Photosynthesis Light for Horticulture

Lighting for growth
Lamps and lighting for horticulture

Properly balanced	blue and red colours to optimise growth
Improves	the yield and quality of greenhouse crops
Specially developed	for horticulture
More PAR	on average compared to standard HPS
Stable	PAR performance
Wide range	250-750W

Horticulture

Main application area

Greenhouses

Growers of food plants find artificial light just as important as it is for flowering plants. GE's specially-developed range of horticultural lamps enable growers to use artificial lighting to improve the yield and quality of greenhouse crops and time growth to meet market demands.

Light output and lumen maintenance on their own are not enough to create plant growth. Plants require a certain radiation level to help with the photosynthesis that enables them to grow, and others factors such as day length also play an important part. Photosynthetically Active Radiation (PAR), measured in micromole/sec, is essential for plant growth. Lucalox™ Photosynthesis Lamps (PSL) are high pressure sodium lamps with a spectrum that gives the best possible PAR, with stable lumen and micromole maintenance, in a greenhouse lighting regime.

Lucalox™ PSL lamps are available in 230V with 250W, 400W and 750W options, and in 400V with 600W, 750W.

Lucalox™
PhotoSynthesis Lamp (PSL) range

GE's range of horticultural lamps has been extended with the addition of 600W electronic product, so the range now spans 250-750 watts with 230 and 400 volt options, to suit both OEMs and growers.

NEW PRODUCT

600W 400V Electronic PSL

- **High initial mean PAR 1120µMol**
- **Long service life of 12,000 HOURS (B10)**

PSL technology

Performance and reliability

- **GE's advanced sodium resistant ceramic helps eliminate early failures to give a rated service life of 10,000 to 12,000 hours for Lucalox™ PSL products.**
- **In order to achieve maximum performance, GE recommends lamp replacement when the Rated Service Life is reached.**
- **The lamps use extra rugged monolithic arc tubes equipped with GE Reliable Starting Technology which provides continuous high performance.**

High xenon-fill gas

- **Extra light and PAR (Photosynthetically Active Radiation) output.**
- **More resistance to mains voltage fluctuations.**

Zirconium gettering system

- **Improves PAR maintenance that drives constant and uniform plant growth.**
- **The diameter of the frame wire in the lamp has been minimised to reduce shading in the installation without affecting the robustness of the lamp.**
- **Monolithic arc tube construction for durability and lumen maintenance.**

Photosynthetically Active Radiation to extend daylight

The effect of optical radiation on plants has been studied extensively. Generally, photons emitted in the spectral region of 400-700nm are particularly effective. Therefore the simple measurement of the quantity of light (Lux) is not sufficient for the horticultural market. Photosynthetically Active Radiation (PAR) and Photosynthetic Photon Flux (PPF) are more useful measurements.

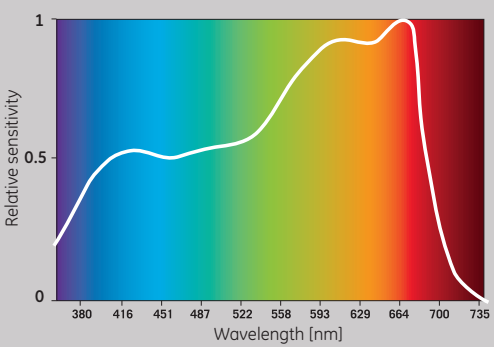
PPF is defined as flux of the photons emitted in the 400-700nm wavelength range by the light source. It is expressed in micromoles/second (µmol/s), where 1 micromole means $6x10^{17}$ photons.

The Lucalox™ PSL range from GE has optimised spectra for greenhouse use, with an enhanced red portion of the light output.

- Plants can be used over a longer period
- In winter, fruit can be produced with taste to match summer fruit
- Production can start earlier
- Year-round cultivation is possible

Spectral range

Plants respond to light of varying colour. In general, red light causes plants to become tall and "leggy" while blue light, when used alone, can cause low, stocky growth. A proper balance of red and blue energy produces plants that have normal growth and shape.



Plants have different sensitivity to different wavelengths.

Day and night
Photoperiodism

The relative length of day and night and the seasons is important to plants. The number of hours of darkness in a 24-hour cycle is an important factor in determining blossoming and growing time.

