PRODUCT PROFILE **LED PAR56 Underwater**

1. General Description

The Sylvania LED PAR56 Underwater represents the first solid state light source to be rolled out by your Photo-Optic product & market development team. We have engineered a top class professional product to deliver dynamic lighting effects in swimming pools, fountains and other underwater illuminations.

This market is already served by quite a number of competitive products, almost all of which are of Chinese origin. These range from low power 'toys' whose light output is particularly unimpressive, to advanced high-tech lamps embracing the latest LED technology to deliver a light intensity approaching that of halogen – but whose price is so high that few consumers are tempted to make the investment. We therefore had to make a careful choice about the performance and price level to pitch our product.

In 2008 we came close to launching a basic version of an LED PAR56 with a plastic housing. That idea was quickly discontinued when it became apparent that Sylvania customers expect a more professional light output than we were able to achieve with our low cost Chinese-sourced product – and indeed that the market is prepared to pay much higher prices for the more powerful versions.

Now we are ready to return to the market with a professional quality lamp designed in Tienen but manufactured under our control in China. Thanks to a particularly intelligent design we have been able to solve several known problems with competitors' lamps and boost our output to very high levels. It is not the brightest lamp on the market, instead we have chosen an output that is sufficiently powerful for professional applications but without resulting in a product that would be too expensive to sell in significant volumes.

Figures 1 and 2 show two general views of the new lamp:

Figure 1 – LED PAR56 Side View

Figure 2 – Front View

Note that the lamp is only suitable for use under water at the present time, to achieve satisfactory cooling. Pending life test results, it may at a later date be released for free-burning in air. This could extend its applications to other stage/studio entertainment lighting effects in the Photo-Optic business. If you have specific feedback on this area contact Lieven Maes to assist in building a business case for the same.

2. Product Characteristics

ELECTRICAL DATA :		*Nominal*	*Minimum*	*Maximum*
Lamp Voltage :	(V)	12.0	10.0	14.0
Lamp Current :	(A)	2.75	-	3.0
Lamp Wattage :	(W)	25	20	30
Power Factor :	(cos φ)	0.75	0.60	-
Notes :		Lamp can only be used with magnetic transformer. Not suitable for use with electronic transformer. Not suitable for use with dimming apparatus. Suitable for either AC or DC operation.		

PHOTOMETRIC DATA :				
Peak Intensity RGB :	(cd)	1100	-	-
Beam Angle :	(°)	25 x 25	-	-

PHYSICAL DATA :			
Bulb :		PAR-56	Silver painted aluminium
Cap :		2 screw terminals	Same as incandescent PAR56
Maximum Diameter :	(mm)	178.0	
Maximum Length :	(mm)	114.0	
Rim Thickness :	(mm)	10.0	
Gross Weight :	(kg)	1.25	

OPERATING CONDITIONS :				
Ambient Temp. :	(℃)	25	-10	40
Burning Position :		Universal		
Environment :		Under water to max. depth 2 metres.		

LIFE :

Rated Average Life : (hours) 20,000

Note that rated life can only be achieved whilst operating under water to provide the necessary degree of cooling. Limit operation in free air to maximum 15 minutes.

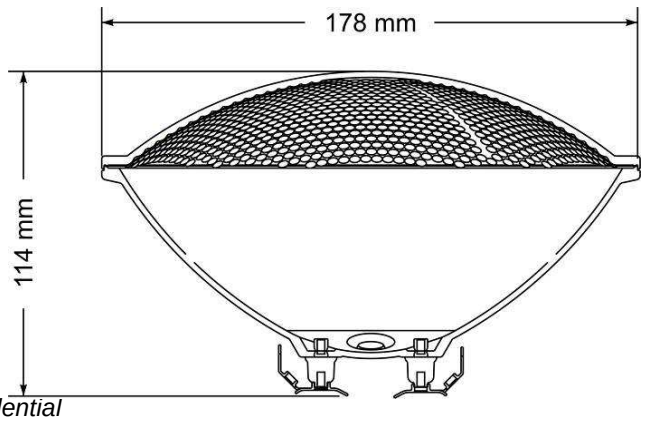
PACKAGING :

Individual full colour sleeves packed within a 6-way outer carton.

