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**Graphic technology — Prepress digital  
data exchange —**

Part 4:

**Wide gamut display-referred standard  
colour image data  
[Adobe RGB (1998)/SCID]**

*Technologie graphique — Échange de données numériques de  
préimpression —*

*Partie 4: Données d'image standard montrées en référence par gamme  
large de couleur [Adobe RGB (1998)/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 12640-4 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 3: CIELAB standard colour image data (CIELAB/SCID)*
- *Part 4: Wide gamut display-referred standard colour image data [Adobe RGB (1998)/SCID]*
- *Part 5: Scene-referred standard colour image data (RIMM/SCID)*

## Introduction

### 0.1 Need for standard digital test images

Standard test images provide a set of data that can be used for any of the following tasks:

- evaluating the colour reproduction of imaging systems;
- evaluating colour image output devices;
- evaluating the effect of image processing algorithms applied to the images;
- evaluating the coding technologies necessary for the storage and transmission of high-definition image data, etc.

Because they exist as standard, well-defined image data sets, typical of the high quality image content commonly encountered, standard test images enable users to be confident that the images will produce good quality reproductions, if properly rendered, and that they provide a reasonable test of the evaluation task being undertaken. No limited set of images can fully test any system but the sets provided give as reasonable a test as can be expected from a limited image set. Furthermore, the existence of a standard set enables users in different locations to produce comparisons without the need to exchange images prior to reproduction.

However, different applications require that the standard image data be provided in different image states using different image encodings (see ISO 22028-1). The user needs to select those appropriate to the evaluation task being undertaken. Whilst transformation of the image data to another image state is always possible, there is, in general, no agreement amongst experts as to how this is best done. Thus, it has been considered preferable to provide data in different image states in the various parts of ISO 12640.

ISO 12640-1 provides a set of 8-bits-per-channel data that is defined in terms of CMYK dot percentages. The colours resulting from reproduction of CMYK data are strictly defined only at the time of printing, and as such the data are only applicable to evaluation of CMYK printing applications. Transformations to other image states and colour encodings might not be well defined. In fact, the data might not even be useful for CMYK printing processes different from those typically found in traditional graphic arts applications, as the image data are defined to produce “pleasing” images when reproduced on systems using “typical” inks and producing “typical” tone value rendering. Printing systems that use inks of a distinctly different colour, or produce a very different tone value rendering, will not reproduce them as pleasing images without a well-defined colour transformation. Moreover, with a bit depth of only 8 bits per channel any colour transformation employed might well introduce artefacts.

ISO 12640-2 provides a set of test image data encoded both as XYZ values with each channel scaled to the range 0 to 65 535, and as sRGB (defined in IEC 61966-2-1), with a bit depth of 8 bits per channel. (The higher bit depth for the XYZ encoding is necessary because of the perceptual non-uniformity of the linear colour space.) Both sets of data are optimized for viewing on a reference sRGB CRT display in the reference sRGB viewing environment, and relative to CIE standard illuminant D65 for which the XYZ tristimulus values were computed prior to scaling. The images are mainly designed to be used on systems utilizing sRGB as the reference encoding, and as such are mainly applicable to the consumer market and those systems for which the colour monitor is the “hub” device. Although such systems are used for some applications in the graphic arts industry, sRGB is by no means the most common image encoding. Furthermore, a particular drawback is the fact that the sRGB colour gamut is quite different in shape to the colour gamut of typical offset printing. This difference can necessitate fairly aggressive colour re-rendering to produce optimal prints from sRGB image data.

ISO 12640-3 provides a set of test image data with a large reflection medium colour gamut, illuminated using illuminant D50. The bit depth of the natural images is 16 bits per channel, while the colour charts and vignettes are 8 bits per channel. In order to be useful for applications where large, print-referred output gamuts are encountered, common in graphic technology and photography, it was felt that it would be desirable to produce an image set in which some colours are permitted to be encoded close to the boundary

of the full colour gamut attained with surface colours. Furthermore, from the perspective of colour management, it is advantageous if the images are referenced to illuminant D50, which is the predominant reference illuminant used in graphic arts and photography, for both viewing and measurement. For this reason, it has also become the predominant reference illuminant for most colour management applications.

This part of ISO 12640 provides a set of wide gamut test image data encoded as Adobe RGB with a bit depth of 16 bits per channel. These data are optimized for viewing on a reference Adobe RGB display in the reference Adobe RGB viewing environment [defined in the *Adobe RGB (1998) Color Image Encoding specification*]. The preferred rendering of these images to any media, other than the reference Adobe RGB display in the reference Adobe RGB viewing environment, is dependent on the media and viewing environment used. Therefore, no colorimetry associated with reproduction on any other media is provided.

The images are mainly designed to be used on systems utilizing Adobe RGB as the reference encoding, and as such are mainly applicable to the professional market and those systems for which the wide gamut colour monitor is the “hub” device. Such workflows are popular among professional photographers, and are increasingly used in the graphic arts. The Adobe RGB reference display colour gamut is closer to typical offset printing gamuts than the sRGB reference display colour gamut. Adobe RGB encoded images generally require much less aggressive colour re-rendering going to print than sRGB encoded images, although this difference can necessitate colour re-rendering between Adobe RGB images and sRGB images. The purpose of this part of ISO 12640 is therefore to provide a test image data set with a larger colour gamut than sRGB, related to the Adobe RGB wide gamut display-referred colour space. The bit depth of the natural images and synthetic images is 16 bits per channel.

The possible wide gamut colour encoding choices considered were Adobe RGB, opRGB (IEC 61966-2-5) and ROMM RGB (ISO 22028-2). For this part of ISO 12640 we want the images well-colour-rendered to a well-defined large gamut reference display. For this reason, Adobe RGB was preferred over the other two choices. With opRGB the completeness of the colour rendering is left more ambiguous, i.e. it is not as clearly output-referred, and the reference medium and viewing conditions are also slightly different. ROMM RGB (ISO 22028-2) is clearly output-referred, but the reference medium is a virtual reflection print (the ICC perceptual reference medium).

