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Graphic technology — Prepress digital data exchange —

Part 2: XYZ/sRGB encoded standard colour image data (XYZ/SCID)

Technologie graphique — Échange de données numériques de préimpression —

Partie 2: Données d'images en couleur normalisées codées XYZ/sRGB (XYZ/SCID)

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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 2.

The main task of technical committees is to prepare International Standards. 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 possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12640-2 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

ISO 12640 consists of the following parts, under the general title *Graphic technology — Prepress digital data exchange*:

— *Part 1: CMYK standard colour image data (CMYK/SCID)*

— *Part 2: XYZ/sRGB encoded standard colour image data (XYZ/SCID)*

Part 1 was published in 1997 with the number ISO 12640 and is in the process of being renumbered.

A Part 3, under the title of *CIELAB standard colour image data (CIELAB/SCID)*, is in preparation.

Introduction

The technical content of this International Standard was initiated by the Image Processing Technology Standard Committee in Japan as input to, and in coordination with, ISO/TC 130, WG 2.

0.1 The need for standard XYZ/sRGB digital test images

The existing Standard Colour Image Data (CMYK/SCID, ISO 12640) is defined in terms of CMYK dot percentages and as such is mainly applicable to printing applications. If attempts are made to apply it to other systems such as monitors, CMY printers, etc., the following problems arise.

— The image data, being expressed in terms of CMYK dot percentages, have no simple relationship to colorimetric values.

— The image data have a bit depth of only 8-bits, often causing inaccurate colour conversions.

— The image data are output-referred to a CMYK printing device; additional colour rendering may be required to create image data suitable for other devices.

In order to solve these problems a set of image data has been prepared that

— is expressed as sRGB encoded ITU-R BT.709-3 RGB primary based tristimulus values, and

— is output-referred to the standard sRGB display and viewing conditions defined in IEC 61966-2-1.

Furthermore, this part of ISO 12640 also provides 16-bit CIE XYZ image data that correspond to the display produced CIE XYZ tristimulus values for the sRGB image data, with a display white point chromaticity equivalent to that of CIE Illuminant D_{65}.

Because they exist as consistent and high quality image data sets, images of this part of ISO 12640 are expected to be widely used for the following:

— evaluating the colour reproduction capability of imaging systems and output devices;

— evaluating the coding technologies necessary for the storage and transmission of high-definition image data, etc.

0.2 Characteristics of test images

The performance of any colour reproduction system will normally be evaluated both subjectively (by viewing the final output image) and objectively (by measurement of control elements). This requirement dictates that the test images include both natural scenes (pictures) and synthetic images (computer graphics, a business graph, a colour chart and a colour vignette).

Because the results of subjective image evaluation are strongly affected by the image content, it was important to ensure that the natural images were of high quality and contained diverse subject matter.

0.3 Development of digital test images

A survey was conducted of all TC130 member countries to identify desirable image content and to solicit submission of suitable images for consideration. The image set that resulted consists of eight natural and seven synthetic images. The natural images include flesh tones, images with detail in the extreme highlights or shadows, neutral colours, brown and wood tone colours which are often difficult to reproduce, memory colours, complicated geometric shapes, fine detail, and highlight and shadow vignettes. The synthetic images selected were generated electronically and include computer graphics, a business graph, a colour chart and a series of colour vignettes.

All of the images consist of pixel interleaved data with the data origin at the upper left of the image, as viewed normally, and organized by rows. The file formats of the RGB images are compliant with TIFF 6.0 format. TIFF 6.0 does not define a method for storing XYZ colourspace. The XYZ images set the TIFF Photometric tag to 2 (RGB), which allows TIFF readers to open the TIFF file; however, the image will not be displayed correctly. The images can be imported and manipulated as necessary by a wide variety of commonly used imaging software packages, on platforms in general use in the industry. See Annex C for details of the TIFF header.

Graphic technology — Prepress digital data exchange —

Part 2:
XYZ/sRGB encoded standard colour image data (XYZ/SCID)

1 Scope

This part of ISO 12640 specifies a set of 15 standard colour images (encoded as both 16-bit XYZ and 8-bit RGB digital data provided in electronic data files) that can be used for the evaluation of changes in image quality during coding, image processing (including transformation compression and decompression), displaying on a colour monitor or printing. They can be used for many graphic technology applications such as research, development, product evaluation, and process control.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61966-2-1:1999, *Multimedia systems and equipment — Colour measurement and management — Part 2-1: Default RGB colour space - sRGB*

ITU-R BT.709-3:1998, *Parameter values for the HDTV standards for production and international programme exchange*

TIFF, Revision 6.0 Final, Aldus Corporation (now Adobe Systems Incorporated), June 3, 1992

3 Terms and definitions

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

3.1
check sum
sum of the digits in a file that can be used to check if a file has been transferred properly

NOTE Often, only the least significant bits are summed.

3.2
colour sequence
order in which the colours are stored in a data file

3.3
colour space
geometric representation of colours in space, usually of three dimensions

[CIE Publication 17.4, definition 845-03-25]

NOTE This part of ISO 12640 is based on two colour spaces, XYZ and sRGB. The relationship between XYZ and sRGB is given in 5.2.

3.4
global colour change
change to the colours in an image applied consistently to all parts of the image

NOTE This is in contrast to a local colour change where selected spatial areas of an image are changed separately from the rest of the image area.

3.5
orientation
origin and direction of the first line of data, with respect to the image content, as viewed by the end user

NOTE The codes used to specify orientation are contained in ISO 12639.

3.6
pixel
smallest element of an image that can be uniquely processed, and is defined by its spatial coordinates and encoded with colour values

NOTE If a pixel is the result of interpolation, then it shall be noted as such.

3.7
pixel colour value
numeric values associated with each of the pixels

3.8
pixel interleaving
colour data organized such that the XYZ or RGB colour values for one pixel of each colour space are followed by the same sequence of colour values for the next pixel

NOTE 1 The specific order of colours is determined by the **ColorSequence** (3.2) tag as defined in ISO 12639.

NOTE 2 Other forms of data interleaving are line and plane.

3.9
tristimulus values
amounts of the three reference colour stimuli, in a given trichromatic system, required to match the colour of the stimulus considered

[CIE Publication 17.4, definition 845-03-22]

4 Image data

This part of ISO 12640 consists of colour image data, encoded as 16-bit XYZ data and 8-bit sRGB data, for 8 natural images and 7 synthetic images. The image characteristics of these data are described in Clause 5 and the data structure in Clause 6. The image data itself is contained in thirty data files that are included in this part of ISO 12640. File names correspond to the image names as described in 5.3 and 5.4.

5 Data description and definition

5.1 Data set definition

Each set of standard colour image data consists of eight natural (photographed) images and seven synthetic images created digitally on a computer. The natural images are identified as N1 to N8, and each of them also has a descriptive name derived from the picture content (e.g. woman with glass). The synthetic images,

identified as S1 to S7, consist of computer graphics images, a business graph, a colour chart and a series of colour vignettes.

The sRGB images are identified by ISO-sRGB in small type in order to distinguish them from the XYZ images which have the designation ISO-XYZ. The co-ordinates of the text insertion are provided in Annex D.