ORIGIN :

Designed by Tienen and manufactured in China exclusively for Havells-Sylvania Ltd.

DRAWING :



3. Features and Benefits

Feature	Advantage
Incandescent retrofit	Will fit into virtually all existing luminaires. The curve of the reflector and front lens is same as the industry standard incandescent swimming pool lamp GE 300PAR56/12V.
High luminous intensity	18 high output LEDs focused into a medium beam deliver a powerful output for professional applications
Saturated LED Colours	LED light appears much richer and more vibrant than light from filtered halogen or other coloured lamps.
Sylvania Patent Pending colour control technology	Light output mode can be switched between continual colour changing or fixed at any desired colour, simply by switching off briefly and then back on again.
Remote control	Optional Sylvania remote control and receiver facilitates setting of light colour from the poolside with no need to return to the mains switches.
Unique sealing method	Thanks to a novel invention we avoid the use of unreliable silicone sealants which can deteriorate over time, to ensure full IP68 water tightness during the long lamp life.
Chlorine-resistant materials	Thanks to the selection of the correct materials, the lamp will not rust or corrode when immersed for prolonged periods in chlorinated or salt water.
20,000 hour life	Will last a lifetime, low maintenance costs.
25 Watt rating	Costs very little to operate. Relatively cool burning. Zero heat in beam.
Instant light	No delay or run-up time after switch-on.

3.1 Visual Features

One of the primary features of LEDs is their ability to efficiently create extremely rich, pure and saturated colours. Conventional light sources are unable to achieve such purity of output, with the result that their colours often look somewhat pale and washed out. The spectral power distribution charts below show how pure is the light from LED lamps. This is compared with coloured halogen and fluorescent lamps, whose spectra are broader and lead to a weaker colour effect.

