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Graphic technology — Prepress digital data exchange —

Part 3:
CIELAB standard colour image data (CIELAB/SCID)

Technologie graphique — Échange de données numériques de préimpression —

Partie 3: Données d'images en couleur normalisées CIELAB (CIELAB/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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

This second edition cancels and replaces the first edition (ISO 12640-3:2007), of which it constitutes a minor revision. The changes are as follows:

— CIE Publication 15:2004 has been changed to CIE Publication 15 Colorimetry;

— in 3.4, the definition of colour space has been updated based on revision to CIE Publication 17 in 2020;

— in the Bibliography, CIE S 17:2020 ILV has been updated to International lighting vocabulary, 2nd edition.

A list of all parts in the ISO 12640 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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.

Because they exist as standard, well-defined, high-quality image data sets, typical of the range of image content commonly encountered, they 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 image data 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 three 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 are not necessarily 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 will probably introduce artefacts.

ISO 12640-2 provides a set of test image data encoded both as XYZ tristimulus values with a depth of 16 bits per channel 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 XYZ 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 values were computed. 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 than the colour gamut of typical offset printing. This difference can necessitate fairly aggressive colour re-rendering to produce optimal prints from sRGB image data.

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 attainable 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, both for viewing and measurement. For this reason it has also become the predominant reference illuminant for most colour management applications.

The purpose of this document is, therefore, to provide a test image data set with a large colour gamut related to 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.

0.2 Definition of the reference colour gamut

The reference colour gamut defined for this document originated from three quite separate sources. However, it was noted that there was considerable similarity between the three. One definition came from work within ISO/TC 130 itself, and this arose by consideration of various sets of published data, which together were taken to define the colour gamut of surface colours. The other definitions arose from work within Hewlett-Packard, which was focused on the colour gamut obtainable by printing, and that of a group of German photographic printing experts. The similarity of these led to the conclusion that it is desirable to reconcile them into a single gamut that would be taken as the reference colour gamut for this document. Full details of the reference colour gamut and its derivation are given in Annex B.

0.3 Characteristics of the test images

The performance of any colour reproduction system is normally evaluated both subjectively (by viewing the final output image) and objectively (by measurement of control elements). This requirement dictated 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 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 and that cover the full reference colour gamut defined. It is also important to have some images that contain subtle differences in near-neutral colours. 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 ISO/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 eight natural images, eight colour charts and two colour vignettes. The natural images include flesh tones, images with detail in the extreme highlights or shadows, neutral colours, brown and wood-tone colours that are often difficult to reproduce, memory colours, complicated geometric shapes, fine detail, and highlight and shadow vignettes. The colour charts and colour vignettes show the reference colour gamut (in CIE Lab colour space) in cross-sections for 16 and 8 hue angles, respectively.

0.4 File format of the digital test images

All of the images consist of pixel interleaved data (L^* then a^* then b^*) with the data origin at the upper left of the image, as viewed naturally, and organized by rows. These data are available as individual files, which are a normative part of this part of this document. The image file format is as specified in ISO 12639:2004, Annex H, with BitsPerSample set to 16, 16, 16. The images can be imported and manipulated as necessary by a wide variety of imaging software tools and platforms commonly in general use in the industry. See Annex D for details of the TIFF header.

All colour charts and vignettes consist of files in Adobe®[1] PDF format.

1) This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named.

Graphic technology — Prepress digital data exchange —

Part 3: CIELAB standard colour image data (CIELAB/SCID)

1 Scope

This document specifies a set of standard large gamut colour images (encoded as 16-bit CIELAB digital data) 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 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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)*

ISO 13655, *Graphic technology — Spectral measurement and colorimetric computation for graphic arts images*

ISO 22028-1, *Photography and graphic technology — Extended colour encodings for digital image storage, manipulation and interchange — Part 1: Architecture and requirements*

PDF Reference: *Adobe Portable Document Format, Version 1.4* 3rd edition., Adobe Systems Incorporated, (ISBN 0-201-75839-3)

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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

Note 1 to entry: Often, only the least significant bits are summed.

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 and/or medium

[SOURCE: ISO 12640-4:2011]

3.3
colour sequence
order in which the colours are stored in a data file

3.4
colour space
geometric representation of colour in space

Note 1 to entry: A colour space is usually of three dimensions

Note 2 to entry: This entry was numbered 845-03-25 in IEC 60050-45:1987

[SOURCE: CIE S 17:2020 ILV: International Lighting Vocabulary, 2nd edition, modified]

3.5
colour value
numeric values associated with each of the pixels

3.6
data range
range of integers for a given variable in between a minimal and maximal value

3.7
global colour change
change to the colours in an image (often selectively by colour region) applied consistently to all parts of the image

Note 1 to entry: 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.

3.8
orientation
specifies the origin and direction of the first line of data with respect to the image content as viewed by the end user

Note 1 to entry: The codes used to specify orientation are contained in ISO 12639.

3.9
pixel
smallest discrete picture element in a digital image file

3.10
pixel interleaving
colour data organized such that the L^*, a^* and b^* colour space values for one pixel are followed by the same sequence of colour values for the next pixel; the specific order of colour components is determined by the ColorSequence tag as defined in ISO 12639

Note 1 to entry: Other forms of colour data interleaving are line and plane.