5.2 Relationship between CIE XYZ and sRGB colour data

5.2.1 Characteristics of standard output-referred sRGB image data

In order to assure maximum interoperability among a large number of imaging devices, sRGB image data are output-referred to the hypothetical sRGB display and viewing conditions specified in IEC 61966-2-1. Whatever colour processing is required to produce the desired image appearance on the sRGB display in the sRGB viewing conditions shall be performed prior to encoding sRGB image data. The sRGB image data should be considered to convey the desired sRGB appearance. Subsequent colour rendering may be performed to produce a somewhat different appearance as necessitated by different media capabilities and viewing conditions, but in general such colour rendering should not automatically alter the appearance in a substantial way, or consider that the sRGB image data is “unfinished”. Exceptions to this rule include editing and manipulation of image data by a user, and the processing of arbitrary RGB image data which may not be sRGB.

5.2.2 Relationship between XYZ data and sRGB data

The encoding transformations between CIE 1931 XYZ tristimulus values and sRGB digital values are specified in IEC 61966-2-1, and are provided below. These transformations define how XYZ tristimulus values shall be calculated from 8-bit sRGB values. The colorimetric values so determined shall be those of the intended image colorimetry when viewed on the reference display, in the reference viewing conditions, by the standard observer.

The relationships are defined as follows:

$$R'_{\text{sRGB}} = R_{\text{8bit}} / 255 \tag{1}$$

$$G'_{\text{sRGB}} = G_{\text{8bit}} / 255 \tag{2}$$

$$B'_{\text{sRGB}} = B_{\text{8bit}} / 255 \tag{3}$$

where

R_{8bit} is the code value for sRGB R in 8-bit encoding;

G_{8bit} is the code value for sRGB G in 8-bit encoding;

B_{8bit} is the code value for sRGB B in 8-bit encoding;

R'_{sRGB} is the sRGB R image value;

G'_{sRGB} is the sRGB G image value;

B'_{sRGB} is the sRGB B image value.

If $R'_{\text{sRGB}} \leqslant 0{,}040\,45$, then $R_{\text{sRGB}} = R'_{\text{sRGB}} / 12{,}92$; else $R_{\text{sRGB}} = \left(R'_{\text{sRGB}} + 0{,}055/1{,}055\right)^{2{,}4}$.

If $G'_{\text{sRGB}} \leqslant 0{,}040\,45$, then $G_{\text{sRGB}} = G'_{\text{sRGB}} / 12{,}92$; else $G_{\text{sRGB}} = \left(G'_{\text{sRGB}} + 0{,}055/1{,}055\right)^{2{,}4}$.

If $B'_{\text{sRGB}} \leqslant 0{,}040\,45$, then $B_{\text{sRGB}} = B'_{\text{sRGB}} / 12{,}92$; else $B_{\text{sRGB}} = \left(B'_{\text{sRGB}} + 0{,}055/1{,}055\right)^{2{,}4}$.

and

$$\begin{pmatrix} X \\ Y \\ Z \end{pmatrix} = \begin{pmatrix} 0{,}412\,4 & 0{,}357\,6 & 0{,}180\,5 \\ 0{,}212\,6 & 0{,}715\,2 & 0{,}072\,2 \\ 0{,}019\,3 & 0{,}119\,2 & 0{,}950\,5 \end{pmatrix} \begin{pmatrix} R_{\text{sRGB}} \\ G_{\text{sRGB}} \\ B_{\text{sRGB}} \end{pmatrix} \tag{4}$$

where R_{sRGB}, G_{sRGB} and B_{sRGB} represent linear sRGB values, and the X, Y and Z values represent those that would be measured if the sRGB images were displayed on a hypothetical sRGB display, and the measurements are conducted in a fashion that eliminates veiling glare and viewing flare.

The CIE Publication 131 XYZ tristimulus values resulting from Equation (4) are relative values scaled from 0,0 to 1,0 (not 0,0 to 100,0 as is sometimes done). Absolute tristimulus values are calculated from the 0,0-to-1,0 scaled relative values by multiplying by 80 (the sRGB display white point luminance).

5.2.3 XYZ image data

The XYZ image data computed in 5.2.2 are converted to 16-bits-per-channel code values (which are contained in the XYZ image data files) by normalizing them with the corresponding value for the display white point and multiplying by the data range represented by 16 bits. Thus:

$$X_{\text{16bit}} = 65\,535 \times (X / X_{65}) \tag{5}$$

$$Y_{\text{16bit}} = 65\,535 \times (Y / Y_{65}) \tag{6}$$

$$Z_{\text{16bit}} = 65\,535 \times (Z / Z_{65}) \tag{7}$$

where

X_{16bit} is the code value for X in 16-bit encoding;

Y_{16bit} is the code value for Y in 16-bit encoding;

Z_{16bit} is the code value for Z in 16-bit encoding;

X, Y and Z are any set of tristimulus values computed in 5.2.2, which are the tristimulus values of a pixel on the display, excluding internal flare, veiling glare, and viewing flare;

X_{65}, Y_{65} and Z_{65} are the tristimulus values of the display white point.

5.2.4 Image data arrangement

The image data are pixel-interleaved in the order of R then G then B (8-bit), or X then Y then Z (16-bit). The arrangement of data follows the scanning of each image from the upper left corner to the right, then moving to the next lower horizontal line.

5.3 Natural images

The characteristics and typical usage for the natural images are provided in Table 1. The descriptive names of these images are given following the identification code. Figure 1 shows reduced-size reproductions of the natural images. The natural images have the following characteristics:

— Picture size 4 096 × 3 072 pixels;

NOTE 1 The natural images (4 096 × 3 072 pixels) produce a physical image size of 256 mm by 192 mm when rendered at 16 pixels/mm.

— Interleaving pixel interleaving;

— Colour sequence RGB or XYZ;

— Colour values RGB data consisting of three 8-bit values;
XYZ data consisting of three 16-bit values;

— Image data orientation horizontal scanning starting from top left and ending at bottom right.

NOTE 2 Although the original of the image “Field fire” is a painting, it is classified as a natural image.

NOTE 3 The encoding of the data in the headers of the individual files is provided in Annex C, and is in accordance with the formats specified in ISO 12639.

NOTE 4 The unused light end code values for N1 and N5 limit the tonal range present in these images.

NOTE 5 Clipping at light or dark end of N2, N4 and N8 may impact perceived quality for highly critical observers. However, such clipping is present in many typical images.