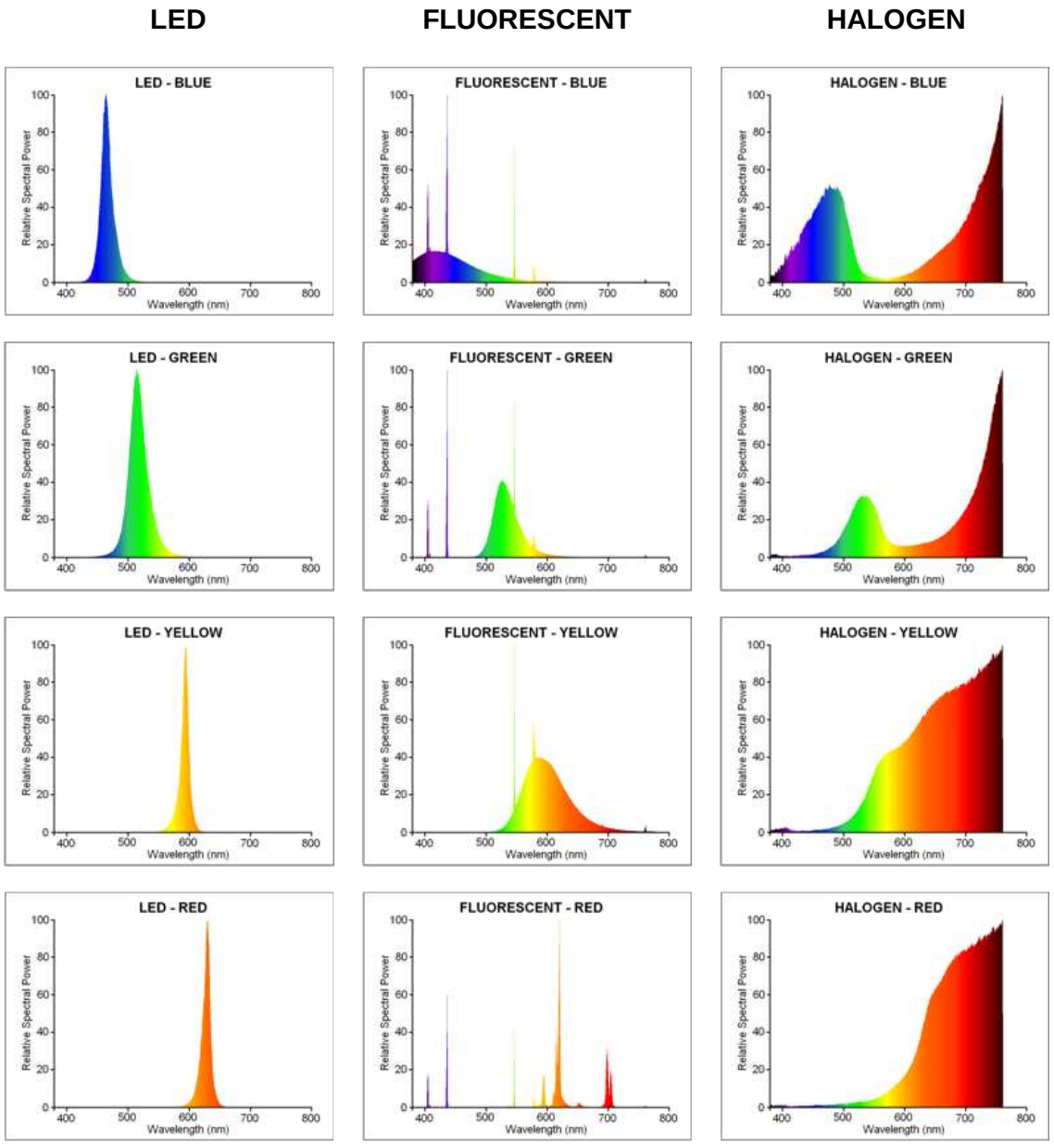


Figure 3 – SPD's of Coloured LEDs, Fluorescent & Halogen Lamps

3.2 Colour Control Method

Competitive LED PAR56 lamps often come with a remote control which transmits a signal directly to the lamp. This works fine through the air, but when the LEDs are installed a metre deep under water, the radio signal may not penetrate. This makes colour changing difficult and leads to customer irritation. Also depending on the signal strength, perhaps only some LEDs in the swimming pool will respond to the signal, while others fail to react and do not follow the colour of the rest.

Sylvania has overcome this weakness by enabling the lamp's colour to be simply set by switching its power source on and off (patent pending).

When the lamps are switched on they enter a mode of continual colour cycling, and during a period of 20 seconds they pass through the whole spectrum of colours. The light can be fixed at any desired colour simply by switching it off, and back on again within 2 seconds. To resume colour changing mode again, simply repeat the switching action a second time.

The sequence of events required to fix colour is illustrated diagrammatically in Figure 4.