## 0.2 Characteristics of the 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 (colour charts and colour vignettes). 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. However, by requiring the images to look natural, it is difficult within a single, relatively small, sample set to produce elements in the scene that contain the subtle colour differences required in such test images, that cover the full reference colour gamut defined. Thus, while most images contain colours that extend to the gamut boundary this is often only for a limited range of hues in each image. The full reference colour gamut can only be explored by utilizing the synthetic colour chart.

A survey was conducted of all TC 130 member countries to identify desirable image content and to solicit submission of suitable images for consideration. The image set that resulted consists of 14 natural images, a colour chart and a series of colour vignettes. 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 colour chart and colour vignette show the colour gamut of this wide gamut display-referred colour space.

## 0.3 File format of the digital test images

All of the images consist of pixel interleaved data (R then G then B) with the data origin at the upper left of the image, as viewed naturally, and organized by rows. These data are included as individual files within this part of ISO 12640. The image file format is as specified in ISO 12639:2004 (TIFF/IT). The images can be imported and manipulated as necessary by a wide variety of imaging software tools and platforms in general use in the industry. See Annex C for details of the TIFF header.

# Graphic technology — Prepress digital data exchange —

## Part 4:

### Wide gamut display-referred standard colour image data [Adobe RGB (1998)/SCID]

**IMPORTANT** — The electronic file of this document contains colours which are considered to be useful for the correct understanding of the document. Users should therefore consider printing this document using a colour printer.

## 1 Scope

This part of ISO 12640 specifies a set of standard wide gamut display-referred colour images [encoded as 16-bit Adobe RGB (1998) digital data] that can be used for the evaluation of changes in image quality during coding, image processing (including colour re-rendering and colour space transformations, compression and decompression), displaying on a colour monitor and printing. These images can be used for research, testing and assessing of output systems such as printers, colour management systems and colour profiles.

## 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.

ISO 12639:2004, *Graphic technology — Prepress digital data exchange — Tag image file format for image technology (TIFF/IT)*

Adobe RGB (1998) *Color Image Encoding*, Version 2005-05, May 2005. Available at: <http://www.adobe.com/digitalimag/pdfs/AdobeRGB1998.pdf>

## 3 Terms and definitions

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

### 3.1

#### **Adobe RGB**

three-component colour image encoding defined in *Adobe RGB (1998) Color Image Encoding*

### 3.2

#### **colour gamut**

solid in a colour space, consisting of all those colours that are present in a specific scene, artwork, photograph, photomechanical or other reproduction; or are capable of being created using a particular output device or medium

[ISO 12231]

### 3.3

#### **colour sequence**

order in which the colours are stored in an image data file

### 3.4

#### **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 listed in ISO 12639:2004.

### 3.5

#### **pixel**

smallest discrete picture element in a digital image file

### 3.6

#### **pixel interleaved**

colour data organized such that the RGB colour space values for one pixel are followed by the same sequence of colour values for the next pixel

NOTE The specific order of colour components is determined by the ColourSequence tag as defined in ISO 12639:2004. Other forms of colour data interleaving are line and plane.

## 4 Requirements

This part of ISO 12640 provides a set of images contained in 16 image data files which form an integral part of this part of ISO 12640. Their file names are listed in Tables 1 and 2. The colour image data shall be encoded as defined in *Adobe RGB (1998) Color Image Encoding* (hereafter referred to as Adobe RGB) using 16 bits per channel and 48 bits per colour. The image characteristics of these data are described in Clause 5, and the electronic data structure is described in Clause 6.

The procedures and guidelines for use of the image data files are given in Annex A. The image data integrity, excluding any headers, shall be checked using the check-sum procedure outlined in Annex B. Typical TIFF/IT file headers used for image files are described in Annex C. Label text insertion is described in Annex D. The histogram and gamut plots for the image data files are shown in Annex E.

## 5 Data set characteristics

### 5.1 General

The orientation of the image data is defined in accordance with ISO 12639, where a value of "1" in TAG 274 indicates that the data are to be loaded from top left, horizontally; the 0th row represents the visual top of the image and 0th column represents the visual left-hand side. The image data are pixel interleaved in the colour sequence of R then G then B (16 bits per channel) for the natural images and synthetic images.

### 5.2 Data set definition

The set of standard colour image data consists of 14 natural (photographed) images and two synthetic images created digitally on a computer. The synthetic images consist of one colour chart with various patches, and one colour vignette. The natural images are identified as N1 to N14, respectively, and each of them also has a descriptive name derived from the picture content (e.g. Crayons). The synthetic images are identified as S1 and S2.

The label "ISO 12640-4 RGB" is inserted in each image. The co-ordinates of the text insertion are provided in Annex D.

NOTE The image set defined in this part of ISO 12640 is based on the Adobe RGB reference display gamut. Image sets contained in other parts of ISO 12640 are based on different reference media and can be more suitable for use in evaluations where the other reference media are more relevant.

### 5.3 Natural images

The characteristics and typical usage of the natural images are shown 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 14 natural images have the following characteristics:

|                         |                                                  |
|-------------------------|--------------------------------------------------|
| Resolution:             | 16 pixels/mm                                     |
| Colour values:          | Adobe RGB data consisting of three 16-bit values |
| File format:            | ISO 12639:2004 (TIFF/IT)                         |
| Label on image:         | ISO 12640-4 RGB                                  |
| Image data orientation: | Load from top left, horizontally                 |

