Frequently Asked Questions

Light and Color

What changes can I expect to notice when retrofitting T12 lamps with T8 lamps?

A question is sometimes asked after T8 OCTRON® lamps are used in retrofit lighting projects to replace T12 lamps such as the *warm white* and *cool white* colors. The question is if there are possible health effects due to this change. This question arises due to observed color differences, especially skin tones, under the old and the new lighting.

The output of both of these lamp types covers the same spectral range, i.e., neither emits power radiation that the other one does not. However, the power is distributed differently within the visible spectrum. The most obvious difference under the new lighting is that objects often look redder than they had under the old lighting. The fact that skin may appear slightly redder suggests to some people that there may be a relation to ultraviolet and sunburn even though such a relation does not exist.

Reduced to its simplest form, objects do not have inherent color; rather, they have reflective properties. An object will reflect certain color components and absorb other color components of the light that falls on it. Consequently, the color of the light reflected from an object depends on both the light from the light source *and* how it is modified by the object's reflective properties. We tend to speak of objects as though they possessed a color because the change in appearance generally is not too large under most common light sources. A change in the color appearance of an object viewed under different sources of light is well known. One rarely thinks about it except in special circumstances such as viewing clothing under daylight as well as under the lighting in the store. Color is a visual perception related to many factors, the light and the object reflectance being two of the most important. In many circumstances, it is not possible to say whether a different appearance of an object is due to the object or due to the light source.

There is a significant difference between the new tri-phosphor fluorescent lamps such as the OCTRON types and the older halo-phosphor lamps such as the *warm white* and *cool white* colors. Although the color of the light from the two lamp types may appear identical, the power distribution through the spectrum differs. Most of the older lamp types were deficient in red emission even though it is not apparent from the lamp color appearance. This caused a dulling of reddish objects, including skin color, in relation to their appearance under lighting such as sunlight and incandescent lamps. Because of new technologies developed in recent years, the tri-phosphor lamps have an improved red emission that, from the standpoint of color, represents a more balanced distribution of power through the spectrum.

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A person usually does not think about the differences in the color appearance of objects when going from one lighting situation to another such as from incandescent lighting in the home to fluorescent lighting in the office to daylight out-of-doors because this is such a common place experience. These changes are apparent only when one looks for and thinks about them. A difference in the colors of some objects is most likely to be noticed when a lighting retrofit occurs. This is because a before/after comparison will call attention to any change. Also, there usually will be side-to-side comparisons because the light typically is changed progressively through a building or group of buildings. Once the difference is noticed and one is conscious of it, it frequently will remain apparent and obvious for some period of time. Also, the added red content is more likely to be observed here than under incandescent lighting because the apparent color *of the light itself* is not as red as incandescent light where adaptive visual process could tend to reduce the apparent redness of objects.

The entire class of the tri-phosphor fluorescent lamps including the OCTRON lamps have been in wide use throughout the world for over a decade, and they are rapidly replacing the older types of fluorescent lamps. One of the reasons is that higher efficiencies can be achieved, i.e., less energy is required to provide a given level of light. A second, but equally important reason, is the superior color quality of these lamps. There are a variety of ways to describe this factor. A common method is to use the *Color Rendering Index (CRI),* a measure of an average change in color appearance of color samples under a light source compared to appearance of the same samples seen under well accepted benchmark lighting such as daylight. The OCTRON tri-phosphor fluorescent lamps are available in the range from 75 to 85 CRI compared to the 52 and 62 of the *warm white* and *cool white* lamps, a very significant improvement.

Clearly, it is expected that skin tones will appear redder under the new lighting than they did under the old lighting. However, changing lamp types has not introduced anything new such as significantly higher levels of UV that could cause physiological responses. Since the OCTRON lamp properties are known to make objects such as skin appear redder and since there is no putative mechanism for change of lamp types to have a direct effect, reports of any actual physiological changes, allergic responses, etc. are likely to be due to other environmental factors. It should be noted that the OCTRON lamps are classified in the *Exempt Group* under ANSI/IESNA RP-27.3-96, Recommended Practice for Photobiological Safety for Lamps - Risk Group Classification and Labeling. This classification is defined as ”(t)he philosophical basis for the Exempt Group is that the lamp does not pose any photobiological hazard for the end points in this standard.”

Beyond color, another observation sometimes is made about retrofit lighting installations. Even when the designed light level of the new system is no higher than that of the old system, it may be observed that the light level is higher. Because the output of a fluorescent lamp decreases gradually throughout its life, the light level suddenly will increase when all old lamps in a space are replaced at once. Further, as dirt collects on light fixtures, it will cause an appreciable loss of light. Since light fixtures are cleaned and sometimes new reflectors installed as part of the retrofit work, this contributes to a higher initial light level. This higher *initial* light level is necessary and is deliberately designed into a lighting system to allow for the normal decrease in light level as the lighting system is used.

Occasionally, an individual may believe that the environment is physically warmer under the new lighting. Because retrofit lighting generally uses the same or a lessor number of lamps, because the lamps are lower wattage, and because the ballasts have lower losses, there is actually a reduction in power and therefore a reduction of heat introduced into the space. If a change occurs in thermal conditions, it is likely to be related to the HVAC system, the use of windows, etc.

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