Table 1 — Natural images

ID	Image name	Aspect	Characteristics
N1	Woman with glass	Portrait	Close-up image of a woman with a glass; suitable for evaluating the reproduction of human skin tones
N2	Flowers	Landscape	Useful for assessing tonal reproduction of highlight tones and contouring in dark tones
N3	Fishing goods	Portrait	Low-key image of fishing goods; suitable for evaluating image sharpness
N4	Japanese goods	Landscape	Image obtained by photographing a collection of Japanese traditional handicrafts, including many highly saturated colours; suitable for evaluating colour reproduction capabilities
N5	Field fire	Landscape	Useful for evaluating the accuracy of colour reproduction for delicate colours
N6	Pier	Landscape	Image with complicated geometric shapes; suitable for evaluating the results of image processing
N7	Threads	Landscape	Image of woollen yarn, colour pencils and ribbons; suitable for evaluating the colour gamut of devices
N8	Silver	Portrait	Image of silverware; suitable for evaluating the tone reproduction of greys, as well as the reproduction of the lustrous appearance of metallic objects

N1 — Woman with glass

N2 — Flowers

N3 — Fishing goods

N4 — Japanese goods

N5 — Field fire

N6 — Pier

N7 — Threads

N8 — Silver

Figure 1 — Reduced-size reproductions of the natural images

5.4 Synthetic images

5.4.1 General

The synthetic images consist of computer graphics, a business graph, a colour chart and a series of colour vignettes. Figure 2 shows reduced-size reproductions of the synthetic images. The interleaving, colour sequence, colour values and orientation are the same as for the natural images. The image sizes are given in Table 2.

Table 2 — Synthetic images

ID	Image name	Aspect	Height, pixels	Width, pixels
S1	Teapot	Landscape	360	480
S2	Japanese doll	Landscape	1 536	2 048
S3	Cat	Landscape	1 536	2 048
S4	Sports	Portrait	2 048	1 536
S5	Business graph	Landscape	1 536	2 048
S6	Colour chart	Landscape	1 332	2 736
S7	Colour vignettes	Landscape	2 608	4 256

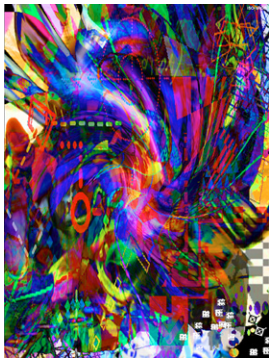
Images S1 to S5 were originally defined as 8-bit sRGB data by the way that they were produced. The 16-bit XYZ data representing them were prepared by applying the sRGB-to-XYZ transform described in 5.2.2 to 8-bit sRGB data. Images S6 and S7 were defined by first determining equal intervals in CIE L^*. For each set of intervals selected for the various parts of the images, the appropriate L^* values (with a^* and b^* both set equal to 0) were converted to 16-bit XYZ data, and then to 8-bit sRGB using appropriate normalization and the XYZ-to-sRGB transform specified in IEC 61966-2-1.

NOTE Images S1 and S2 contain some clipped highlight areas which will be reproduced without detail.

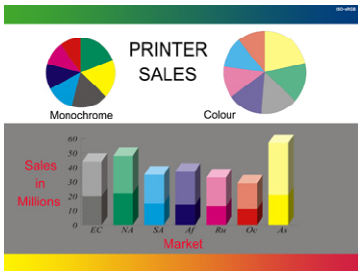
S1 — Teapot

S2 — Japanese doll

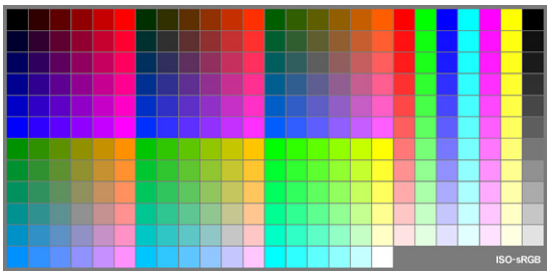
S3 — Cat



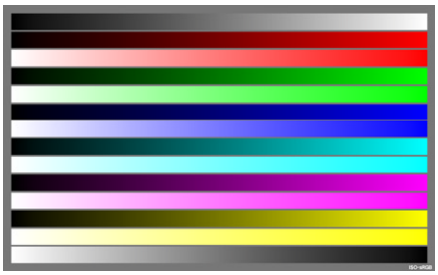
S4 — Sports



S5 — Business graph



S6 — Colour chart



S7 — Colour vignettes

Figure 2 — Reduced-size reproductions of the synthetic images

5.4.2 Computer graphics

Computer graphics are artificially generated pictures. Thus they are characterized by the fact that, in contrast to natural images, they include large, noise-free, constant-hue areas, and gradation areas in which the hue and/or lightness changes very smoothly.

S1 and S2 are both three-dimensional computer graphics pictures with shadows, while S3 and S4 are both two-dimensional computer graphics pictures without shadows.

The four computer graphics pictures have been produced for monitor display, and have a bit depth resolution of 8 bits for each of the sRGB channels.

— S1, Teapot:

  Image S1 is a three-dimensional computer graphic obtained by mapping a watercolour painting onto a widely used three-dimensional data set named UTAH Teapot. In general, a curved surface is approximated with polygonal surfaces. However, by the use of a ray tracing method based on Bezier clipping, the objects are displayed highly accurately. Further, the delicate tones characterizing watercolours are expressed in terms of the Bezier function and are deemed to have been reproduced sufficiently well.

— S2, Japanese doll:

  Image S2 was produced by mapping the data of an actual photograph of a three-dimensional object onto a three-dimensional computer graphic. A computer graphics artist two-dimensionally arranged various data sets, including a primitive, standard three-dimensional data, two-dimensional data, a two-dimensional computer graphics sketch, etc.

  The design intent is to visualize a scene of the new multi-media world by placing side-by-side the mask of Fukusuke and modern goods such as a personal computer, compact disc, etc. The former represents one of the traditional characters in Japan, while the latter represent digital appliances.

— S3, Cat:

  Image S3 is an example of two-dimensional computer graphics, and has been produced from a digital image obtained by sampling a photograph. The image data were subjected to domain separation; each domain was modified, taking into account the characteristics of the human eye and the hue, as well as the shape of the domain, according to the preference of the computer graphics artist. The image is characterized by including a wide gamut of colour information.

— S4, Sports:

  This image was produced by first sampling an original photograph of a skier, and then subjecting the digital data to hue and shape processing according to the preference of the computer graphics artist.

  The design intent of this image is to express vivacity (sprightliness) by fusing sporting animal spirits with the fine arts. The image characteristically contains painting-like elements having a broad range of colour information and well-balanced hues.

5.4.3 Business graph

Image S5 is a business-graph consisting of a bar chart, pie charts, gradation bars and letters. The bar chart includes seven bars against a neutral background, and each bar consists of five segments, i.e., a primary colour segment, thinner, middle- and highlight-tone segments of the same colour, a darkened primary colour segment and a darkened middle-tone colour segment. One of the pie charts is coloured with seven primary colours, and the other with seven less saturated primary colours, both against a white background. The business-graph contains two gradation bars, one starting from yellow and ending with orange, and the other changing from grass green to deep blue.

5.4.4 Colour chart

5.4.4.1 Layout

Image S6 is a colour chart that consists of colour patches that are all specified to be within the colour space defined by the ITU-R BT.709-3 RGB primaries, without the use of negative tristimulus values. By using these patches, the fidelity of colour reproduction of an image output device to the colorimetry of the original image file may be evaluated objectively by measurement. Image S6 (XYZ) is encoded in 16-bit XYZ, and image S6 (sRGB) is encoded in 8-bit sRGB. The chart has two sections:

— section containing 6^3 (i.e. 216) tertiary colour patches;

— primary, secondary and grey (tertiary) colour section (77 patches in total).