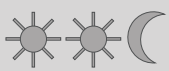
Night length triggers seed germination, tuber and bulb formation, and other growth characteristics such as colour, enlargement of leaves and stem size and shape. This rhythmic characteristic is called photoperiodism and is of great value to growers.

Plants can be classified according to photoperiodicity.

Short day (long night)

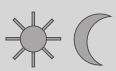
The perennial Chrysanthemum and the Poinsettia, which flower in the autumn, are examples of *short-day (long-night)* plants. They fail to flower when the day length, or period of light, is extended beyond a critical value.

Long day



Long-day plants, such as the China Aster and Tuberous Rooted Begonia, flower only with a day length longer than a critical value.

Day neutral



Day-neutral plants, such as the Rose and Carnation, are not limited by photoperiod.

Understanding these principles enables commercial growers to use artificial light profitably, so that flowering and vegetable harvesting can be timed for markets.

Timing

Slow down

The *Perennial Chrysanthemum* is a short-day length plant that will not flower when the day is long (short-night). To postpone flowering Chrysanthemum growers, instead of lengthening the day, interrupt the night for about four hours. This makes the night appear short to plants, which then continue to grow vegetatively instead of starting to flower.

A more economical method of postponing flowering of Chrysanthemums is to apply cycles of light, switching light on for 10 minutes and off for 50 minutes, for four hours during the night, instead of applying light continuously. This is cyclic lighting. It is an effective way of growing flowers. If lighting levels are higher then the grower will see better stem and flower quality and less opportunity for disease.

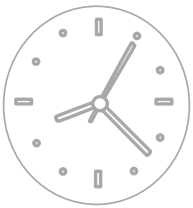
Speed up

The *China Aster* is a typical long-day (short-night) plant. Long-day plants can be brought to flower ahead of the normal time by lengthening the day. Relatively low intensities of light are enough to induce flowering, when applied early in the morning or at the end of the day. A dark-period interruption - from a few minutes to a few hours - as with other long-day plants, effectively induces flowering just as it inhibits flowering of short-day plants.

Poinsettias must have complete and continuous darkness for about 12 hours a day in order to flower. Even 1 minute of light in the middle of the dark period will prevent their flowering.

Tuberous Begonias flower only when daily dark periods are short - less than 12 hours - but they require long dark periods for best production of tubers. Flowering of tomatoes, however, is not influenced by photoperiod.

Setting the clock

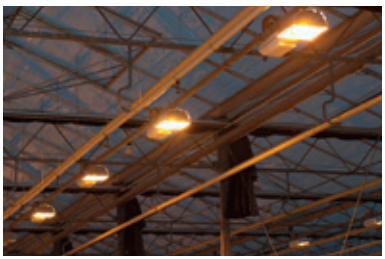


Add

Use Lucalox™ PSL as an additional daytime source of light, boosting existing light levels and aiding photosynthesis.

Extend

Use Lucalox™ PSL as a means of extending the growth time per day. Lights can be switched on at dusk or other non daylight hours.



Extend

Use Lucalox™ PSL as an extension to the growing season through usage during the winter months.

Substitute

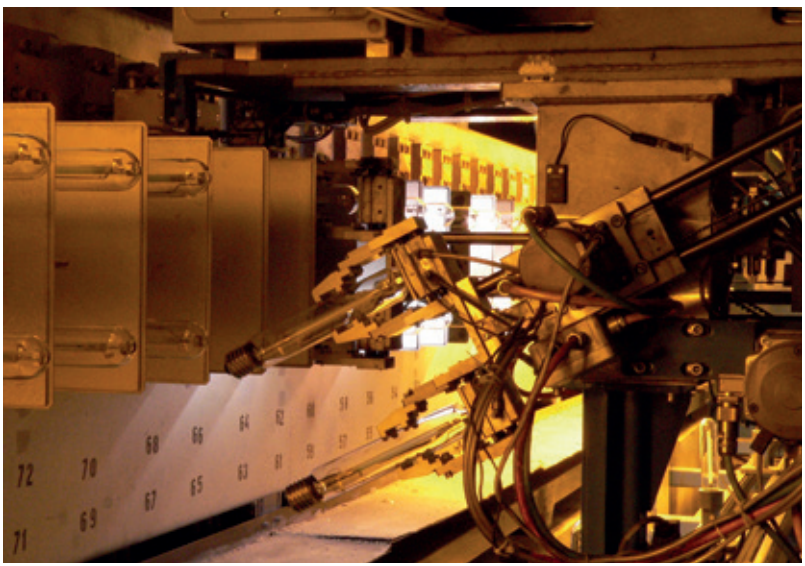
Use Lucalox™ PSL as a complete natural light substitute for total environmental control in growing rooms and biological research establishments.

