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Viewing conditions — Graphic technology and photography

Conditions d'examen visuel — Technologie graphique et photographie

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

Attention is drawn to the fact that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 3664 was prepared jointly by Technical Committees ISO/TC 42, *Photography* and ISO/TC 130, *Graphic technology*, with input from ISO/TC 6, *Paper, board and pulps*.

This second edition cancels and replaces the first edition (ISO3664:1975) which has been technically revised. This revision of the 1974 version of the International Standard meets the current needs of the Graphic Technology and Photographic industries and minimizes differences between viewing equipment. It should be noted that this revision contains multiple specifications, each of which is appropriate to specific requirements. Users should ensure that they employ the specification which is appropriate to their application.

Annexes A to C of this International Standard are for information only.

Introduction

While colour and density measurements play important roles in the control of colour reproduction, they cannot replace the human observer for final assessment of the quality of complex images. Colour reflection artwork, photographic transparencies, photographic prints, and photomechanical reproductions such as on-press and off-press proofs, or press sheets, are commonly evaluated for their image and colour quality, or compared critically with one another for fidelity of colour matching. Paper and other substrates contribute to the colour appearance and controlling the colour of these is equally critical. However, it should be noted that the paper industry has its own set of International Standards for unprinted paper which differ in illumination conditions from those recommended in this International Standard.

There is no doubt that the best viewing condition for the visual assessment of colour is that in which the product will be finally seen. Where this is known, and it is practical to do so, the various people in the production chain may sensibly agree to use this viewing condition for all evaluation and comparison. However, it is important that this be properly agreed upon in advance and that it be specified that such a viewing condition is NOT ISO-defined.

Unfortunately, such agreement is often not practical. Even if a particular end-use condition is known, it may be impractical to provide everybody in the production chain with sufficiently consistent viewing apparatus. Since deficiencies in light sources and viewing conditions, and inconsistencies between colour viewing facilities, can distort the colour appearance of substrates, reproductions and artwork, they are likely to cause miscommunication about colour reproduction and processing. This International Standard provides specifications for illumination and viewing conditions that, when properly implemented, will reduce errors and misunderstandings caused by such deficiencies and inconsistencies.

The illumination used to view colour photographic prints, photomechanical reproductions, and transparencies needs to provide adequate amounts of radiant power from all parts of the ultraviolet and visible spectrum to avoid distorting their appearance from that observed under commonly used sources of illumination such as daylight. The ultraviolet content is important where fluorescent samples, which are excited in this region, are encountered; a phenomenon associated with many of the paper substrates on which images are reproduced as well as with some of the dyes and pigments themselves.

To ensure consistency with the 1974 International Standard, as well as the majority of equipment in current use, the reference spectral power distribution specified in this International Standard is CIE Illuminant D_{50}. Many of the reasons for the selection of illuminant D_{50} in 1974, as opposed to any other CIE daylight illuminant, are equally applicable today. Much consideration was given to changing the reference illuminant to be CIE F8, a 5 000 Kelvin illuminant more typical of fluorescent lamps. However, it was felt that this would provide only a

minimal conformance advantage (as shown in informative annex B) and the actual goal is for the illumination to simulate natural daylight.

Because it is very difficult to produce artificial sources of illumination which closely match the spectral power distribution of daylight, it is important that the tolerances specified within this International Standard provide a compromise between that required for lamp manufacturing purposes and that for consistent viewing. In this International Standard three constraints which define the colour of the light falling on the viewing plane apply, one directly and two indirectly, and all three must be met simultaneously if a viewing apparatus is to be in compliance.

The chromaticity, which directly defines the colour of the illumination at the viewing surface, is specified as that for illuminant D_{50} and the tolerance by a circle in the CIE 1976 Uniform Chromaticity Scale (UCS) diagram having a specified radius around that value. To establish the compliance of the spectral power distribution of the illumination to that of illuminant D_{50} the methods defined in CIE Publications No. 13.3 and No. 51 are both specified. One defines the colour rendering quality of a lamp; the other its ability to correctly predict metamers. Both requirements are important to the graphic technology and photographic industries.

Because CIE Publication No. 51 does not currently address illuminant D_{50}, additional virtual metamers for this illuminant, for both visible and ultraviolet evaluation, were calculated and are defined in this International Standard. They were derived from those published in CIE Publication No. 51 and are equivalent to them. Also, based on experimental work described in annex B, a practical tolerance of acceptability has been defined, alongside a Colour Rendering Index requirement. (It should be noted that subsequent to the preparation of the final draft of this International Standard, the CIE has prepared and published Supplement 1 to CIE Publication 51 which incorporates the virtual metamers for CIE illuminant D_{50}. The combination of CIE Publication 51 and Supplement 1 is identified as CIE Publication 51.2-1999.)

The perceived tonal scale and colours of a print or transparency can be significantly influenced by the chromaticity and luminance of other objects and surfaces in the field of view. For this reason, ambient conditions, which may affect the state of visual adaptation, need to be designed to avoid any significant effects on the perception of colour and tone and immediate surround conditions need to be specified also. Such specifications are provided in this International Standard.

