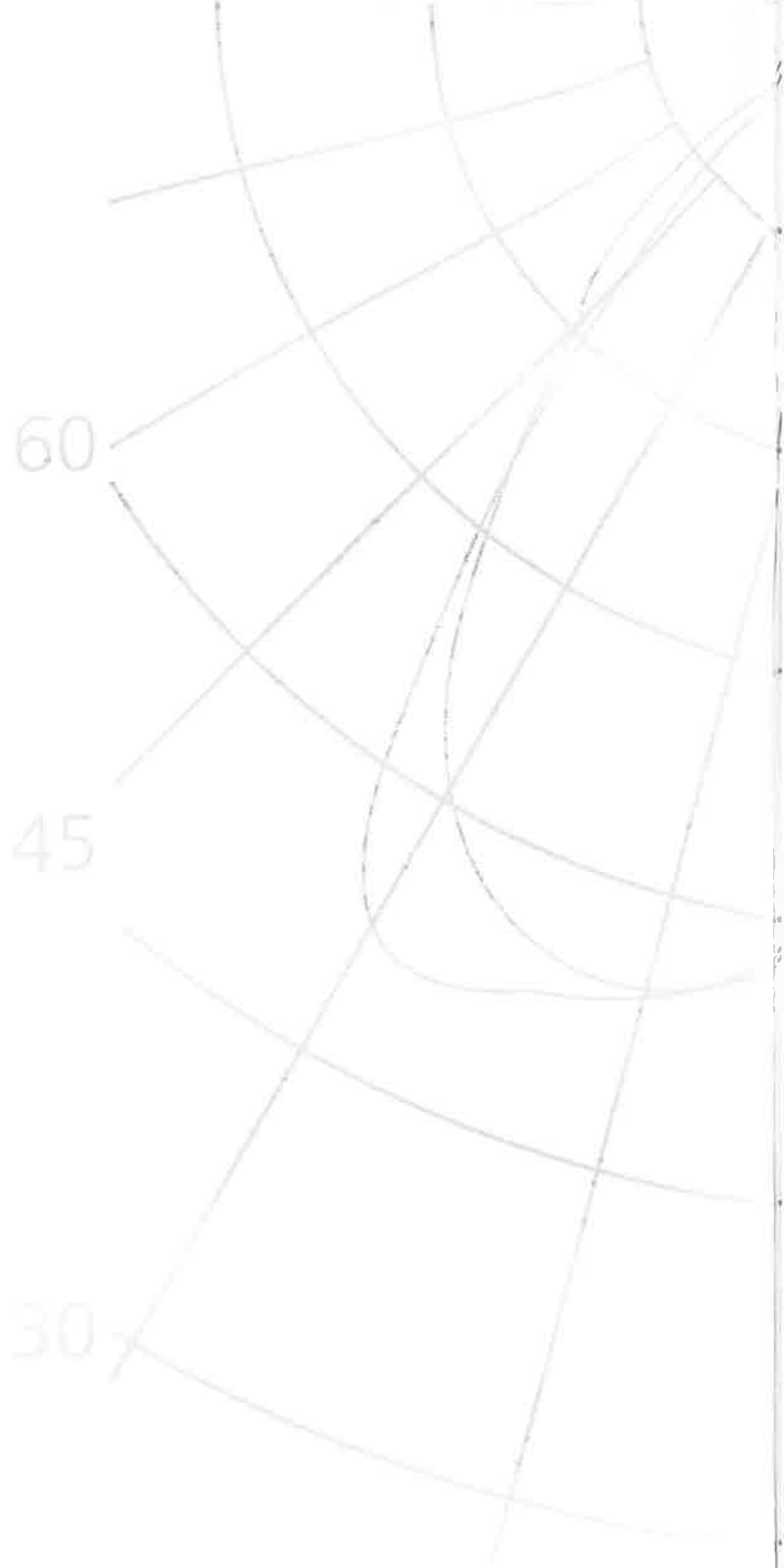
Technical Manual

Metal Halide Lamps



**Sylvania
Lighting
International**

A Source of Inspiration



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SYLVANIA

TECHNICAL MANUAL

Metal Halide Lamps

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MetalArc and Britelux Product Range Summary

This Technical Manual is aimed at luminaire designers, users and specifiers of lighting for commercial and industrial applications. The choice of Metal Halide lamps and the applications for which they are suited are many and varied and can include shop lighting, malls and airport concourses and also in floodlighting applications for security and sport.

Metal Halide lamps are powerful gas discharge lamps characterised by the emission of a broad spectrum of white light of excellent quality. Where such quality requirements combine with the need for operating economy i.e. the highest efficacy (lumens/Watt) then Metal Halide represents the best choice.

Sylvania, MetalArc and Britelux are brands of SLI Inc. Sylvania Lighting International Incorporated is a publicly quoted company on the New York Stock Exchange. Over 5000 people are employed world wide. MetalArc is the generic brand name for the commercial range of Metal Halide lamps and Britelux is the brand name used for the industrial ranges

Choosing a Lamp

When choosing a Metal Halide lamp type there are three principal points to consider:

- **The power rating, quality (Tc, Ra) and quantity of light (lumens) needed.** Lamps are available with a wide range of correlated colour temperatures (Tc) such as Warmwhite 3000-3200 Kelvin (K), Coolwhite 4000-4300K and Daylight 6000K). The Ra colour rendering index for most types lies in the DIN class range 1a to 2b category, Ra 90+ to 79 -very good. Lamps are offered in a variety of finishes, the most common being a clear tubular envelope. Within the Britelux and MetalArc series coated elliptical bulb lamps are available which can reduce glare in indoor low mounting height applications and enhance the light quality.

- **The ballast and ignitor configuration** to be preferred for efficiency or economy reasons, or which exists (in the case of lamp replacement). Metal Halide lamps may either be suitable for use with HSL Mercury-compatible or SHP High Pressure Sodium - compatible control gear, or may have specific requirements such as CWA or constant wattage ballasts.

- **The advisability of enclosure**

The need for enclosure may arise from two considerations:

1. The need to ensure that no contamination of the application occurs, such as in food processing applications.
2. The need to filter out ultraviolet (UV) light.

Within the above product families, types exist which are 'self-protected' i.e. need no enclosure for safety reasons.

UV STOP types will require a safety glass as well but this need no longer be of the more expensive UV filtering type, therefore saving on luminaire cost.

Examples:

Self-protected types: MetalArc E27 with the 'MP' designation.
E40 cap: Britelux HSI-SX 400W BU only

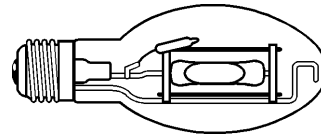
UV STOP types: HSI-TD with the UVS designation

The Range

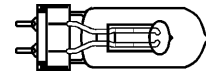
A wide variety of different versions of Metal Halide lamps are offered. This ensures that the application is served with the most efficient and longest service life solution. A list of the main product families is given below:

Low wattage (70 - 250W)

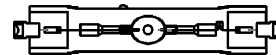
MetalArc E27 (75-150W)



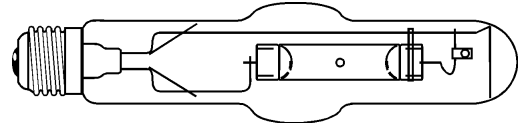
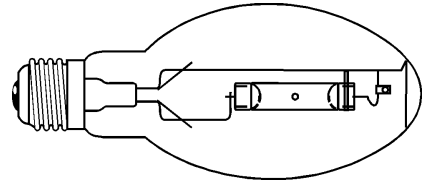
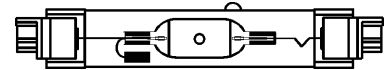
MetalArc HSI-T G12 (70 & 150W)



MetalArc HSI-TD Double-ended (70W-150W)

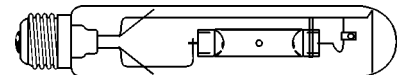


MetalArc E27, HSI-TD double ended, HSI-T G12 single ended series (70/150W) generally can use control gear designed for SHP High Pressure Sodium lamps, however, for dedicated Metal Halide ballasts with tighter manufacturing tolerances (+/- 3% versus +/-10% for SHP) and multi-voltage input tapings will often give the best results. Compatibility with SHP gear means that some luminaires which have been designed for High Pressure Sodium lamps can use MetalArc lamps with only slight modifications. In the case of MetalArc E27, for example, only a 750V DC rated E27 lampholder need be substituted.

Medium wattage - Sodium compatible**Britelux HSI-TSX****Britelux HSI-SX E40 (250/400W)
Coated****MetalArc HSI-TD Double-ended
(250W Fc2 caps)**

Britelux HSI-SX coated and HSI-TSX Tubular E40 series (250 and 400W) lamps can be used on standard configuration SHP High Pressure Sodium ballasts and ignitors, therefore offering the choice of the correct light from one luminaire type and save on stock and parts holding.

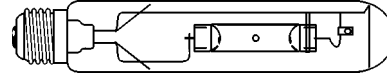
Note: HSI-TD 250W are best used with dedicated, thermally protected Metal Halide ballasts which are provided with line voltage tapping options

**Medium wattage - Mercury compatible
HSI-T 4K Tubular E40 series
(250 and (250 and 400W)**

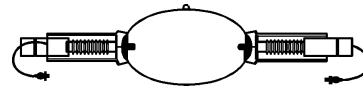
Mercury control gear-compatible with Impulse or Superimposed Pulse Ignitor (SIP) added to the circuit which offers the least control gear cost for the luminaire manufacturer.

High wattage (1000W and 2000W)

HSI-T Tubular E40 (1000 & 2000W)



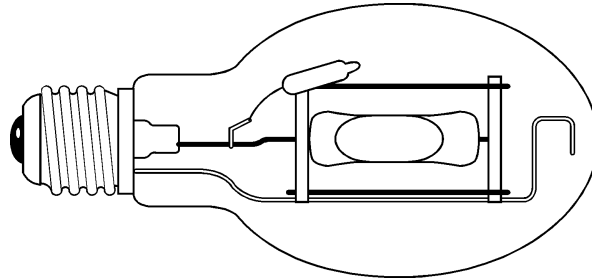
HSI-TD 2000W/D cable



These specialist lamps are used for sports ground and stadium lighting because of their superb colour and efficiency. They are a requirement for the demanding quality requirements of outside TV broadcast companies.

