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Essential Guide to LED's in 2011

Andrew Orange's insightful jargon busting handbook to using LED Lighting

LED Pt 1

The thing about LED lighting technology is that most of us know it is the way ahead. Problem is – we are not really sure how to use it properly … yet.

LED's are spreading across our world like an aluminous rash heralding a new age of energy efficient lighting that once they are fitted can be forgotten. Once only seen as little lights on your stereo – seemingly they can now be used to uplight 80m high buildings! But can we trust them to really be a replacement of other tried and tested lamp technology?

Why would we use an LED source, say in a downlight?

Colour: LED's can at last now match the same colour rendering of our beloved incandescent GLS lamp.

Longevity: usually quoted as 50,000 hours which is over 11 years if you leave the lights on for 12 hours everyday.

Low maintenance: No lamp changing and when they begin to fade after a decade or so, manufacturers are now beginning to make the LED replaceable in the fitting.

Energy efficiency: Very highly efficient saving huge amounts of energy and running costs with the fittings paying for themselves many times over.

Part L1A: Building Regs now allow all of a new low energy lighting scheme to count towards a buildings a minimum value target emissions rate. 75% of luminaires are now required to be low energy over 45 lumens per circuit watt – many LED fittings are now essential choices.

True directional light: Halogen lamps reflect varying degrees of beam (flood etc) but they loose efficiency in the process. An LED's lens directs the light more efficiently.

Robust: Solid state lighting (which LED's are) has no filament to burn out and can handle tough conditions.

Dimmable: LED's can be dimmed but the colour remains the same. If you want to mimic an incandescent source and enjoy a warmer glow as you dim you will be disappointed with most fittings. There are breakthroughs in this technology so watch this space!

Environmental: With some fittings made from 85% recycled aluminium and 100% recyclable in addition to their efficiency, they have a very low carbon footprint. Additionally, unlike compact fluorescent lamps they contain no mercury.

Small: Dimensionally smaller and more compact that ordinary compact fluorescents.

LED Pt 2

The LED revolution is gaining momentum with a recent development by Audi cars who have won the race to successfully create a car with all LED headlamps, opening the door to mass production for LED integration to all their cars. So having previously looked at the potential benefits, can these developments be embraced by interior designers and specifiers of interior applications?

Let's simplify the decision making process and cut through some of the jargon in choosing an LED downlight:

How powerful: Measured as lumens. Lumens reveals the measurement of how much light is actually emitted by the fitting. For instance we often see a specification of 3 × 1W, However this is misleading as we do not know from this statement the power or effectiveness (lumens/watt) of the LED unit.

How effective: The LEDs efficiency in producing light is measured in lumens per watt. How well it ability to deliver this light level to how much power is being used to make the LED function. There will be a cost for this 'efficiency' as a high output LED can reduce its effective lifespan if the fitting is running at a higher level of power to achieve the desired intensity of light. We have to note the transformer size, typically 350mA or the higher and often more costly 700mA.

Colour Temperature: The figure given describes the colour of white light the fitting will try and deliver. We will discuss this in more depth another time, However you need to know that 2700K is a warm white moving up to 6500K which is a near daylight effect, with 4000K as a neutral white. To head for a colour similar to the standard a low voltage halogen we should be aiming for 2700K to 3000K.

Colour Binning: A strange term that is an attempt by manufacturers to put colours of light given by an LED into a cluster or bin, may be to warn us of imminent disappointment! LED technologists are busy resolving this issue but until now if you compare three different 3000K (warm white) LED's they can all have a visually different colour. The Bin tells us into which group we can expect the visible light to fall.

Colour Rendering: This CRI value is one of the main indicators on how accurately the light will reflect the true colour of the object it is illuminating. A CRI of 100 being perfect down to zero. Some manufacturers are claiming an excellent CRI 97.

Driver: The power pack that runs the LED, very often 350mA or 700 mA.

So how do we use all that and arrive at a (quick) answer?

