

Incandescent Light 2500K



LED Light 5500K



These photos of 'Bat End' Orient Cave Jenolan, show the before and after views. The original incandescent lighting gives a warm flat wash of yellow orange over all surfaces. By contrast the cool white LED lighting reveals subtleties in the natural colours and hues as well as exposing the three dimensional view to give depth and variations in texture.

THE DEVELOPMENT OF WEIDMULLER LED LIGHTING SYSTEMS FOR SHOW CAVES

– David Head*

WHO IS WEIDMULLER?

Weidmuller has over sixty years of experience as a leading manufacturer of Power Electrical and Electronic products for industry and employs over 4000 people globally. Weidmuller's products are distributed worldwide in over seventy countries for use in power stations, process plants, electrical switchboards, machines and vehicles wherever electrical power is terminated, switched, conditioned or transformed.

Weidmuller Australia has always been at the forefront of innovation and fit-for-purpose product development. In line with this strategy in 2004 a decision was made to develop customer-specific LED lighting solutions for niche markets. Our initial focus was for railway rolling stock lighting. This has been very successful and development continues to grow rapidly to a point where Weidmuller has now produced the first LED Locomotive Headlights.

WHY SHOW CAVES?

You may be wondering why Weidmuller decided to develop products for the very specialised niche market of show cave lighting. Having visited many caves over the years, and being passionate about cave conservation, I was prompted to investigate the possibility of developing dedicated LED lighting equipment for show caves. My initial contact was with Jenolan Caves, west of Sydney. Through their keen interest and desire to upgrade their lighting systems, much of our development has been carried out at Jenolan. None of this development would have been possible without the co-operation and vision of Jenolan's Dan Cove and David Rowling.

WHY LED LIGHTS?

Having looked at the typical cave lighting systems and the many problems that often occur, we decided to tackle some of the key issues. These points are of major importance to show cave lighting.

Lamp Life

Typical incandescent lamps last only about 1000 to 2000 hours where LED's have a life of up to 50,000 hours. This results in far less intervention in delicate and fragile areas of caves to replace blown globes. The occupational health and safety issue is also very important as in many caves the lights are located in precarious positions and often at great heights.

Heat Reduction

As typical halogen lamp can have a surface temperature of 250 Deg C, the resultant temperature increase in the vicinity of the light can adversely affect the cave. In one experiment we found the heat from a 50W halogen lamp could boil a cup of water in just 20 minutes. It's not difficult to imagine the level of damage that can occur when halogen lamps are often left on for more than half an hour during a tour.

Our LED lights have a maximum surface temperature of between 35 and 50 deg C even if left on for extended periods. Infrared radiation from incandescent lamps can lead to lampen flora growth. LED lights do not emit infrared radiation in their light beam.

Below is an example of the use of all cool white LED's



The Egyptian Colonnades, Orient Cave, Jenolan.
Photo: Ted Matthews. This example uses a combination of cool white and neutral white to accent the natural colour variations.

Power Reduction

LED's are able to deliver many times the light output of incandescent globes. This can be as much as six times. This leads to a corresponding reduction in power requirements. Initially this may not seem a major issue but when you consider how much power is being used by all the lights inside a cave it quickly adds up.

As an example the original incandescent lights in the Orient Cave at Jenolan consumed a total of 8000 watts. This has been reduced to only 1200 watts with the installation of Weidmuller LED lights. With the cost of mains power steadily increasing, any effort to reduce power usage is worth consideration.

Safety – Extra Low Voltage

While it is possible to power many of our LED lights from 110 or 240VAC, by far the most popular option is to use a 24VDC system. The use of a 24VDC system has many advantages. Firstly it is inherently safe and can be wired by non technical

staff. There is no requirement to have an electrician wire up the lights in a 24VDC system.

In many cases it is the cave guides that have an intimate understanding and knowledge of where particular lights should be installed to achieve the best possible illumination of cave features. After all, it is the guides who will be using the lights!

Secondly it becomes very easy to provide battery back up in a 24VDC system. Caves, being often located in somewhat remote locations frequently experience mains power outages. Nothing is worse than having to walk out of a cave under torch light due to a black out. Visitors are not happy and guides become frustrated. This experience can be a thing of the past if the power system is battery backed. It is quite possible to continue tours for even a few days under battery power without any visitors even knowing there was a black out.

Colour Temperature: Warm/Neutral/Cool?

Since electric lights first appeared in show caves many different lighting techniques have been utilised. Various types of incandescent globes have been used to illuminate the majority of caves. These lights have provided a soft warm glow to caves and enabled many decorations and formations to be illuminated.

The warm yellow light was due to the design constraints of the incandescent globes. It was not possible to achieve a more natural clean light without greatly reducing the life of the globes or reducing their intensity with filters.

With the arrival of LED's we are no longer limited to yellowish lights that limit the ability to experience the colour subtleties of cave decorations. With LED's we have much more control over the colour temperature of the light. The typical colour temperature of light from incandescent globes is in the region of 2700 to 3300K. In contrast natural daylight is around 6000K. With high quality LED's we can obtain white light from 2800 to over 6000K.

Weidmuller LED lights are available in three colour temperatures:

Warm White	2800K
Neutral White	4000K
Cool White	5500K

THE FUTURE

Weidmuller's involvement in LED lighting of show caves is continually developing. Over the past six years we have seen huge gains in the light output and efficiency of LED's that have enabled us to design new, innovative and more reliable products. I would like to thank the many people from caves all over the world who have provided valuable feedback to assist us in the design and development of products to meet your needs.

* Electronics Development Manager and Principal Engineering Consultant, Weidmuller Australia.