

### Colour temperature and colour rendering

Invariably while selecting a lamp source till some time back, these two characteristics of light source did not receive the emphatic attention as it should receive especially with advent of various colour temperatures as are available now in Indian market.

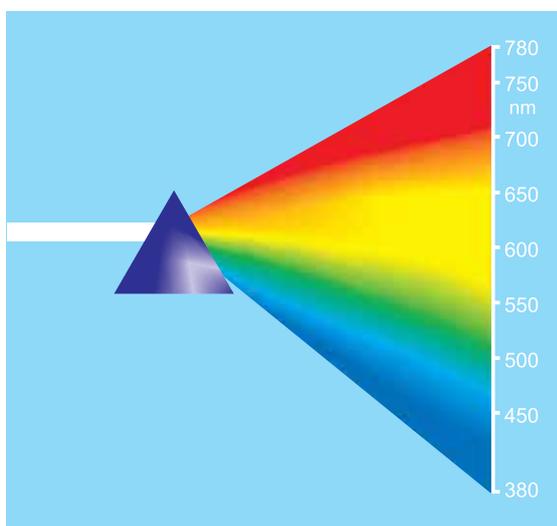
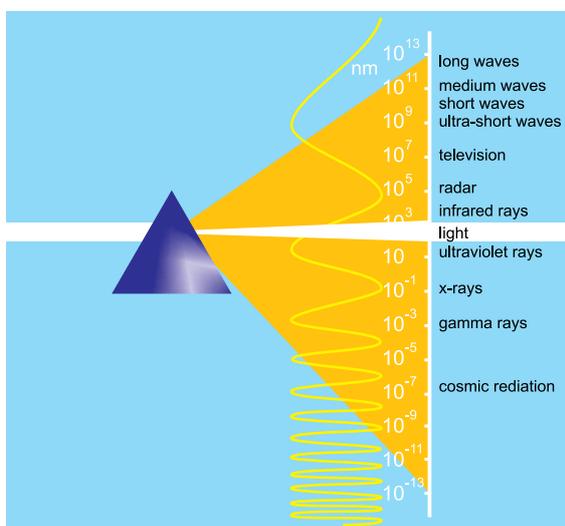
Any artificially lit space characteristic is determined by the light colour used and true reflection of the colourful ambience of the space i.e. colour rendering. These two properties are not inter dependent on true scientific platform as two different lamps of same colour temperature will not necessarily have same colour rendition property ( MV lamp of 4000K with CRI of 40 Vs MH lamp of 4000K with CRI of 80/85 or. Halogen lamp of 3000K with CRI of 100 Vs MH lamp of 3000K with CRI of 80). The reason for this is the richness of spectrum the light source emits from 370nm to 780nm. While halogen has continuous spectrum, MH lamps will exhibit, depending upon chemical dose, peculiar deficiency in some wavelength, thus affecting the colour rendition properties.

General guide line for choosing correct lamp source is

- 1) CRI between Ra 90 to 100 : Excellent colour rendition property, to be used where colour appraisal is a main and critical process. eg. paintshops, cloth store.
- 2) CRI between Ra 75 to 90 : Good colour renditions. To be used where colour identification/appraisal is not principal task. eg. Aquarium lighting, goldsmith, non-clothing shops and shopping malls.
- 3) CRI between Ra 60 to 75 : Acceptable colour rendition. To be used where colour identification is of minor importance. eg. Roadway or area lighting, garden or general illuminance, for a naked eye however CRI differential below 75 is not very perceptable to common man.

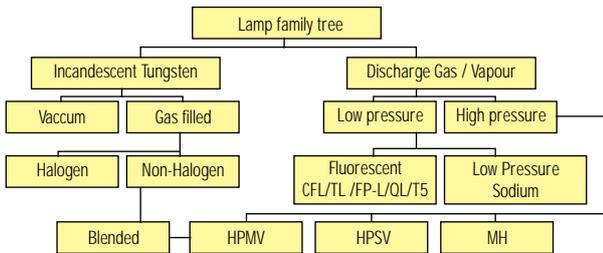
| Colour Rendering Index<br>As per DIN 5035 | Colour Rendering Category |
|---|---------------------------|
| 100-90                                    | 1A                        |
| 90-80                                     | 1B                        |
| 80-70                                     | 2A                        |
| 70-60                                     | 2B                        |
| 60-40                                     | 3                         |
| 40-00                                     | 4                         |

To benefit identification of colour temperature (K) most popular colour temperatures favoured in lighting applications are:  
 2700 K Warm White (WW)  
 4000 K Natural Day light (NDL)  
 6500 K Cool Day light (CDL)



A source generating visible radiation through applied stimulus either thermal or electrical is popularly called Lamp.

First known artificial lamp source known to human mind was in 450 BC in the shape of oil lamp in Egypt. Rapid development of lamp technology has expanded lamp family tree to presently known lamp sources. The Lamp family is very big and is ever expanding. It is broadly classified in primary two groups which further subdivides in sub groups as under :



While selection of Incandescent Lamp is relatively easier and is guided by basic desired instincts of sparkle and ambience, selection of discharge Lamp either a low or high pressure ones needs careful understanding of the system needs and system environment to ensure optimal use of the resource selection (discharge lamps exhibit negative voltage - current characteristic).

**Discharge Lamps - Low Pressure**

Popularly known as Fluorescent Tube Lamp and is perhaps the most widely used low-pressure mercury vapour lamp for indoor/outdoor applications. There are five groups of LPMV Lamps :

**1. Tubular Fluorescent Lamp**

T12/T10/T8/T5/T4 in different wattage



Say T-12 indicates 12 times 1/8 of an inch (25.4) and can be calculated as

$$= \frac{12 \times 1 \times 25.4}{8} = 38.10 \sim 38 \text{ mm}$$

All of these categories can be facilitated in ignition by electromagnetic ballast (EMB) with starter- a warm start ignition or high frequency ballast (HF) without starter - with option of warm start and cold start but at the cost of life of lamp (most of the Lamp are not designed for cold ignition).

The efficient selection between T12/T8/T5 for Indian sub-continent needs to be exploited by each prospective buyer.

**2. Bent Fluorescent Lamp**

Though not very popular in Indian subcontinent, these are available

| FTL Type | Trade Name | Tube dia (mm) | Wattage Range (W)              | Recommended gear to be used |
|----------|------------|---------------|--------------------------------|-----------------------------|
| T12      | Flat line  | 38            | 20/40/65/80                    | EMB                         |
| T10      | Mid line   | 32            | 16/32/40                       | EMB/ HF                     |
| T8       | Thin line  | 26            | 18/36                          | EMB/ HF                     |
| T5       | Slim line  | 16            | 14/21/38/35/74/<br>39/49/54/80 | HF                          |
| T4       | Ultra line | 13            | 6/8/12/14                      | HF                          |

in T9 in wattage 22/32/40/60W and can be used with EMB or HF gear. T5 in 28/54W is slowly gaining grounds.