Note: HSI-TD 2000W require dedicated thermally protected ballasts which are provided with line voltage tapping options

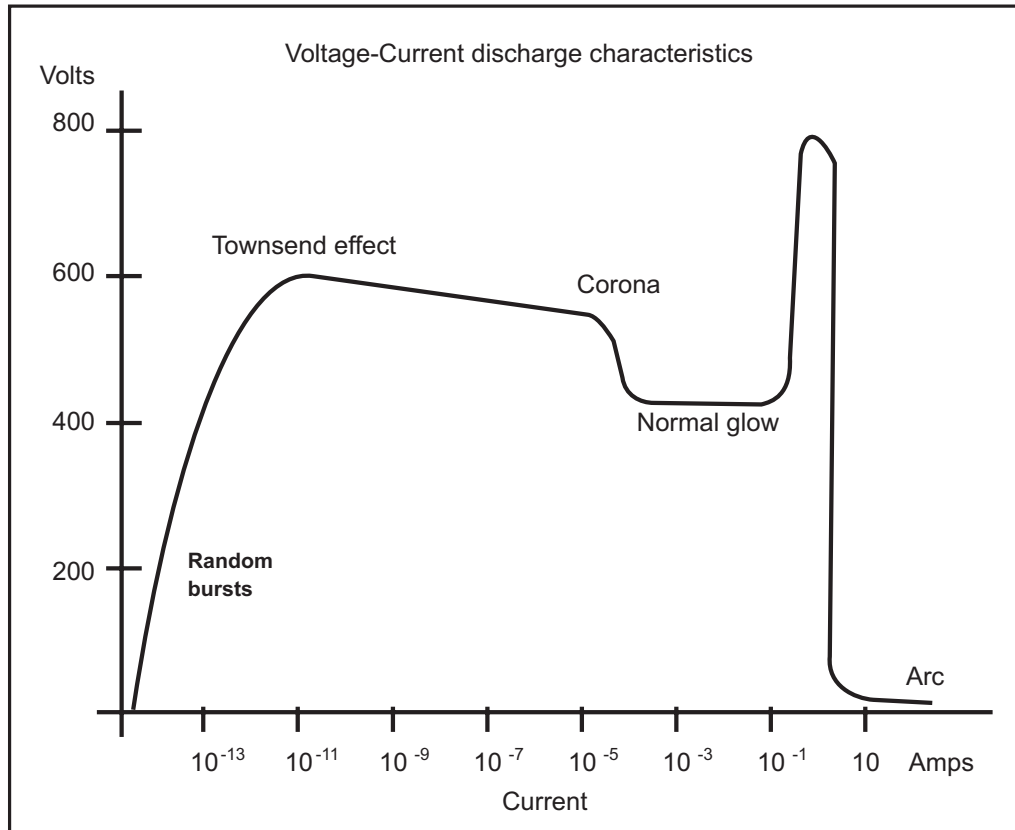
Principles of Operation



Metal Halide (MH) lamps date back to the early 1960's when technologists began to look for methods of improving the colour of 'colour-corrected' Mercury (HSL) lamps. Mercury arc tubes (without a coated outer bulb) radiate a rather weak blue-green light and UV radiation at the 254.3 nanometer (nm) spectrum line. For the HSL type the light production process is completed by applying a phosphor coating to the inside of the outer bulb. Metal Halide lamps are similar in format and construction to Mercury lamps to which a very precisely developed 'cocktail' of metal salts have been added in the arc tube itself.

These metal salts (generally halides), when in the vapour form and participating in the gas discharge process, emit characteristic colours directly from the arc tube. By combining a range of metal halides it is possible to fit around the colours missing from the poorer Mercury spectrum and provide a substantial increase in Ra value, from about 50 to 75. By increasing the temperatures and pressures the luminous efficacy of the system can also be improved, from 60 to 100 lumens per Watt (lm/W) consequently saving both on installation and running costs.

Voltage/Current Characteristics

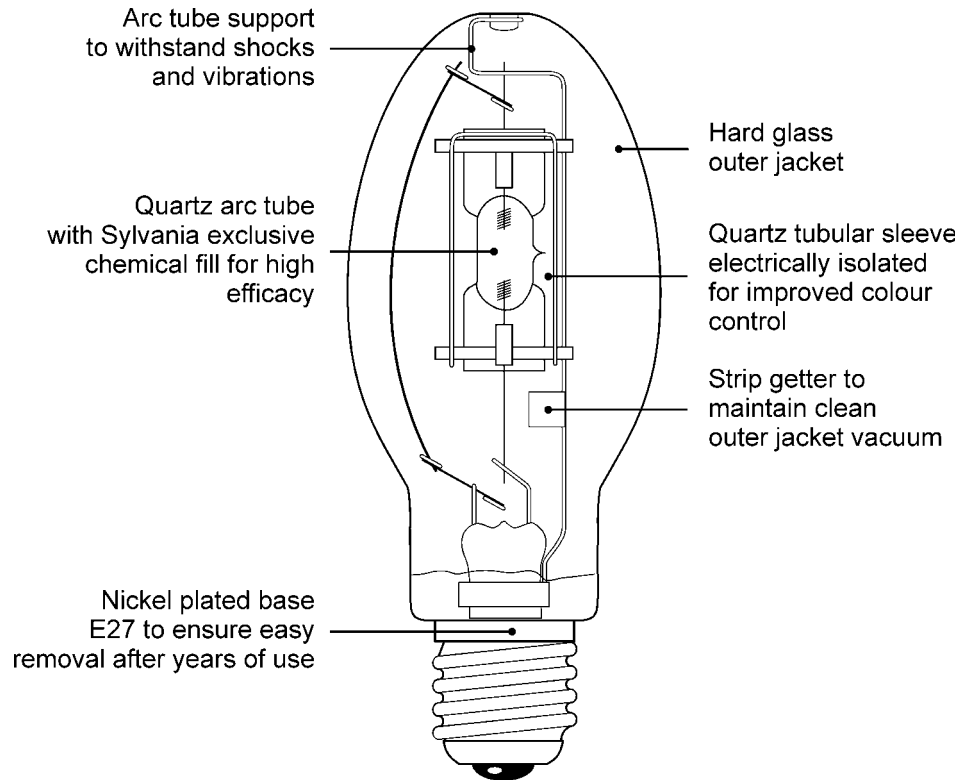


The above diagram illustrates the V/I (voltage to current) relationship of a typical MH lamp ballasted by a choke ignitor circuit. A suitable ballast must always be used with any gas discharge lamp.

Two main points are of some interest:

1. The process of electron generation in the arc tube after starting is known as the Townsend 'avalanche'. Without the connection of a ballast the lamp current would continue to increase exponentially.
2. A high voltage is required initially to break down the Argon starting gas in the arc tube and bring the lamp through the glow-to-arc transition in order to provide a short switch-on time.

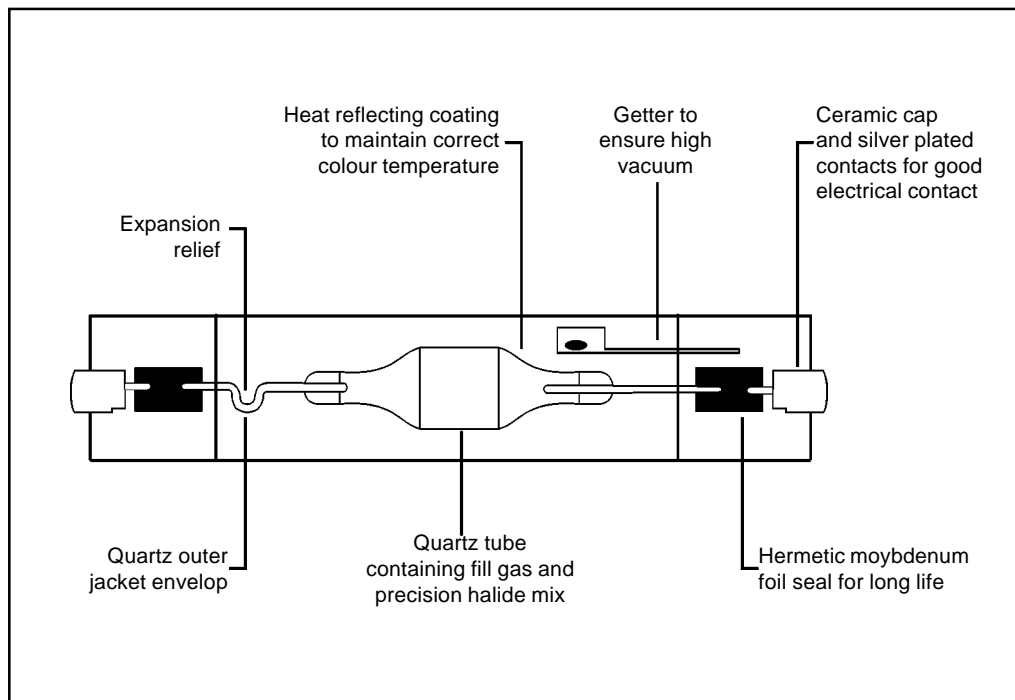
Construction



MH lamps may vary in outer jacket construction and cap type but though in many respects the construction of Metal Halide lamps is similar to Mercury HSL, the precision required in manufacturing, the complexity of the chemistry in use and the thermodynamics are vastly more demanding and the results in terms of light colour quality are significantly better than Mercury types.

The manufacturing tolerances on gas fill purity, mercury dose, internal dimensions and volume demanded for MH lamps are very critical as are the end coatings on the arc tube. These are needed to preserve the correct temperature regime for the electrodes, keeping the lamp colour as constant as possible.

The HSI-TD construction is presented below, as a typical example.



Outer Jacket :

All E40 and E27 lamps: Thick borosilicate glass, which is resistant to high temperatures, filters some UV radiation, designed to resist thermal shock and mechanical damage.

All double ended and G12 single ended types: Quartz glass for very high temperature resistance and a robust construction.

Outer Jacket Gasfill:

HSI-T 4K E40 and Britelux lamps only: Inert Nitrogen gas to provide cooling for the arc tube by convection to the outer jacket wall but without reacting with other materials present ensuring a long service life.

All HSI-TD double ended and G12 single ended HSI-T types and MetalArc E27: Vacuum maintained by a chemical getter strip or button which reacts with any gas or water vapour left inside the outer jacket after sealing ensuring a long service life.

Internal Powder Coating:

E27 and E40 elliptical bulb lamps are provided with an evenly applied high transmission internal coating. The principal function is to reduce disability glare and improve the user's visual acuity where the lamp may be viewed directly, or where the luminaire optical system particularly requires a large luminous 'area'. Some coatings also add an extra red content to improve light colour.

Starting Aids:

Unless specifically mentioned in the relevant data sheet, an external electronic ignitor is required in the operating circuit. (Some lamps are additionally fitted with starting enhancers to enable rapid and reliable starting).

Britelux and HSI-T lamps are fitted with a single auxiliary electrode/resistor set which promotes fast lamp start up. It then later disconnects the electrode via a bi-metal strip after the lamp transitions from 'glow to arc' during starting so that lamp life is prolonged. One version of the HSI-T 2000 lamp is provided with an internal ignitor and needs none in the external circuit.

Caps:

Nickel plated brass for corrosion protection through life. All E40 types feature a metal-to-glass thread mould and a neck solder lock to provide at least 5Nm torque resistance. This ensures good contact-making with the lampholder and resists any chance of loosening during life due to local installation vibration.

E27 lamps are cemented to withstand 3Nm of torque. A high temperature solder is used to secure the centre contact electrical connections, for improved reliability.

Arc Tube:

Metal Halide arc tubes are made from high transparency quartz which has been shaped at each end to seal-in the discharge electrodes. Sylvania has recently introduced the 'preformed' arc tube technique which gives superior stability and maintenance of colour temperature throughout life.