Plant colour and leaf formation

Photoperiod also influences plant responses such as colour and formation of the leaves.

Coleus, for example, under continuous lighting, produces dark red leaves with bright green edges. Less than 10 hours of light per day results in less sturdy plants and paler colours. The tulip bulb is the main source of food reserve, and the light is needed mainly to develop the plants' green colour. Stems attain their greatest length if grown under lighting.

Quality from start to finish



Guaranteed
GE is constantly engaged in a global quality process. A statistical quality system, designated SIX SIGMA, is applied in all areas of the company from manufacturing through to sales. The lamps comply with the IEC/EN 62035 standards.

GE offers warranties to distributors of its Lucalox™ PSL lamps. The warranty comprises two parts:

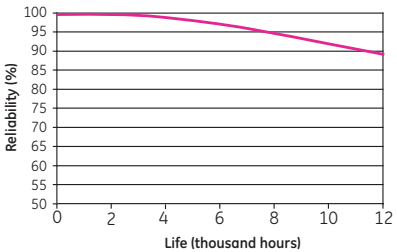
- Warranty on lamp reliability (Lamp Survival).
- Warranty on PAR (Photosynthetically Active Radiation) maintenance.

Reliable performance
While light quality is paramount, reliability and performance have also been key factors in the development of the Lucalox™ PSL lamp range.

Robust construction, reliable starting technology and improved lumen maintenance ensure peace of mind against early lamp failures and provide the consistency demanded for perfect growing conditions.

Typical PAR maintenance

Typical lamp survival



Single ended 230V

230V 250W

Lamp volts:	115V
Current:	2.7A
Watts:	250W
100 h lumens:	33,000
100 h PAR:	430 µmole/sec
Packing:	12 or 63

230V 400W

Lamp volts:	110V
Current:	4.3A
Watts:	420W
100 h lumens:	56,500
100 h PAR:	710 µmole/sec
Packing:	12 or 63

230V 600W

Lamp volts:	115V
Current:	6.0A
Watts:	615W
100 h lumens:	90,000
100 h PAR:	1080 µmole/sec
Packing:	12 or 63

230V 750W

Lamp volts:	115V
Current:	7.4A
Watts:	755W
100 h lumens:	112,000
100 h PAR:	1320 µmole/sec
Packing:	12 or 63

Single ended 400V

400V 600W

Lamp volts:	200V
Current:	3.6A
Watts:	620W
100 h lumens:	85,000
100 h PAR:	1120 µmole/sec
Packing:	12 or 63

400V 600W EL

Lamp volts:	200V
Current:	3.6A
Watts:	620W
100 h lumens:	85,000
100 h PAR:	1120 µmole/sec
Packing:	12 or 63

(Electronic ballast)

400V 750W

Lamp volts:	205V
Current:	4.4A
Watts:	765W
100 h lumens:	104,000
100 h PAR:	1390 µmole/sec
Packing:	12 or 63

Special purpose lamps.
Not suitable for household illumination.

Product identification

The following glossary of terms will help you when selecting lamps in this section. Within each product line, lamps are divided into families – within these families, lamps are listed by wattage. The Product Description can be used as a quick reference to each product's attributes. Where Life or Average Life are stated we refer to the industry standard definition of how many hours of operation 50% of a given installation will exceed.

Product description: Lamp reference – describes the lamp's main characteristics

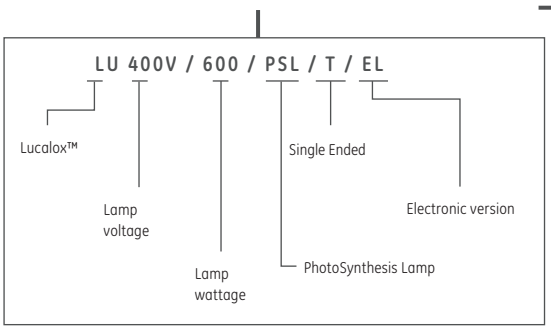
Product code: GE SKU code. Choose code according to pack quanity.