NOTE The sRGB and XYZ image data encoded can be converted to display-produced image colorimetry using the transforms specified in 5.2.2 and 5.2.3. However, display-produced colorimetric values do not include any internal flare, veiling glare, or viewing flare, and therefore do not exactly represent the colorimetry which would be observed if a hypothetical sRGB display were viewed. When comparing the fidelity of a colour reproduction to that of an original, it is generally more appropriate to compare viewer-observed colorimetric values.

The fidelity of measured-reproduction colorimetry to original-image colorimetry (display produced or viewer observed) should not generally be considered as indicative of the quality of the reproduction. To produce optimal quality, it is frequently necessary to adjust the colorimetry of a reproduction to be different from that directly associated with the image data in order to account for differences between the sRGB-viewing conditions and the reproduction-viewing conditions, and because of differences between the sRGB and reproduction medium luminance ratios and colour gamuts.

The colorimetric data for each of the patches in the chart are recorded in the text data file “CHART.CSV”.

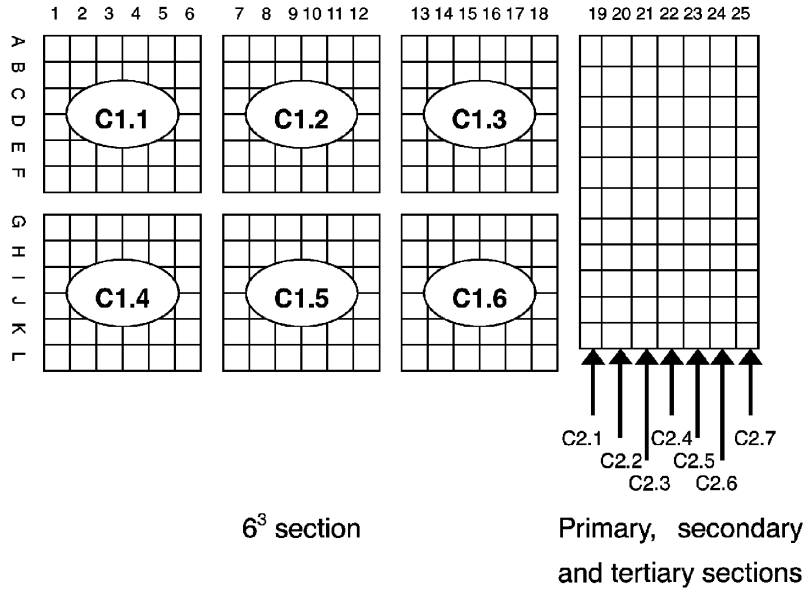


Figure 3 — Colour chart (S6)

5.4.4.2 Generation of the content of the 6^3 colour section

The XYZ and sRGB image data for the 6^3 section of image S6 were obtained by the following procedure.

a) Determine step differences by uniformly dividing the full range of L^* (0 to 100) into 6 steps.

b) Convert each L^* value (assuming a^* and b^* values of 0) to XYZ data normalized to a range from 0 to 1.

c) Convert the resulting 6 XYZ values to linear sRGB values using Equation (8).

$$\begin{pmatrix} R_{\text{sRGB}} \\ G_{\text{sRGB}} \\ B_{\text{sRGB}} \end{pmatrix} = \begin{pmatrix} 3,240\,6 & -1,537\,2 & -0,498\,6 \\ -0,968\,9 & 1,875\,8 & 0,041\,5 \\ 0,055\,7 & -0,204\,0 & 1,057\,0 \end{pmatrix} \begin{pmatrix} X \\ Y \\ Z \end{pmatrix} \quad (8)$$

d) Obtain 6^3 linear sRGB combinations by combining the 6 resultant linear sRGB values in all combinations. Then derive the XYZ data corresponding to each of the 6^3 linear sRGB value sets using Equation (9).

$$\begin{pmatrix} X \\ Y \\ Z \end{pmatrix} = \begin{pmatrix} 0,412\,4 & 0,357\,6 & 0,180\,5 \\ 0,212\,6 & 0,715\,2 & 0,072\,2 \\ 0,019\,3 & 0,119\,2 & 0,950\,5 \end{pmatrix} \begin{pmatrix} R_{\text{sRGB}} \\ G_{\text{sRGB}} \\ B_{\text{sRGB}} \end{pmatrix} \quad (9)$$

e) Obtain 8-bit sRGB' values corresponding to each of the 6^3 linear sRGB values using the following system of relationships.

If $R_{\text{sRGB}} \leqslant 0,003\,130\,8$, then $R'_{\text{sRGB}} = 12,92 \times R_{\text{sRGB}}$; else $R'_{\text{sRGB}} = 1,055 \times R_{\text{sRGB}}^{(1,0/2,4)} - 0,055$.

If $G_{\text{sRGB}} \leqslant 0,003\,130\,8$, then $G'_{\text{sRGB}} = 12,92 \times G_{\text{sRGB}}$; else $G'_{\text{sRGB}} = 1,055 \times G_{\text{sRGB}}^{(1,0/2,4)} - 0,055$.

If $B_{\text{sRGB}} \leqslant 0,003\,130\,8$, then $B'_{\text{sRGB}} = 12,92 \times B_{\text{sRGB}}$; else $B'_{\text{sRGB}} = 1,055 \times B_{\text{sRGB}}^{(1,0/2,4)} - 0,055$.

Between the 6 blocks (C1.1 to C1.6 in Figure 3) the G value is altered as the block parameter. Within each block, the R value is stepped along the horizontal direction, and the B value along the vertical direction.

5.4.4.3 Generation of the contents of the primary, secondary and grey (tertiary) colour section

The XYZ and sRGB data for the various sections were prepared by the following procedure.

a) Step a) of the procedure defined in 5.4.4.2 was repeated but with the following changes: the range of L^* was changed from (0 to 100) to (0 to 90), the number of steps was changed from 6 to 10, and one step of L^* = 5 was added to produce 11 steps altogether. The steps b) and c) defined in 5.4.4.2 were used to obtain the linear sRGB values.

b) Suitable combinations of linear sRGB values were defined to provide the primary (red, green, blue), secondary (cyan, magenta, yellow) and grey (tertiary) colours.

c) By using the same procedures as those described in steps d) and e) of 5.4.4.2, the XYZ data were computed for each linear sRGB combination. The linear sRGB values were also used to produce the 8-bit sRGB values.

It should be noted that the reason for not including a twelfth level in each of these scales is that the logical choice would have been the white point (L^* = 100, a^* = b^* = 0). But this step is common to all the colours and is already included in the tertiary colour section.

These scales vary in the vertical direction in terms of RGB, and are arranged horizontally in the order R, G, B, C, M, Y, and grey.

5.4.5 Colour vignettes

5.4.5.1 General

Image S7 is a set of coloured vignettes in which the lightness continuously changes in the horizontal direction. By using this pattern, it is possible to evaluate the tone reproduction characteristics, or the number of reproducible tonal levels, which may be obtained with any output device. One can also visually judge the effects of the important image-processing tasks of tonal modification or data compression on tone

reproduction. In particular, when discontinuities due to quantization are generated, readily recognizable vertical stripes will appear.