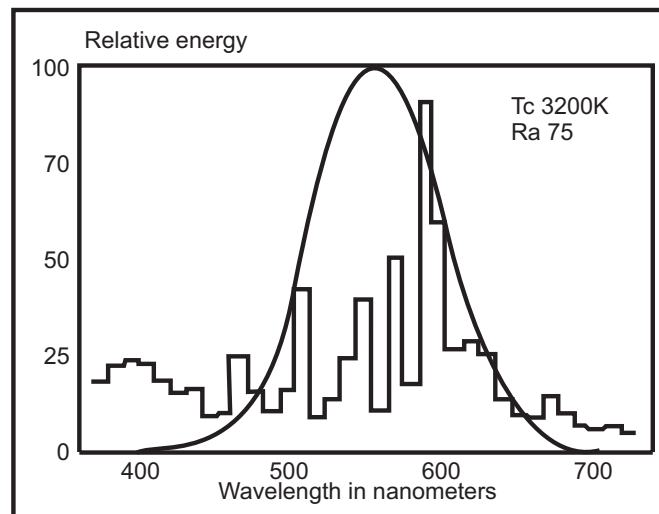
Depending on the chemistry within the arc tube the tungsten electrodes can be impregnated with emitter material which aids fast starting. The electrodes are connected to the cap through Molybdenum foils sealed in to the arc tube ends. Some types require a coating on the arc tube seal to keep the 'cold spot' temperature (the lowest operating temperature area) at the optimum value and therefore the light output of the lamp. This presents as a white paint of Aluminium oxide and is applied by a flame-spray process. Each arc tube also contains a low pressure argon fill gas to aid starting.

MetalArc E27 lamps are additionally fitted with a clear quartz shroud around the arc tube. As a result the 75W, 100W and 150W ratings may be used without a cover glass in the luminaire, at least as far as safety is concerned, saving on luminaire construction cost.

Note: It should be noted that a fully run-up arc tube will have a partial vapour pressure of Mercury of between 8 and 16 atmospheres and a temperature of about 800C. (For this reason, unless specifically stated otherwise, MH luminaires must be fitted with protective front glasses).

Chemical Constituents:

Sylvania have developed and pioneered the use of Sodium-Scandium chemistry for all of the range they produce because this system gives a superior lumen efficacy, stable colour through life and a high Ra value. The spectral power distribution of a 3000K Warmwhite de Luxe HSI-TD 150W is presented below.



By using a two component system a wide range of colour temperatures can be offered together with good initial lamp-to-lamp colour stability preserved through life. The main features of the Sodium-Scandium system are listed below:

Luminous efficacy: 80 to 100 lumens per Watt

Ra: DIN Class 2a or 75

Colour stability +/- 300K, good

Life: over 10,000 h (average rated life)

Competitive systems use a multi-component approach often combining up to five different chemicals in the colour-producing 'cocktail' dosed into the arc tube of the lamp. Each additional chemical component introduces the independent potential for variability which may result in significant lamp to lamp colour variation and much further variation through life. A well chosen and highly developed two component system such as Sodium-Scandium can give better results, particularly in combining high efficacy with very good colour.

Applications and Target Markets

Metal Halide lamps are designed with a very wide variety of applications/luminaire types in mind and can perhaps be easier classified by means of general areas as follows:

Application	Recommended Lamp Type
For Indoor Commercial Downlighting and Mini-floods:	MetalArc E27 70/100/150W or HSI-T 70/150W
For Shop Window/Merchandising:	HSI-TD double ended 70/150W or
For Lo-Bay Indoor Commercial:	HSI-T 4K and Britelux HSI-TSX 250 and 400W
For Hi-Bay Indoor Industrial:	Britelux HSI-SX and HSI-TSX 250 and 400W
For General Area or Facade Floodlighting:	HSI-T 4K E40 250 and 400W
For Sports Ground and Stadium Lighting:	HSI-T 4K E40 1000 and 2000W HSI-TD 2000W/D

Relative Features and Benefits

MetalArc and Britelux lamps are a white light discharge source and represent an alternative to High Pressure Sodium (SHP) or Mercury Vapour (HSL) lamps.

Features	Benefits
1. Efficacy of 80 -100 lm/W	Similar to SHP, more efficient than Mercury giving lower power costs
2. Colour Tc range 3200 - 6000K	Wider range of white light colour temperatures increases range of applications possible, both Indoor and Outdoor. (SHP 2050K, HSL 3800 - 4300K)
3. Ra: Class 2b, 75	Significantly better colour rendering than SHP (Ra 25) or HSL (Ra 50-60) improving visual quality
4. Britelux is SHP-gear compatible	MH lamps can be run on standard SHP ballasts, which adds no extra expense to the system
5. HSI-T 4K E40 is HSL-gear compatible	MH lamps can be run on standard HSL ballasts, plus a suitable ignitor and give the lowest control gear cost
6. Range of ratings and outer jacket sizes similar to SHP and HSL	Luminaires designed for SHP types need no optical modification to use BRITELUX types rationalising stocks and parts

Product Range and ILCOS Codes

Product Description
Product Code

ILCOS Code

**HSI-T SINGLE ENDED G12
BIPIN CAP**

20335 HSI-T 70W /3K G12

MT-70/30/1b-H95/E-G12-25/84

20336 HSI-T 150W /3K G12

MT-150/30/1b-H95/E-G12-25/84

**HSI-TD DOUBLE ENDED R7's/Fc2
3000K**

20918 HSI-TD 70W/WDL

MD-70/32/1b-H95/E-Rx7s-21/120/H45

20919 HSI-TD 150W/WDL

MD-150/32/2a-H95/E-Rx7s-24/137/H45

20945 HSI-TD 250W/WDL

MD-250/32/1b-H100/E-Fc2-26/162/H45

4000K

20941 HSI-TD 70W/NDL

MD-70/42/1b-H95/E-Rx7s-21/120/H45

20939 HSI-TD 150W/NDL

MD-150/42/1b-H95/E-Rx7s-24/137/H45

20943 HSI-TD 250W/NDL

MD-250/42/1b-H100/E-Fc2-26/162/H45

6000K

21032 HSI-TD 70W/D

MD-70/52/1a-H95/E-Rx7s-21/120/H45

21035 HSI-TD 150W/D

MD-150/52/1a-H95/E-Rx7s-24/137/H45

21038 HSI-TD 250W/D

MD-250/52/1a-H100/E-Fc2-26/162/H45

UV STOP**3000K**

21030 HSI-TD 70W/WDL/UVS

MD-70/32UVS/1b-H95/E-Rx7s-21/120/H45

21033 HSI-TD 150/WDL/UVS

MD-150/32UVS/2a-H95/E-Rx7s-24/137/H45

21036 HSI-TD 250W/WDL/UVS

MD-250/32UVS/1b-H100/E-Fc2-26/162/H45

4000K

21031 HSI-TD 70W/NDL/UVS

MD-70/42UVS/1b-H95/E-Rx7s-21/120/H45

21034 HSI-TD 150W/NDL/UVS

MD-150/42UVS/1b-H95/E-Rx7s-24/137/H45

21037 HSI-TD 250W/NDL/UVS

MD-250/42UVS/1b-H100/E-Fc2-26/162/H45

Product Description**ILCOS Code**Product Code

HSI-T 4K E40 - MERCURY COMPATIBLE

20394 HSI-T 250W 4K CL	MT-250/40/2b-H125/E-E40-47/257/H20
20546 HSI-T 400W 4K CL	MT-400/40/2b-H125/E-E40-47/283/H20
20597 HSI-T 1000W 4K CL	MT-1000/40/2b-H130/E-E40-67/382/H20
20598 HSI-T 2000W 220/240V 4K CL	MT-2000/40/2b-H135/E-E40-100/430/H20
20533 HSI-T 2000WS 380/440V 4K CL	MT-2000/40/2b-H245/E-E40-100/430/H20
20540 HSI-T 2000WS/I/ 380/440V 4K CL	MT-2000I/40/2b-H245/E-E40-100/430/H20

HSI-TD DOUBLE - ENDED 2000W

20339 HSI-TD 2000W/D Cable	MD-1950/58/1a-H100/E-Cable-36/187/H45
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BRITELUX E40 - SHP COMPATIBLE

24407 250W HSI-TSX	MC-250/54/2b-H100/E-E40-47/257
24409 400W HSI-TSX	MC-400/54/2b-H100/E-E40-120/290
20771 250W HSI-SX/BU CO	ME-250/37/2a-H95/E-E40-90/211/H15
20772 250W HSI-SX-SX/BU CL	MC-250/40/2b/-H95/E-E40-90/211/H15
20773 400W HSI-SX/BU CO	ME-400/37/2a-H100/E-E40-120/290/H15
20774 400W HSI-SX/BU CL	MC-400/54/2b-H100/E-E40-120/290/H15

METALARC E27

20731 MP75 CO/U	ME/T-75/32/2a-H95/E-E27/54/138
20730 MP75 CL/U	MC/T-75/32/2a-H95/E-E27/54/138
20733 MP100 CO/U	ME/T-100/32/2a-H100/E-E27/54/138
20732 MP100 CL/U	MC/T-100/32/2a-H100/E-E27/54/138
20751 MP150/CO/U	MC-150/32/2a-H95/E-E27/54/138
20750 MP150/CL/U	ME-150/32/2a-H95/E-E27/54/138

Compliance with Standards: EN's and IEC's

Notes and definitions:

CENELEC: The European Union standards-setting body which publishes directives and standards relating to the safety and performance of electrical products and which are incorporated into relevant EU member state standards, laws or regulations.

Low Voltage Directive: A set of EU regulations concerning electrical safety and the harmonisation and adoption of standards.

EMC: Electromagnetic Compatibility standard: Ensures that certain electrical products do not cause interference with the operation of other devices.

EN: European Norm - originally an IEC until accepted by CENELEC.

IEC's: International Electrotechnical Standards: Industry standards normally becoming EN's.

CE mark: applied to the lamp or packaging materials and evidence that the manufacturer meets all relevant EU standards.

Sylvania Metal Halide lamps comply with the relevant requirements of the following IEC's/EN's unless otherwise stated:

- IEC 61-1 Lamp caps
- IEC 188 - Mercury lamps
- IEC 662 - High Pressure Sodium lamps
- IEC 923 Ballasts for HID lamps
- IEC 927 Ignitors (including RF emissions)
- IEC 410 QA Inspection Plan
- CE marking

Compliance with Standards (cont.)