4 Requirements

This document consists of the images contained in the 18 image data files which are part of this document. Their file names are listed in Table 4. The image characteristics of these data are described in Clause 5 and the electronic data structure in Clause 6.

5 Data description and definition

5.1 Data set definition

The set of standard colour image data consists of eight natural (photographed) images and ten synthetic images created digitally on a computer. The synthetic images consist of eight colour charts consisting of various patches, each 10 mm square, and two colour vignettes. 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. bride and groom). The synthetic images are identified as CC1 to CC8, CV1 and CV2.

The images are identified by the designation CIELAB/SCID. The co-ordinates of the text insertion are provided in Annex E.

NOTE The image set defined in this document is based on the large gamut defined in Annex B. Image sets contained in other document are based on different gamuts and can be more suitable for use in evaluation of other applications.

5.2 Colour encoding used in this document

5.2.1 Image data encoding

The image data encoding shall be in accordance with the requirements of ISO 22028-1.

The image data are the desired CIELAB colorimetry defined by CIE Publication 15[10], and measured in accordance with ISO 13655, of reproductions of the images on the reference medium, with the reference medium white point selected as the colour space white point. The image data are output-referred, having been rendered to the reference medium of the ICC.1:2004-04[11] perceptual rendering intent, which is defined as a hypothetical print on a substrate specified to have a neutral reflectance of 89 % (the reference medium white point) and the darkest printable colour on this medium is assumed to have a neutral reflectance of 0,347 31 % of the substrate reflectance (the reference medium black point). The rendering target colour gamut for the reference medium is specified in Annex B. The reference viewing environment is based on standard viewing condition P2, as specified for graphic arts and photography in ISO 3664, but extended in the following way: the surfaces immediately surrounding the image are assumed to be a uniform matt grey with a reflectance of 20 %. The reference viewing environment is also assumed to have a viewing flare of 0,75 % of the luminance of the reference white. The CIELAB image data are encoded as specified in 5.2.3 and 5.2.4.

5.2.2 Image data arrangement

The image data are pixel-interleaved in the colour sequence of L^* then a^* then b^* (16 bits) for the natural images and L^* then a^* then b^* (8 bits) for the colour charts and the vignettes. The arrangement of data follows the scanning of each image from the upper left corner to the upper right, then moving to the next lower horizontal line. The resolution is 12 pixels/mm for every natural image.

5.2.3 CIELAB image data (16 bits per channel)

The CIELAB data for the natural images are encoded as 16-bit integers per channel, derived by multiplying the L^*, a^* and b^* values for each pixel with the corresponding value for the data range.

$$\begin{aligned} L^*_{16\text{bit}} &= \text{round}\left(65\,535 \times \frac{L^*}{100}\right) \\ a^*_{16\text{bit}} &= \text{round}\left(256 \times a^*\right) \\ b^*_{16\text{bit}} &= \text{round}\left(256 \times b^*\right) \end{aligned} \qquad (1)$$

where $L^*_{16\text{bit}}$, $a^*_{16\text{bit}}$ and $b^*_{16\text{bit}}$ represent normalised 16-bit values of L^*, a^* and b^*.

The data range of the values is:

$L^*\in\{0..100\}$, $a^*\in\{-128..+127\}$ and $b^*\in\{-128..+127\}$,

$L^*_{16bit}\in\{0..65\ 535\}$, $a^*_{16bit}\in\{-32\ 768..+32\ 512\}$ and $b^*_{16bit}\in\{-32\ 768..+32\ 512\}$, a^*_{16bit} and b^*_{16bit} are signed integers.

NOTE −32 678 = −128 × 256, and 32 512 = 127 × 256.

5.2.4 CIELAB image data (8 bits per channel)

The CIELAB data for the colour charts are encoded as 8-bit integers per channel, derived by multiplying the L^*, a^* and b^* values for each pixel with the corresponding value for the data range.

$$\begin{aligned} L^*_{8bit} &= \mathrm{round}\left(255\times\frac{L^*}{100}\right) \\ a^*_{8bit} &= \mathrm{round}\left(a^*\right) \\ b^*_{8bit} &= \mathrm{round}\left(b^*\right) \end{aligned} \qquad (2)$$

where L^*_{8bit}, a^*_{8bit} and b^*_{8bit} represent normalised 8 bit values of L^*, a^* and b^*.

The data range of the values is:

$L^*\in\{0..100\}$, $a^*\in\{-128..+127\}$ and $b^*\in\{-128..+127\}$,

$L^*_{8bit}\in\{0..255\}$, $a^*_{8bit}\in\{-128..+127\}$ and $b^*_{8bit}\in\{-128..+127\}$, the a^*_{8bit} and b^*_{8bit} are signed integers.

5.3 Natural images

The characteristics of the eight natural images, shown in Figure 1, are given in Table 1.