**Table 1 — Natural images**

| Name          | Aspect, image size                  | Characteristics and typical usage                                                                                                                    |
|---------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| N1 Crayons    | Horizontal,<br>4 096 × 3 072 pixels | Picture of crayons with high saturation colours; useful for checking edge-of-gamut reproduction                                                      |
| N2 Flowers    | Vertical,<br>3 072 × 4 096 pixels   | Useful for assessing tonal reproduction of highlight tones and saturated reds                                                                        |
| N3 Yarn       | Horizontal,<br>4 096 × 3 072 pixels | Image of yarn, wool and thread suitable for evaluating the colour gamut of devices, texture and fine detail reproduction                             |
| N4 Fishing    | Vertical,<br>3 072 × 4 096 pixels   | Fishing goods with fine detail, suitable for evaluating image sharpness and reproduction of detail                                                   |
| N5 Vases      | Horizontal,<br>4 080 × 3 072 pixels | Picture of transparent and semi-transparent vases, suitable for evaluating the reproduction of smooth highlight tones                                |
| N6 Leaves     | Horizontal,<br>4 096 × 3 072 pixels | Useful in evaluating the reproduction of subtle tonal variation in the leaves and of shadow detail in the dark brown of the trunks of the trees      |
| N7 Borabora   | Horizontal,<br>4 124 × 3 024 pixels | Landscape image; suitable for the evaluation of the reproduction of deep blue and green colours with subtle tonal variation                          |
| N8 Sunflower  | Horizontal,<br>3 040 × 2 014 pixels | Field of sunflowers with memory colours for sky, trees and grass; suitable for evaluating the reproduction of natural scenes                         |
| N9 Bride      | Vertical,<br>3 072 × 4 096 pixels   | Close-up image to evaluate the reproduction of human skin tones                                                                                      |
| N10 Walkathon | Vertical,<br>2 000 × 3 008 pixels   | Image of children in walking gear with bright balloons can be used to check the reproduction of images that include saturated colours and skin tones |
| N11 Spoon     | Horizontal,<br>4 096 × 3 072 pixels | Image of silverware to evaluate the reproduction characteristics of highlight tones and neutral colours                                              |
| N12 Violin    | Vertical,<br>3 072 × 4 096 pixels   | Low-key image of a room scene containing miscellaneous objects to evaluate dark colours, particularly browns                                         |
| N13 Glass     | Horizontal,<br>4 096 × 3 072 pixels | Image of glassware to evaluate the reproduction characteristics of highlight tones, shadow tones and neutral colours                                 |
| N14 Beach     | Horizontal,<br>3 040 × 2 014 pixels | Image of a sunny beach shot from shade of trees can be used to evaluate the reproduction of images having a high dynamic range                       |



**N1 Crayons**



**N2 Flowers**



**N3 Yarns**



**N4 Fishing**



**N5 Vases**



**N6 Leaves**



**N7 Borabora**



**N8 Sunflower**

**Figure 1 (continued)**



N9 Bride



N10 Walkathon



N11 Spoon



N12 Violin



N13 Glass



N14 Beach

Figure 1 — Reduced size reproductions of the natural images

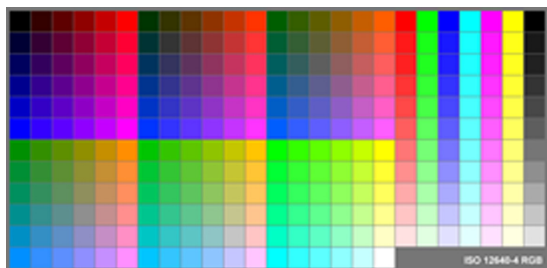
## 5.4 Synthetic images

### 5.4.1 Synthetic image content

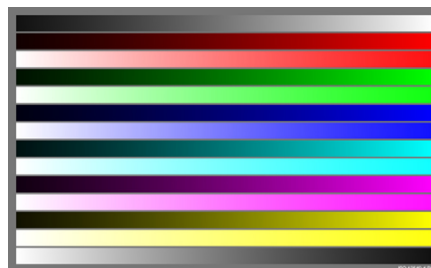
The synthetic images consist of a colour chart and a series of colour vignettes. Figure 2 shows reduced-size reproductions of the synthetic images. The interleaving, colour sequence, colour values and orientation are the same as for the natural images. The image sizes are shown in Table 2.

Table 2 — Synthetic images

| Name |                  | Aspect    | Height<br>pixels | Width<br>pixels |
|------|------------------|-----------|------------------|-----------------|
| S1   | Colour chart     | Landscape | 1 332            | 2 736           |
| S2   | Colour vignettes | Landscape | 2 608            | 4 256           |



S1 Colour chart



S2 Colour vignettes

Figure 2 — Reduced-size reproductions of the synthetic images

## 5.4.2 Colour chart

### 5.4.2.1 Design of colour chart

Image S1 (shown schematically in Figure 3) is a colour chart that consists of colour patches that are all specified to be within the Adobe RGB reference display colour gamut. 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 S1 is encoded in 16-bit Adobe RGB. Each part of the chart has two sections:

- section containing  $6^3$  (i.e. 216) tertiary colour patches;
- primary, secondary and tertiary grey colour section (77 patches in total).

The Adobe RGB image data encoded can be converted to viewer-observed image colorimetry using the transforms specified in *Adobe RGB*. The complete transformation, through the normalized tristimulus values to the viewer-observed tristimulus values, should be used.

**NOTE** When comparing the fidelity of a colour reproduction to that of an original, it is generally most appropriate to compare viewer-observed colorimetric values. However, the fidelity of measured reproduction colorimetry to original image colorimetry is not generally 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 any differences between the Adobe RGB viewing conditions and the reproduction viewing conditions, and because of differences between the Adobe RGB and reproduction medium colour gamuts.

#### 5.4.2.2 Generation of the content of the 6<sup>3</sup> colour section

- Determine step differences by uniformly dividing the black and white normalized (not viewer-observed) range of  $L^*$  (0 to 100) into six steps.
- Convert each normalized  $L^*$  value (assuming  $a^*$  and  $b^*$  values of 0) to 32-bit floating  $XYZ$  data normalized to range from 0 to 1; that is the maximum  $XYZ$  values are 0,950 5, 1,000 0 and 1,089 1, respectively.
- Convert the resulting six normalized  $XYZ$  values to linear  $RGB$  values using Equation (1).

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 2,04159 & -0,56501 & -0,34473 \\ -0,96924 & 1,87597 & 0,04156 \\ 0,01344 & -0,11836 & 1,01517 \end{bmatrix} \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} \quad (1)$$

d) Obtain 16-bit Adobe RGB (1998) component values  $R'$ ,  $G'$  and  $B'$  corresponding to each of the  $6^3$  linear  $RGB$  values using Equation (2).

$$\left. \begin{aligned} R' &= \text{Round} (65\,535 \times R^{1/2,199\,218\,75}) \\ G' &= \text{Round} (65\,535 \times G^{1/2,199\,218\,75}) \\ B' &= \text{Round} (65\,535 \times B^{1/2,199\,218\,75}) \end{aligned} \right\} \quad (2)$$

NOTE This clause follows the procedure described in 4.3.4 of *Adobe RGB (1998) Color Image Encoding*.