Product Family	Relevant Standards
MetalArc E27 (75-150W)	IEC/EN 60598-1. M150 must be operated in a closed fixture
MetalArc HSI-T G12 (70 & 150W)	IEC/EN 60598-1. Must be operated in a closed fixture IEC publication 1167 - Metal Halide lamps
MetalArc HSI-TD Double-ended (70W-250W)	IEC/EN 60598-1. IEC publication 1167 - Metal Halide lamps
Sodium compatible	
Britelux HSI-TSX and	IEC 662 (safety). IEC/EN 60598-1. Must be operated in a closed fixture
Britelux HSI-SX E40 (250W) Coated	IEC 662 (safety). IEC/EN 60598-1. Must be operated in a closed fixture
<i>N.B. Britelux HSI-SX E40 (400W) Coated BU only does not require a cover glass.</i>	
Mercury compatible	
HSI-T Tubular 4K E40 (250 & 400W)	IEC 188 (safety). IEC/EN 60598-1. Must be operated in a closed fixture
HSI-T Tubular E40 (1000 & 2000W)	IEC 188 (safety). IEC/EN 60598-1. Must be operated in a closed fixture

Lamp Data (Electrical)

Product Description

Product Code

	Lamp Voltage (V) Volt	Lamp Current (I) Ampere	Power (w) Watt	V/I Ratio Ohm	PFC Value Mfd
HSI-T SINGLE ENDED G12 BIPIN CAP					
20335 HSI-T 70W /3K G12	95	1.0	75	188.0	12
20336 HSI-T 150W /3K G12	95	1.8	150	99.0	20
HSI-TD DOUBLE ENDED R7's/Fc2 3000K					
20918 HSI-TD 70W/WDL	95	1.0	75	188.0	12
20919 HSI-TD 150/WDL	95	1.8	150	99.0	20
20945 HSI-TD 250W/WDL	100	3.0	250	60.0	32
4000K					
20941 HSI-TD 70W/NDL	90	1.0	75	188.0	12
20939 HSI-TD 150/NDL	95	1.8	150	99.0	20
20943 HSI-TD 250W/NDL	100	3.0	250	60.0	32
6000K					
21032 HSI-TD 70W/D	108	1.0	75	188.0	12
21035 HSI-TD 150/D	102	1.8	150	99.0	20
21038 HSI-TD 250W/D	112	3.0	250	60.0	32
UV STOP 3000K					
21030 HSI-TD 70W/WDL/UVS	95	1.0	75	188.0	12
21033 HSI-TD 150/WDL/UVS	95	1.8	150	99.0	20
21036 HSI-TD 250W/WDL/UVS	100	3.0	250	60.0	32
4000K					
21031 HSI-TD 70W/NDL/UVS	90	1.0	75	188.0	12
21034 HSI-TD 150/NDL/UVS	95	1.8	150	99.0	20
21037 HSI-TD 250W/NDL/UVS	100	3.0	250	60.0	32
HSI-T 4K E40 MERCURY COMPATIBLE					
20394 HSI-T 250W 4K CL	130	2.1	245	71	18
20546 HSI-T 400W 4K CL	130	3.4	400	45	28
20597 HSI-T 1000W 4K CL	130	8.25	1000	18.5	65
20598 HSI-T 2000W 220/240V 4K CL	135	16.5	1960	9.95	125
20533 HSI-T 2000WS 380/440V 4K CL	245	9.0	2000	28.0	35
20540 HSI-T 2000WS// 380/440V 4K CL	245	9.0	2000	28.0	35

Product Description
Product Code

	Lamp Voltage (V) Volt	Lamp Current (I) Ampere	Power (w) Watt	V/I Ratio Ohm	PFC Value Mfd
HSI-TD DOUBLE - ENDED 2000W					
20339 HSI-TD 2000W/D Cable	205	11.3	1950	uc	60
BRITELUX E40 - SHP COMPATIBLE					
24407 250W HSI-TSX	100	2.9	265	60.0	40
24409 400W HSI-TSX	105	4.4	425	39.0	45
20771 250W HSI-SX/BU CO	100	2.9	265	60.0	40
20772 250W HSI-SX/BU CL	100	2.9	265	60.0	40
20773 400W HSI-SX/BU CO	105	4.4	425	39.0	45
20774 400W HSI-SX/BU CL	105	4.4	425	39.0	45
METALARC E27					
20731 MP75 CO/U	95	1.0	75	188.0	10
20730 MP75 CL/U	95	1.0	75	188.0	10
20733 MP100 CO/U	100	1.2	100	148.0	12
20732 MP100 CL/U	100	1.2	100	148.0	12
20751 MP150/CO/U	95	1.8	150	99.0	20
20750 MP150/CL/U	95	1.8	150	99.0	20

u.c. = under consideration

Run-up Conditions

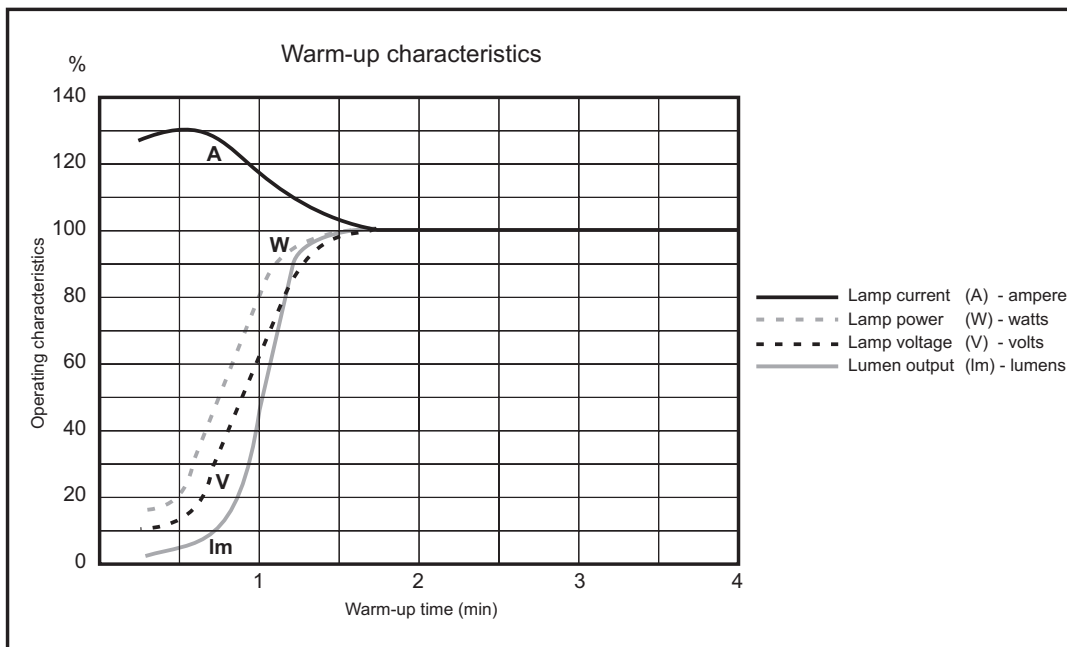
During the first 1.5 - 2 minutes after switch on, up to +40% more current is drawn from the supply until the lamp stabilises. Accordingly the following minimum fuse ratings should be used, per lamp:

70 - 100W: 2.5A
 150W: 4.0A
 250W:10.0A
 400W: 10.0A
 1000W: 15.0A
 2000W 220/240V: 25.0A
 2000W 380/440V: 25.0A

Fuse ratings for multiple lamp circuits:

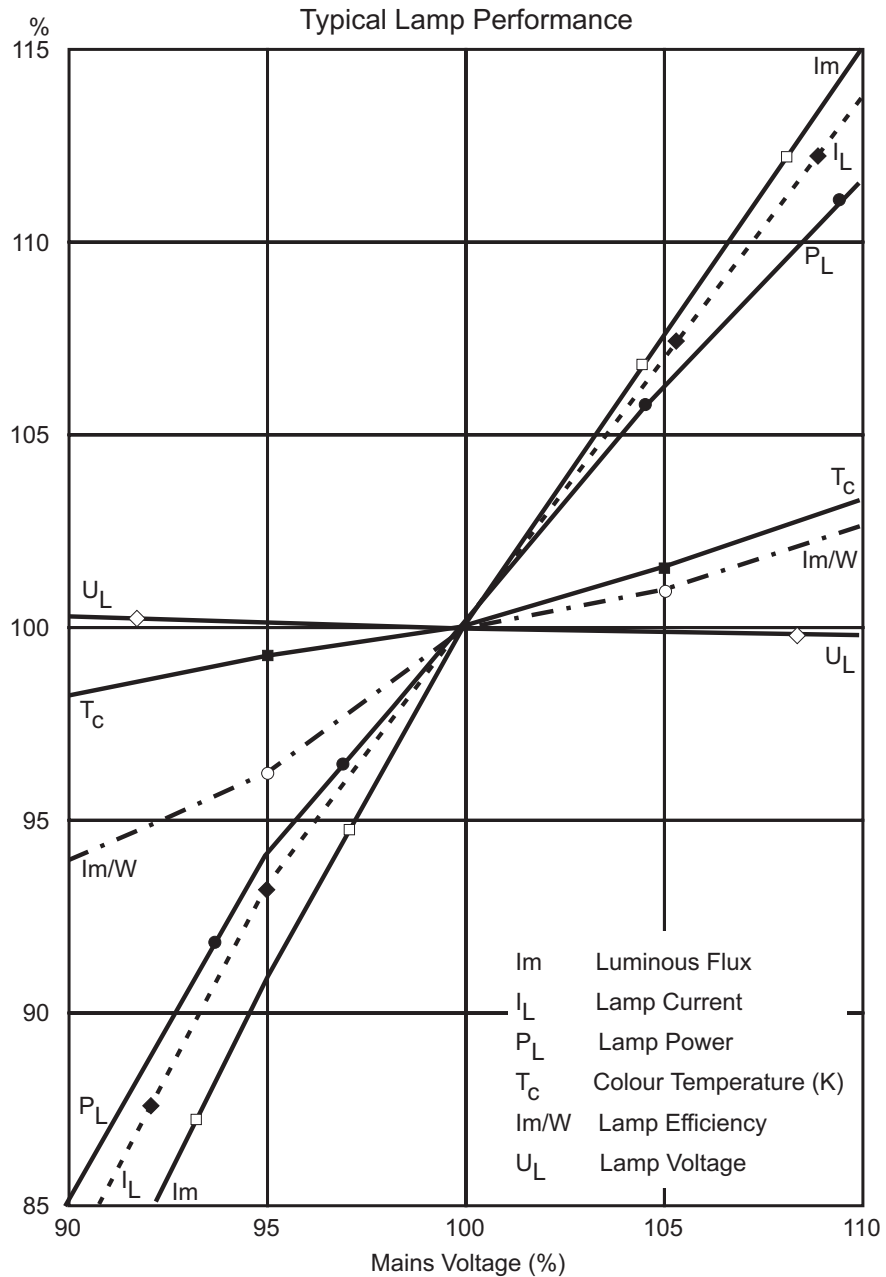
Number of lamps per circuit

TYPE	1	2	3	4	5	6
70-75W	4	4	4	4	6	6
100-150W	4	4	6	10	10	10
250W	10	16	16	20	20	20
400W	16	20	20	25	25	25
1000W	20	25	35	40	50	63
2000W	20	25	25	40	50	63



Line Voltage Variation and Lamp Performance

The following graph illustrates the behaviour of medium wattage sodium-scandium MH lamps when the line voltage varies:



Note: Continuous over-wattage operation should be avoided since lamp life will be shortened.

Three-Phase Systems

With the exception of the 380/440V 2000W 4K E40 and HSI-TD 2000W-D lamp types, all other lamps listed on pages 22 and 23 are intended for operation on single phase to neutral operation on 230V - 240V 50Hz control gear. Cross phase operation can be used but then care should be taken to ensure that the wattage loading on each phase is precisely balanced. Circuit breakers should be arranged to disconnect all three phases in the case of a lamp or luminaire extinguishing. The neutral line should always be connected according to the ballast manufacturer's instructions.

Check the ballast marking to ensure that the correct voltage type is being used. Many manufacturers offer multi-tapped types where a choice can be made in up to three steps - 220V, 230V and 240V, and it is strongly recommended that such types are used. All ballasts should operate a lamp stably at minus 5% of the rated line voltage on the tap chosen.