Table 1 — Characteristics for natural images

Parameter	Characteristics
Resolution	12 pixels/mm
Colour values	16 bits/channel L^*, a^* and b^*, with respect to illuminant D50 (defined as media-relative, i.e. such that a white in the image has the L^*, a^* and b^* values of 100, 0, 0)
File format	ISO 12639:2004, Annex H, with BitsPerSample set to 16, 16, 16 This format also readable with TIFF 6.0 with extension, photometric interpretation tag 8, CIELAB, signed encoding.
Label on image	CIELAB/SCID
Image data orientation	Horizontal scanning starting from top left and ending at bottom right

NOTE The natural images have been colour-rendered to produce the desired image colorimetry on the reference print medium as described in Annex B. For the most part, the image colours will be within the reference colour gamut. However, it is possible for some image colours to be slightly outside (this is somewhat dependent on how the convex hull of the gamut is constructed). It is sometimes necessary to gamut map the results of colour rendering and re-rendering processing to exactly fit the destination device colour gamut.

The description and typical usage of the natural images are given in Table 2. The descriptive names of these images are given following the identification code. Figure 1 shows reduced size sRGB reproductions of the natural images. Statistical and gamut data for each of the natural images are shown in Annex F, as histograms of the L^* values and a^* versus b^* plots for each image, respectively.

Table 2 — Natural images

Name	Aspect, image size	Description and typical usage
N1 Bride and groom	Horizontal, 2 560 × 2 048 pixels	Image of a bride wearing white clothes and groom wearing black clothes. Used to evaluate the rendering of human skin tones and neutral colours, especially highlights and shadows.
N2 People	Horizontal, 2 560 × 2 048 pixels	Image consisting of five people wearing colourful clothes, sitting on a dark leather couch. Used to evaluate the colour rendering of extremely colourful objects in the presence of skin tones and neutrals.
N3 Cashew nuts	Vertical, 2 048 × 2 560 pixels	Image of dried fruits and filled containers used to evaluate tonal and colour rendering, in particular adjustments for grey component replacement.
N4 Meal	Horizontal, 2 560 × 2 048 pixels	Image with widely recognizable cooked food and pastel colours. Used to evaluate high-key tonal rendering and food memory colours.
N5 Mandolin	Vertical, 2 048 × 2 560 pixels	Image of goods, including metallic objects, used to evaluate the reproduction of colours, as well as the reproduction of the lustrous appearances of metallic objects.
N6 Tailor scene	Horizontal, 2 560 × 2 048 pixels	Still-life image of textile used to evaluate the tone reproduction in a range of neutrals and textile structures (object moiré).
N7 Wool	Horizontal, 2 560 × 2 048 pixels	Image of different coloured balls of wool used to evaluate the reproduction of details in highly chromatic areas.
N8 Fruits	Square, 2 024 × 2 024 pixels	Image of a range of fruits and vegetables. The memory colours of strawberries, oranges, lemons, green grapes, apples, pears, tomatoes and bell peppers are particularly suitable for the evaluation of the naturalness of colour re-rendering processes.

a) N1 Bride and groom

b) N2 People

c) N3 Cashew nuts

d) N4 Meal

e) N5 Mandolin

f) N6 Tailor scene

g) N7 Wool

h) N8 Fruits

Figure 1 — Reduced size sRGB reproductions of the natural images

5.4 Synthetic images

5.4.1 Colour charts

There are eight colour charts, each of which consists of a number of colour patches that sample the reference colour gamut. Each chart contains a number of patches at two hue angles, with each pair separated by 180°. The design intent was to provide samples at hue angle intervals of 22,5° (from 0° to 337,5°). However, the limitations imposed by 8-bit data means that the intended hue angles can only be approximated to within ±1°.

The colour charts show all the samples within the reference colour gamut at L^* intervals of 10 (from L^* = 0 to L^* = 100) and C^*_{ab} intervals of 10 (from C^*_{ab} = 0 to the C^*_{ab} value above the maximum C^*_{ab} value for that L^* value from the reference colour gamut). These maximum C^*_{ab} values are given in Table 3, and are derived from the reference colour gamut described in Annex B of this document, rounded to the nearest value. Again, the limitations of the 8-bit data mean that the intended values shown in Table 3 can only be approximated. The L^* values achieved are to within ±0,2, and the C^*_{ab} values to within ±1 C^*_{ab}.

Because of this design, the maximum and minimum L^* values, and maximum C^*_{ab} values, in the charts lie outside the reference colour gamut. This ensures that the whole of the reference colour gamut can be evaluated (within the patch sampling limitations of the charts). The CIELAB values for each patch in the charts are given in Annex G.

NOTE Applications that show the CIELAB values when these files are opened are likely to show the L^* values as the integer value given in Table 3, despite the limited accuracy caused by the 8-bit resolution. Thus, these are the values quoted in Annex G.

The size of each chart is 275 mm × 137 mm. The size of each colour patch is 10 mm × 10 mm and the distance between adjacent patches is 1 mm. Each chart has a grey background of L^* = 80.

Figure 2 shows reduced size reproductions of the eight colour charts.