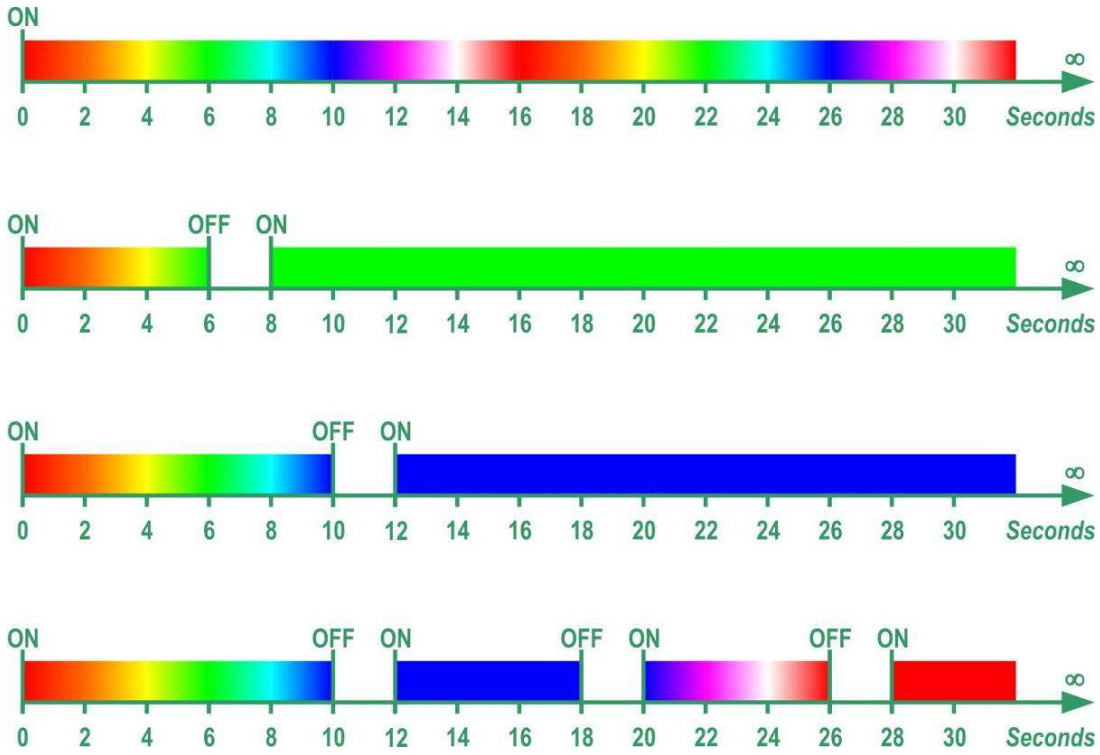


Figure 4 – Illustration of Colour Control Method

3.3 Remote Control Option

Often for safety reasons, the switch leading power to the swimming pool may be located remotely. So it's not always possible to see the colour of the lamps and know when to switch them to fix the light output colour. Sylvania offers the perfect solution with our optional remote control and receiver kit. The receiver can be installed up to 20 metres away from the swimming pool, at the point where the mains electricity is supplied.

The handheld remote control features two buttons which turn the power On and Off. The range of the receiver to the transmitter is approximately 20 metres, and this enables the lamps to be controlled in comfort from the poolside. Thanks to its wireless battery-powered operation, there is no risk of electric shock.

Incidentally this remote control kit is simply a radio controlled On/Off switch. It can of course be used for many other applications where remote switching of lights is required. The remote control and receiver are pictured in Figure 5.

Figure 5 – Optional Remote Control & Receiver

Technical Data Receiver Unit:
Voltage : 200-250V AC
Max. Load : 1 Amp (250 Watts)

Technical Data Remote Control:
Battery : Type 123 (12V)
Range : Max. 20 metres

Wiring Diagram:
Note that the receiver works on the mains supply only, and must be installed on the 230V side of the circuit! Its output should be connected to the transformer(s) driving the lamps.

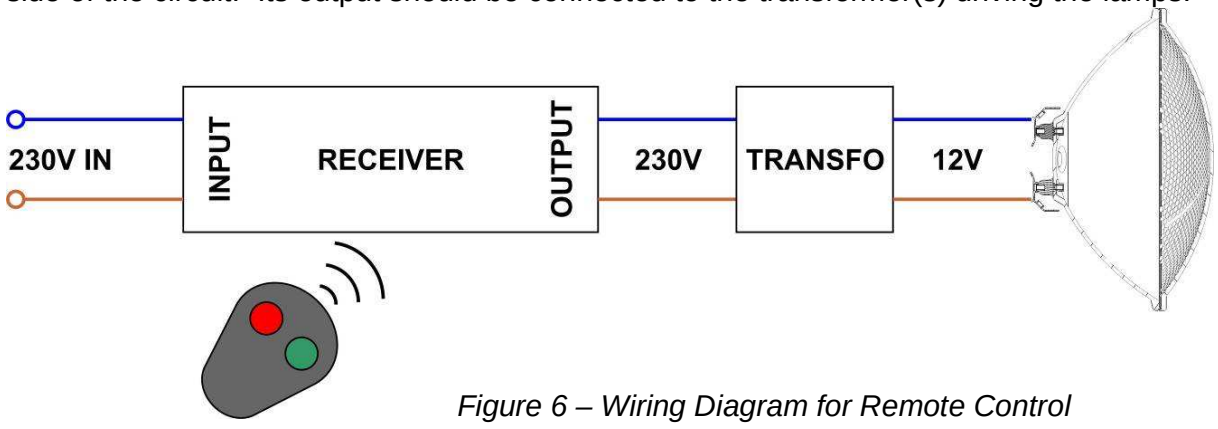


Figure 6 – Wiring Diagram for Remote Control

3.4 Product Quality & Design

Many LED PAR56 lamps are plagued by a problem of weak waterproof seals. Normal incandescent PAR56 lamps are made from glass, and the front lens can be sealed to the reflector by melting them together.