Experience in the industries covered by this International Standard has revealed the need for two levels of illumination; a high level for critical evaluation and comparison, and a lower level for appraising the tone scale of an individual image under illumination levels similar to those under which it will be finally viewed. This International Standard provides these two levels of illumination.

The higher level is essential to graphic technology where comparison is being made; such as between original artwork and proof, or to evaluate small colour differences between proof and press sheet in order to control a printing operation. It is effective in these situations because it enhances the visibility of any differences. The high level of illumination is also appropriate in photography when comparing two, or more, transparencies or when critically evaluating a single image to assess the darkest tones that can be printed.

Since, despite adaptation, the level of illumination has quite a significant effect on the appearance of an image, the lower level is required in order to appraise the image at a level more similar to that in which it will be finally viewed. Although it is recognized that quite a wide range of illumination levels may be encountered

in practical viewing situations, the lower level chosen is considered to be fairly representative of the range encountered. For this reason it is applicable to aesthetic appraisal, including the conditions for routine inspection of prints.

The viewing of transparencies is specified both for direct viewing and by projection. Additional conditions are also specified for those conditions where transparencies are to be compared to a print. The particular surround specified for transparencies recognises the way that a transparency should be viewed for optimum visibility of the dark tones, but acknowledges that practical viewing equipment is likely to have ambient conditions that introduce some viewing flare. The combination of surround and flare produce an appearance that is fairly representative of how the transparency will look in a typically lighted room.

Small transparencies are commonly evaluated in graphic technology by direct viewing. When it is necessary to view transparencies directly, they should be viewed according to the conditions specified for that situation. However, for some purposes, smaller transparencies are not viewed directly because the viewing distance for correct perspective and perception of detail is too small for visual comfort. Furthermore, when small transparencies are reproduced for publication or other purposes, they are usually enlarged. To ease comparison, it is helpful to enlarge the transparency image when comparing it to the print. For these reasons, a viewing condition may be required which provides a magnified image when viewed at an appropriate distance.

Colour monitors are increasingly being used to display and view digital images in graphic technology and photography. In order to ensure consistency of assessment in this situation it is important that the viewing conditions in which the monitors are placed are reasonably well specified. However, it should be noted that adherence to these specifications does not ensure that the monitor will match the hardcopy without provision of a defined colour transformation to the displayed image, or use of proper colour management. This aspect of matching is beyond the scope of this International Standard. In practice, even with high quality colour management, an accurate match is difficult to achieve because the luminance levels generally differ significantly between hardcopy (print or transparency) and softcopy (monitor).

Thus, it should be noted that the specifications for images viewed on colour monitors, provided in this International Standard, are for images viewed independently of any form of hardcopy; conditions for direct comparisons between hardcopy and softcopy (even where a suitable colour transformation has been applied) are beyond the scope of this International Standard which can be seen as being primarily relevant where successive viewing of hardcopy and softcopy takes place. ISO 12646, Graphic Technology - Colour proofing using a colour display, currently at Working Draft level in TC 130, is being prepared to provide more detailed recommendations where direct comparison is required. In general it may be stated that for such comparisons it is desirable to view the colour monitor under the lower levels of ambient illumination specified in this International Standard and with the maximum level of luminance achievable, and the hardcopy sample at the lower levels of illumination specified for printed matter in this International Standard (and their equivalent for transparencies). However, it should be noted that this will, in turn, affect the perceived tone and colourfulness of the hardcopy.

Viewing conditions — Graphic technology and photography

1 Scope

This International Standard specifies viewing conditions for images on both reflective and transmissive media, such as prints (both photographic and photomechanical) and transparencies, as well as images displayed in isolation on colour monitors. Specifically, it shall be used for:

— critical comparison between transparencies, reflection photographic or photomechanical prints and/or other objects or images,

— appraisal of the tone reproduction and colourfulness of prints and transparencies at illumination levels similar to those for practical use, including routine inspection,

— critical appraisal of transparencies which are viewed by projection, for comparison with prints, objects, or other reproductions, and

— appraisal of images on colour monitors which are not viewed in comparison to any form of hardcopy.

This International Standard is not applicable to unprinted papers.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on the International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest editions of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5-2:1991, *Photography — Density measurements — Part 2: Geometric conditions for transmission density.*

ISO 5-3:1995, *Photography — Density measurements — Part 3: Spectral conditions.*

ISO 5-4:1995, *Photography — Density measurements — Part 4: Geometric conditions for reflection density.*

ISO 12646:____[1)], *Graphic technology — Displays for colour proofing — Characteristics and viewing conditions.*

CIE Publication No. 13.3, 1995, *Method of measuring and specifying the colour rendering properties of light sources*, 2nd edition.

CIE Publication No. 15.2, 1986, *Colorimetry.*

CIE Publication No. 51, 1981, *A method for assessing the quality of daylight simulators for colorimetry.*

CIE Publication No. 17.4, 1987, *International lighting vocabulary.*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
chromaticity
property of a colour stimulus defined by its chromaticity co-ordinates, or by its dominant or complementary wavelength and purity taken together
[CIE Publication No. 17.4:1987, 845-03-34]

3.2
colour rendering index
measure of the degree to which the psychophysical colour of an object illuminated by a test illuminant conforms to that of the same object illuminated by the reference

1) To be published.