### 5.4.2.3 Generation of the content of the primary, secondary and tertiary grey colour section

The Adobe RGB data for columns 19 to 25 were prepared using the following procedures:

- a) Step a) of the procedure defined in 5.4.2.2 was repeated, except that the division of the range of  $L^*$  (from 0 to 90) was changed from 6 to 10 steps, and one step of  $L^*=5$  was added to produce 11 steps altogether. Then steps b) and c) defined in 5.4.2.2 were used to obtain the linear  $RGB$  values.
- b) Suitable combinations of linear  $RGB$  values were defined to provide the primary (red, green, blue), secondary (cyan, magenta, yellow) and tertiary (grey) colours.
- c) By using the same procedures as those described in step d) of 5.4.2.2 the 16-bit Adobe RGB values were computed for each linear  $RGB$  combination.

It should be noted that the reason for not including a 12th 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.

### 5.4.3 Colour vignettes

#### 5.4.3.1 Description of the colour vignettes

Image S2 is a set of colour vignettes in which the lightness continuously changes along 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. It is possible visually to 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.

#### 5.4.3.2 Generation of the content of the vignettes

Using the procedures described in 5.4.2.3 (except that the  $L^*$  range from 0 to 100 was divided into 4 096 intervals) the Adobe RGB data representing the primary, secondary and tertiary colours were obtained.

As shown in Figure 4 image S2 consists of two vignettes for each of the primary, secondary and tertiary colours. For the primary and secondary colours, 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 frame surrounding all the vignettes, and the spaces between the individual vignettes, have a black and white normalized  $L^* = 50$  and  $a^* = b^* = 0$ .

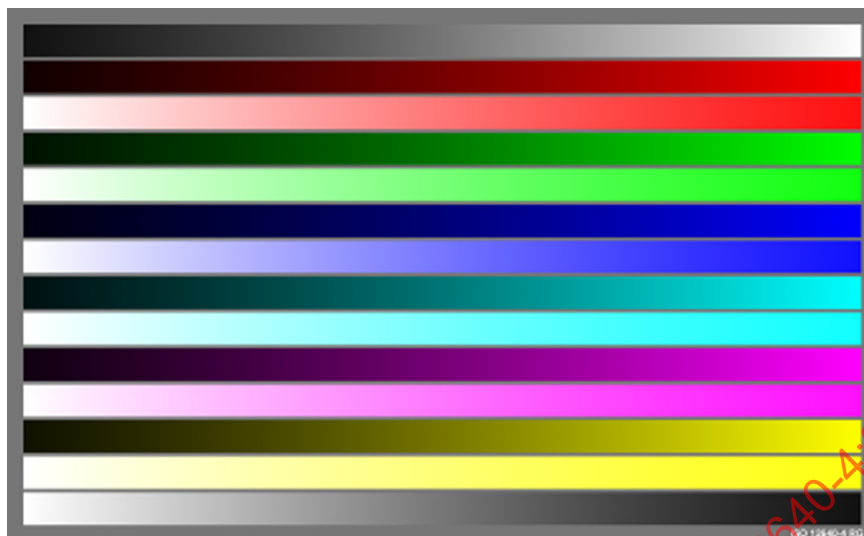


Figure 4 — Colour vignettes (S2)

## 6 Electronic data

Image data are contained in 16 data files that are included in this part of ISO 12640. File names correspond to the image IDs as described in 5.2 and 5.3. Table 3 shows the file name, size, 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 image data files are in accordance with ISO 12639:2004. The check-sums given in Annex B may be used to check the data integrity.

The restrictions on the use of these image data files are described in Annex A.

Table 3 — Image file characteristics

| File name               | File size<br>bytes | Height<br>pixels | Width<br>pixels | Colour<br>space | Colour values       | Descriptive name |
|-------------------------|--------------------|------------------|-----------------|-----------------|---------------------|------------------|
| N01_Crayons.tif         | 75 499 008         | 3 072            | 4 096           | RGB             | Three 16-bit values | Crayons          |
| N02_Flowers.tif         | 75 499 008         | 4 096            | 3 072           | RGB             | Three 16-bit values | Flowers          |
| N03_Yarn.tif            | 75 499 008         | 3 072            | 4 096           | RGB             | Three 16-bit values | Yarn             |
| N04_Fishing.tif         | 75 499 008         | 4 096            | 3 072           | RGB             | Three 16-bit values | Fishing          |
| N05_Vases.tif           | 75 204 096         | 3 072            | 4 080           | RGB             | Three 16-bit values | Vases            |
| N06_Leaves.tif          | 75 499 008         | 3 072            | 4 096           | RGB             | Three 16-bit values | Leaves           |
| N07_Borabora.tif        | 74 827 392         | 3 024            | 4 124           | RGB             | Three 16-bit values | Borabora         |
| N08_Sunflower.tif       | 36 736 896         | 2 014            | 3 040           | RGB             | Three 16-bit values | Sunflower        |
| N09_Bride.tif           | 75 499 008         | 4 096            | 3 072           | RGB             | Three 16-bit values | Bride            |
| N10_Walkathon.tif       | 36 097 536         | 3 008            | 2 000           | RGB             | Three 16-bit values | Walkathon        |
| N11_Spoon.tif           | 75 499 008         | 3 072            | 4 096           | RGB             | Three 16-bit values | Spoon            |
| N12_Violin.tif          | 75 499 008         | 4 096            | 3 072           | RGB             | Three 16-bit values | Violin           |
| N13_Glass.tif           | 75 499 008         | 4 096            | 3 072           | RGB             | Three 16-bit values | Glass            |
| N14_Beach.tif           | 36 736 896         | 2 014            | 3 040           | RGB             | Three 16-bit values | Beach            |
| S01_ColourChart.tif     | 21 867 648         | 1 332            | 2 736           | RGB             | Three 16-bit values | Colour chart     |
| S02_ColourVignettes.tif | 66 599 424         | 2 608            | 4 256           | RGB             | Three 16-bit values | Colour vignettes |

## **Annex A** (normative)

### **Guidance for use of digital data**

#### **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 Guidelines for use**

##### **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 label 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 label is included as part of, or with, the images.

