STANDARDS UPDATE

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This issue of the standards update will focus on a series of related standards that are being revised jointly by ISO TC130 (Graphic technology) and ISO TC42 (Photography).

What Standards are Involved

The three standards involved are (1) the four parts of ISO 5 (*Photography and graphic technology—ISO standard density measurements*), (2) ISO 3664 (*Viewing conditions—Graphic technology and photography*), and (3) ISO 13655 (*Graphic technology—Spectral measurement and colorimetric computation for graphic arts images*). These three standards together form the basis for viewing, metrology, color management, and process control within the graphic technology and photographic industries.

Although the work is spread among three Joint Working Groups, there is close coordination between the participants and a significant degree of overlap of participants.

Within ISO each standard is the responsibility of a single committee. This means that when the subject matter overlaps the interest area of more than a single committee, some form of liaison or joint activity must be established to insure that the interests of all affected parties are taken into account. The strategy adopted by TC130 and TC42 has been to form Joint Working Groups (JWG) to accomplish the necessary revisions and review. The advantage of JWGs is that where a JWG is responsible for a document, the National Bodies (NBs) that participate in either committee are expected to participate and ballot the document.

Who's Responsible

Both ISO 5 and ISO 3664 are standards that have historically been the responsibility of TC42. Therefore, TC42 is responsible to lead the joint activity on those two documents. ISO 5 is the responsibility of TC42/JWG 21 and ISO 3664 is being revised by TC42/JWG24. ISO 13655 on the other hand was initially created by TC130 so its revision is being coordinated by TC130/JWG8.

More Detail on the Revisions

While it is impossible to detail all of the revision being accomplished, a brief overview should be both doable and helpful.

ISO 5—Density Measurements

ISO 5 consists of four parts as follows:

- *Part 1: Terms, symbols, and notations*
- *Part 2: Geometric conditions for transmittance density*
- *Part 3: Spectral condition*
- *Part 4: Geometric conditions for reflection density*

These four parts work together and are inter-related as though they were one document—in fact there is some discussion that they should be combined into a single document. Historically the various parts were prepared at different times and as such have been carried ever since as individual documents.

An interesting historical note is that ISO standards numbers are sequentially based and assigned when a a new work item ballot (which is necessary to start any standards work) is approved. Therefore, ISO 5 was the fifth standard to be started within ISO.

There have been two main thrusts in this revision of the ISO 5 series. First, the earlier versions of the standards were primarily aimed at the manufacture of filter instruments. The impact of this was that the reference conditions that actually defined the various measurements was lacking in many cases. The major complication that resulted was related to those situations where separate tolerances were required for graphic applications and photographic applications. This revision includes a definition of the reference measurement condition as well as, in some cases, different tolerances for both photographic and graphic arts applications.

The other major change is related to the definition of the spectral characteristics associated with the different "types" of density. The following is extracted directly from the introduction to the new draft of ISO 5-3.

In the early years of densitometry, the spectral responses of instruments were specified only in terms of the color filters used in the construction. Although it was seldom the case, it was assumed that the spectral responses of the detector and the source spectral energy distributions, as well as all intervening optical components, were the same in all instruments.

In more recent times, densitometry standards have specified that the combination of all these components equal some given set of published "documentary" values. If each of these components are approximated by a mathematical function then their combination could be approximated by simply multiplying the spectral characteristics, wavelength by wavelength, and compiling the results into a table of numbers known as the spectral products. Such a specification allows flexibility to the manufacturer while providing for improved accuracy and precision. It also allows for reference materials to be manufactured and certified based on fundamental measurements.

In this revision of ISO 5-3 it has been recognized that the use of simple filter instruments is in decline, the more common method of "measuring" ISO density makes use of computations based on measurements of the spectral reflectance factor or spectral transmittance of the specimen under study.