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Is it safe to recommend LEDs - Part 3 the conclusion!

We've looked at why we should consider LED technology and then what we should look out for when choosing an LED downlight. Now let's apply this and take a look at an example.

A good customer said to me that specifying LED downlights throughout her current project would be like having a 25 year old surgeon performing an operation on her now, rather than waiting five years until he had more experience and made his mistakes on others! If she had to choose the more expensive consultant over a junior doctor, experience wins every time.

Are her fears still founded? After all you will be specifying these lights from hence forth – and you want them to serve your client well – without call backs!

LED A vs. 50w Halogen Downlight

We have to consider LED fittings differently to other luminaires. The LED itself is one of a number of interdependant components that make up the whole fitting. The efficacy, longevity and value of a product must be assessed using the following criteria.

How Powerful: Lumens is the key figure but the number must be read together with the driver size and the colour of light it's producing. In general a very warm white will not be as efficient as a colder white light. For our purposes let's test a warm white LED.

LED A = 633 lumens emitted by the fitting with a warm white at 700Ma
50W LV Downlight = approx 800–900 lumens
50W Mains downlight = approx 550 lumens

Does it Deliver: How much light will each fitting give me? The LOR or Light Output Ratio can be useful as that shows us how much light is actually getting out of the fitting into the room compared to how much started at the LED itself. We could have a great LED that just doesn't deliver. However, this method of efficiency is not fail safe when used with LEDs and is secondary to how much light actually is measured outside of the fitting.

LED A has an LOR of 83% and is tested by the BSI. The punch of the light is not as defined as a 50W halogen loosing the scalloped edge of light, an advantage for some?

Colour: Will the colour be constant when using a number of the same fitting? An LED's white light is made up of a mixture of blue, red and green. There can be a slight colour shift towards one of those primary colours even though the colour temperature (ie 3000k) is the same. This is minimised by selecting more expensive LED chips that come from the same refined 'bin' which provide consistency. I prefer to use an LED unit that specifies the bin it is from to ensure they are all the same.

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Heat: LED's run very hot and need an effective heat sink to loose the heat quickly; ensuring the thermal management of the LED is within acceptable limits. A cooler LED is a happier, more colour consistent, longer lasting LED. Unfortunately there is no measurement of heat loss efficiency to compare, but being aware of this fact is essential when installing. Importantly the more air flow we can give the product the better the heat will be lost.

Recess depths are an essential consideration in the design. Poorer quality LED's will run at a heat which is too high to ensure the warm white colour remains constant for it's proposed lifespan – therefore turning whiter with age.

LV Downlights also generate alot of heat leaving both technologies vulnerable to the effects of running at high temperatures.

Lifespan:
LED A runs to 100,000 hours at a lower 700Ma, winning hands down.
50W Long life MR16 lamp gives at best 5000 to 6000 hours

CRI: This CRI value is one of the main indicators on how accurately the light will reflect the true colour of the object it is illuminating.
LED A 85% at 3000K warm white
50W Tungsten Halogen has a better colour rendering than most standard lamps but the LED is a good rival.

Aesthetics: We may find a fab product that looks pig ugly.
LED A can be fitted into one of the standard bezels (front plates) that we usually use and has a magnetic inner plate to allow the recessed parts to drop down into the room.

Wattage: What are the running costs of each fitting?
LED A has 4 LED's giving us 9.8W running at 700Ma (12W overall with driver)
50W Halogen's are running at 5 times the cost, with actual consumption over 50W

Value for Money
LED A costs just under double a good quality low voltage downlight.
However, you will be replacing the 50W lamp twenty times before the LED becomes unacceptable and it will be constantly running at nearly 5 times the cost of electricity.

Overall Conclusion

My lady interior designer's fears are justified but short lived. Various LED downlight solutions are strongly challenging the status quo at increasingly acceptable prices. My choice of LED A together with a couple of others have become too good to ignore now.

Visit houseoforange.co.uk and join me in the pursuit of the best solutions of lighting for you and your customer.

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