Table 3 — Colour charts: Maximum chroma value (C^*_{ab}) with respect to lightness (L^*) and hue angle (h_{ab})

h_{ab}	Maximum C^*_{ab} for L^* =								
	10	20	30	40	50	60	70	80	90
0°	26	52	74	91	91	82	67	47	25
22,5°	23	50	73	94	95	86	71	51	28
45°	21	45	70	91	100	99	88	67	37
67,5°	16	35	53	70	85	97	104	105	69
90°	14	30	47	62	75	88	101	112	120
112,5°	14	31	47	64	77	90	100	105	96
135°	17	37	56	76	91	99	96	81	50
157,5°	20	43	67	90	99	93	80	60	34
180°	20	41	62	81	92	86	71	52	28
202,5°	20	38	55	69	81	77	66	49	27
225°	20	38	53	65	76	72	62	47	27
247,5°	24	42	58	69	72	64	53	39	21
270°	32	55	70	75	70	61	49	34	19
292,5°	55	85	90	85	76	64	50	35	18
315°	46	85	101	97	87	73	58	41	21
337,5°	31	63	85	102	99	88	70	49	26

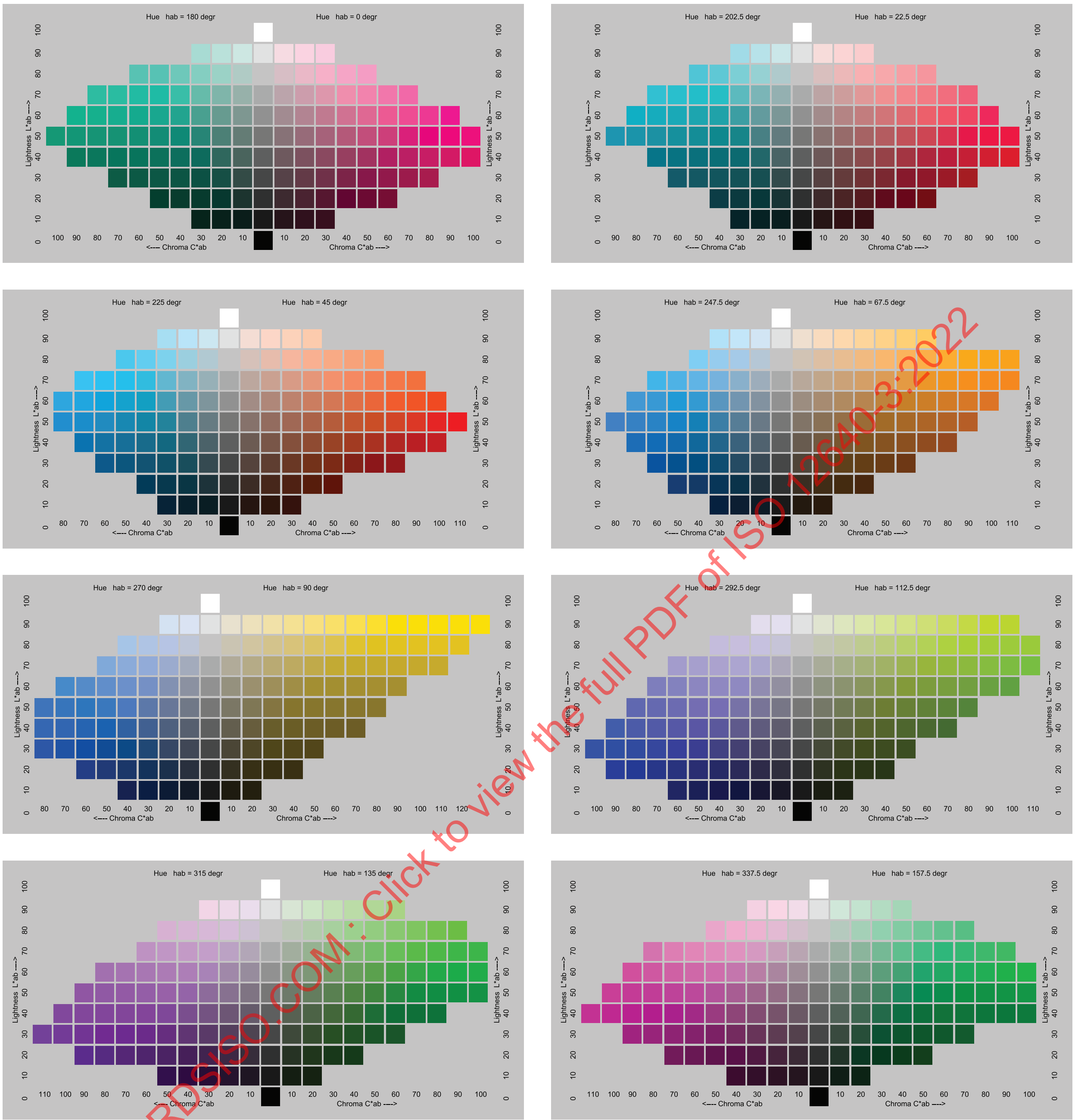


Figure 2 — Reduced size sRGB reproductions of the colour charts CC1 to CC8

5.4.2 Vignettes

The vignettes were built as two sets, a full and a reduced colour gamut set. All vignettes are defined for eight hue angles, at 45° intervals between 0° and 315°, inclusive. For the full reference colour gamut set, the first vignette at each hue angle is linearly scaled from black (L^* = 3,137 3, C^*_{ab} = 0) to the maximum chroma of the reference colour gamut at the corresponding level of lightness as shown in Table 4. The second vignette for each hue angle has the constant L^* value given in Table 4 from grey (C^*_{ab} = 0) to the L^* and maximum C^*_{ab} values given in Table 4. The third vignette is scaled from white (L^* = 100, C^*_{ab} = 0) to the L^* and maximum C^*_{ab} values given in Table 4.