#### **A.3 Guidelines for distribution and sharing**

##### **A.3.1 General**

Many of the intended uses of these images require that they be used at several locations and/or by several participants in test programmes. 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 might 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 programmes

Copies of these data files, or derivative files, may be exchanged between participants in test and evaluation programmes. 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 programmes, 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 Table B.1 may be used to check the data integrity. These values are calculated by summing each image plane ( $R$ ,  $G$ ,  $B$ ) 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-sum**

| Image               | Hex |     |     |     | Decimal |     |     |     |
|---------------------|-----|-----|-----|-----|---------|-----|-----|-----|
|                     | $R$ | $G$ | $B$ | $T$ | $R$     | $G$ | $B$ | $T$ |
| N1 Crayons          | EE  | 79  | E0  | 47  | 238     | 121 | 224 | 71  |
| N2 Flowers          | D6  | 0B  | FA  | DB  | 214     | 11  | 250 | 219 |
| N3 Yarn             | 1B  | 2A  | 96  | DB  | 27      | 42  | 150 | 219 |
| N4 Fishing          | D6  | F8  | AA  | 78  | 214     | 248 | 170 | 120 |
| N5 Vases            | FA  | C1  | 70  | 2B  | 250     | 193 | 112 | 43  |
| N6 Leaves           | 3E  | 83  | 49  | 0A  | 62      | 131 | 73  | 10  |
| N7 Borabora         | 86  | 74  | 29  | 23  | 134     | 116 | 41  | 35  |
| N8 Sunflower        | 90  | 97  | FA  | 21  | 144     | 151 | 250 | 33  |
| N9 Bride            | 81  | 08  | 5B  | E4  | 129     | 8   | 91  | 228 |
| N10 Walkathon       | 8B  | 84  | D5  | E4  | 139     | 132 | 213 | 228 |
| N11 Spoon           | 59  | 7F  | A2  | 7A  | 89      | 127 | 162 | 122 |
| N12 Violin          | F9  | 9   | 65  | 67  | 249     | 9   | 101 | 103 |
| N13 Glass           | 97  | B3  | DD  | 27  | 151     | 179 | 221 | 39  |
| N14 Beach           | 9F  | 3A  | 27  | 0   | 159     | 58  | 39  | 0   |
| S1 Colour chart     | A8  | A8  | A8  | F8  | 168     | 168 | 168 | 248 |
| S2 Colour vignettes | CE  | 23  | A6  | 97  | 206     | 351 | 166 | 151 |

## Annex C (informative)

### Typical TIFF/IT file header used for image files

The TIFF/IT file header encoding of the colour picture file named “N01\_Crayons.tif”, “Crayons”, is shown in Figure C.1. This encoding uses tags defined in ISO 12639:2004 (TIFF/IT). The PhotometricInterpretation tag is set to 2 (RGB) in this file.

The fields shown in Table C.1 are not included and take their default values.

**Table C.1 — Default fields for TIFF/IT headers**

| Field               | Value      | Interpretation                   |
|---------------------|------------|----------------------------------|
| NewSubfileType      | 0          |                                  |
| Orientation         | 1          | Load from top left, horizontally |
| RowsPerStrip        | $2^{32}-1$ | Only one strip                   |
| PlanarConfiguration | 1          | Pixel interleaved                |

| Offsets             | Value                                                                                                                                     |      |          |                  |       | Description                                                     |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------|----------|------------------|-------|-----------------------------------------------------------------|
|                     | ***TIFF/IT 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 in this IFD: 16 entries in this IFD                   |
|                     | Tag#                                                                                                                                      | Type | Count    | Value-<br>offset |       |                                                                 |
| 0000000A            | 0100                                                                                                                                      | 0003 | 00000001 | 1000xxxx         | 256   | ImageWidth: 4096 pixels/line                                    |
| 00000016            | 0101                                                                                                                                      | 0003 | 00000001 | 0C00xxxx         | 257   | ImageLength: 3072 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 | 00000600         | 273   | StripOffsets: 00000600h (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         | 33482 | Copyright: pointer to the area of 00000298h                     |
| 000000BE            | 8773                                                                                                                                      | 0007 | 00000230 | 00000282         | 34675 | ICC profile: pointer to the area of 00000282h                   |
| 000000CA            | 00000000                                                                                                                                  |      |          |                  |       | Pointer to next IFD: None                                       |
|                     | ***Value area***                                                                                                                          |      |          |                  |       |                                                                 |
| 00000200            | 0010                                                                                                                                      | 0010 | 0010     |                  |       | BitsPerSample: 16,16,16 (16 bits/sample for each separation)    |
| 00000206            | 43 52 41 59 4F 4E 53 52 47 42 00 xx xx xx<br>xx xx<br>xx xx xx xx xx xx xx xx xx xx                                                       |      |          |                  |       | ImageDescription: "CRAYONSn"                                    |
| 00000220            | 49 53 4F 20 54 43 31 33 30 2F 57 47 32 00<br>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 38 3A 30 34 3A 30 31 20 31 30 3A<br>30 30<br>3A 30 30 00 xx xx xx xx                                                             |      |          |                  |       | DateTime: "2008:04:01 10:00:00n"<br>(April 1, 2008 at 10:00:00) |
| 00000258            | 43 6F 70 79 72 69 67 68 74 20 32 30 30 38<br>20 49<br>53 4F 2C 20 41 6C 6C 20 72 69 67 68 74 73<br>20 72<br>65 73 65 72 76 65 64 2E 00 xx |      |          |                  |       | Copyright:<br>"Copyright 2008 ISO, All rights reserved.n"       |
| 00000282 - 000004B1 |                                                                                                                                           |      |          |                  |       | ICC profile data                                                |
| 000004B2 - 000005FF |                                                                                                                                           |      |          |                  |       | not used                                                        |
|                     | ***Image data***                                                                                                                          |      |          |                  |       |                                                                 |
| 00000600 - 048005FF |                                                                                                                                           |      |          |                  |       | Image data area is from 00000600h to 048005FFh                  |

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

Figure C.1 — TIFF/IT file header encoding of the colour picture file named "N01\_Crayons.tif"

## Annex D (informative)

### Label text insertion

It should be noted that each image has a text label, ISO 12640-4 RGB, inserted in the image. Pixels representing this text have a coded value of either 0 or 65 535. This text serves to distinguish between Adobe RGB images of this part of ISO 12640 and the sRGB images of ISO 12640-2.