However LEDs are made of plastic, and will be completely destroyed at the high temperatures needed to melt glass. The standard Chinese approach is to make LED PAR56 using the same glass lens and reflector as incandescent lamps, and to stick the two pieces together with silicone.

The siliconed seal is not always sufficiently strong and water can leak inside the lamps, causing electrical short-circuit and failure.

The Sylvania design uses no silicone. Instead we use a metal rear section and a plastic front lens. The metal rear section functions as a heat sink and allows the use of high power LEDs, to achieve a powerful light output. The plastic front lens is sealed to the metal reflector with a rubber O-Ring. This is held in place with a metal outer ring which is screwed over the reflector. It compresses the O-ring between the front lens and reflector and achieves an extremely strong water-tight seal. A cross-section of the design is shown in Figure 7. The reflector is grey, the front lens yellow, the retaining ring pink, and the double O-ring seals blue.

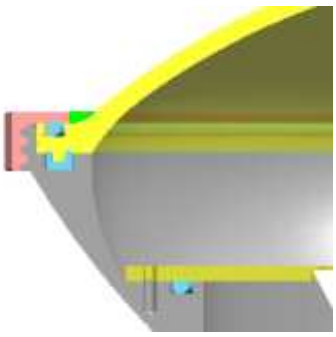


Fig. 7 – Waterproof Seal

3.5 Light Intensity & Distribution

Due to the use of multiple tiny LEDs, the beam of many competitive lamps is poor. The beam shape is uneven and there can be colour separations in the projected light. The Sylvania lamp uses double optics – one set on the LEDs themselves, and secondly a lenticuled lens over the lamp. This achieves a uniform beam as pictured in Figures 8 & 9.

Figure 8 – Projected Beam (RGB)

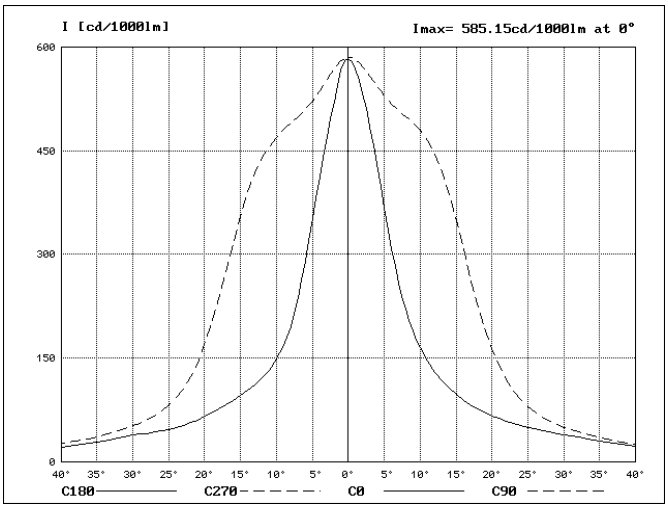


Figure 9 – Beam Intensity Distribution

4. Competition

Primarily all Chinese origin products. Market prices ranging from €10 to €350 depending on product performance and quality. Due to the fragmented market, there are no specific key competitors at the present time.

Competitive products can mainly be classified as follows:

Glass Body Lamps	Contain 5mm LEDs and Silicone seals Light output always low, because the glass body traps the heat of the LEDs. Reliability generally poor, because the glass body does not allow heat to escape and the electronic driver becomes too hot, with a consequent risk of premature failure Silicone sealing method unreliable. Lowest cost products.
Plastic Body Lamps	Generally better reliability owing to no silicone seal. The plastic parts can be melted together. The plastic is still not a good heat conductor, and this limits the use of high power LEDs. Mid-range prices.
Metal Body Lamps	Like Sylvania design. Good thermal properties of the metal body permit use of high power LEDs, to achieve a high luminous intensity. Reliability generally better owing to improved cooling Cost can be very high depending on design.