Use of Ignitors

With the exception of the 20540 HSI-T 2000S/I 380/440V type, which contains an internal ignitor, all MH lamps require an ignitor in the external circuit for reliable and faster starting.

Impulse Type

These ignitors are generally of the mono-pulse type, operating once per 50Hz half cycle. They develop a voltage pulse of up to 750V (250 & 400W) up to 1200V for about 40 microseconds and are used only on Mercury compatible MH lamps types as follows:

20394 HSI-T 250W

20546 HSI-T 400W

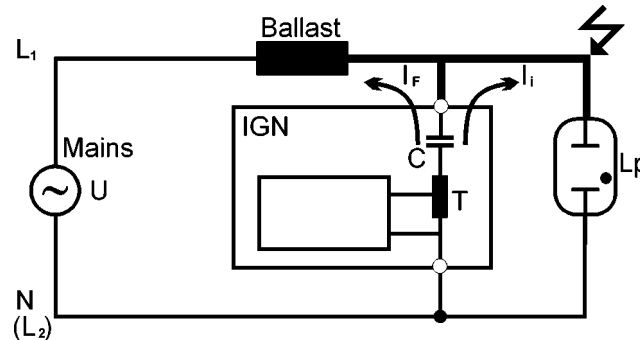
20597 HSI-T 1000W

20598 and 20533 HSI-T 2000W.

N.B. 1. Ignitor designs based on glow-starters may pulse the ballast continuously upon lamp failure and cause premature ballast failure.

N.B. 2. The 20540 HSI-T 2000W/S/I type is elf starting and needs no external ignitor. Check the ballast manufacturer's connection diagram with care.

Impulse Ignitor Layout



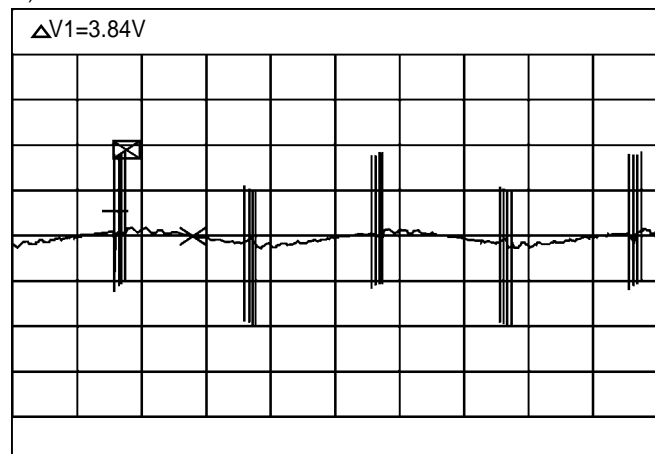
N.B. Ignitor designs based on glow-starters may pulse the ballast continuously upon lamp failure and cause premature ballast failure.

Super Imposed Pulse type

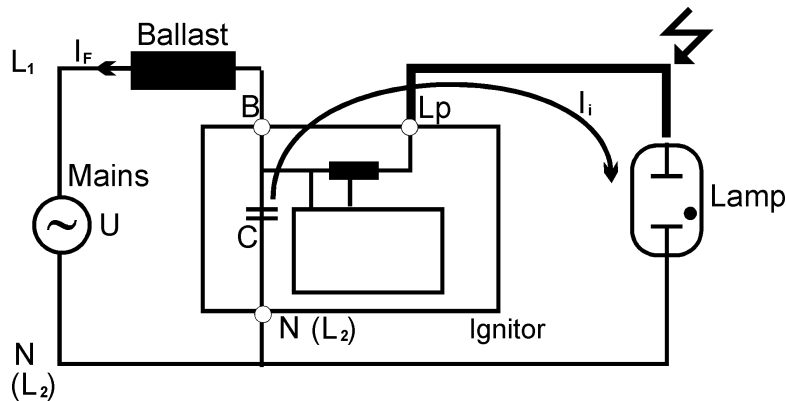
Most MH lamps benefit in terms of starting reliability through life from a different type of starting voltage pulse. When a lamp fails certain impulse ignitors will pulse the lamp continuously. SIP solid state electronic ignitors can be designed to self-disconnect from the circuit after a precise time has elapsed, until the electrical supply is reset. In terms of safety, the latter type is to be preferred. The SIP ignitor has the following properties:

1. It does not need to use the ballast as a pulse transformer and re stresses the ballast less.
2. A 3.5 to 4.5kV 2 microsecond width triple pulse train is superimposed on the ballast open circuit voltage during starting at very precise points in each 50Hz half cycle which most favours reliable lamp starting. A typical pulse profile is shown below.

* (see relevant data sheet)



In order to achieve the performance described above the ignitor remains in series with the ballast and lamp after starting and must be of the correct current rating. Check the ignitor manufacturer's label if in doubt. The diagram below illustrates a typical SIP set up:



Lampholder Specification for MetalArc E27 Lamps

The standard E27 lampholder (as used for High Pressure Sodium SHP 50 and 70W lamps) is rated for a maximum peak pulse of 2.3kVpk (500V DC rated). Since MetalArc E27 lamps require 3.3 to 4.5 kVpk a 750V DC rated lampholder must be used. E.g., Bender and Wirth 10064Z, Vossloh type 626.

Power Factor Correction

Choke-ignitor circuits without power factor correction will yield a low lagging power factor of between 0.3 and 0.5. This means that only 30-50% of the current drawn from the supply is effective in powering the lamp and is thus considered undesirable by power supply companies. In most larger commercial or industrial installations the power supply company will financially penalize a consumer where power factors fall below 0.85. Although it is possible to install bulk power factor correction at the mains supply panel it is usual to correct the power factor in each luminaire installed. The conventional method is to add a power factor correction capacitor to the luminaire which is connected across the incoming line terminals. The value of the capacitor required is stated for convenience in the relevant data sheet for the lamp concerned and is also summarised on page 22 above - 'Electrical Data'.

Electromagnetic Compatibility

It is necessary to comply with EMC regulations concerning conducted RF emissions. Ballasts and ignitors should comply with IEC 923 and 927 and it is strongly recommended that EMC testing is performed on the luminaire by a competent test house to ensure compliance.

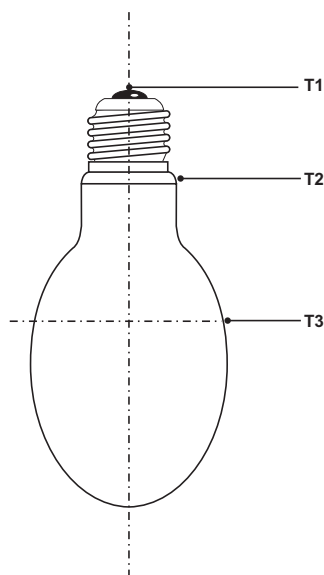
Lamp Testing and Safety

If a lamp or its luminaire are suspected as defective consult the section 'Troubleshooting'. For design, photometric or construction test purposes the following points should be observed:

1. Refer to the relevant IEC's or EN's listed above, which contain detailed required procedures.
2. Light output (luminous flux) measurements must be made in a 1.5m diameter Ulbricht sphere on lamps aged 100h, in a 25C ambient temperature on an appropriate reference ballast at +/- 0.1% of the nominal line voltage. Take care to observe any burning position limitations. Burn the lamp for at least 15 minutes in the sphere and do not move it before measurement.

3. True RMS electrical instruments (CCF capability 2.5) should be used and only switched in after the ignitor has started the lamp and the ignitor ceased operating in order to avoid the c.4.5kV pulses affecting the instruments.

Critical Temperatures



MH lamps have three limit temperatures to be observed. Each limit must be considered as a 'worst case maximum' in situ in the luminaire having paid due regard to the maximum ambient temperature in the installation and +10% line voltage.

Measuring point		Maximum temperature (Celsius)
T1	- Centre contact E27	210
	- Centre contact E40	250
T2	- Cap Rim	210
T3	- Bulb (horizontally above the arc tube)	400

Burning Position Recommendations

The data sheet for each of the MH lamp types covered by this manual and available on a separate CD-ROM, gives information on the burning position limitations. The following points should be observed:

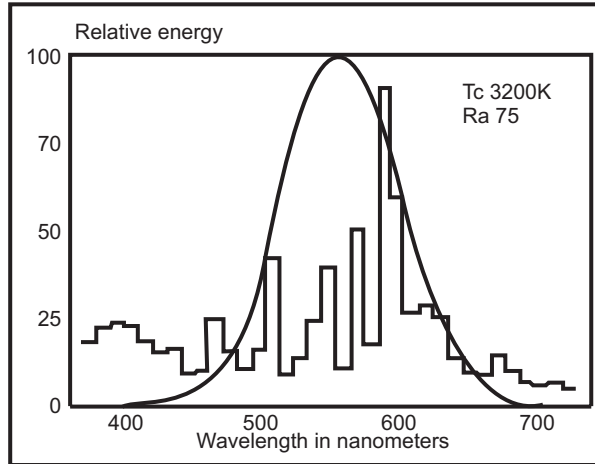
1. Clear tubular outer jacket types are generally designed for and work best when operated within +/- 20 degrees of the horizontal.
2. Elliptical coated types are generally designed for and work best when operated within +/- 15 degrees of the vertical with the lamp cap in the up position (i.e. above the arc tube).
3. Where a limit is prescribed, treat this as a safety issue and *do not exceed the limit*.
4. Lamps which may be burned in any position will not pose a safety problem but may not always burn at the best light output or with the nominal colour point (see 1 and 2 above). Owing to luminaire interactions it is difficult to generalise on such effects but up to 20% lower performance may result in worst cases. Data given is for base up operation.

Hot Restrike Performance

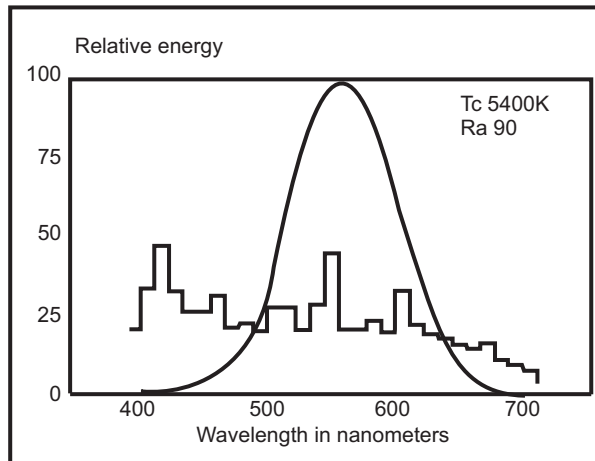
Lamps which extinguish when hot will not re-light for many minutes. The hot arc tube gas and vapours will be at too high a pressure for the ignitor to successfully start the lamp and only waiting to cool down will achieve a restart. Certain manufacturers provide special hot restrike ignitors which may be used with RX7's, Fc2, or cable connected double ended linear lamps or, if the restrike time does not cause substantial inconvenience or danger, versions which do not pulse the lamp continuously but cut out until the electricity supply is recycled on and off.