**3. Non Integrated Compact Fluorescent Lamps**

These Lamps are finding favours in specifier's market and are sub divided as follows :

FP-L (or PL-L) with two parallel tubes

FP-L (or PL-C) with four tubes in square formation

MP-L (or PL-T) with six tubes

The selection process needs guidance in geometry, cap of Lamp and length of lamp as invariably these lamps are chosen in false ceiling environments. The lamps with 2 pin (with starter hidden in cap bulb) are recommended for use with electromagnetic ballast only. However, 4 pin CFL is recommended to be operated either with electromagnetic (EMB) or high frequency (HF) electronic gear.

**4. Retrofit Compact Fluorescent Lamp**

These are ideal for replacement in domestic circuits & GLS Lamps. These lamps are self-ballasted and are with electronic ballast. However, these ballast though expected to replace GLS Lamps, they do so except in power factor which though not affect buyer / consumer but certainly to utility companies. One must endorse high power factor version of retrofit CFL, which is now-a-days a demand of developing world and Western World.

**5. Electroless Fluorescent Lamp (Induction Lamps)**

This lamp type is still in development stage and commercially not yet affordable. The cost to use these lamps in common use in developing world (including India) is not very encouraging at date.

However, these lamps selection at inaccessible heights is worth the try due to maintenance less performance over very extended life period claimed. The available wattage as on date of publication are 15/23/35/55/85/125/165/185/400W in different colour temperature.

These lamps only work on high frequency (HF) ballast. The categories discussed have reliable ignition methods as they do not start on applying the mains voltage. These lamps can be stabilized/ignited by three principal ways:

**i) The cold start ignition:**

In this type a high initial voltage (780 Vrms) is applied to lamp built-in electrodes. The electrodes design needs special attention for robust construction. The life cycle of lamps subjected to this switching ignition cycle is less than other accepted ignition methods. This method is available only through high frequency ballast only.

**ii) Warm start ignition:**

This method adopts sending a specified current through electrodes to preheat these to emission temperature (700 K) to initiate the discharge. The electrode design can be thinner and economical. This procedure ensures prolonged life span of the lamp and can be achieved by conventional electromagnetic on high frequency ballast of special nature. The life time of lamp in this case is nearly independent of the switching cycle.

**iii) Rapid start:**

A specified ignition voltage and preheat current both are applied to the lamp source simultaneously. In electromagnetic circuits with starter switches help functioning these lamps with noticeable delays. The high frequency gear however, takes less than one sec. to ignite the lamp. The life cycle of lamp source in this ignition however is more independent on the switching cycles and is ideal for advanced light level monitoring system using DALI or light sensor circuits or even at energy economy installations such as educational institutions.

(for further details on the fluorescent gears please refer our separate ballast catalogue published)

**Discharge lamps- high pressure**

Mainly these lamps fall in broadly 3 categories Mercury Vapour (MV), Sodium Vapour (SV) and Metal Halide lamp (MH).

Mercury Lamp selection in today's world is on decline due to higher efficacy of lamps now available without sacrificing any light quality. The use, therefore, of normal mercury lamp should be avoided.

The Retrofit metal halide we offer to match the wattage of mercury in old installation with minor component addition (low pulse ignitor), perfectly ensures practically no cost additions are made in running a old mercury vapour industrial installation.

Following table suggest you the Retrofit solution we can offer :

| Mercury Wattage | Lumen Lm | Life BH | Retrofit MH** | Lumin Lm | Avg. life BH |
|-----------------|----------|---------|---------------|----------|--------------|
| 125*            | 6200     | 5000    | 125           | 10000    | 12000        |
| 250             | 12750    | 5000    | 250           | 23000    | 10000        |
| 400             | 22750    | 5000    | 400           | 30000    | 15000        |
| 1000            | 40000    | 5000    | 1000          | 12000    | 10000        |

\* for 125W MH lamps please seek a separate quote

\*\* Appropriate ignitor required to be added in old fittings to help reliable ignition of lamp.

**Lamp life and depreciation**

There are various definitions of the lamp life- the technical, individual life is the number of hours after which one particular lamp fails. This greatly depends on the practical circumstances, and is therefore of no practical use.

- the guaranteed life is a certain agreement by contract between the supplier and the user. The operating conditions are specified in the contract. The lifetime can differ from the concepts of life normally used.
- the average rated life time is the number of burning hours which have elapsed when 50 per cent of a large batch of lamps have failed. This life-expectancy figure is normally published by the lamp manufacturers.
- the economic life is the number of burning hours after which the total light output of an installation, under specific conditions, suffers a depreciation of about 30 per cent.
- economic life, based on running costs is the number of operating hours between group replacements of lamps for which the calculated running costs are the lowest, without the lighting level dropping below specified minimum value.

**Lamp behavior as function of the frequency**

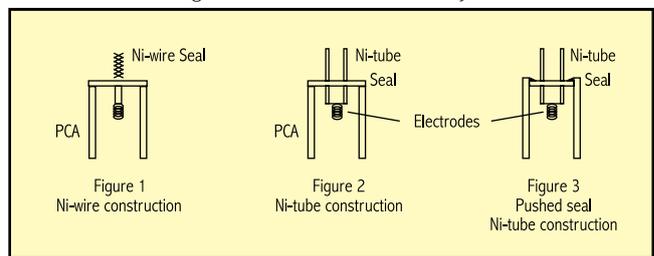
HID lamps do not properly function on DC (Direct Current). This is due to the one side emission of the electrodes and the de-mixing of the gas. Practically all HID lamps are developed for conventional gear on a 50 or 60 Hz mains supply. Electromagnetic and hybrid solutions (Conventional gear in combination with electronics) work on these frequencies. Low-frequency square-wave electronic HID ballasts (LFSW) operate on a frequency between 70 and 400 Hz, which prevents flickering. Fully electronic ballasts for HID lamps are becoming available with higher operating frequencies (10-500 kHz). The frequency and waveform of an electronic ballast cannot be chosen freely but are dependent on lamp type condition and temperature. A wrong choice of frequency and/or waveform can have a very negative effect on lamp performance and/or lifetime.

Laboratory experience have shown that the different types of

HID lamps can only be stabilised on certain frequency bands. Outside these restricted bands, not only the efficiency may drop, but the discharge tube may be mechanically damaged by acoustic resonance, or electrodes may break off. Electronic gear units are therefore only suitable for specified lamp types. Conversely, some HID lamps can only be operated on their electronic gear since there is no conventional alternative.

Sodium lamp is most favoured lamp for out-door and selected indoor application for industry today. The lamp is well established by its versatile usage and better presentation and endurance to voltage drops observed across the country.

Recently however, unscrupulous manufacturers have been manufacturing lamps with discarded and harmful technology. One should select a lamp where an arc tube (PCA) has been manufactured with correct process. Else unsuspecting buyers shall find inferior lumen and life package is being delivered instead of material conforming to standards laid down by IEC.



From three figures above SV lamps manufactured as per figure 1 shall have far less life and less lumen package in comparison with Lamps with arc tube manufactured as per figure 2. Top class quality of lamp employs PCA sealing techniques as laid down in fig.3 pushed seal NI-tube construction technology which is unparalleled in SV Lamp manufacturing process.

In order of selection figure 1,2 & 3 technologies can be described simply as poor, acceptable and best in performance scale of lumen and life of lamp.

