

Colour rendering according to TM-30-15

Colour rendering describes the correspondence between the colour of objects when illuminated by a test light source and by a reference light source. Colour rendering is therefore not an absolute quantity, rather it always depends on the selected reference illuminant. In particular, colour rendering is a measure neither of colour preference nor of naturalness. This means that light sources with high colour rendering are not necessarily preferable - thus revealing key weaknesses in the metric used today. The colour rendering index R_a (according to CIE publication 13.3), based on only eight test colours (all of which unsaturated), is only meaningful for the reference illuminant concerned and often does not correlate with the (subjective) visual evaluation.

In 2015, the Illuminating Engineering Society (IES) published the standard IES TM-30-15 in the US. TM-30-15 is a method for describing colour rendition using two metrics: colour fidelity R_f and colour gamut R_g . These definitions include some fundamental improvements and are based on a uniform colour space CIECAM02-UCS, on the tristimulus value functions $\bar{x}(\lambda)$, $\bar{y}(\lambda)$ and $\bar{z}(\lambda)$ for a 10° observer, and on a large selection of 99 colours, including many saturated ones. As shown by extensive studies of the Technische Universität Darmstadt, IES TM-30-15 still has substantial shortcomings:

- The direction of the colour difference in the colour space is not taken into account.
- The gamut definition is not colour group-specific.
- The gamut definition R_g does not correspond to the notion of the saturation property of the light sources.
- Only the entire quantity (gamut) is specified, however the shape of the colour volume is also of importance.
- Research shows a negative correlation in some cases between gamut and user preference.
- The 99 test colours are very unevenly distributed across colour space.

Because of these shortcomings, the relevant international expert committee of the CIE (International Commission on Illumination) resolved unanimously in October 2016 that the fidelity index R_f (based on IES TM-30-15 and incorporating an improvement by the CIE in autumn 2016) should be used exclusively for scientific purposes and is specifically not

suitable for replacing the existing colour rendering index R_a . Consequently, the evaluation of light sources shall continue to be based on the colour rendering index R_a for all purposes other than scientific ones.

Meanwhile, the CIE has established an expert group to develop the fidelity index into a fully-fledged colorimetric system that could replace the colour rendering index R_a .

At the present time the ZVEI shares the concerns of the international expert community and endorses the CIE's decision not to use TM-30-15 for regulatory purposes or to evaluate or describe light sources.

Contact:

ZVEI - Zentralverband Elektrotechnik-
und Elektronikindustrie e.V.
German Electrical and Electronic
Manufacturers' Association
Lighting Division
Lyoner Strasse 9
60528 Frankfurt am Main, Germany
Phone: +49 69 6302-293
Fax: +49 69 6302-400
E-mail: licht@zvei.org

www.zvei.org

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