The reduced reference colour gamut set consists of the same arrangement, except that the minimum and maximum lightness is restricted to L^* = 10 and L^* = 90, respectively, and the chroma values to 85 % of the reference colour gamut for the same levels of lightness L^* as shown in Table 4.

NOTE The 8-bit resolution necessitates some of the C^*_{ab} values being rounded.

The size of the vignettes is 250 mm in length and 10 mm in width. The vignettes are calculated in 4 096 steps. They are arranged to a set on a grey background with L^* = 80. The size of one set is 308 mm × 263 mm.

Figure 3 shows a reduced size reproduction of the vignette CV1.

Table 4 — Maximum and reduced chroma values and corresponding level of lightness for 8 hue angles

Parameter	Hue angle h_{ab}							
	0°	45°	90°	135°	180°	225°	270°	315°
Lightness (L^*)	48	52	95	65	50	51	37	31
Maximum chroma (C^*_{ab})	92	101	123	100	92	75	76	100
Colour values (a^*, b^*)	(92, 0)	(71, 71)	(0, 123)	(−71, 71)	(−92, 0)	(−53, −53)	(0, −76)	(71, −71)
Reduced chroma (C^*_{ab})	78	86	105	85	78	64	65	85
Colour values (a^*, b^*)	(78, 0)	(61, 61)	(0, 105)	(−60, 60)	(−78, 0)	(−45, −45)	(0, −65)	(60, −60)

Figure 3 — Reduced size sRGB reproduction of the maximum chroma vignette CV1

5.4.3 Synthetic image format

The colour charts and vignettes are written in the PDF 1.4 format.

6 Electronic data

6.1 Image file characteristics

Image data are contained in 18 data files that are included in this document. File names correspond to the image IDs as described in 5.3 and 5.4. Table 5 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. Image height and width are provided for raster files. The checksums given in Annex C shall be used to check the data integrity.

The restrictions on the use of these image data files shall be in accordance Annex A.

Table 5 — Image file characteristics

File name	File size bytes	Height pixels	Width pixels	Colour values L^*, a^*, b^*	Descriptive name
N1.TIF	31 458 304	2 048	2 560	Three 16-bit values	Bride and groom
N2.TIF	31 458 304	2 048	2 560	Three 16-bit values	People
N3.TIF	31 458 304	2 560	2 048	Three 16-bit values	Cashew nuts
N4.TIF	31 458 304	2 048	2 560	Three 16-bit values	Meal
N5.TIF	31 458 304	2 560	2 048	Three 16-bit values	Mandolin
N6.TIF	31 458 304	2 048	2 560	Three 16-bit values	Tailor scene
N7.TIF	31 458 304	2 048	2 560	Three 16-bit values	Wool
N8.TIF	24 580 480	2 024	2 024	Three 16-bit values	Fruits
CC1.PDF	12 507	—	—	Three 8-bit values	Chart h_{ab} 0°/180°
CC2.PDF	14 001	—	—	Three 8-bit values	Chart h_{ab} 22,5°/202,5°
CC3.PDF	13 869	—	—	Three 8-bit values	Chart h_{ab} 45°/225°
CC4.PDF	13 982	—	—	Three 8-bit values	Chart h_{ab} 67,5°/247,5°
CC5.PDF	12 377	—	—	Three 8-bit values	Chart h_{ab} 90°/270°
CC6.PDF	14 115	—	—	Three 8-bit values	Chart h_{ab} 112,5°/292,5°
CC7.PDF	14 057	—	—	Three 8-bit values	Chart h_{ab} 135°/315°
CC8.PDF	14 186	—	—	Three 8-bit values	Chart h_{ab} 157,5°/337,5°
CV1.PDF	90 015	—	—	Three 8-bit values	Vignette maximal chroma
CV2.PDF	89 213	—	—	Three 8-bit values	Vignette reduced chroma

6.2 Image file formats

The natural images N1.TIF to N8.TIF are recorded as 16-bit CIELAB data in accordance with ISO 12639 (also readable by TIFF 6.0 extended, photometric interpretation tag 8, CIELAB, signed encoding). The colour charts and vignettes CC1.PDF to CC8.PDF and CV1.PDF and CV2.PDF are recorded as PDF files in accordance with PDF 1.4.

Annex D shows the file header of image N1.TIF.

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 document 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" colour 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 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 programs. The following uses have been interpreted to be acceptable and allowed 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 document 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 document, obtained from the appropriate standards agency, as part of the package allows the inclusion of similar or derived data as needed 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 document.