The SV lamps come in two shapes unlike mercury vapour lamps. There are coated/frosted elliptical lamps or clear tubular ones. Off late clear elliptical lamps are also available in the range and can be selected in variety of application in industrial domain especially in well glass and high-bays.

Generally sodium lamps are single ended lamps i.e. metal or ceramic cap is at one end of glass shell. However, double ended sodium lamps in Rx7s in 70W & 150W are available in quartz enclosure and make the fixture very compact.

New introduction of 600 W with almost same LCL as that of 400W has improved better and compact photometric results one can now select a fixture of 1 x 600W SON-T instead of 2x400W age-old model and save not only on capital cost but the recurring one too.

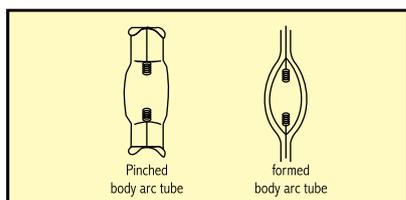
**Metal Halide Lamp**

This source off late has found immense preference over conventional other sources. Excellent light characteristic of these lamps coupled with improved efficiency and life has led to wide spread acceptance of this source.

However, most of buyers are not briefed by manufactureres about peculiar characteristic of this lamp source. These are following :

- Unlike other sources, multiple options in colour temp of lamp.
- Tendency to exhibit active failure at the end of lamp life.
- Extra sensitive to applied voltage and voltage drops.
- High pulse (5KV) for reliable ignition
- Tendency to shift colour over life of lamp

These lamps come in double ended and single ended lamp construction for different application :



Critical component in any discharge lamp is its arc tube. Pinch body arc tube technology has some inherent process problems of thermal imbalance due to which lamp shifts its colour temperature over period of time.

Alternate emerging technology of formed body arc tube has more precise geometry of the arc tube chamber thus helping maintain the arc temp constant and reducing cold spots within arc chamber. This in-turn helps maintain lamp colour even at the end of the lamp life.

These lamps come in various lamp temperatures (2700K to 12000 K) however following are more popular in India 2700K (warm white), 4000K (neutral day light) and 6500K (cool daylight). Warm colours are good to create the ambience in the diamond or goldsmith's shop, these are also recommended for the cloth stores selling variety of colourful clothes. NDL is an ideal source for the flood lighting as there is hardly any dominant traces of any colours. Cool day light (CDL) is great for the bill board and out door lighting on moderate sizes. Smaller wattages lamps especially 70 and 150W lamps are perfect to be used in the billboard lighting with this colour temperature.

Unlike all the lamps in the family, invariably the Metal Halide lamps exhibit no-passive failures at the end of the lamp life. It means the arc tube may explode with harmful and hazardous effects to surrounding. It is essential to use these lamps in enclosed luminaires with toughened lenses either of glass or polycarbonate. There are protected version of metal halide lamps available which provide the protective quartz envelope ( over 3mm thick) over the entire arc tube length. In case of the active failure in this case, the explosive forces can not pierce the quartz enclosure and the exploded hot ach-tube quartz material gathers in to the lamp shell. These lamps are very popular in the low wattages and can be used in open enclosure environments.

Metal halide lamp performance is sensitively dependent upon the supply voltage and is designed to malfunction in case the voltage in variance with 240V+/- 3%. The performance can not be guaranteed in these lower voltages. One may find flickering of lamp, may be shift of the lamp colour or both or sometime if voltage is below 200V then even un-reliable ignition if operated in lower voltages.

**End of Lamp life**

The lamps when come to end of its productive "Service life", may affect the gear it is drawing current from. Discharge lamps, predominantly high pressure lamps; must be understood correctly therefore as to when these lamps can be concluded as coming to an end of its service life in live installations.

- 1 Chemical reactions that take place within discharge tube, causes the tube to leak over a period of time. The hot gases flow through this leak into outer bulb and is noticeable as a weak discharge in outer bulb (especially in clear tubular versions).
- 2 If the chemical composition changes or the operating temperature being too high, the lamp voltage rises and lamp starts cycling and/or extinguishes.
- 3 The outer bulb or discharge tube leaks very slowly, the lamp changes colour and may even fail to operate in a short-time

- 4 Operating lamp voltage increases over period of use with time while lamp operates (4 volts in MV, 10 to 15 volts in MH and as high as 60 volts in SV). This enhanced voltage forces lamp to draw higher current from ballast. This peculiar lamp behaviour inflicts harm on any perfectly healthy ballast and exposes it to premature failure. It is advisable therefore that judicious record of lamp replacement cycles is maintained to avoid further loss of production from possible blackouts on production floors with timely replacement of the lamps showing the symptoms explained.

Some arc tubes come end protective glass shrouds or have Teflon coatings on their outer bulbs shattering and to allow them to be used safely in open luminaires.MH lamps carry ratings such as "E" (Enclosed), "S" (Suitable) and "O" that identify under what conditions they should be used According to American National Standards Institute (ANSI), the "E" rating refers to lamps that enclosed luminaires that meet the safety requirements of UL1598. The lamps that are considered suitable for open luminaire operation only the vertical position  $\pm 15^\circ$  and turned off at least 15 minutes per week relamping is required before reaching rated life. The "O" rat lamps that can be operated in both open and enclosed luminaire.

**Dead lamp disposal**

All waste is invariably used in our country for landfill. Even toxic and hazardous material waste which lighting industry is using also goes into landfill area.

Mercury is a base ingredient in all discharge lamps to facilitate reliable lamp ignition and in fluorescent lamps especially have liquid dose of mercury. Mercury from lamps can get into the environment through breakages which can release both mercury and mercury contaminated phosphors. Incineration releases both soluble and non-soluble mercury into atmosphere and accounts for 90% of the mercury released into atmosphere from fluorescent & HID lamps.

While elimination of mercury in lamp manufacturing is not possible especially in fluorescent, reduction of dosage from 50 mg per 4' FTL produced in 1980-1990 to 23 mg in the decade of 1990-2000 with now new initiative of 10 mg in same tube is a laudable achievement by the fluorescent lamp manufacturers, disposal of spent or dead lamp inventory in unguided fashion even today by the end users is exposing our country to great environmental risk of land and water contamination.

It is therefore advised that we educate our selves to the safer ways of handling and eliminating the hazardous lighting waste so that we protect our environment help it free from man made pollution.

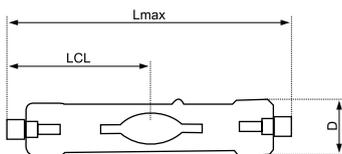
For more information please visit,  
[www.epa.gov](http://www.epa.gov)  
[www.envirobiz.com](http://www.envirobiz.com)  
[www.1800cleanup.org](http://www.1800cleanup.org)

MH Double Ended Lamps  
(MHDE for enclosed luminaires)



Double ended Rx7s cap metal halide lamp with formed body arc tube for 70W / 150W and pinch body for 250W.

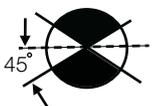
Dimensions (in mm)



| Type | Lmax(mm) | D(mm) | LCL(mm) |
|------|----------|-------|---------|
| 70W  | 118      | 22    | 59      |
| 150W | 136      | 23    | 69      |
| 250W | 136      | 28    | 69      |

Colour options available 4000K & 6000K

Burning Position



Specification

Low/ medium wattage metal halide lamps with a quartz discharge “uniform” body arc tube containing perfect dose of halides with Kr85 gas to soften the reliable ignition voltage.