5.4.5.2 Generation of the content of the vignettes

Using the procedures described in 5.4.4.3 (except that the L^* range from 0 to 100 was divided into 4 096 intervals), the sRGB data corresponding to the XYZ data representing the primary, secondary and tertiary colours were obtained.

As shown in Figure 4, image S7 consists of two vignettes for each of the primary, secondary and tertiary colours. For the primary and secondary ones, the upper vignettes start with black and the lower ones with white. Both then change towards the most saturated colour of each hue from left to right. For the tertiary (grey) vignettes, the upper one starts with black changing towards white from left to right while in the lower one the order is reversed.

The frames surrounding all the vignettes, and the spaces between the individual vignettes have $L^* = 50$ and $a^* = b^* = 0$.

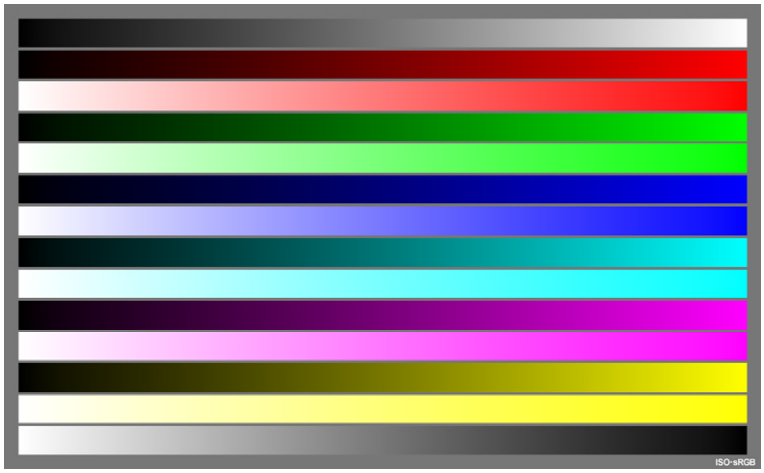


Figure 4 — Colour vignettes (S7)

6 Electronic data

6.1 Image data characteristics

Image data are contained in thirty data files that are included in this part of ISO 12640. File names correspond to the image IDs as described in 5.3 and 5.4. Table 3 shows the file name, size, colour spaces, colour values and descriptive name of each data file, as well as the pixel height and width of each image. The file size shown represents the file as recorded and includes headers, etc. The check-sums given in Annex B may be used to check the data integrity.

The restrictions on the uses of these image data files is described in Annex A. Guidance on colour reproduction is given in Annex E.

6.2 File structure

The following file formats are used for each data type:

— RGB image data TIFF, Revision 6.0;

— XYZ image data Special TIFF structured file format based on TIFF 6.0 and ISO 12639.

Annex C shows the TIFF 6.0 file headers of images: N1XYZ.TIF and N1RGB.TIF.

The set of RGB SCID image files is compatible with TIFF Revision 6.0, Section 6 and Section 20.

The set of XYZ image files is not compatible with TIFF 6.0 or TIFF/IT because neither recognizes XYZ data. Thus, it has been necessary to use the PhotometricInterpretation field (tag 262) set to 2, which is specified for RGB data. Thus applications will typically display the wrong colours, since XYZ will be interpreted as RGB. The ColorSequence field (defined in ISO 12639) is set to 'XYZ' in these SCID data sets.

Table 3 — Data contents for natural and synthetic images

File name	File size bytes	Height pixels	Width pixels	Colour space	Colour values	Descriptive name
N1XYZ.TIF	75 498 496	4 096	3 072	XYZ	Three 16-bit values	Woman with glass
N1RGB.TIF	37 749 760	4 096	3 072	RGB	Three 8-bit values	Woman with glass
N2XYZ.TIF	75 498 496	3 072	4 096	XYZ	Three 16-bit values	Flowers
N2RGB.TIF	37 749 760	3 072	4 096	RGB	Three 8-bit values	Flowers
N3XYZ.TIF	75 498 496	4 096	3 072	XYZ	Three 16-bit values	Fishing goods
N3RGB.TIF	37 749 760	4 096	3 072	RGB	Three 8-bit values	Fishing goods
N4XYZ.TIF	75 498 496	3 072	4 096	XYZ	Three 16-bit values	Japanese goods
N4RGB.TIF	37 749 760	3 072	4 096	RGB	Three 8-bit values	Japanese goods
N5XYZ.TIF	75 498 496	3 072	4 096	XYZ	Three 16-bit values	Field fire
N5RGB.TIF	37 749 760	3 072	4 096	RGB	Three 8-bit values	Field fire
N6XYZ.TIF	75 498 496	3 072	4 096	XYZ	Three 16-bit values	Pier
N6RGB.TIF	37 749 760	3 072	4 096	RGB	Three 8-bits values	Pier
N7XYZ.TIF	75 498 496	3 072	4 096	XYZ	Three 16-bit values	Threads
N7RGB.TIF	37 749 760	3 072	4 096	RGB	Three 8-bit values	Threads
N8XYZ.TIF	75 498 496	4 096	3 072	XYZ	Three 16-bit values	Silver
N8RGB.TIF	37 749 760	4 096	3 072	RGB	Three 8-bit values	Silver
S1XYZ.TIF	1 037 824	360	480	XYZ	Three 16-bit values	Teapot
S1RGB.TIF	519 424	360	480	RGB	Three 8-bit values	Teapot
S2XYZ.TIF	18 875 392	1 536	2 048	XYZ	Three 16-bit values	Japanese doll
S2RGB.TIF	9 438 208	1 536	2 048	RGB	Three 8-bit values	Japanese doll
S3XYZ.TIF	18 875 392	1 536	2 048	XYZ	Three 16-bit values	Cat
S3RGB.TIF	9 438 208	1 536	2 048	RGB	Three 8-bit values	Cat
S4XYZ.TIF	18 875 392	2 048	1 536	XYZ	Three 16-bit values	Sports
S4RGB.TIF	9 438 208	2 048	1 536	RGB	Three 8-bit values	Sports
S5XYZ.TIF	18 875 392	1 536	2 048	XYZ	Three 16-bit values	Business graph
S5RGB.TIF	9 438 208	1 536	2 048	RGB	Three 8-bit values	Business graph
S6XYZ.TIF	21 867 136	1 332	2 736	XYZ	Three 16-bit values	Colour chart
S6RGB.TIF	10 934 080	1 332	2 736	RGB	Three 8-bit values	Colour chart
S7XYZ.TIF	66 598 912	2 608	4 256	XYZ	Three 16-bit values	Colour vignettes
S7RGB.TIF	33 299 968	2 608	4 256	RGB	Three 8-bit values	Colour vignettes

Annex A
(normative)

Standard colour image digital data — Guidance for use

A.1 General

To ensure that these images can be used successfully for the testing and comparisons for which they are intended, all use shall conform to the procedures and guidelines described in A.2 and A.3.

A.2 Image manipulation

A.2.1 Reproduction

All reproductions of these images shall contain an annotation identifying this part of ISO 12640 as the data source and shall retain the colour space identifier included in the image data.