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 document.

Annex B
(informative)

Definition of the reference colour gamut

B.1 Development of the reference colour gamut

The reference colour gamut defined for this document was derived from three different colour gamuts developed quite independently, but for similar reasons. The first was developed within ISO/TC 130 in order to provide an estimate of the gamut of surface colours for the purposes of this document. The second was produced by Hewlett-Packard as the gamut of colours produced by all colour printers, during their own product development work, and offered to the International Color Consortium (ICC) as a reference colour gamut for the Profile Connection Space for perceptual renderings defined in ICC.1:2004-04. It was also offered to ISO/TC 130 for consideration in the definition of the reference gamut required for this document. During the development of this standard another useful gamut was brought to the attention of the committee. This is a gamut known as PhotoGamutRGB, which is based on measurement of the results obtained from silver halide printers used for producing photographic prints from digital photographs.

On review it became clear that, although there were some differences, there was also considerable similarity between these gamuts. So, it was agreed by the committee that the data from the three sources could be reconciled in order to produce the single reference colour gamut defined for this document. This reconciliation is described in B.5. However, for information purposes, the derivation of each of the gamuts is briefly described.

B.2 Gamut of surface colours

The initial specification for the reference colour gamut for this document was obtained by finding the maximum gamut obtainable with surface colours, according to the published data available to the committee in 1998. The main sources of this data were the Pointer[8] gamut, data for Pantone colours, the SOCS[6] data and data for photographic media available to the committee. Some additional samples were also measured.

In 1980, Pointer published an investigation of the gamut of real surface colours[8], in which colour data was analysed from the following sources:

— 768 colours from the Munsell Limit Color Cascade;

— 310 colours from the Matte Munsell Atlas;

— 1 393 colours from ink and paint samples, textiles, coloured plastics and papers (measured in the investigation[8]);

— 1 618 colours describing flower colours (tabulated by the Royal Horticultural Society).

Altogether, the colour coordinates of 4 089 colours were available.

Pointer[8] combined these colour data and published the maximum chroma value at 36 hue angles and 16 lightness levels. However, the Pointer gamut data refer to CIE standard illuminant C, whereas the committee needed the gamut with respect to illuminant D50. The Pointer gamut boundary data was therefore converted to that for D50 using the Bradford chromatic adaptation conversion used in CIECAM97s. The D50 Pointer data were then combined with other colour data exhibiting high chroma values. In particular, the data for 1 025 Pantone colours, a series of new colour data measured from printed samples and the colorimetric data from the SOCS data set (see ISO/TR 16066) were included.

From these XYZ data the colour gamut was calculated as a convex hull and then transformed into the CIELAB colour space. Table B.1 shows the maximum chroma value obtainable with surface colours for 36 hue angles and 19 lightness levels calculated as a convex hull for illuminant D50 and the 1931, 2°, standard colorimetric observer.

Table B.1 — Gamut of surface colours: Maximum chroma value (C^*_{ab}) with respect to lightness (L^*) and hue angle (h_{ab})

h_{ab}	Maximum C^*_{ab} for L^* =																		
	5	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**
0°	30	42	49	56	63	70	77	80	82	83	84	82	72	60	48	37	26	16	6
10°	28	40	48	56	63	70	77	80	82	82	83	82	75	63	51	39	28	16	6
20°	25	40	49	57	64	72	79	83	84	84	85	84	79	67	55	42	30	18	6
30°	17	34	51	60	68	77	85	88	89	88	89	88	86	74	61	48	34	20	7
40°	13	26	39	52	65	78	90	96	97	96	95	93	93	85	71	56	40	24	9
50°	11	22	33	43	54	65	75	85	95	99	102	100	98	94	87	69	49	29	11
60°	10	19	29	38	48	57	66	74	83	91	98	104	107	105	97	84	59	35	13
70°	9	18	26	35	43	52	60	68	75	82	89	96	102	108	113	99	77	44	16
80°	8	17	25	33	41	49	56	63	70	77	83	89	95	101	106	112	104	64	20
90°	8	16	25	32	40	47	54	61	68	74	79	85	91	96	102	107	112	113	30
100°	8	17	25	32	40	47	53	60	66	72	77	83	88	93	98	103	108	96	43
110°	9	17	25	33	41	48	54	60	66	72	77	83	88	93	98	99	94	67	25
120°	9	18	27	35	43	50	57	63	68	74	80	85	91	97	97	90	77	47	17
130°	10	21	30	39	47	55	61	67	73	79	85	91	97	100	91	82	62	37	14
140°	12	24	34	43	50	57	63	70	76	82	87	92	93	90	86	78	52	30	11
150°	14	28	39	48	54	61	68	75	81	88	93	91	87	83	75	66	45	26	9
160°	16	31	44	53	61	68	75	82	87	92	92	89	84	75	68	58	40	23	9
170°	17	34	49	60	70	73	76	79	83	88	86	83	78	70	62	53	38	22	8
180°	16	33	47	59	67	69	73	77	82	86	83	80	73	67	59	50	36	21	8
190°	16	31	43	53	60	63	67	71	75	78	77	75	69	64	56	48	35	21	8
200°	16	30	41	48	54	59	63	67	71	72	71	70	65	60	54	47	36	21	8
210°	16	29	38	44	51	56	60	64	68	68	68	66	62	57	51	44	35	22	8
220°	17	29	37	43	49	55	59	63	66	66	66	65	61	56	50	42	34	23	8
230°	18	30	36	42	48	54	60	64	66	66	66	65	61	56	50	42	33	23	9
240°	20	31	37	43	49	55	61	67	67	68	68	67	62	56	49	41	33	24	11
250°	22	32	38	45	51	57	63	68	70	71	68	63	58	52	45	38	31	24	14
260°	25	34	41	48	54	61	66	71	71	70	66	61	55	50	43	37	30	23	17
270°	29	38	46	53	61	67	72	73	73	71	66	60	54	49	42	35	29	22	14
280°	36	45	53	62	70	76	77	78	78	73	66	60	54	49	42	35	29	22	10
290°	45	56	67	77	84	84	83	83	80	75	68	62	56	50	43	36	29	22	8
300°	62	78	91	98	94	91	89	85	82	77	71	65	59	52	46	38	30	20	7
310°	74	96	97	100	100	98	94	90	86	81	76	70	62	55	48	39	30	18	6
320°	53	71	78	85	92	99	101	96	91	85	79	73	66	58	50	41	28	17	6
330°	42	58	65	72	79	86	92	95	93	89	85	77	70	60	50	38	27	16	6
340°	36	49	57	64	70	77	84	89	89	90	89	83	72	59	48	37	26	15	5
350°	32	45	52	59	66	72	79	83	84	86	88	84	71	59	48	37	26	15	5