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.

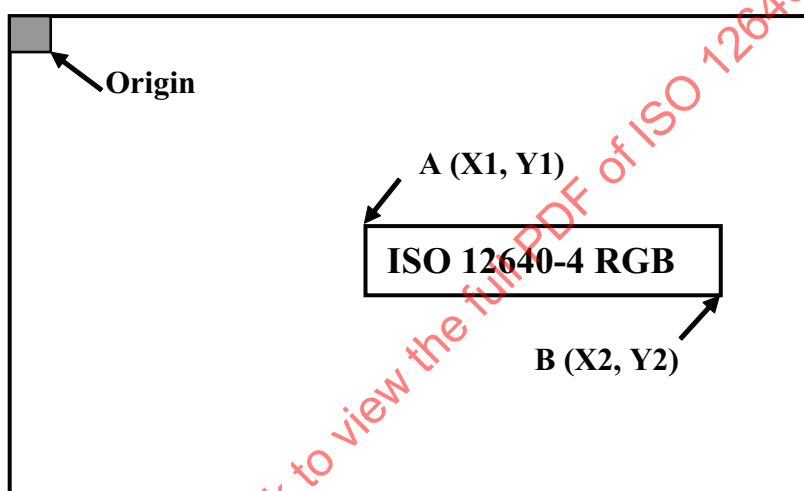


Figure D.1 — Definition of the co-ordinates of the text insertions

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

| Image | Name             | $A (X_1, Y_1)$ | $B (X_2, Y_2)$ |
|-------|------------------|----------------|----------------|
| N1    | Crayons          | (61, 2 991)    | (449, 3 028)   |
| N2    | Flowers          | (61, 4 015)    | (449, 4 052)   |
| N3    | Yarn             | (3 645, 2 991) | (4 033, 3 028) |
| N4    | Fishing          | (2 621, 4 015) | (3 009, 4 052) |
| N5    | Vases            | (3 645, 42)    | (4 033, 79)    |
| N6    | Leaves           | (61, 2 991)    | (449, 3 028)   |
| N7    | Borabora         | (61, 2 943)    | (449, 2 980)   |
| N8    | Sunflower        | (2 589, 1 933) | (2976, 1 969)  |
| N9    | Bride            | (2 621, 42)    | (3 009, 79)    |
| N10   | Walkathon        | (1 549, 42)    | (1 937, 79)    |
| N11   | Spoon            | (3 654, 2 991) | (4 033, 3 028) |
| N12   | Violin           | (61, 42)       | (449, 79)      |
| N13   | Glass            | (61, 42)       | (449, 79)      |
| N14   | Beach            | (61, 1 933)    | (449, 1 970)   |
| S1    | Colour chart     | (2 313, 1 254) | (2 701, 1 291) |
| S2    | Colour vignettes | (3 833, 2 549) | (4 221, 2 586) |

## Annex E (informative)

### Histogram and gamut plots

A histogram of the  $L^*$  values, and  $a^*$  versus  $b^*$  plots of three  $L^*$  slices of each natural image are shown in Figures E.1 to E.14.

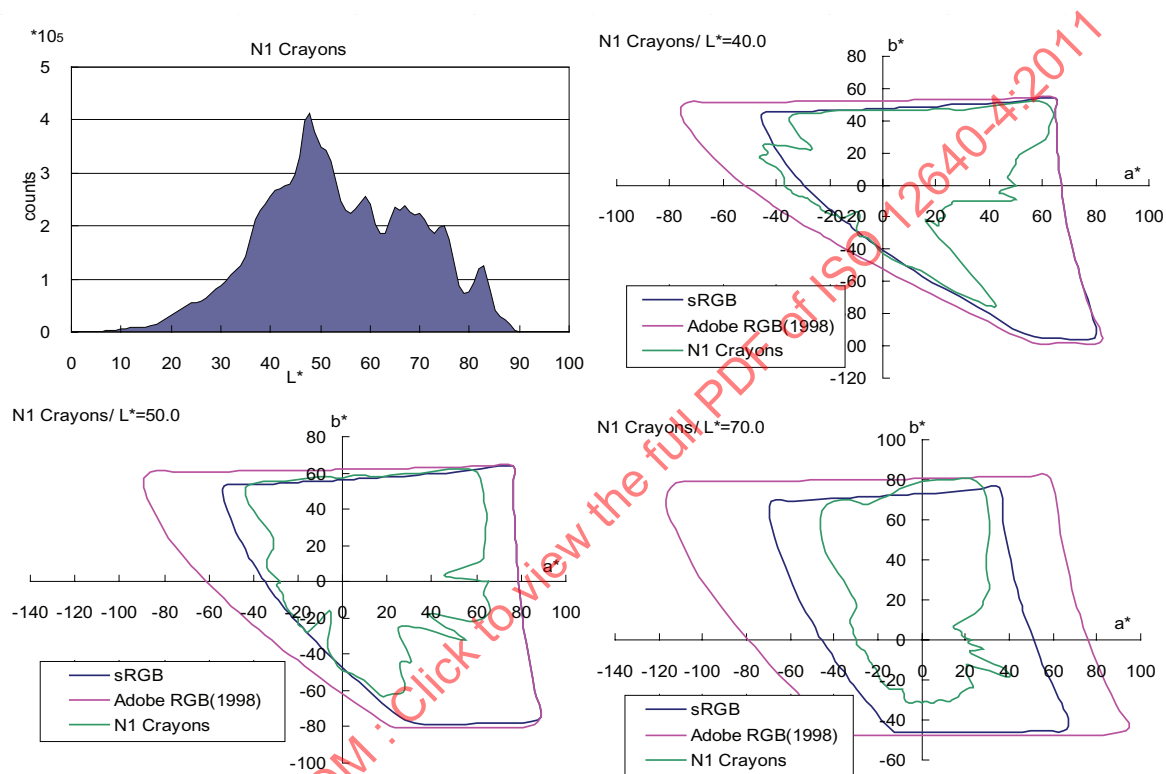


Figure E.1 — Histograms of the  $L^*$  values and  $a^*$  versus  $b^*$  plots of  $L^*=40, 50$  and  $70$  for N1 Crayons