“UV-Protect” quartz casing helps to reduce health hazards. Perfectly blown arch tube offers improved thermal stability and colour/ lumen maintenance. Reduced “hot restrike” time helps early restoration of output after voltage interruptions.

Warm-up time @240V, 50Hz, 1-2 min for 70/150W and 2-3 min for 250W.

Hot restrike time @240V, 50Hz 2-3min for 70/150W and 8-10min for 250W.

The lamp requires separate ballast and ignitor.

Recommended to be used in enclosed luminaires.

Exhibit sensitivity to supply voltage. Performance may be hampered if healthy supply (240V±3%) is unavailable for continuous operation.

To avoid colour deviation, ensure that the sealed bulge portion of the lamp is facing up-ward during the operation.

Applications

- Bill boards
- Showrooms
- Marriage halls
- Small area lighting

Technical Details

| Ordering Code | Lamp Wattage(W) | Cap Base | Lamp Voltage(V) | Lamp Current(A) | Colour Temp(K) | CRI | Lumen* |
|---------------|-----------------|----------|-----------------|-----------------|----------------|-----|--------|
| LHSM23070499  | 75W             | Rx7s     | 90              | 1.0             | 4000           | 80  | 5800   |
| LHSM23070699  | 75W             | Rx7s     | 90              | 1.0             | 6000           | 80  | 5800   |
| LHSM23015499  | 150W            | Rx7s     | 98              | 1.8             | 4000           | 85  | 12000  |
| LHSM23015699  | 150W            | Rx7s     | 98              | 1.8             | 6000           | 85  | 12000  |
| LHSM23025699  | 250W            | Rx7s     | 100             | 3.0             | 6000           | 85  | 20000  |

\*Lumen out put after 100 burning hrs.

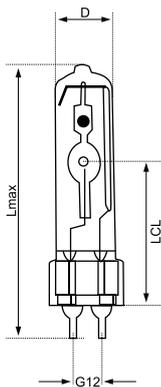


MH Single Ended Quartz Tube Lamps  
(MHSEQ for enclosed luminaires)



Single ended G-12 base compact metal halide lamp with formed body arc tube for improved light output and enhanced colour stability.

Dimensions (in mm)



| Type | Lmax(mm) | D(mm) | LCL(mm) |
|------|----------|-------|---------|
| 70W  | 110.0    | 23.0  | 56.0    |
| 150W | 110.0    | 23.0  | 56.0    |

Colour options available 4000K & 6000K

Burning Position



Universal



Specification

Compact low wattage designed lamp allows precise beam control for narrow beam floods for out door or in optically designed indoor down lighters.

“UV-Protect” quartz casing helps to reduce health hazards. Firm G12 ceramic base ensures firm grip in holder eliminating vibration related problems.

Warm-up time @240V, 50Hz, 1-2 min.

Hot restrike time @240V, 50Hz 2-3min.

The lamp requires separate ballast and ignitor.

“Uniform” quartz tube ensures thermal stability and colour/lumen stability. Kr85 additive improves hot restrike performance.

Lamp designed for operation with special “hot restrike ignitor”.

Lamp recommended to be used with enclosed luminaires.

Exhibit sensitivity to supply voltage. Performance may be hampered if healthy supply (240V±3%) is unavailable for continuous operation.

Applications

- Spot lights
- Down lighters
- Window display
- High ceiling light
- Monument lighting

Technical Details

| Ordering Code | Lamp Wattage(W) | Cap Base | Lamp Voltage(V) | Lamp Current(A) | Colour Temp(K) | CRI | Lumen* |
|---------------|-----------------|----------|-----------------|-----------------|----------------|-----|--------|
| LHSM15070699  | 75W             | G 12     | 92              | 1.00            | 6000           | 85  | 5200   |
| LHSM15015699  | 150W            | G 12     | 96              | 1.80            | 6000           | 85  | 11500  |

\*Lumen out put after 100 hrs. burning in vertical position published. Metal halide lamps in other than vertical position offer lower lumens.



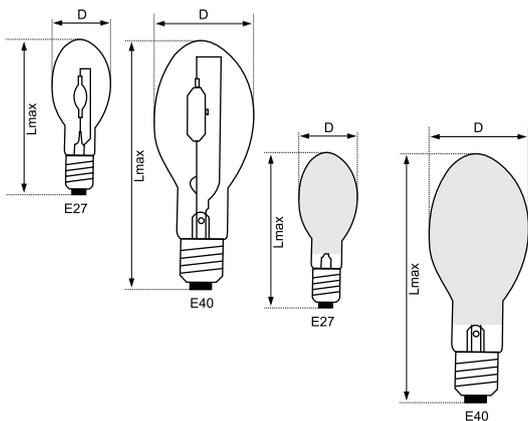
# MH Single Ended Elliptical Lamps

(MH SEE for enclosed luminaires)



Single ended coated elliptical E27/ E40 Metal Halide lamp..

### Dimensions (in mm)

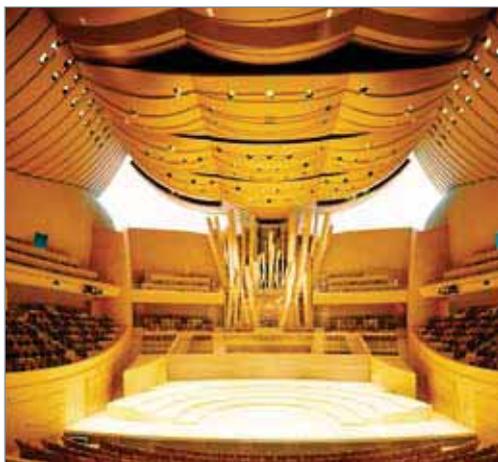


| Type | Lmax(mm) | D(mm) |
|------|----------|-------|
| 70W  | 141.0    | 54.0  |
| 150W | 141.0    | 54.0  |
| 250W | 226.0    | 90.0  |
| 400W | 280.0    | 129.0 |

### Burning Position



Universal



### Specification

Encased in hard glass ovoid shell of quality glass discharge tube containing precise dose of (sodium & scandium) metal iodides and ignition facilitating Kr85 mixture.

Lamps need suitable ballast and ignitor for reliable ignition. Lamp must be used in enclosed luminaires.

Available in either coated ovoid or clear ovoid shell. Clear elliptical lamps to be used with faceted photometry to avoid dark shadows in 250/400W lamps owing to pinched body ark tube.

Typical Warm-up time @240V, 50Hz, 1-2 min for 70/150W and 2-3 min for 250 / 400W lamps.

Hot restrike time @240V, 50Hz 2-3min for 70/150W and 10-15min for 250/400W lamps.

For reliable ignition, select suitable ignitor from range with pulse voltage of  $3.0 < p < 4.5 \text{ kV}$ .

Exhibit sensitivity to supply voltage. Performance may be hampered if healthy supply ( $240V \pm 3\%$ ) is unavailable for continuous operation.