Lumen Output and Colour Selection

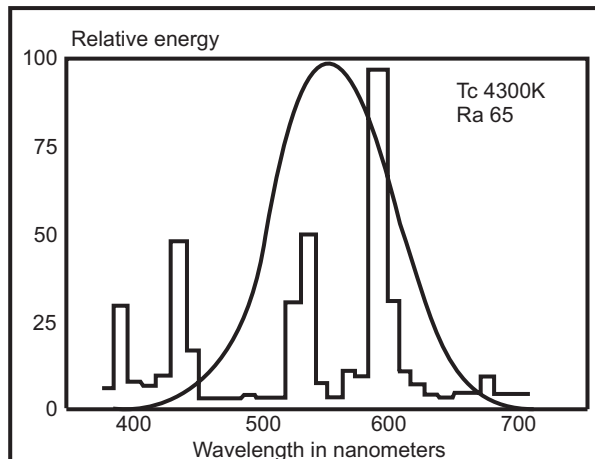
Spectral Energy Data for Typical MH Types



HSI-TD 3K



HSI-TD 4K



HSI-TD 6K

Product Code	Tc = 3000K	Tc = 4000	Tc = 6000K
Product Designation	Correlated Colour Temperature		
Luminous Flux (lumens)			

HSI-T SINGLE - ENDED G12 BIPIN CAP

20335 HSI-T 70W /3K G12	5200		
20336 HSI-T 150W /3K G12	12000		

HSI-TD DOUBLE - ENDED R7's/Fc2 3000K

20918 HSI-TD 70W/WDL	5500		
20919 HSI-TD 150/WDL	13000		
20945 HSI-TD 250W/WDL	20000		

4000K

20941 HSI-TD 70W/NDL		5800	
20939 HSI-TD 150/NDL		13000	
20943 HSI-TD 250W/NDL		20000	

5200K

21032H SI-TD 70W/D			5400
21035H SI-TD 150/D			11000
21038 HSI-TD 250W/D			18000

UV STOP 3000K

21030 HSI-TD 70W/WDL/UVS	5500		
21033 HSI-TD 150/WDL/UVS	13000		
21036 HSI-TD 250W/WDL/UVS	20000		

4000K

21031 HSI-TD 70W/NDL/UVS		5800	
21034 HSI-TD 150/NDL/UVS		13000	
21037 HSI-TD 250W/NDL/UVS		20000	

HSI-T 4K E40 - MERCURY COMPATIBLE

20394 HSI-T 250W 4K CL	19000		
20546 HSI-T 400W 4K CL	36000		
20597 HSI-T 1000W 4K CL	81000		
20598 HSI-T 2000W 240V 4K CL	189000		
20533 HSI-T 2000WS 440V 4K CL	200000		
20540 HSI-T 2000WS/I/440V 4K CL	200000		

Product Code	Tc = 3000K	Tc = 4000	Tc = 6000K
Product Designation	Correlated Colour Temperature		
Luminous Flux (lumens)			

HSI-TD DOUBLE - ENDED 2000W

20339 HSI-TD 2000W/D Cable			200000
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BRITELUX E40 - SHP COMPATIBLE

24407250W HSI-TSX	21000		
24409400W HSI-TSX	40000		
20771250W HSI-SX/BU CO	21000		
20772250W HSI-SX/BU CL	21000		
20773400W HSI-SX/BU CO	40000		
20774400W HSI-SX/BU CL	40000		

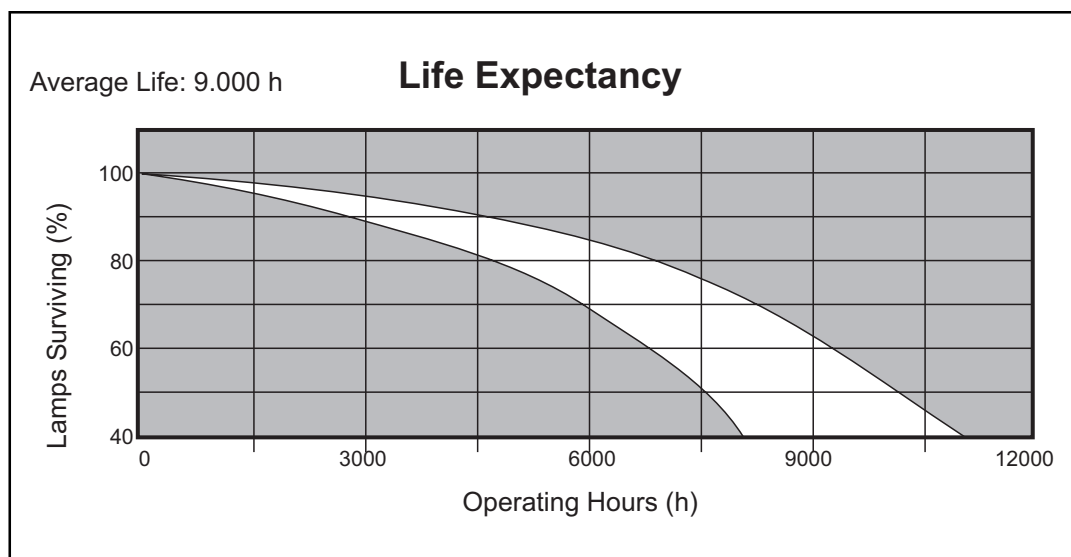
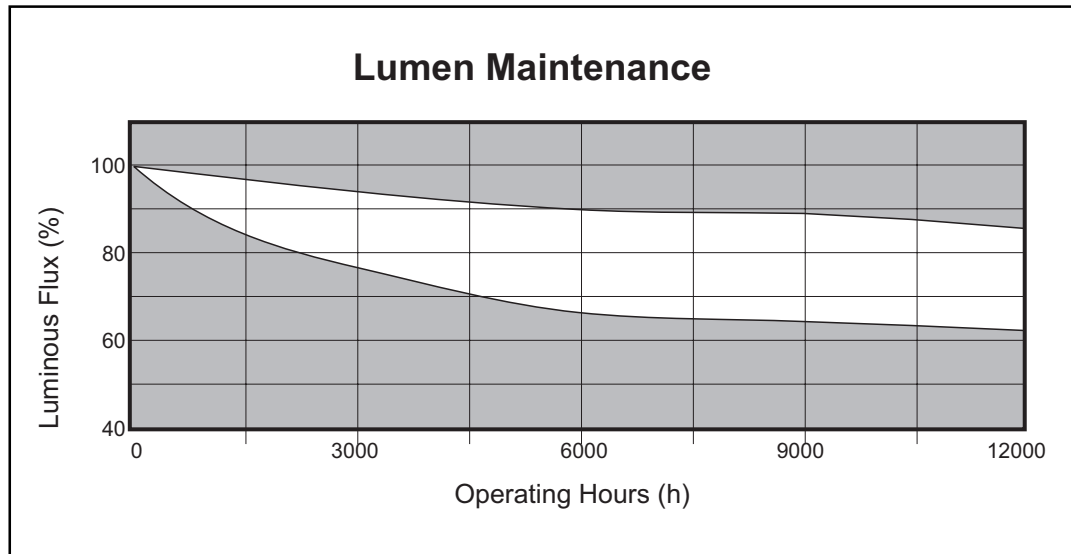
METALARC E27

20731 MP75 CO/U	5000		
20730 MP75 CL/U	5500		
20733 MP100 CO/U	8100		
20732 MP100 CL/U	8500		
20751 M150/CO/U	12500		
20750 M150/CL/U	13000		

Lumen Maintenance and Lamp Survival

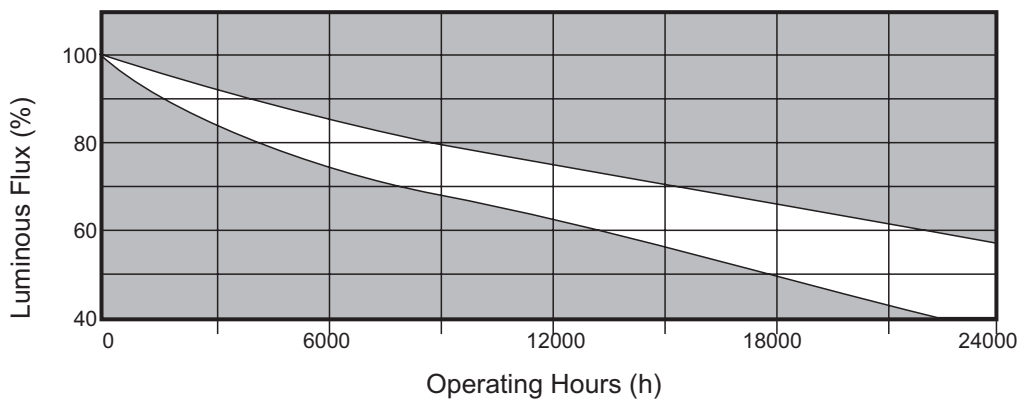
The following graphs represent typical performance for the main three groups of Metal Halide lamp:

HSI-TD 70 - 250W



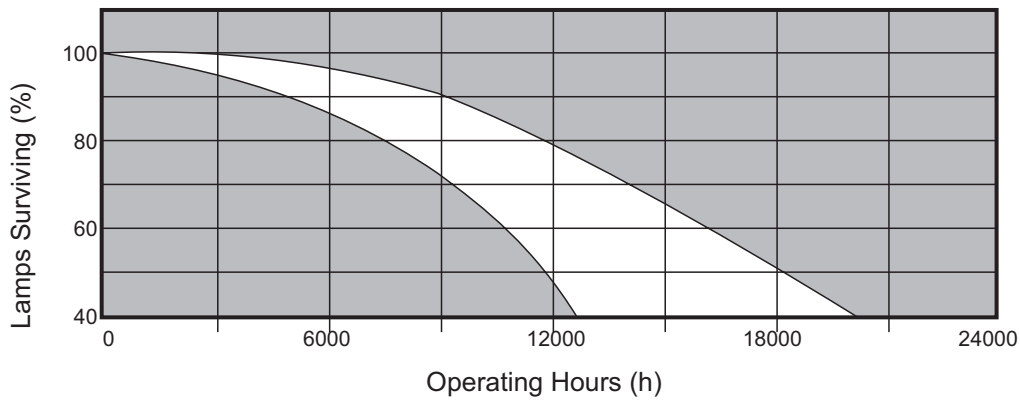
Britelux and HSI-T 250 and 400W

Lumen Maintenance



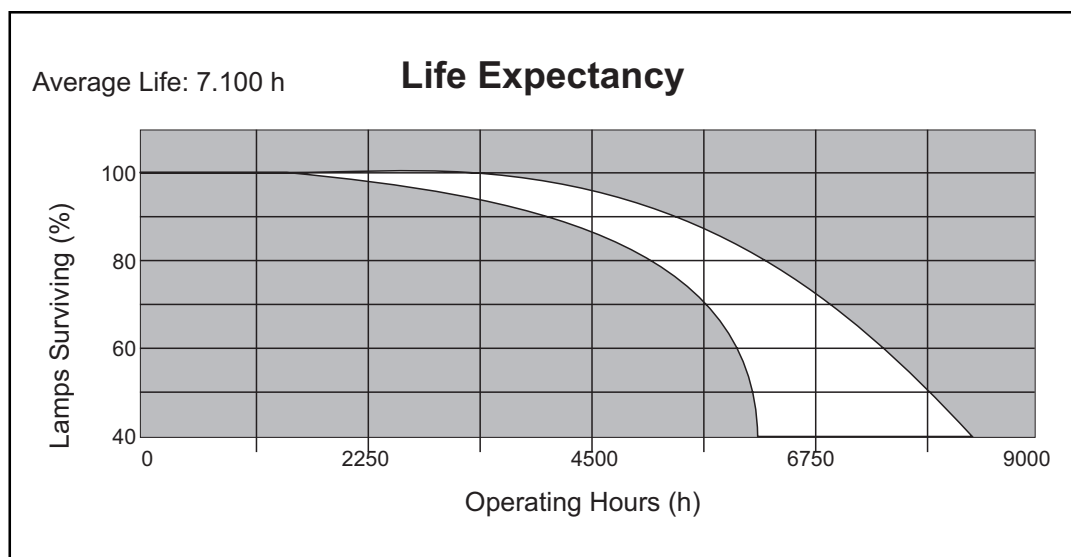
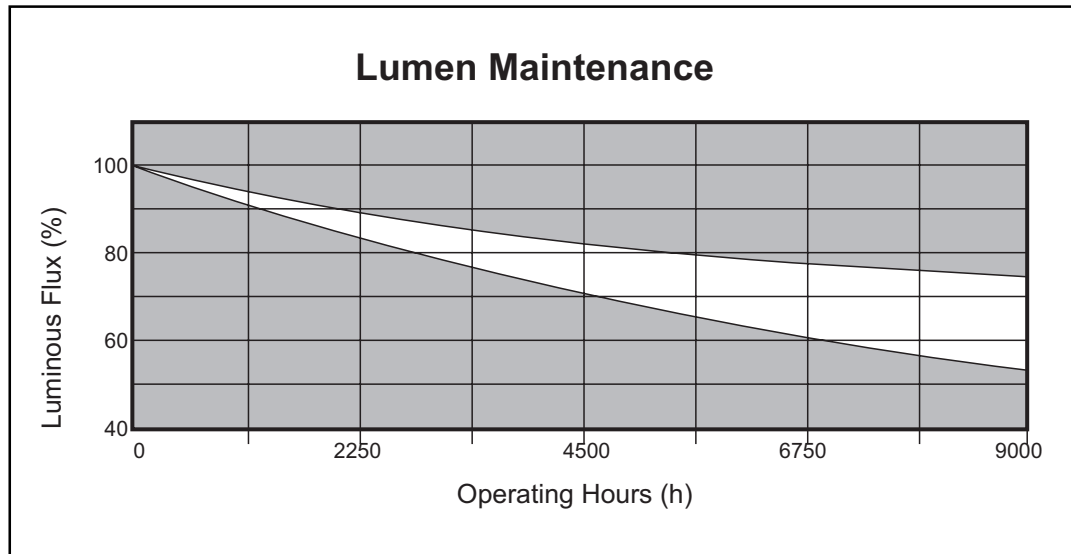
Average Life: 14.500 h

Life Expectancy



HSI-T 2000W, S and S/I versions

The data presented above is obtained under ideal operating conditions in our laboratories and is provided for guidance only.

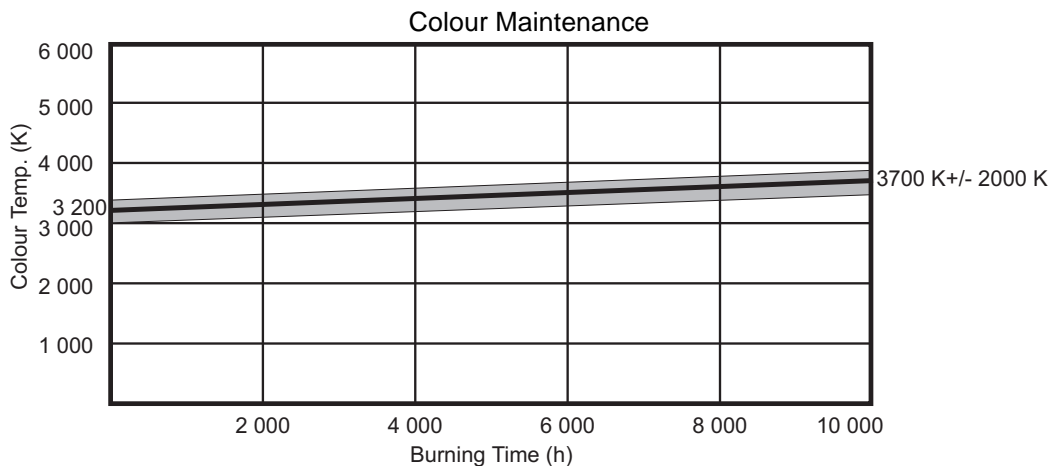


Colour Temperature Variation Through Life

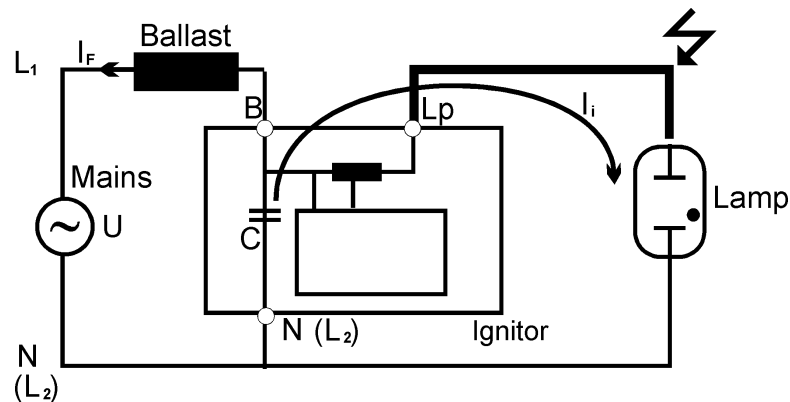
Sylvania Metal Halide lamps are manufactured using a technique described as 'blow moulded' for the arc tube. This process ensures that the internal dimensions and the volume of the arc tube are consistent, which means that the colour shift tolerances from lamp to lamp are minimised. **Initial colour differences** between lamps may have a number of causes.

- In general lamps may vary initially by a small amount ± 200 Kelvin, due to manufacturing tolerances.
- Ballast tolerances for MH lamps are tighter than for other HID lamps to ensure top performance and are specified at $\pm 3\%$. Voltage tapings (220/230/240Volt) with a 5% tolerance band are provided to ensure that the ballast powers a lamp at its rated wattage whatever the nominal input voltage. Always measure the line voltage and connect the appropriate tapping.
- Some reflector designs may reflect infrared radiation back to the lamp, forcing its power consumption and consequently its colour temperature to change.

Due to chemical changes within the arc tube that normally occur during life, the colour temperature may change typically by ± 500 K. Depending on the type of chemistry involved the shift may move to the 'blue' or 'red'. Almost all Sylvania lamps use the Sodium-Scandium chemistry system, which tends to move only a small amount towards the blue (increasing Kelvin value) as the following diagram indicates:



Ballast Recommendations



50Hz Magnetic: Tapped Ballasts

All lamps are ballasted on a series inductor circuit generally laid out as in the above diagram. See also the section on page 26 concerning Ignitors.

Thermal protection for HSI-TD double ended and HSI-T G12 single ended types:

Towards the end of life electrode wear, due to chemical erosion, may be sufficiently uneven to cause rectification i.e. the presence of a DC component in the lamp current. Other conditions may cause a gradual increase in the lamp current. Both conditions can cause the ballast core temperature to rise which may in turn cause a failure. Accordingly HSI-TD and HSI-T Metal Halide lamps should only be operated with a thermally protected ballast (usually a thermistor embedded in the ballast core which self-resets on cooling down). The following manufacturers may be consulted for further information:

Tridonic:

Vossloh Schwabe:

Magnetek:

Helvar:

W.J. Parry:

Atlas Components:

Transtar:

(Note: The above list is not exhaustive nor intentionally exclusive)

Dimensions (max. overall length and cross-section)

Product Description	Max. Overall Length (mm)	Max. diameter (mm)
HSI-T SINGLE ENDED G12 BIPIN CAP		
HSI-T 70W /3K G12	76	26
HSI-T 150W /3K G12	76	26
HSI-TD DOUBLE ENDED R7's/Fc2		
HSI-TD 70W/WDL	117.6	22
HSI-TD 150/WDL	135.4	25
HSI-TD 250W/WDL	162	27.5
HSI-T 4K E40 - MERCURY COMPATIBLE		
HSI-T 250W 4K CL	257	47
HSI-T 400W 4K CL	270	63
HSI-T 1000W 4K CL	382	47
HSI-T 2000W 240V 4K CL	430	102
HSI-T 2000WS 440V 4K CL	430	102
HSI-T 2000WS/I/440V 4K CL	430	102
HSI-TD DOUBLE - ENDED 2000W		
HSI-TD 2000W/D Cable	187	40
BRITELUX E40 - SHP COMPATIBLE		
250W HSI-TSX	260	48
400W HSI-TSX	270	63
250W HSI-SX/BU CO	227	91
250W HSI-SX/BU CL	227	91
400W HSI-SX/BU CO	292	122
400W HSI-SX/BU CL	292	122

Product Description	Max. Overall Length (mm)	Max. diameter (mm)
METALARC E27		
MP75 CO/U	138	54
MP75 CL/U	138	54
MP100 CO/U	138	54
MP100 CL/U	138	54
MP150 CO/U	138	54
MP150 CL/U	138	54

Switching, Dimming and Continuous Operation

Switching

All life data provided for Sylvania Metal Halide lamps is based on the Average Rated Life concept, which is the point at which a statistically significant population of lamps will have reached 50% survival. Switching frequency will have a marked influence on life. The switch cycle used in life test is 2 times per day, 11 hours on and 1 hour off.

Dimming

Lamp colour and lamp power are intimately connected. Changes in power produced by dimming will change the colour of the lamp drastically and shorten its life. As a rule the poor results produced by dimming Metal Halide lamps do not warrant the effort or expense involved.

Lamp Cap Types

The lamp caps used for HID lamps are described in detail in IEC 61-1/EN60061-1 and the relevant lamp data sheet as follows:

- E27:** Lamp holders used with MetalArc E27 lamps should be 750V DC/4.0kV peak pulse rated.
- E40:** Lamp holders used with E40 type lamps should be 4.5kV peak pulse rated.
- HSI-T G12:** If hot restrike is desired, a lampholder with a peak pulse rating of 25kV is required.
- RX7's:** For HSI-TD 70W and 150W only.
- Fc2:** For HSI-TD 250W only

Luminaire Design Considerations

Luminaires must be constructed to the requirements of relevant sections of IEC598/EN60598.

Enclosure and Safety

Metal Halide lamps operate at significantly high internal pressure and the reflector must for safety reasons generally be provided with a protective toughened glass cover. There are only a few exceptions:

Exceptions: MetalArc E27 with the MP designation may be operated without a protection glass. Under certain conditions Britelux 400W (vertical base-up burning only) may also be operated without a protection glass. It should be noted that certain applications would benefit from the use of a UV filter glass enclosure irrespective of safety considerations where for example fabrics may be caused to fade.