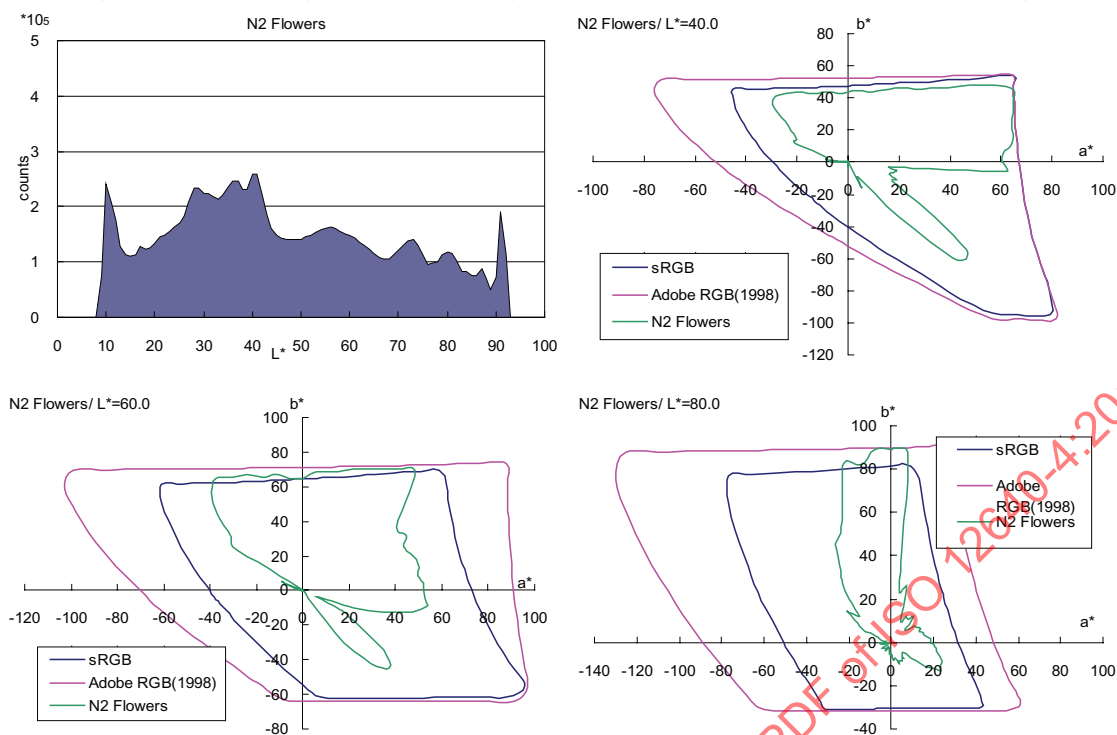


Figure E.2 — Histograms of the  $L^*$  values and  $a^*$  versus  $b^*$  plots of  $L^*=40, 60$  and  $80$  for N2 Flowers

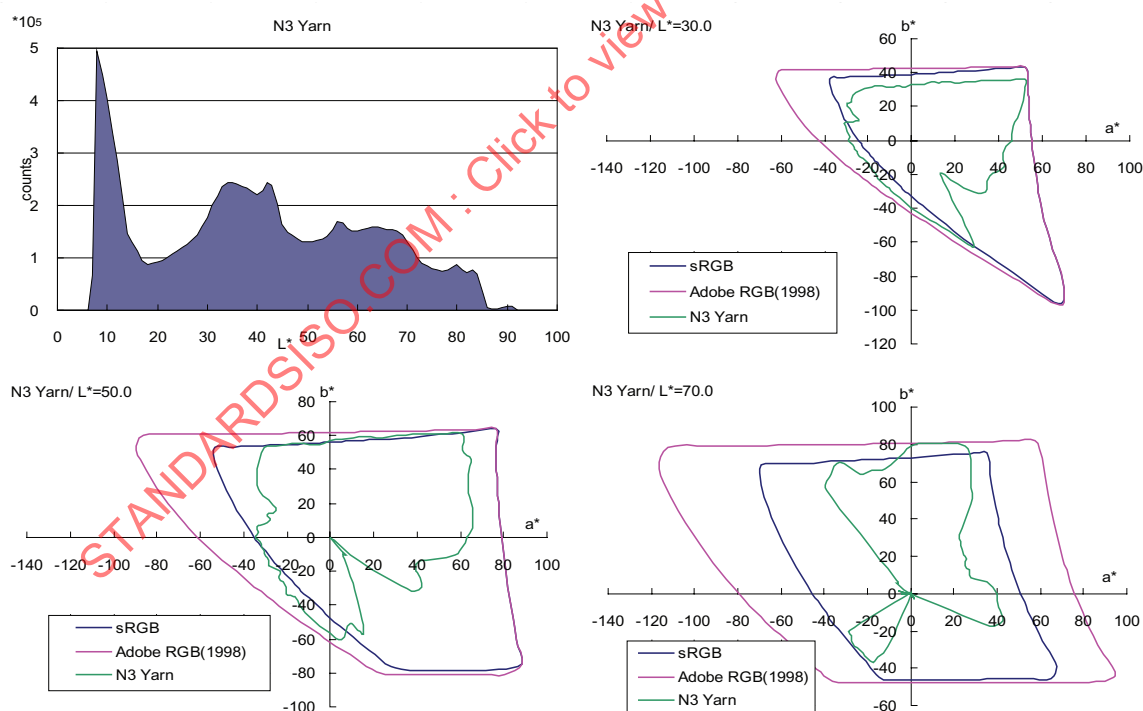


Figure E.3 — Histograms of the  $L^*$  values and  $a^*$  versus  $b^*$  plots of  $L^*=30, 50$  and  $70$  for N3 Yarn