### Applications

- Highbays
- Paint shops
- Atrium lighting
- Airport lounges
- Shopping malls
- Railway terminals

### Technical Details

| Ordering Code       | Lamp Wattage(W) | Cap Base | Lamp Voltage(V) | Lamp Current(A) | Colour Temp(K) | CRI | Lumen* |
|---------------------|-----------------|----------|-----------------|-----------------|----------------|-----|--------|
| <b>Clear Lamps</b>  |                 |          |                 |                 |                |     |        |
| LHSM01070499        | 70W             | E 27     | 90              | 1.00            | 4000           | 70  | 6000   |
| LHSM01015499        | 150W            | E 27     | 100             | 1.80            | 4000           | 65  | 12500  |
| <b>Coated Lamps</b> |                 |          |                 |                 |                |     |        |
| LHSM01170499        | 70W             | E 27     | 90              | 1.00            | 4000           | 70  | 5600   |
| LHSM01115499        | 150W            | E 27     | 100             | 1.80            | 4000           | 65  | 12000  |
| LHSM02125499        | 250W            | E 40     | 105             | 3.00            | 4000           | 65  | 19000  |
| LHSM02140499        | 400W            | E 40     | 110             | 4.45            | 4000           | 75  | 32000  |

\*Lumen out put after 100 hrs. burning in vertical position published. Metal halide lamps in other than vertical position offer lower lumens.



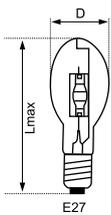
MH Single Ended Elliptical Pro Lamps  
(MH SEEP for open luminaires)



Single ended clear elliptical " Protected" Metal Halide lamp E27 cap for open fixtures.



Dimensions (in mm)



| Type | Lmax(mm) | D(mm) |
|------|----------|-------|
| 70W  | 141.0    | 54.0  |
| 150W | 141.0    | 54.0  |

Burning Position



Universal



Specification

Encased in hard glass ovoid shell of quality glass discharge tube containing precise dose of (sodium & scandium) metal iodides and ignition facilitating Kr85 mixture.

Lamps need suitable ballast and ignitor for reliable ignition. Lamp designed to be used in open luminaires.

The tube of lamp is shielded by special integral quartz tube. This protects the lamp, avoid hard glass shell from breaking in the event of active fixture of lamp while in operation.

Protected lamp is perfect solutions for open type luminaries.

Typical Warm-up time @240V, 50Hz, 1-2 min for 70/150W.

Hot restrike time @240V, 50Hz 2-3min for 70/150W.

For reliable ignition, select suitable ignitor from range with pulse voltage of  $3.0 < p < 4.5kV$ .

Exhibit sensitivity to supply voltage. Performance may be hampered if healthy supply (240V±3%) is unavailable for continuous operation.

Applications

- Highbays
- Paint shops
- Atrium lighting
- Airport lounges
- Shopping malls
- Railway terminals

Technical Details

| Ordering Code | Lamp Wattage(W) | Cap Base | Lamp Voltage(V) | Lamp Current(A) | Colour Temp(K) | CRI | Lumen* |
|---------------|-----------------|----------|-----------------|-----------------|----------------|-----|--------|
| LHSM01370499  | 75W             | E 27     | 90              | 1.00            | 4000           | 70  | 5600   |
| LHSM01315499  | 150W            | E 27     | 100             | 1.80            | 4000           | 65  | 12000  |

\*Lumen out put after 100 hrs. burning in vertical position published. Metal halide lamps in other than vertical position offer lower lumens.



# MH Single Ended Tubular Clear Lamps

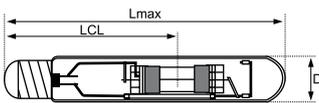
(MH SET for enclosed luminaires)



Single ended clear tubular E-40 Metal Halide lamp suitable for flood lighting and street lighting application.



### Dimensions (in mm)

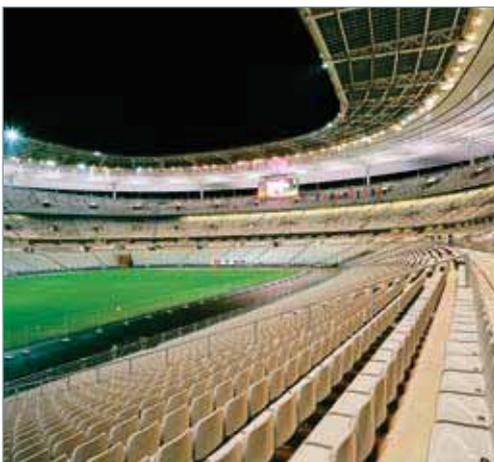


| Type | Lmax(mm) | D(mm) | LCL(mm) |
|------|----------|-------|---------|
| 250W | 252.0    | 46.0  | 146.0   |
| 400W | 275.0    | 46.0  | 163.0   |

### Burning Position



Universal



### Specification

Encased in hard and clear tubular shell of quartz discharge tube containing precise dose of metal iodide (sodium & scandium) and ignition facilitating Kr85 mixture.

Lamps need suitable ballast and ignitor for reliable ignition. Lamps offer higher lumen output in vertical mounting than in horizontal operating position.

Lamps must be used in enclosed luminaire.

Select reliable ignitor from range with minimum pulse voltage of  $3.0 < P < 4.5$  KV. MV gear based MH SET lamps if used with low pulse ignitor (800V), hot restrike time shall be 15-20 min. Recommended our HNM27000 series SI parallel for long distance quick hot restrike (12min) for MV based MH lamp.

Warm-up time of 3-5 min @ 240V, 50Hz

Hot restrike time of SV gear based lamp 10-15 min @ 240V, 50Hz

Exhibits extra sensitivity to supply voltage. Performance may be hampered if healthy supply ( $240V \pm 3\%$ ) voltage is unavailable for continuous operation

### Applications

- Area lighting
- Facade lighting
- Marshalling yards
- Horticulture lighting

### Technical Details

| Ordering Code | Lamp Wattage(W) | Cap Base | Lamp Voltage(V) | Lamp Current(A) | Colour Temp(K) | CRI | Lumen* |
|---------------|-----------------|----------|-----------------|-----------------|----------------|-----|--------|
| SV Gear       |                 |          |                 |                 |                |     |        |
| LHSM12025499  | 250W            | E 40     | 95              | 3.00            | 4000           | 65  | 20000  |
| LHSM12140499  | 400W            | E 40     | 95              | 4.45            | 4000           | 65  | 33000  |

\*Lumen out put after 100 hrs. burning in vertical position published. Metal halide lamps in other than vertical position offer lower lumens.

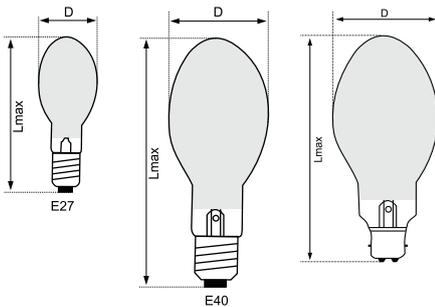


# High Pressure Mercury Vapour Lamps (MV)



Elliptical, internally phosphor coated glass shell, high pressure mercury vapour lamp with 2/3 pin BC/ E27/ E40 cap suitable for 220 to 240V, 50 Hz, AC supply.