B.3 Printer gamut

Hewlett-Packard had undertaken a study of the gamut of colours available from a wide range of printing devices. A composite gamut produced from this data, as a series of CIELAB L^* versus C^*_{ab} plots defined at 16 hue angles, was presented. Table B.2 shows the gamut boundary data extracted from those plots which represent the maximum chroma values C^*_{ab} obtainable with printing devices calculated for illuminant D50 and the 1931, 2°, standard colorimetric observer.

Table B.2 — Printer gamut: Maximum chroma value (C^*_{ab}) with respect to lightness (L^*) and hue angle (h_{ab})

h_{ab}	Maximum C^*_{ab} for L^* =								
	10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**
0°	25	50	68	83	86	81	65	45	20
22,5°	20	50	75	82	85	81	60	40	20
45°	10	37	68	98	101	102	88	59	30
67,5°	8	27	45	60	76	91	105	108	60
90°	10	22	37	52	69	82	98	112	123
112,5°	10	28	45	60	75	90	103	107	90
135°	12	33	55	75	96	101	95	81	45
157,5°	15	40	63	84	98	95	80	60	32
180°	15	40	62	81	89	85	75	50	25
202,5°	19	35	53	69	76	74	66	49	27
225°	20	37	50	60	68	70	63	48	27
247,5°	20	40	53	62	69	57	45	31	18
270°	32	55	68	68	60	50	40	27	15
292,5°	55	82	92	80	68	55	42	29	15
315°	40	92	103	96	90	70	53	36	18
337,5°	33	60	85	97	98	90	71	51	26

B.4 PhotoGamutRGB

This was a gamut defined by a group of colour imaging experts involved with the reproduction of digital photographs in Germany[9]. It was defined as a means of providing pleasing reproductions of sRGB images when printed using commercial silver halide photographic printers. This is achieved by assigning the PhotoGamutRGB ICC profile to sRGB images prior to printing, thereby re-rendering the images.

The gamut definition was based on measurement data from a number of silver halide printers and is supposed to be both a superset printer and a fuzzy target for re-rendering. Table B.3 shows the gamut boundary derived from measurements of silver halide printing devices and calculated for illuminant D50 and the 1931, 2°, standard colorimetric observer.

Table B.3 — PhotoGamutRGB: Maximum chroma value (C^*_{ab}) with respect to lightness (L^*) and hue angle (h_{ab})

Hue angle h_{ab}	Maximum C^*_{ab} for L^* =								
	10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**
0°	16	41	66	86	81	67	51	31	15
20°	18	43	69	90	85	67	50	30	13
40°	10	30	55	80	93	77	57	35	15
60°	8	20	39	55	73	92	80	50	20
80°	6	18	31	47	61	75	90	100	50
100°	6	18	30	45	60	73	85	96	75
120°	8	20	35	50	67	83	85	65	40
140°	10	28	47	67	89	90	70	50	29
160°	17	39	62	90	99	85	62	41	20
180°	12	30	50	72	90	80	66	40	20
200°	11	28	42	60	80	76	60	40	20
220°	11	28	41	57	74	69	51	34	18
240°	13	30	46	60	66	52	40	26	12
260°	19	40	59	67	59	49	36	21	10
280°	33	60	77	70	60	59	35	21	10
300°	65	103	90	80	69	52	39	24	12
320°	25	72	100	96	83	69	50	31	17
340°	19	49	76	98	97	81	62	40	20

NOTE The data above has been extracted from the PhotoGamutRGB_avg6c.ICC profile and black point scaled in *XYZ*, to bring the black point from L^* = 0 to L^* = 3,137 3 (ICC black for perceptual rendering).