A.2.2 Modification

Any images created by modification of these data (derivative images) shall also have a visible identifier added within the image. The accompanying material shall include a tabulation of the steps used to modify the image data, including all editing steps used, as well as any data rescaling or interpolation.

A.2.3 Colour manipulation

Any colour or tonal manipulation of these images shall be restricted to “global” changes only.

A.2.4 Cropping

Cropping of these images shall be permitted, so long as the appropriate image colour space identifier is included as part of, or with, the images.

A.3 Distribution and sharing

A.3.1 Introduction

Many of the intended uses of these images require that they be used at several locations and/or by several participants in test programs. The following uses have been interpreted to be acceptable and allowable by ISO.

A.3.2 For-profit sale

Neither the data, nor images printed from these data, shall be sold “for profit”, except as defined in A.3.3.

A.3.3 Test and evaluation packages

It shall be permitted to include the data corresponding to these images, or derivations of these images, as part of test and evaluation packages to be sold or provided free of charge where an authentic copy of this part of ISO 12640 is included as part of the complete package.

NOTE It is recognized that certain test and evaluation packages that will make use of these images may need to embed the data to be used within other data processing procedures. The inclusion of an authentic copy of this part of ISO 12640, obtained from the appropriate standards agency, as part of the package will allow the inclusion of similar or derived data as required within the package.

A.3.4 Test and evaluation programs

Copies of these data files, or derivative files, may be exchanged between participants in test and evaluation programs. The sponsoring organization shall be capable of showing ownership of an authentic copy of this part of ISO 12640.

A.3.5 Reports

It shall be permitted to display these images as part of the report of test programs, or in advertisements, as long as the organization sponsoring the display is in possession of an authentic copy of this part of ISO 12640.

Annex B
(normative)

Check-sum data

The check-sums given in Tables B.1 and B.2 may be used to check the data integrity. These values are calculated by summing each image plane (X, Y, Z, R, G, B) with a one-byte accumulator. The overflow bit of the accumulator is ignored. The total accumulation, T, for all three planes is also shown. These data are shown in both hex and decimal notation. These check-sums apply only to the image data and exclude any headers.

Table B.1 — Check-sums for XYZ data

Image name	Decimal				Hex			
	X	Y	Z	T	X	Y	Z	T
Woman with glass XYZ	229	168	216	101	E5	A8	D8	65
Flowers XYZ	155	242	78	219	9B	F2	4E	DB
Fishing goods XYZ	24	234	130	132	18	EA	82	84
Japanese goods XYZ	47	37	56	140	2F	25	38	8C
Field fire XYZ	185	174	51	154	B9	AE	33	9A
Pier XYZ	166	235	239	128	A6	EB	EF	80
Threads XYZ	19	238	36	37	13	EE	24	25
Silver XYZ	154	60	167	125	9A	3C	A7	7D
Teapot XYZ	116	193	161	214	74	C1	A1	D6
Japanese doll XYZ	47	102	12	161	2F	66	0C	A1
Cat XYZ	92	14	29	135	5C	0E	1D	87
Sports XYZ	202	63	22	31	CA	3F	16	1F
Business graph XYZ	139	124	13	20	8B	7C	0D	14
Colour chart XYZ	248	120	248	104	F8	78	F8	68
Colour vignettes XYZ	86	75	211	116	56	4B	D3	74

Table B.2 — Check-sums for RGB data

Image name	Decimal				Hex			
	R	*G*	*B*	*T*	*R*	*G*	*B*	*T*
Woman with glass RGB	10	138	47	195	0A	8A	2F	C3
Flowers RGB	245	144	17	150	F5	90	11	96
Fishing goods RGB	127	37	189	97	7F	25	BD	61
Japanese goods RGB	82	82	54	218	52	52	36	DA
Field fire RGB	137	112	21	14	89	70	15	0E
Pier RGB	229	245	30	248	E5	F5	1E	F8
Threads RGB	141	106	17	8	8D	6A	11	08
Silver RGB	148	49	79	20	94	31	4F	14
Teapot RGB	50	29	87	166	32	1D	57	A6
Japanese doll RGB	223	47	24	38	DF	2F	18	26
Cat RGB	145	151	36	76	91	97	24	4C
Sports RGB	66	9	180	255	42	9	B4	FF
Business graph RGB	189	137	45	115	BD	89	2D	73
Colour chart RGB	156	156	156	212	9C	9C	9C	D4
Colour vignettes RGB	196	225	23	188	C4	E1	17	BC

Annex C
(informative)

Typical TIFF file headers used for image data

C.1 General

C.2 and C.3 show the TIFF file headers for the XYZ and RGB files of image N1, “Woman with Glass,” of the XYZ/SCID image set.

C.2 Example of TIFF file header for the XYZ image

The TIFF file header encoding of the colour picture file named N1XYZ.TIF in the XYZ set of XYZ/SCID is shown in Figure C.1. This encoding uses tags defined in TIFF 6.0. The ColorSequence tag (defined in ISO 12639) is set to 'XYZ' in this file.

NOTE XYZ images use Photometric = 2 (RGB) and ColorSequence = 'XYZ'.

The following fields are not included and take their default values.

— NewSubfileType = 0;

— Orientation = 1 (load from top left, horizontally);

— RowsPerStrip = $2^{32} – 1$ (only one strip);

— PlanarConfiguration = 1 (pixel interleaving).

In Figure C.1, the symbol “n” represents a null byte, and “x” represents a “don't care” hexadecimal digit for padding data.

Offsets	Value					Description
	TIFF File Header					
00000000	4D4D					Byte order “MM”(big-endian)
00000002	002A					Version number: 42
00000004	00000008					Pointer to the 1st: the 1st IFD begins in 8th byte in a file
	the 1st IFD					
00000008	0010					Number of entries in this IFD: 16 entries in this IFD
	Tag#	Type	Count	Value-offset		
0000000A	0100	0003	00000001	0C00xxxx	256	ImageWidth: 3072 pixels/line
00000016	0101	0003	00000001	1000xxxx	257	ImageLength: 4096 lines/image
00000022	0102	0003	00000003	00000200	258	BitsPerSample: pointer to the area of 00000200h
0000002E	0103	0003	00000001	0001xxxx	259	Compression: 1(no compression)
0000003A	0106	0003	00000001	0002xxxx	262	PhotometricInterpretation: 2 (normally for RGB image)
00000046	010E	0002	00000014	00000206	270	ImageDescription: pointer to the area of 00000206h
00000052	010F	0002	0000000E	00000220	271	Make(Vendor name): pointer to the area of 00000220h
0000005E	0111	0004	00000001	00000400	273	StripOffsets: 00000400h (pointer to the image data)
0000006A	0115	0003	00000001	0003xxxx	277	SamplesPerPixel: 3
00000076	0117	0004	00000001	04800000	279	StripByteCounts: 75,497,472 bytes in the strip
00000082	011A	0005	00000001	00000230	282	XResolution: pointer to the area of 00000230h
0000008E	011B	0005	00000001	00000238	283	YResolution: pointer to the area of 00000238h
0000009A	0128	0003	00000001	0003xxxx	296	ResolutionUnit: cm
000000A6	0132	0002	00000014	00000240	306	DateTime: pointer to the area of 00000240h
000000B2	8298	0002	00000029	00000258	33432	Copyright: pointer to the area of 00000258h
000000BE	84E1	0002	00000004	58595A00	34017	ColorSequence: “XYZn”
000000CA	00000000					Pointer to next IFD: None
	Value area					
00000200	0010	0010	0010			BitsPerSample: 16,16,16,(16-bits/sample for each separation)
00000206	57 4F 4D 41 4E 20 57 49 54 48 20 47 4C 41 53 53 58 59 5A 00 xx xx xx xx xx xx					ImageDescription: “WOMAN WITH GLASSXYZn”
00000220	49 53 4F 20 54 43 31 33 30 2F 57 47 32 00 xx xx					Make(Vendor name): “ISO TC130/WG2n”
00000230	00003E80 00000064					XResolution: 16000/100 (160 pixels/cm)
00000238	00003E80 00000064					YResolution: 16000/100 (160 pixels/cm)
00000240	32 30 30 32 3A 30 34 3A 30 31 20 31 30 3A 30 30 3A 30 30 00 xx xx xx xx					DateTime: “2002:04:01 10:00:00n” (April 1, 2002 at 10:00:00)
00000258	43 6F 70 79 72 69 67 68 74 20 32 30 30 32 20 49 53 4F 2C 20 41 6C 6C 20 72 69 67 68 74 73 20 72 65 73 65 72 76 65 64 2E 00 xx					Copyright: “Copyright 2002 ISO, All rights reserved.n”
00000282 – 000003FF						not used
	Image data					
00000400 – 048003FF						Image data area is from 00000400h to 048003FFh