### Dimensions (in mm)



| Type | Lmax(mm) | D(mm) |
|------|----------|-------|
| 125W | 166.0    | 75.0  |
| 160W | 169.0    | 75.0  |
| 250W | 220.0    | 90.0  |
| 400W | 280.0    | 120.0 |

### Burning Position

125/160W Blended

Other HPMV



### Specification

Encased in hard coated ovoid shell of quartz glass discharge tube containing mercury under high pressure.

Quick run-up time of 3-4 min for 80% light output.

Except blended lamps (125W, 160W), lamps have universal burning position and requires only ballast. No ignitor needed.

Blended lamp is self ballasted and is direct plug-in type needing no external ballast. (Blended lamps are in soft glass shell, avoid water splash while in operation)

### Applications

#### Blended Lamps

Shops/Gradens  
Car Parks/Garages

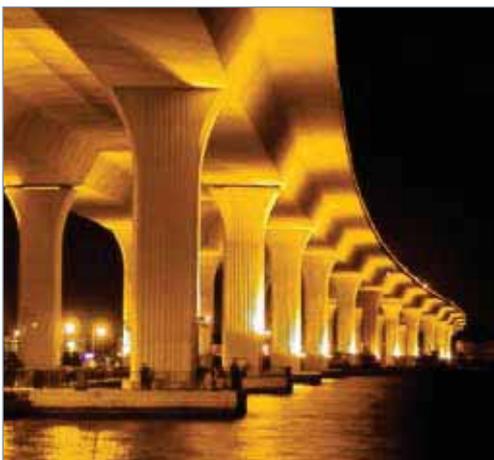
#### Normal HPMV

Workshops  
Internal roads  
Gardens/Parks

### Technical Details

| Ordering Code  | Lamp Wattage(W) | Cap Base | Lamp Voltage(V) | Lamp Current(A) | Colour Temp(K) | CRI | Lumen* |
|----------------|-----------------|----------|-----------------|-----------------|----------------|-----|--------|
| <b>Blended</b> |                 |          |                 |                 |                |     |        |
| LHSG00112199   | 125W BLL        | B 22d2   | 160             | 0.60            | 3600           | 40  | 2400   |
| LHSG01112199   | 125W BLL        | E 27     | 160             | 0.60            | 3600           | 40  | 2400   |
| LHSG00116199   | 160W BLL        | B 22d2   | 180             | 0.75            | 3600           | 61  | 3200   |
| <b>HPMV</b>    |                 |          |                 |                 |                |     |        |
| LHSG00112099   | 125W            | B 22d3   | 125             | 1.15            | 4000           | 46  | 6200   |
| LHSG01112099   | 125W            | E 27     | 125             | 1.15            | 4000           | 46  | 6200   |
| LHSG02125099   | 250W            | E 40     | 135             | 2.10            | 4000           | 40  | 14200  |
| LHSG02140099   | 400W            | E 40     | 140             | 3.25            | 4000           | 40  | 22750  |

\*Lumen out put after 100 hrs. burning

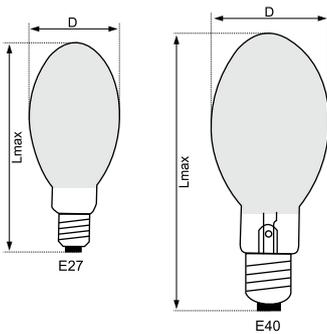


High Pressure Sodium Vapour  
Elliptical Lamps (SON-E)



Elliptical, coated internally with uniform diffusing powder, high pressure sodium vapour lamp with E27/ E40 cap suitable for 220 to 240V, 50 Hz, AC supply.

Dimensions (in mm)



| Type      | Lmax(mm) | D(mm) |
|-----------|----------|-------|
| 70W       | 152.0    | 70.0  |
| 70W (lgn) | 152.0    | 70.0  |
| 150W      | 221.0    | 90.0  |
| 250W      | 221.0    | 90.0  |
| 400W      | 290.0    | 120.0 |

Burning Position



Universal



Specification

Encased in hard glass ovoid shaped coated shell a polycrystalline translucent aluminium (PCA) discharge tube.

Coated internally with uniform layer of diffusing powder through special process.

PCA tube contains amalgam of mercury and sodium with other inert gas for better starting.

The outer bulb evacuated with getter coat to ensure high light output.

Warm up time @240V, 50Hz, 15-20 min for 80% of light output.

Hot restrike time @240V, 50Hz less than 60 sec.

High luminous efficacy among family of lamps.

Exhibit lower sensitivity towards supply condition.

Offers better visual acuity even at low CRI.

Needs external ballast and ignitor 1.8<p<2.5KV.

Applications

- Foundries
- Facade lighting
- Roadways B1 & B2
- Steel mills/Godowns
- Highbay/Industrial lighting

Technical Details

| Ordering Code | Lamp Wattage (W) | Cap Base | Lamp Voltage (V) | Lamp Current (A) | Colour Temp (K) | CRI | Lumen* |
|---------------|------------------|----------|------------------|------------------|-----------------|-----|--------|
| LHSS01170099  | 70W              | E 27     | 90               | 0.98             | 1950            | 25  | 5600   |
| LHSS01170199  | 70W(lgn)         | E 27     | 90               | 0.98             | 1950            | 25  | 5600   |
| LHSS02115099  | 150W             | E 40     | 100              | 1.80             | 1950            | 25  | 13500  |
| LHSS02125099  | 250W             | E 40     | 100              | 3.00             | 1950            | 25  | 25000  |
| LHSS02140099  | 400W             | E 40     | 105              | 4.45             | 1950            | 25  | 46000  |

\*Lumen out put after 100 hrs. burning

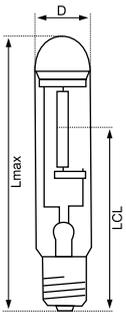


# High Pressure Sodium Vapour Tubular Lamps (SON-T)



Tubular shaped, clear high pressure sodium vapour lamp with E27/E40 cap suitable for 220 to 240V, 50Hz, AC supply.

### Dimensions (in mm)



| Lamp Type | Lmax(mm) | D(mm) | LCL(mm) |
|-----------|----------|-------|---------|
| 70W       | 156.0    | 37.0  | 104.0   |
| 150W      | 203.0    | 46.0  | 132.0   |
| 250W      | 253.0    | 46.0  | 158.0   |
| 400W      | 281.0    | 46.0  | 175.0   |
| 600W      | 281.0    | 46.0  | 175.0   |

Burning Position



Universal



### Specification

Encased in hard glass tubular shaped clear shell, a polycrystalline translucent aluminium discharge tube.

PCA tube contains amalgam of mercury and sodium with other inert gas for better starting.

Low number of weld construction (7 nos) ensure enhanced life & very few failures.

Warm up time @240V, 50Hz, 15-20 min for 80% of light output.

Hot restrike time @240V, 50Hz less than 60 sec.

High luminous efficacy among family of lamps.

Exhibit lower sensitivity towards supply condition.

Offers better visual acuity even at low CRI.