Enclosure may result in a temperature rise within the reflector housing. This may lead to adverse changes in lamp wattage, colour and life. The reflector and fixture design should be such that the lamp voltage does not increase more than 5 Volt compared to operating the same lamp in free air at 25 Celsius.

Ultra-Violet Radiation

Metal Halide lamps may radiate some of their output in the UV sector of the electromagnetic spectrum. UV radiation may be of the UVC (Germicidal), UVB (Erythermal) or UVA (Skin tanning or colour bleaching) variety.

The table below gives an overview by MH product category:

Lamp Type	UV Radiation type	Protection required?
MetalArc E27 (75-150W)	A, B negligible	Discretionary
MetalArc HSI-T G12 (70 & 150W)	C, B and A	Advised*
MetalArc HSI-TD (70W-250W)	C, B and A	Advised*
Britelux HSI-TSX and Britelux HSI-SX E40 (250/400W) Coated	A, B negligible A, B negligible	Discretionary Discretionary
HSI-T Tubular 4K E40 (250 & 400W)	A, B negligible	Discretionary
HSI-T Tubular E40 (1000 & 2000W)	A, B negligible	Discretionary

* A filter glass such as UVILEX 390 is recommended

Disposal

The disposal of all discharge lamps must be treated as a specialised task and confided to a properly trained person. Metal Halide lamps contain small amounts of Mercury and Sodium in the arc tube which is normally in the iodide form. The arc tube is surrounded by an outer jacket which contains a sub-atmospheric pressure of inert gas, or a vacuum. Breaking the outer jacket must be done wearing safety glasses, gloves and any other equipment prescribed by the Health and Safety Authority and should be performed in a well ventilated space in the dry. The outer jacket glass will implode on breaking so releasing glass fragments and should be done inside an open-topped metal container. These fragments may be crushed and recycled after collection.

The arc tubes should not be broken under any circumstances or exposed to water but can be temporarily stored in the dry before putting to waste. Local authority waste disposal regulations are to be observed at all times and in the case of doubt consult the appropriate authority. It is not necessary to return lamps to the manufacturer. Specialised recycling companies should preferably be used to carry out disposal where practical and available.

Troubleshooting

General: When investigating an apparent fault it is imperative for safety reasons that the operating circuit is switched off.

Always check the fuse or circuit breaker in the external circuit first. If tripped, reset or replace the fuse cartridge but if the fuse trips out again then it is most likely the fault is in the luminaire (device) or lamp. Next ensure that the correct lamp has been inserted into the luminaire socket. The ballast maker's label should give the correct information.

Please use the following checklist in order to determine how to rectify the fault:

A. Lamp out

1. Check that the supply is switched on and that the external fuse has not tripped. If the fuse trips again then:
 - a. Check that the power factor capacitor has not developed a short circuit condition. You may remove it temporarily to check.
 - b. Check that all wiring insulation is in good condition. An electric strength test with a PAT (portable appliance tester) should be made. Replace any defective wiring. If the lamp still does not start then switch off and verify that all internal wiring connections in the luminaire are properly connected and go to 2.
2. Make sure that there is good 'Earth' continuity between the terminal block and the luminaire frame. Repeat the PAT test and go to 3.
3. If no attempt to start the lamp is observed, switch off again and withdraw the device's local fuse, if serviceable. Check or replace the fuse.
4. If the lamp still does not start and the operating circuit contains a starter, replace it.
5. Isolate the ballast and for choke inductors only perform a continuity check using a multi-meter equipped with a low voltage DC battery. Never 'Megger' test any ballast for any reason. If an open circuit or zero impedance is found then replace the ballast.
6. If the lamp still does not start consult the manufacturer.

B. Lamp does not appear to give its full output

1. Ensure the correct lamp is fitted.
2. Check the electrical supply available voltage and match this it to the ballast maker's label information. If ballast taps have been provided make sure the most suitable one has been connected.
3. Check that the luminaire is venting properly to avoid heat building up. Many instances of overheating are related to poor design or over-running a luminaire with a lamp and/or ballast combination for which

it was never designed. Sometimes restricted ventilation or improper burning position may be the cause. Use all common sense methods to allow the luminaire to thermally stabilise properly. Consult the luminaire manufacturer.

4. The lamp is not burning in the optimum position in the luminaire/ installation. Consult the manufacturer's data sheets.

C. Lamp flashes and does not ignite again

No ballast present - rectify the fault

Ballast short-circuited - replace the choke

Check the connections with the manufacturer's label

Capacitor in parallel with lamp - replace and connect properly

D. Lamp does not ignite, but remains in the glow stage

Lamp damaged after over loading

Ignitor defective - replace

Choke open circuit voltage is low - check for correct choke type

E. Lamp cycles (ignites but then extinguishes quickly) or shows signs of arc tube blackening

Lamp is at the end of life -replace

Luminaire is too hot - go to 3 above.

Line voltage variation is too great - check and consult the electricity supplier

F. Lamp develops bulges or crevices in the outer jacket

Overloaded, check ballast type and all connections. Replace lamp.

G. Lamps operate with abnormal colour

- Check only after 100 hours operation. Then check burning position is within limits prescribed on the data sheets. For HSI-TD lamps check that the arc tube tip-off is not pointing down. If so then reposition lamps in the lampholder at once before switching on again.

Table of Equivalents

Product Descriptions

SYLVANIA Description	Version	Philips Description	Osram Description	Mazda Description	GE Europe Description
		MH	PowerStar		MultiVapour
HSI-T SINGLE - ENDED G12 BIPIN CAP	3000K	MHW-T	HQI	MTI/L	
HSI-TD DOUBLE - ENDED R7's/Fc2	3000K	MHW-TD	HQI/T WDL	MTI/L	MQI/T 30
	4000K	MHN-TD	HQI/T ND		MQI/T 43
	6000K		HQI/T D		
HSI-T 4K E40 - MERCURY COMPATIBLE	4000K	HPI-T		MAI/H	MBI/F
HSI-TD DOUBLE - ENDED 2000W	6000K		POWERSTAR 2000	MBI/L	
BRITELUX E40 - SHP COMPATIBLE					
CO - E	4000K		HQI-E		
CL - E	4000K				
TSX	4000K		HQI-T		
METALARC E27			HQI/E		

Glossary

Term

Meaning

MH	Metal Halide lamp
SHP	High Pressure Sodium lamp
HSL	Mercury Vapour lamp
HSI-T	Metal Halide lamp, single ended, G12 cap or E40
HSI-TD	Metal Halide lamp, double ended, RX7's, Fc2 caps or cable connector
Britelux	HSI-SX or HSI-TSX Metal halide lamp
HSI-SX	Britelux Metal Halide Elliptical Coated E40 cap UP burning position
HSI-TSX	Britelux Metal Halide Tubular Clear E40 universal burning position
SIP	Super-imposed pulse electronic ignitor

Worldwide Marketing and Manufacturing Locations



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Fax (+43) 2249 7460-33

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1930 ZAVENTEM
Tel. (+32) 2 711 05 00
Fax (+32) 2 725 60 60

Manufacturing Location:

Sylvania N.V.
Industriepark
3300 TIENEN
Tel. (+32) 16 80 02 11
Fax (+32) 16 81 89 45

DENMARK

Sylvania A/S
Jernholmen 38
2650 HVIDOVRE
Tel. (+45) 36 78 36 00
Fax (+45) 36 78 05 53

FINLAND

Sylvania-Lumiance Oy
Sirrikuja 3A
00940 HELSINKI
Tel. (+358) 0 3421 100
Fax (+358) 0 3421 099

FRANCE

Marketing Location:

SLI France S.A.
(Sylvania, Claude, Concord)
Tour Neptune
20, place de Seine - Courbevoie Cédex 20
92806 PARIS-LA-DÉFENSE
Tel. (+33) 1 41 26 61 51
Fax (+33) 1 41 26 61 52

Manufacturing Locations:

22, rue Berjon
69336 LYON Cédex 09
Tel. (+33) 72 19 12 00
Fax (+33) 72 19 12 01-3

Lighting Centre

rue des Acières
42000 SAINT-ETIENNE
Tel. (+33) 77 92 27 30
Fax (+33) 77 92 27 31

Manufacturing Location:

Z.I. de Montreynaud
11, Rue Victor Grignard
42000 SAINT-ETIENNE
Tel. (+33) 77 92 27 27
Fax (+33) 77 93 41 50

GERMANY

Sales & Manufacturing Location:
SLI Lichtsysteme GmbH
Graf-Zeppelin Str. 9-11
91056 ERLANGEN
mail: Postfach 1740
D-91051 ERLANGEN
Tel. (+49) 91317930
Fax Manuf. (+49) 9131 793-203
Mkt (+49) 9131 793-388

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Sylvania A.E.
19,5 Km Lavriou Ave.
19002 Peania
Tel. (+30) 1 66 46 564/565/566
Fax (+30) 1 66 47 142

ITALY

Sylvania S.p.A.
Via Figino 105
20016 PEROMI
Tel. (+39) 2 353 43 41
Fax (+39) 2 339 02 60

NETHERLANDS

Lumiance bv
Perkinsbaan 15a
NL-3439 ND NIEUWEGEIN
P.O.Box 1392
NL-3430 BJ NIEUWEGEIN
Tel. (+31) 30 605 76 00
Fax (+31) 30 604 78 97

Manufacturing Location:

Lumiance bv
Oudeweg 155
P.O. Box 6310
2031 CC HAARLEM
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Fax (+31) 23 531 72 86

NORWAY

Sylvania A/S
Postboks 193
Vestvollveien 10
2020 SKEDSMOKORSET
Tel. (+47) 63 87 91 30
Fax (+47) 63 87 90 37

PORTUGAL

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Zona Industrial
da Barruncheira
Lote A, Apartado 69
Carnaxide
2795 LINDA-A-VELHA
Tel. (+351) 1 418 62 17/418 62 40
Fax (+351) 1 418 68 25

SPAIN

SLI Sylvania S.A.
Los Llanos de Jerez 17
Poligono Industrial
28820 COSLADA (MADRID)
Tel. (+34) 91 669 90 00
Fax (+34) 91 671 62 61

SWEDEN

Sylvania AB
Katarina Bangata 79
Box 112 04
10061 STOCKHOLM
Tel. (+46) 8 442 73 30
Fax (+46) 8 442 73 40

SWITZERLAND

Corporate Headquarters

Sylvania Lighting S.A.
20, Route de Pré-Bois
Case Postale 1912
1215 GENEVA 15 (Aéroport)

Export Department:

Tel. (+41) 22 717 08 11
Telex 415 565
Fax (+41) 22 798 37 68
Cable INTELGENT

Swiss Sales Offices:

Sylvania Lighting S.A.
4, Chemin des Léchères
1217 MEYRIN
Tel. (+41) 22 782 00 72
Fax (+41) 22 782 07 42

U.K.

Concord Lighting Ltd.

Avis Way
NEWHAVEN
East Sussex BN9 OED
Tel. (+44) 1273 51 58 11
Fax (+44) 1273 51 26 88

London Showroom

174 High Holborn
LONDON WC1V 7AA
Tel. (+44) 171 497 14 00
Fax (+44) 171 497 14 04

Manufacturing Location:

SLI Lighting Ltd.

Otley Road
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Tel. (+44) 1274 53 77 77
Fax (+44) 1274 53 16 73

AUSTRALIA

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