Figure C.1 — TIFF file header for image N1XYZ.TIF

C.3 Example of TIFF file header of the RGB image

The TIFF file header encoding of the colour picture file named “N1RGB.TIF” in the RGB set of XYZ/SCID is shown in Figure C.2. This encoding uses tags defined in TIFF 6.0.

The following fields are not included and take their default values.

— NewSubfileType = 0;

— Orientation = 1 (load from top left, horizontally);

— RowsPerStrip = $2^{32} – 1$ (only one strip);

— PlanarConfiguration = 1 (pixel interleaving).

The symbol “n” represents a null byte, and “x” represents a “don't care” hexadecimal digit for padding data.

Offsets	Value					Description
	TIFF File Header					
00000000	4D4D					Byte order “MM”(big-endian)
00000002	002A					Version number: 42
00000004	00000008					Pointer to the 1st: the 1st IFD begins in 8th byte in a file
	the 1st IFD					
00000008	0011					Number of in this IFD: 17 entries in this IFD
	Tag#	Type	Count	Value-offset		
0000000A	0100	0003	00000001	0C00xxxx	256	ImageWidth: 3072 pixels/line
00000016	0101	0003	00000001	1000xxxx	257	ImageLength: 4096 lines/image
00000022	0102	0003	00000003	00000200	258	BitsPerSample: pointer to the area of 00000200h
0000002E	0103	0003	00000001	0001xxxx	259	Compression: 1(no compression)
0000003A	0106	0003	00000001	0002xxxx	262	PhotometricInterpretation: 2 (for RGB image)
00000046	010E	0002	00000014	00000206	270	ImageDescription: pointer to the area of 00000206h
00000052	010F	0002	0000000E	00000220	271	Make(Vendor name): pointer to the area of 00000220h
0000005E	0111	0004	00000001	00000400	273	StripOffsets: 00000400h (pointer to the image data)
0000006A	0115	0003	00000001	0003xxxx	277	SamplesPerPixel: 3
00000076	0117	0004	00000001	02400000	279	StripByteCounts: 37,748,736 bytes in the strip
00000082	011A	0005	00000001	00000230	282	XResolution: pointer to the area of 00000230h
0000008E	011B	0005	00000001	00000238	283	YResolution: pointer to the area of 00000238h
0000009A	0128	0003	00000001	0003xxxx	296	ResolutionUnit: cm
000000A6	0132	0002	00000014	00000240	306	DateTime: pointer to the area of 00000240h
000000B2	013E	0005	00000002	00000258	318	WhitePoint: pointer to the area of 00000258h
000000BE	013F	0005	00000006	00000268	319	PrimaryChromaticities: pointer to the area of 00000268h
000000CA	8298	0002	00000029	00000298	33432	Copyright: pointer to the area of 00000298h
000000D6	00000000					Pointer to next IFD: None
	Value area					
00000200	0008	0008	0008			BitsPerSample: 8,8,8 (8-bits/sample for each separation)
00000206	57 4F 4D 41 4E 20 57 49 54 48 20 47 4C 41 53 53 52 47 42 00 xx xx xx xx xx xx					ImageDescription: “WOMAN WITH GLASSRGBn”
00000220	49 53 4F 20 54 43 31 33 30 2F 57 47 32 00 xx xx					Make(Vendor name): “ISO TC130/WG2n”
00000230	00003E80	00000064				XResolution: 16000/100 (160 pixels/cm)
00000238	00003E80	00000064				YResolution: 16000/100 (160 pixels/cm)
00000240	32 30 30 32 3A 30 34 3A 30 31 20 31 30 3A 30 30 3A 30 30 00 xx xx xx xx					DateTime: “2002:04:01 10:00:00n” (April 1, 2002 at 10:00:00)
00000258	00000C37	00002710	00000CDA	00002710		D_{65} white point: x=3127/10000 y=3290/10000
00000268	00000280	000003E8	0000014A	000003E8		ITU-R BT.709-3 primary colours:
	0000012C	000003E8	00000258	000003E8		R(640/1000,330/1000)
	00000096	000003E8	0000003C	000003E8		G(300/1000,600/1000) B(150/1000,60/1000)
00000298	43 6F 70 79 72 69 67 68 74 20 32 30 30 32 20 49 53 4F 2C 20 41 6C 6C 20 72 69 67 68 74 73 20 72 65 73 65 72 76 65 64 2E 00 xx					Copyright: “Copyright 2002 ISO, All rights reserved.n”
000002C2 – 000003FF						not used
	Image data					
00000400 – 024003FF						Image data area is from 00000400h to 024003FFh

Figure C.2 — TIFF file header for N1RGB.TIF

Annex D
(informative)

Text insertion

It should be noted that each image has a text identifier, either “ISO-XYZ” or “ISO-sRGB”, inserted in the image. Pixels representing this text have a coded value of either 0 or 65535/255. This text serves to distinguish between XYZ and RGB images.

The position of the outer boundaries of the text is defined by a rectangle produced from the co-ordinates of two of the corners as shown in Figure D.1. The position of the text in each image (in terms of number of pixels) is given in Table D.1.