Needs external ballast and ignitor  $1.8 < P < 2.5$  kV.

### Applications

- Area lighting
- Apron lighting
- Security lighting
- Monument lighting
- Street/ flyover/ junction lighting

### Technical Details

| Ordering Code | Lamp Wattage (W) | Cap Base | Lamp Voltage (V) | Lamp Current (A) | Colour Temp (K) | CRI | Lumen* |
|---------------|------------------|----------|------------------|------------------|-----------------|-----|--------|
| LHSS11070099  | 70W              | E 27     | 90               | 0.98             | 1950            | 25  | 6500   |
| LHSS12015099  | 150W             | E 40     | 100              | 1.80             | 1950            | 25  | 15000  |
| LHSS12025099  | 250W             | E 40     | 100              | 3.00             | 1950            | 25  | 27000  |
| LHSS12040099  | 400W             | E 40     | 105              | 4.60             | 1950            | 25  | 47500  |
| LHSS12060099  | 600W**           | E 40     | 105              | 6.20             | 1950            | 25  | 85000  |

\*Lumen out put after 100 hrs. burning.

\*\* Soon to be launched.

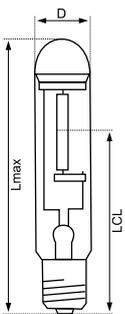


High Pressure Sodium Vapour  
Superlux-T Lamps (SON-SLT)



Tubular shaped, clear high pressure sodium vapour lamp with E40 cap suitable for 220 to 240V, 50Hz, AC supply.

Dimensions (in mm)

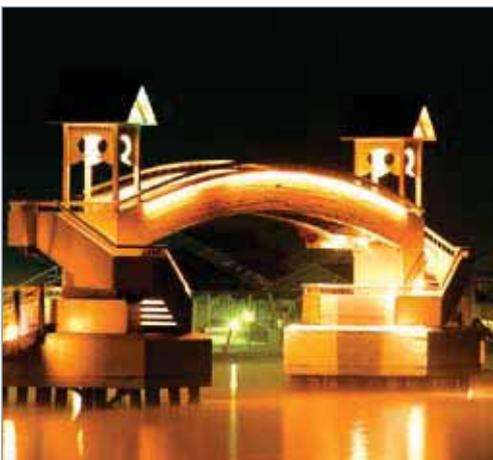


| Lamp Type | Lmax(mm) | D(mm) | LCL(mm) |
|-----------|----------|-------|---------|
| 250W      | 253.0    | 46.0  | 158.0   |
| 400W      | 281.0    | 46.0  | 175.0   |

Burning Position



Universal



Specification

Encased in hard glass tubular shaped clear shell, a polycrystalline translucent aluminium discharge tube.  
PCA tube contains amalgam of mercury and sodium with other inert gas for better starting.  
Low number of weld construction (7 nos) ensure enhanced life & very few failures.  
Warm up time @240V, 50Hz, 15-20 min for 80% of light output.  
Hot restrike time @240V, 50Hz less than 60 sec.  
Highest luminous efficacy (128-132 lm/watt) among HPS family of lamps.  
Exhibit lower sensitivity towards supply condition.  
Offers better visual acuity even at low CRI  
Needs external ballast and ignitor  $1.8 < P < 2.5$  kV

Applications

- Area lighting
- Apron lighting
- Security lighting
- Monument lighting
- Street/ flyover/ junction lighting

Technical Details

| Ordering Code | Lamp Wattage (W) | Cap Base | Lamp Voltage (V) | Lamp Current (A) | Colour Temp (K) | CRI | Lumen* |
|---------------|------------------|----------|------------------|------------------|-----------------|-----|--------|
| LHSS12025299  | 250W             | E 40     | 100              | 3.00             | 1950            | 25  | 32000  |
| LHSS12040299  | 400W             | E 40     | 105              | 4.45             | 1950            | 25  | 53000  |

\*Lumen out put after 100 hrs. burning

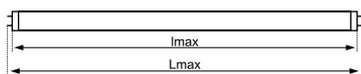


### T5 Fluorescent Lamp



Fluorescent lamp with dia 16mm having high efficiency (HE) and high output (HO) with high colour rendering index, longer life and much lower mercury dose.

#### Dimensions (in mm)



| Type | Lmax(mm) | l(mm)  |
|------|----------|--------|
| 14W  | 563.2    | 549.0  |
| 21W  | 863.2    | 849.0  |
| 28W  | 1163.2   | 1149.0 |
| 54W  | 1163.2   | 1149.0 |
| 80W  | 1463.2   | 1449.0 |

#### Burning Position



Universal



#### Specification

Low pressure mercury vapour lamp with tubular 16mm (T5) dia envelop. Internally coated with triphosphor layer for high efficacy.

Designed for operation with only high frequency electronic ballast due to high lamp voltage; 50Hz electromagnetic ballast will not facilitate operation.

High efficacy over 102 lm/ watt.

Maximum lumen output reached at approx. 35°C in free burning position with HF ballast.

High lumen output & maintenance (92%). Can be ignited from -15°C to +50°C.

Low striation even at low temperature compared with T8/T12 lamps.

Service life with warm start ballast enhanced upto 15000 BH.

Low dimensions of source facilitates miniaturization, lamp cap 'G5'.

High CRI of 85.

Small tube diameter of 16mm also leads to an increased in the efficiency of luminaires.

Available in two colours 2700K & 6500K

#### Applications

- Cove lights
- Homes/ societies
- Commercial areas
- Emergency circuits
- Modern work spaces
- Hotels/ school/ libraries

#### Technical Details

| Ordering Code | Lamp Wattage (W) | Cap Base | Lamp Voltage (V) | Lamp Current (A) | Colour Temp (K) | CRI | Lumen |
|---------------|------------------|----------|------------------|------------------|-----------------|-----|-------|
| <b>T-5 HE</b> |                  |          |                  |                  |                 |     |       |
| LHST26114399  | 14W              | G 5      | 86               | 165              | 2700            | 85  | 1150  |
| LHST26114699  | 14W              | G 5      | 86               | 165              | 6500            | 85  | 1100  |
| LHST26121699  | 21W              | G 5      | 126              | 165              | 6500            | 85  | 1900  |
| LHST26128399  | 28W              | G 5      | 170              | 170              | 2700            | 85  | 2600  |
| LHST26128699  | 28W              | G 5      | 170              | 170              | 6500            | 85  | 2400  |
| <b>T-5 HO</b> |                  |          |                  |                  |                 |     |       |
| LHST27154399  | 54W              | G 5      | 170              | 170              | 2700            | 85  | 4300  |
| LHST27154699  | 54W              | G 5      | 170              | 170              | 6500            | 85  | 4100  |
| LHST27180399  | 80W**            | G 5      | 170              | 170              | 2700            | 85  | 6100  |
| LHST27180699  | 80W**            | G 5      | 170              | 170              | 6500            | 85  | 5700  |

\*Lumen output at 25 C after 100 hrs. burning, \*\* Soon to be launched for retail lighting.

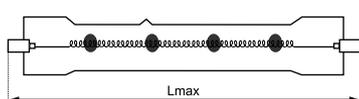


### Halogen Lamp

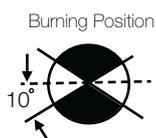


Miniaturised double ended linear halogen lamp.