Thus, for computation purposes, the older, coarsely sampled, tables of spectral products have been supplemented in this revision of the International Standard with the concept of spectral weighting factors. To achieve these, the 10 nm spectral products defined in this and earlier versions of the International Standard have been interpolated in the log domain to 1 nm intervals, converted to the linear domain, and normalized to a peak value of 1. Additional sets of spectral weighting factors have then been derived from these for use with data measured at intervals greater than 1 nm and any densities calculated from these weighting factors will exactly match those obtained with filter instruments conforming exactly to the 10 nm spectral products. Of course, the values for the 10 nm spectral weighting factors differ slightly from those for the 10 nm spectral products, when converted to the linear domain, because the computation of ISO density (vs. the direct measurement of ISO density) is a convolution of spectral weighting factors and spectral reflectance factor (or transmittance) at discrete intervals over the appropriate wavelength range.

In addition, to provide better compatibility with the use of spectrophtometric measuring equipment used for graphic arts colorimetry, three additional illumination conditions have been included to supplement the CIE Illuminant A traditionally specified. These are the conditions M1, M2, and M3 specified in ISO 13655. They basically are equivalent to CIE D50 (M1), CIE D50 with a UV cut filter (M2), and CIE D50 with both a UV cut filter and polarization. Their use and the potential differences in measured results are largely related to the amount of optical brightening agents present in the substrate upon which the image is printed.

The New Work Item and CD of all Parts of ISO 5 has completed ballot successfully and comments were reviewed by TC42/JWG 21 in Paris on April 19, 2008.

ISO 3664—Viewing Conditions

The changes to ISO 3664 are not as significant as the changes to the densitometry standards. The key changes involve the tightening of the compliance tolerances on the UV portion of the D50 spectral power distribution (SPD) and the increasing of the luminance levels of displays used for image appraisal.

As pointed out in the Foreword to this document "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."

The key sections are: Conditions for critical comparison (ISO viewing conditions P1 and T1); Conditions for practical appraisal of prints, including routine inspection, (ISO viewing condition P2), and Conditions for viewing small transparencies by projection (ISO viewing condition T2).

The DIS ballot on ISO 3664 closes August 14, 2008 and will be reviewed in a fall meeting of TC42/JWG 24.

ISO 13655—Spectral Measurement and Colorimetric Computation

When the revision of this document was started, it was observed that almost all graphic arts specimens exhibited fluorescence. In most cases this was due to optical brightening agents contained in the paper substrates. In rare cases, the printing inks were fluorescent. According to the recommendations of the 1996 version of this International Standard, this would have meant that the source used for the measurements (*i.e.*, the spectral power distribution of the sample illumination) was required to closely match CIE illuminant D50. Yet, at that point in time, not a single colour-measuring instrument, sold for the graphic arts market, provided an illumination system that closely matched CIE illuminant D50. Instead, most instruments used incandescent lamps for sources. The spectral power distribution of such lamps have varying amounts of UV content. The variation in UV content between instruments could easily amount to a b* difference of 5 when measuring papers with a high level of optical brightening agents. Consequently, the measurement results for unprinted paper substrates and lighter colors differed appreciably between different instrument models.

It has also been observed that graphic arts viewing booths vary with respect to UV content, even those that comply with the 1996 version of ISO 3664. The practical result is that specimens that have nearly identical measured colorimetric properties, at times will not visually match when viewed in the viewing booth, and vice versa. Only part of such discrepancies can be attributed to fluorescence. There can also be metameric effects due to "non-standard" observers and to instrument wavelength errors, in addition to deviations in the measurement source away from CIE D50. Despite these other potential influences it was deemed important to provide solutions that would minimize the systematic errors introduced by the interaction of paper fluorescence and variations in the spectral power distribution of the sample illumination.

Therefore, in this revision, three specimen illumination choices are specified. Measurement condition M1 requires the spectral power distribution of the specimen illumination to exactly match illuminant D50. Measurement condition M2 only requires that the spectral power distribution of the specimen illumination be provided in the wavelength range from 420 nm to at least 700 nm. and have no substantial radiation power in the wavelength range below 400 nm. Measurement condition M3 has the same sample illumination requirements as M2 and includes a linear polarizer in the influx and efflux portions of the optical path with their principal axes of polarization in the orthogonal or "crossed" orientation.

The DIS ballot on ISO 13655 closed on April 23, 2008, which was after the spring TC130 meeting. A preliminary review of the comments was accomplished and final resolution of comments will occur at a later date.

For suggestions for (or input to) future updates, or standards questions in general, please contact the author at mcdowell@npes.org or mcdowell@kodak.com.