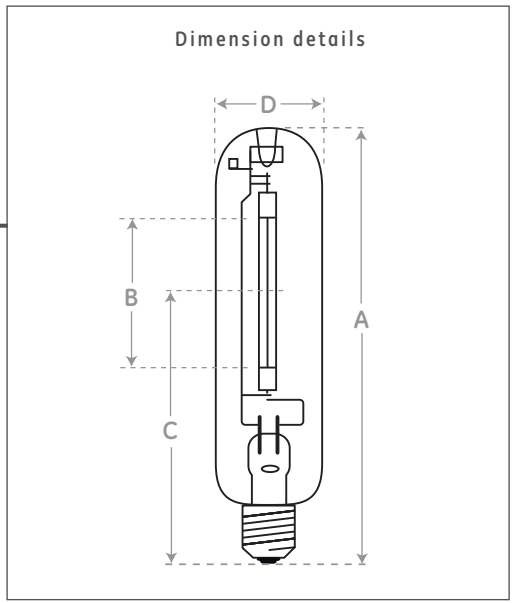
Dimensions: In mm. See diagram.

Performance: This gives an indication of the lamp's brightness and its effect on plant growth.

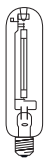
400V - E40 Cap

Volts [V]	Current [A]	Power* [W]	Product Description	Product Code [12 pack]	Product Code [63 pack]	Max Length A [mm]	Arc gap B [mm]	LCL C [mm]	Diameter D [mm]	Cap	100 hour lumens [Lumens]	100 hour PAR [µmole/sec]	Bulb glass	Operating position
200	**3.6**	**620**	**LU400V/600W/PSL/T**	**43440**	**43439**	**292**	**124.5**	169	48	E40/45	85,000	1120	Hard	Universal





Volts [V]	Current [A]	Power* [W]	Product Description	Product Code [12 pack]	Product Code [63 pack]	Max Length A [mm]	Arc gap B [mm]	LCL C [mm]	Diameter D [mm]	Cap	100 hour lumens [Lumens]	100 hour PAR [µmole/sec]	Bulb glass	Operating position
230V - E40 Cap														
115	**2.7**	**250**	**LU250W/PSL/T**	**88665**	**N/A**	**260**	**64**	158	48	E40/45	33,000	430	Hard	Universal
110	**4.3**	**420**	**LU400W/PSL/T**	**17106**	**44304**	**292**	**87**	175	48	E40/45	56,500	710	Hard	Universal
115	**6.0**	**615**	**LU600W/PSL/T**	**17107**	**44305**	**292**	**125**	169	48	E40/45	90,000	1080	Hard	Universal
115	**7.4**	**755**	**LU750W/PSL/T**	**17108**	**44306**	**293**	**130**	178	51	E40/45	112,000	1320	Hard	Universal
400V - E40 Cap														
200	**3.6**	**620**	**LU400V/600W/PSL/T**	**43440**	**43439**	**292**	**124.5**	169	48	E40/45	85,000	1120	Hard	Universal
200	**3.6**	**620**	**LU400V/600/PSL/T/EL****	**63919**	**63922**	**292**	**124.5**	169	48	E40/45	85,000	1120	Hard	Universal
205	**4.4**	**765**	**LU400V/750W/PSL/T**	**43438**	**43437**	**293**	**143**	175	51	E40/45	104,000	1390	Hard	Universal



* Depending on system conditions, lamp power can vary by ±2.5%

** Electronic ballast

Brand cross reference

The following table shows GE and alternative brand Product Descriptions. These cross references are provided as a quick guide and may only represent a near equivalent to other brands. The table contains data from alternative brands' catalogues and website.

GE	PHILIPS	Osram	Sylvania
LU250W/PSL/T		Plantastar Inter 250	
LU400W/PSL/T	MASTER GreenPower 400W EM 230V	Plantastar 400	SHP-TS GroLux 400W
LU600W/PSL/T	MASTER GreenPower 600W EM 230V	Plantastar 600	SHP-TS GroLux 600W
LU750W/PSL/T			
LU400V/600W/PSL/T	MASTER GreenPower 600W EM 400V		SHP-TS GroLux 600W-400V
LU400V/600/PSL/T/EL	MASTER GreenPower 600W EL 400V		
LU400V/750W/PSL/T			