#### Dimensions (in mm)



| Lamp Type | Lmax(mm) |
|-----------|----------|
| 150W TH   | 78.0     |
| 500W TH   | 118.0    |
| 1000W TH  | 189.0    |



#### Specification

Double ended quartz glass clear linear shaped envelop containing self supported single coiled filament with Rx7s caps for firm electrical contact. CRI of almost 100 with CCT 2900K. Requires no external ballast. Operates on 230/240V mains directly. Ideal for emergency circuits due to instant ignition. Current/voltage dimming possibilities for ambience creation. Operation in vertical mounting reduces the life of lamp. Lamp casing not to be touched with bare hand while lamp in operation. Immediate ignition, crisp white light output with dimming possibilities and better light control.

#### Application

- Bill board
- Flood lighting
- General purpose
- Pendal decoration
- Homes/ Family functions

#### Technical Details

| Ordering Code | Lamp Wattage (W) | Cap Base | Lamp Voltage (V) | Lamp Current (A) | Colour Temp (K) | CRI | Lumen |
|---------------|------------------|----------|------------------|------------------|-----------------|-----|-------|
| LHSH10015099  | 150W             | Rx7s     | 230              | 0.65             | 2900            | 100 | 2850  |
| LHSH10050099  | 500W             | Rx7s     | 230/240          | 2.08             | 2900            | 100 | 9000  |
| LHSH10010099  | 1000W            | Rx7s     | 240              | 4.17             | 2900            | 100 | 22000 |



CFL Retrofit



Retrofit range available in 5W to 85W.

Technical Details

| Lamp Wattage                             | Ordering Code | Lumen Output (Lm) |       | Length (L) (mm) | Base/ Dia. (mm) |
|--|---------------|-------------------|-------|-----------------|-----------------|
|  |               | 6500K             | 2700K |                 |                 |
| <b>Retrofit Dwarf</b>                    |               |                   |       |                 |                 |
| 5W (DU)                                  | PHED*#005     | 220               | 240   | 108             | 38              |
| 8W (TU)                                  | PHET*#008     | 400               | 440   | 110             | 45              |
| 11W (TU)                                 | PHET*#011     | 565               | 605   | 115             | 45              |
| <b>Retrofit Normal</b>                   |               |                   |       |                 |                 |
| 11W (DU)                                 | PHED*#011     | 565               | 605   | 142             | 48              |
| 15W (DU)                                 | PHED*#015     | 850               | 900   | 170             | 48              |
| 15W (TU)                                 | PHET*#015     | 850               | 900   | 146             | 52              |
| 20W (TU)                                 | PHET*#020     | 1130              | 1200  | 160             | 52              |
| 23W (TU)                                 | PHET*#023     | 1400              | 1500  | 170             | 52              |
| 27W (TU)                                 | PHET*#027     | 1680              | 1800  | 175             | 52              |
| <b>Retrofit Mini Spiral</b>              |               |                   |       |                 |                 |
| 7W (SP)                                  | PHER*#007     | 330               | 350   | 106             | 44              |
| 9W (SP)                                  | PHER*#009     | 427               | 450   | 110             | 44              |
| 11W (SP)                                 | PHER*#011     | 600               | 640   | 116             | 44              |
| 13W (SP)                                 | PHER*#013     | 750               | 800   | 122             | 44              |
| <b>Retrofit Spiral</b>                   |               |                   |       |                 |                 |
| 15W (SP)                                 | PHER*#015     | 850               | 900   | 138             | 50              |
| 20W (SP)                                 | PHER*#020     | 1130              | 1200  | 146             | 50              |
| 27W (SP)                                 | PHER*#027     | 1680              | 1800  | 156             | 50              |
| <b>Retrofit Higher Range<sup>§</sup></b> |               |                   |       |                 |                 |
| 35W (FU)                                 | PHEF*#035     | 2100              |       | 221             | 80              |
| 45W (FU)                                 | PHEF*#045     | 2700              |       | 241             | 80              |
| 65W (FU)                                 | PHEF*#065     | 3400              |       | 271             | 80              |
| 85W (FU)                                 | PHEF*#085     | 4400              |       | 329             | 80              |

\* = C for Cool Daylight (6500K), W for Warm White (2700K) or D for Cool White (4000K)

# = 14 for E-14, 27 for E-27 or 22 for B-22 base

<sup>§</sup> Not RoHS Compliant



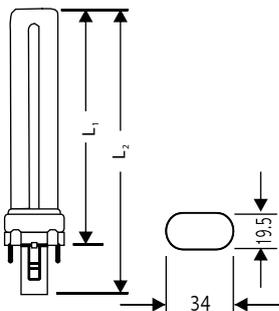
CFL Non-Retrofit



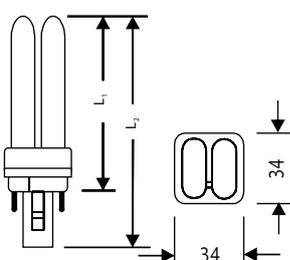
Non-retrofit range available in 5W to 36W.

Dimensions (in mm)

**SU**



**DU**



Technical Details

| Lamp Wattage            | Cat. Ref. No. | Lumen Output (Lm) |       |       | Length (L) (mm) | Lamp Base          |        |
|-------------------------|---------------|-------------------|-------|-------|-----------------|--------------------|--------|
|                         |               | 6500K             | 4000K | 2700K |                 | 2 Pin              | 4 Pin  |
| <b>CFL Non Retrofit</b> |               |                   |       |       |                 |                    |        |
| 5W (SU)                 | PHCS*#005     | 240               | 250   | 250   | 108             | G23                | G24q-1 |
| 7W (SU)                 | PHCS*#007     | 375               | 400   | 400   | 137             | G23                | G24q-1 |
| 9W (SU)                 | PHCS*#009     | 565               | 600   | 600   | 167             | G23                | G24q-1 |
| 11W (SU)                | PHCS*#011     | 850               | 900   | 900   | 237             | G23                | G24q-1 |
| 10W (DU)                | PHCD*#010     | 565               | 600   | 600   | 112             | G24-d <sub>1</sub> | G24q-2 |
| 13W (DU)                | PHCD*#013     | 850               | 900   | 900   | 138             | G24-d <sub>1</sub> | G24q-2 |
| 18W (DU)                | PHCD*#018     | 1130              | 1200  | 1200  | 158             | G24-d <sub>2</sub> | G24q-3 |
| 26W (DU)                | PHCD*#026     | 680               | 1800  | 1800  | 175             | G24-d <sub>3</sub> | G24q-4 |
| <b>FP-L<sup>§</sup></b> |               |                   |       |       |                 |                    |        |
| 18W FP-L                | PHCS*#018     | 1130              | 1200  | 1200  | 200             |                    | 2G11   |
| 36W FP-L                | PHCS*#036     | 2800              | 2900  | 2900  | 415             |                    | 2G11   |

\* = C for Cool Daylight (6500K), W for Warm White (2700K) or D for Cool White (4000K)

# = 02 for 2 Pin or 04 for 4 Pin

§ Not RoHS Compliant



