IES TM-30-15

What is TM-30-15?

IES TM-30-15 is a document approved by the Illuminating Engineering Society (IES) that describes a method for evaluating light source color rendition. The method provides a comprehensive characterization of how the light will affect the color appearance of objects. It takes into account gamut, whilst expanding fidelity to 99 colour swatches.

| CES 1 | CES 2 | CES 3 | CES 4 | CES 5 | CES 6 | CES 7 | CES 8 |
|--------|--------|--------|--------------------|--------|--------|--------|--------|
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| CE5 33 | CES 34 | CES 35 | CES 36 | CES 37 | CES:38 | CES 39 | CES 40 |
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| CES 49 | CES 50 | CES 51 | CES 52 | CES 53 | CE5 54 | CES 55 | CE5 56 |
| CES 57 | CES 58 | CES 59 | CE5 5 0 | CES 61 | CES 62 | CES 63 | CES 64 |
| CES 65 | CES 66 | CES 67 | CES 68 | CES 69 | CES 70 | CES 71 | CES 72 |
| CES 73 | CES 74 | CES 75 | CE5 76 | CES 77 | CES 78 | CES 79 | CES 80 |
| CES 81 | CES 82 | CES 83 | CES 84 | CES 85 | CES 86 | CES 87 | CES 88 |
| CES 89 | CES 90 | CES 91 | CES 92 | CES 93 | CES 94 | CES 95 | CE5.96 |
| CES 97 | CES 98 | CES 99 | | | | | |

What are the main indices?

This system uses three highest-level indices to character the color appearance of objects: Fidelity Index (R_f), Gamut Index (R_g), and Color Vector Graphic.

Fidelity Index (R_f)

Fidelity Index (R_f) measures how 99 color samples are rendered by test source and the reference illuminant and uses average values to rate the color fidelity. It ranges from 0 to 100, with 100 indicating an exact match with the reference illuminant. For architectural interiors, values below 60 are not typically considered appropriate.



R_f=93



Gamut Index (Rg)

Gamut Index (R_g) measures average level of saturation relative to the reference illuminants. First, 99 color evaluation samples are divided into 16 bins. In each bin, all samples are averaged to generate one vertex. Connecting all vertices, one 16-sided polygon is generated. Gamut index is the ratio of the area of test and reference polygon. R_g ranges approximately from 60 to 140.





R_f=93 Rg=90 R_f=78 $R_g = 110$

Color Vector Graphic

Color Vector Graphic shows the color differences (hue and saturation) between test light sources and the reference illuminant. The black circle represents the reference illuminant, and the red circle represents the test light source.



Color Vector Graphic

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Actually, the Color Vector Graphic could show more information related to color rendition, like a shift in or out of the circle represents oversaturation or under-saturation and a shift around the circle means a hue shift (a particular color appears more like another color).





Original



Desaturated

Red-Enhanced



What are other useful indices?

Except above three main indices, some other indices are also useful in the commercial industry.

Sample Fidelity Indices (R_{f,CESi}, i=1-99)

The system could calculate the fidelity value for each 99 color evaluation sample.



Skin Fidelity Index (R_{f, skin})

R_{f, skin} indicates how similarly a given light source will render skin tones to the reference illuminant, which is more concerned in the commercial industry.



Hue Fidelity Indices (R_{f,h#}, #=1-16)

Similar to fidelity index R_f , a fidelity value can be calculated based on the samples in each hue angle bin, named as Hue Fidelity Indices ($R_{f,h\#}$). They provide more detailed information than the average fidelity index, potentially providing information that is more relevant to a specific application.



Chroma Change by Hue Indices (R_{cs,h#}, #=1-16)

Chroma Change by Hue Indices provides numerical values for relative chroma change in each of 16 hue bins. The values are percentages, with the sign indicating whether chroma is increased or decreased.



A measure similar to CIE R9

The single sample with fidelity values that are most correlated with CIE TCS 09—used to calculate CIE R9 is CES07