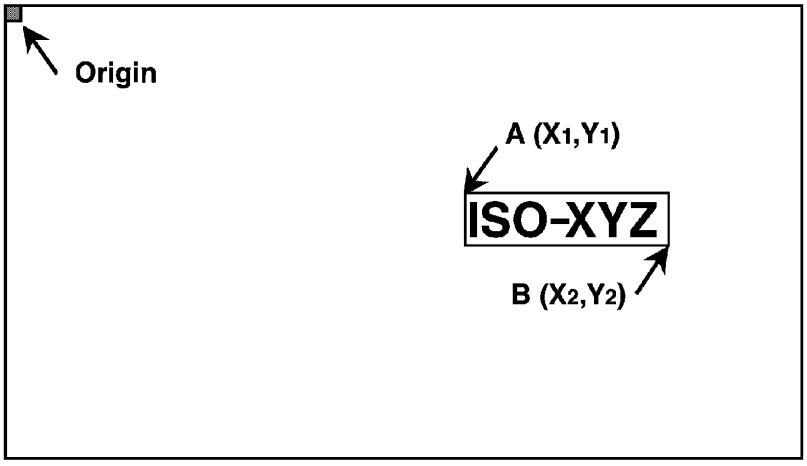


Figure D.1 — Definition of the co-ordinates of the text insertions

Table D.1 — Position and colour of the text in each image

ID	Image name	$A\ (X_1, Y_1)$	$B\ (X_2, Y_2)$	Colour of text
N1	Woman with glass	(35, 4 025)	(254, 4 061)	white
N2	Flowers	(35, 3 001)	(254, 3 037)	white
N3	Fishing goods	(2 817, 4 025)	(3 036, 4 061)	white
N4	Japanese goods	(3 842, 3 001)	(4 061, 3 037)	white
N5	Field fire	(3 842, 35)	(4 061, 71)	white
N6	Pier	(35, 35)	(254, 71)	white
N7	Threads	(3 842, 35)	(061, 71)	white
N8	Silver	(2 817, 35)	(3 036, 71)	white
S1	Teapot	(424, 9)	(473, 16)	white
S2	Japanese doll	(1 922, 15)	(2 031, 31)	black
S3	Cat	(1 922, 15)	(2 031, 31)	white
S4	Sports	(1 410, 15)	(1 519, 31)	white
S5	Business graph	(1 922, 15)	(2 031, 31)	white
S6	Colour chart	(2 482, 1 255)	(2 701, 1 291)	white
S7	Colour vignettes	(4 002, 2 550)	(4 221, 2 586)	white

Annex E
(informative)

Image evaluation and reproduction

In order to ensure that high quality images were provided in this International Standard, it was necessary to define a procedure for visual assessment. There was considerable discussion about whether this should be achieved by assessing them on a colour monitor or on hard copy. While there is a good case for viewing them on a display set-up and according to IEC 61966-2-1, it was decided that reproductions on hard copy were likely to be more critical. Thus, the images were all evaluated by making prints on a Fuji Pictrography digital printer [1)], then assessing the prints under standard viewing conditions according to ISO 3664.

However, since such an approach means that the hard copy prints produced for evaluation were not colorimetrically equivalent to the data, this inevitably creates some difficulty in describing how the prints should be made by anyone trying to approximately replicate those used for assessment. The printed images will have undergone corrections for both chromatic adaptation (as the images are defined for colorimetry using D65 and the viewing condition uses an approximation to D50) and the gamut mapping that is an inevitable part of satisfactorily reproducing such images on hard copy. While the chromatic-adaptation transform is relatively easy to define, the gamut mapping is not. Such transforms are often derived empirically and cannot easily be described mathematically.

Because of the difficulty in defining the gamut mapping, we have not attempted this. However, in Table E.1 we define the tone reproduction, which is an important part of any gamut mapping. We have done this by providing the CIELAB values of the primary, secondary and tertiary colour scales that are part of image S6. The data for the primary and secondary colours allow an approximate definition of the colour-gamut boundary and the scales enable the tone reproduction to be defined. Anyone wishing to reproduce these images in a way that can be considered a good approximation to their optimum reproduction can use these data to ensure that their device is behaving similarly, and then correcting for any gamut differences as necessary.

The measurements in Table E.1 are the average of measurements made of 12 different copies of the image, measured in two different laboratories. All measurements were made in accordance with ISO 13655, relative to the perfect-reflecting diffuser.

1) This printer is an example of a suitable product available commercially. This information is given for the convenience of users of this part of ISO 12640 and does not constitute an endorsement by ISO of this product.

Table E.1 — Measured CIELAB values of reproduced colour scales of image S6

Step No.	Red			Green			Blue		
	L^*	a^*	b^*	L^*	a^*	b^*	L^*	a^*	b^*
1	36,71	64,98	47,15	48,44	-53,86	53,02	18,55	22,67	-60,39
2	37,62	64,26	44,76	49,40	-52,80	54,49	19,44	20,62	-59,91
3	40,14	62,10	41,69	50,49	-51,50	56,23	21,44	20,43	-60,10
4	43,86	58,41	36,52	52,37	-50,15	57,10	27,70	19,03	-58,21
5	49,04	52,31	32,87	55,78	-48,95	53,33	33,82	17,12	-54,91
6	54,40	45,65	27,03	60,69	-45,71	47,49	39,51	15,44	-51,32
7	59,11	40,14	18,94	66,86	-40,22	38,50	47,30	12,72	-45,94
8	65,96	31,41	15,42	73,03	-33,50	29,47	57,21	9,77	-38,64
9	72,15	23,67	11,33	77,57	-27,65	22,18	65,95	6,96	-31,58
10	78,68	15,84	6,05	82,50	-20,05	14,00	74,57	4,80	-23,80
11	84,95	8,58	0,46	86,76	-12,18	5,14	83,09	2,21	-15,13

Step No.	Cyan			Magenta			Yellow		
	L^*	a^*	b^*	L^*	a^*	b^*	L^*	a^*	b^*
1	61,54	-41,36	-21,77	37,76	71,71	-36,23	83,03	-0,73	98,94
2	62,25	-40,79	-21,51	39,78	70,74	-36,50	83,12	-1,32	95,57
3	63,08	-40,29	-20,63	41,95	69,15	-36,64	83,47	-1,13	92,37
4	64,18	-39,55	-19,71	45,07	65,74	-36,65	84,42	-1,74	88,44
5	65,91	-38,15	-18,70	50,53	60,52	-35,14	85,43	-2,48	81,41
6	68,47	-35,91	-16,88	55,47	54,52	-33,19	86,47	-2,70	72,69
7	72,17	-31,77	-15,93	60,27	49,35	-30,58	87,33	-3,15	59,30
8	77,27	-25,62	-14,34	67,70	39,77	-26,19	87,93	-3,32	47,54
9	80,98	-20,41	-12,93	73,69	30,46	-22,08	89,11	-4,00	36,70
10	84,65	-14,62	-10,87	79,49	21,17	-17,37	90,22	-3,82	23,82
11	88,07	-8,46	-8,61	85,19	11,77	-12,06	91,18	-2,49	10,12

Step No.	Grey		
	L^*	a^*	b^*
1	6,93	-0,57	-2,75
2	11,97	-0,84	-0,75
3	18,22	-1,65	-1,41
4	24,69	-0,76	-1,18
5	32,26	-1,28	-1,39
6	39,82	-0,82	-2,93
7	47,52	-0,61	-3,14
8	56,86	-0,53	-1,99
9	65,49	-1,12	-1,52
10	73,76	-0,67	-2,38
11	82,31	-1,18	-3,36

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