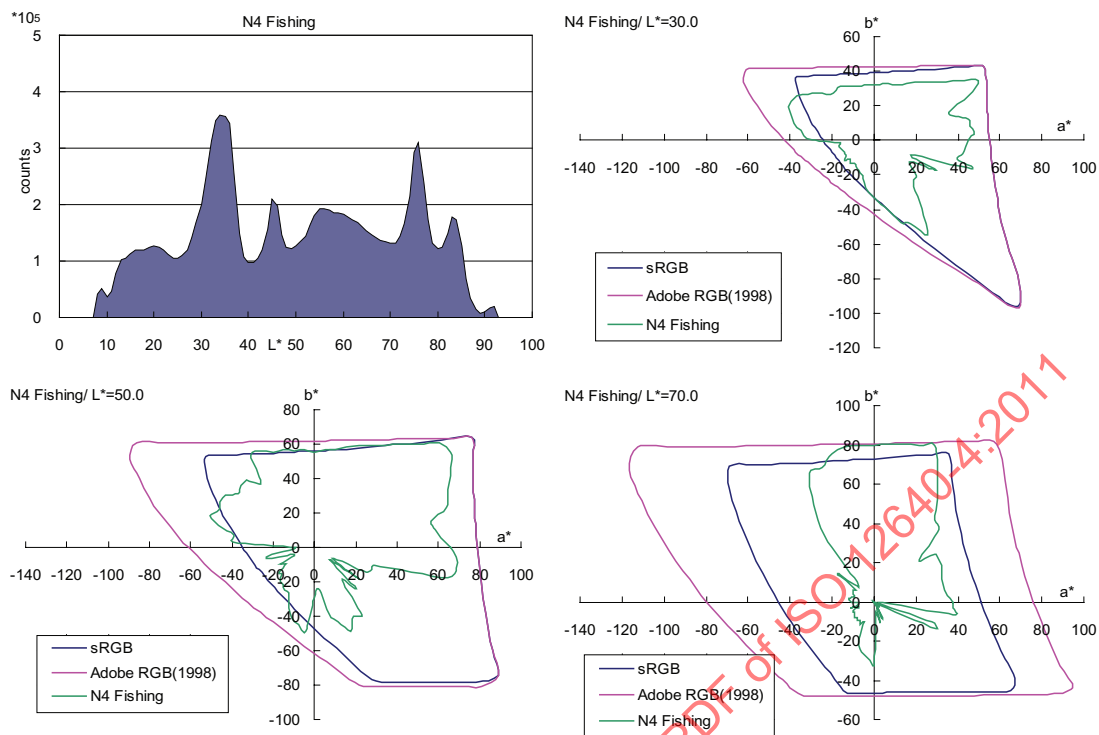


Figure E.4 — Histograms of the  $L^*$  values and  $a^*$  versus  $b^*$  plots of  $L^*=30, 50$  and  $70$  for N4 Fishing

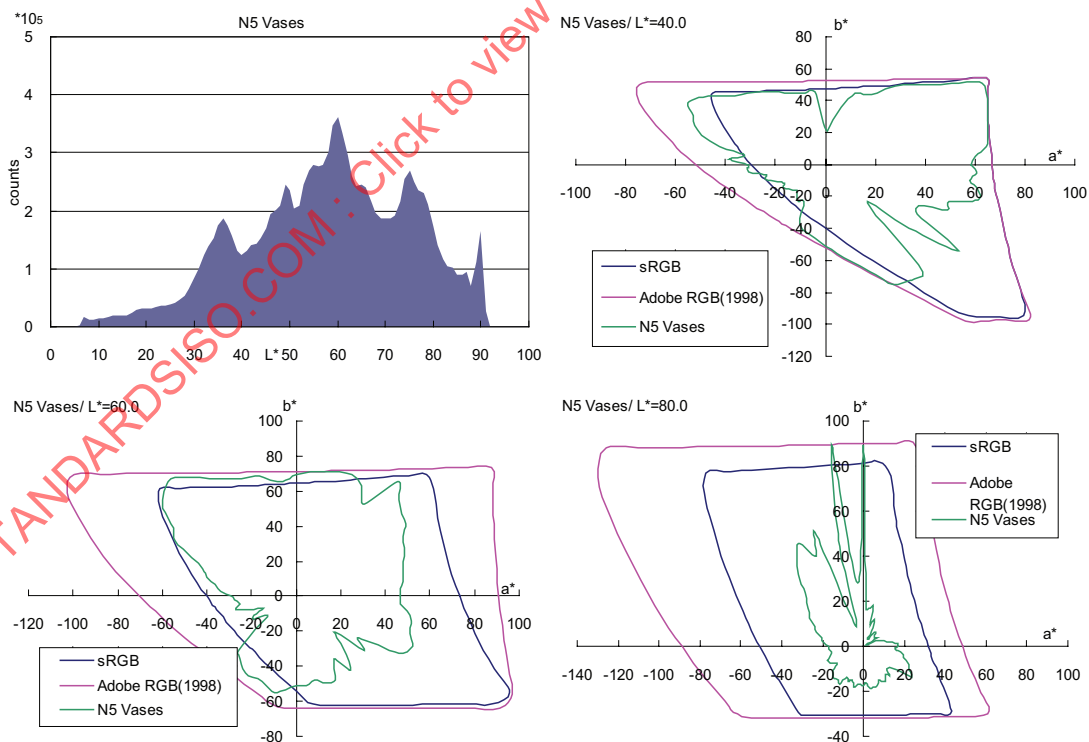


Figure E.5 — Histograms of the  $L^*$  values and  $a^*$  versus  $b^*$  plots of  $L^*=40, 60$  and  $80$  for N5 Vases