



Learn why LED lighting is preferred for
100% inspection systems



LED lighting is now the norm for 100% inspection

Over the past 15 years all inspection companies have used different light solutions for its 100% inspection systems. This document explains the different light solutions and their benefits. Let's look at the following technologies.

- Xenon strobes
- Fluorescent tubes
- Tungsten Halogen
- LED solid state illumination

Xenon Strobes

- Can only be used with area scan cameras and thus used often in vision systems for print inspection, but are not suitable for 100% inspection.
- The light intensity output of a strobe is not stable at all. Variations in intensity between two consecutive strobes from up to 10% are no exception, especially when the bulb starts getting older.
- Typically, the bulbs must be replaced every 3-6 months (15Million strobes) and are they are expensive.
- Strobes cannot be used with to light any highly reflective substrate (foils, metallised films, reflective paper...)
- Light output degrades over life time of the bulb
- Light output varies with temperature variation of the bulb
- Color varies with temperature variation of the bulb

Fluorescent

- Used commonly by suppliers on systems up to 2010.
- Introduces low intensity levels of high frequency AC flicker on inspected image.
- Noise due to AC power supply (low or high frequency)
- There is no possibility to control intensity levels. The intensity of fluorescent tubes cannot be reliably controlled as the gas inside the fluorescent tube is very unstable.
- Light intensity output is not consistent over time and with change in ambient temperature.
- Light intensity is very low compared to Focused LED or Tungsten Halogen light.

- Fluorescent tubes must be replaced every six months.
- Only diffuse light can be generated.

Tungsten Halogen (Fibre Optics)

- Bulbs have a very short life span. Lasts between 500 and 700 hour depending on bulb type and how hard they are driven.
- Non uniform light output.
- Bulbs are expensive, ranging from 25.00Euro to 40.00Euro each.
- Color of light output is approximately 3,500K.
- Very high level of red and green color content.
- Very high maintenance. It is necessary to keep spare light control boxes and lots of spare bulbs in stock.

LED light

- Very long life span. Designed to last up to 100,000 hours (7 to 10 years)
- Reliable due to use of solid state technology and often temperature controlled
- Low maintenance so no bulb replacement.
- Light output is very stable (No Flicker)
- DC-powered
- LED solid state technology
- Resulting in clean noise free inspection images thus better defect detection
- Light output is very even along its length.
- Very high intensity
- Lenses bundle and focus the light
- Results in smaller apertures, sharper images and thus better inspection
- Color temperature of light output is 6,700K which is equal to the color recommended for use with the line-scan cameras.

The table below summarizes the results:

	Strobe	Fluorescent	Halogen	LED
Suitable for 100% inspection	No	Yes	Yes	Yes
Suitable for repeat to repeat inspection	N/A	Yes	Yes	Yes
Suitable for 100% benchmarking GTC	N/A	No	Yes	Yes
Suitable for full color inspection	Medium	Medium	Poor in blue vector 3200K Medium	5600K Yes
Programmable color temperature	No	No	No	Yes
Maintenance	Bulb change 1	Bulb change 2	Bulb Change 1	None 3

Light source	Bulb Gas discharge 1	Bulb Gas discharge 1	Tungsten wire 2	Diode 3
Life time	15M flashes / 3-6 Months 2	6 Months 2	<3 Months 1	100'000H 3
Light intensity	Uncontrollable 1	Low 1	Medium 2	High 3
Cost	Cheap	Cheap	Expensive	Expensive
Spectral stability	Bad 1	Medium 2	Medium 2	Very Good 3
Substrates	Non reflecting 1	Almost all 2	All 3	All 3
Diffuse light	N/A	Yes	Yes	Yes
Focused light	N/A	No	Yes	Yes
Noise	Yes	High frequency AC-noise 1	Little 3	Little 3

Intensity	Fix 1	Fix 1	Variable, but color temp changes 1	Variable, without spectral change 3
Uniformity	N/A 0	Poor 1	Poor 1	Very Good 3

Summary

LED illumination should be the default of all modern inspection solutions, unless an application has a particular requirement for a characteristic found in one of the other technologies. In the past 5 years, OneBoxVision has become the leader in web and sheet inspection.



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