B.5 Reference colour gamut

The reference colour gamut defined for this document is not an attempt to define the gamut of surface colours precisely. Although it is likely that it does include the majority of such colours that do occur, and therefore approximates that gamut, the mixed data sources used to derive it do contribute a degree of uncertainty to the data. This is primarily attributable to the measurement procedures used in each of those studies being loosely specified. In particular, if any of the samples in Table B.1 exhibited fluorescence, the measurement result would be highly dependent on the measurement procedure used. While none of the samples included were known to be highly fluorescent, the uncertain origin of some of them means that this cannot be certain. Thus, the reference colour gamut is simply a gamut that is needed to define the characteristics of the various images included in this standard. To be useful it needs to include the vast majority of surface colours that might be encountered in colour reproduction. However, there possibly will be some coloured samples that give rise to measurements that fall outside of this gamut, particularly highly fluorescent samples, and so it is a "fuzzy" estimate of the precise gamut of surface colours.

A number of considerations went into derivation of the reference colour gamut. The first was how to define the white and black points as these are very important components of the gamut. Since it was anticipated that these images would be widely used in evaluation of colour management systems, it seemed sensible to define the white and black to be consistent with those defined as the white and black for the reference medium in ICC.1:2004-04. These are specified to have a reflectance factor of 0,89 and 0,003 091 1, respectively. While it is likely that neither of these represent the highest reflectance white or lowest reflectance black obtainable with surface colours, they are likely to be close to those, as well as the limits of those obtained in high-quality printing systems. Thus, this dynamic range provides a reasonable approximation to the maximum practical gamut.

There is no fundamental reason to expect that the highest and lowest reflectance colours occurring in practice will necessarily be neutral. However, if they are not, neither is there any fundamental reason to expect them to have their positive chroma at any particular hue. Since any chroma of the lowest and highest reflectance colours is likely to be small, it was decided that the reference white and black is assumed to have a chroma of zero for the purposes of this document.

The second consideration was to decide whether the data is best specified as "absolute" data (i.e. with respect to the perfect reflecting diffuser) or relative to the media white (so that the white is specified to have a reflectance of 100 and all other values are scaled accordingly). The data reported by Hewlett-Packard was provided as media-relative data. However, inspection of the TC 130 data suggested that this data was somewhat mixed. Since the data was obtained by combining that from various sources, the provenance of it, particularly with respect to the reference white, cannot be completely certain. Some of the very high chroma values at L^* values of 95 were felt most likely to be relative, whilst some of the high chroma dark colours were felt most likely to be absolute.

In principle, it makes little difference to the standard whether the data is specified either way, as it is simple to calculate one from the other, providing the reflectance of the white is specified. As there is no reason that the natural images need to have a specified white point, it was decided that making the data relative was sensible; but if absolute data is required by any user, it can be calculated from the defined white.

A third consideration was to provide a relatively smooth surface to the three-dimensional gamut, yet with distinct cusps at each hue angle. These two criteria were deemed desirable in optimizing gamut mapping.

Taking the above criteria into account, the data from the three gamuts was compared in order to provide a combination of the three that could act as the reference colour gamut. In general, the objective was to try to include all the data specified in the three data sets; in other words, to provide a superset of the three data sets. At the same time, it was deemed important to include only colours present in the natural world. Such a minimalist approach could mean that the final data set omitted some realizable surface colours, particularly surface colours obtained by transmission. However, the decision to use the reference black for reflecting media defined in ICC.1:2004-04, together with the requirement for smoothness, meant that some high-chroma colours of low lightness, which were found in the data defined in B.2, had to be omitted. Furthermore, there was some suspicion that some of the values could be absolute measurements, as already stated. For this reason, the reference colour gamut selected for this document does not contain some of the high chroma values at low levels of lightness specified in Table B.1.

The reference colour gamut, calculated for illuminant D50 and the 1931, 2°, standard observer, obtained by empirically combining the gamuts in Tables B.1, B.2 and B.3, is defined in Table B.4, together with the white (L^* = 100, C^*_{ab} = 0) and black (L^* = 3,137 3, C^*_{ab} = 0).

Table B.4 — Reference colour gamut: Maximum chroma value (C^*_{ab}) with respect to lightness (L^*) and hue angle (h_{ab})

h_{ab}	Maximum C^*_{ab} for L^* =																				
	3,137 3	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
0°	0	11	26	39	52	64	74	83	91	92	91	87	82	75	67	57	47	37	25	13	0
10°	0	10	24	38	50	62	73	82	90	92	91	87	82	75	67	58	48	37	26	13	0
20°	0	10	23	37	50	62	73	84	93	94	94	90	85	78	70	60	50	39	27	14	0
30°	0	9	22	35	48	61	74	86	98	100	101	96	90	83	75	65	54	42	30	15	0
40°	0	8	21	34	47	60	73	83	93	97	101	99	97	90	83	73	61	47	34	17	0
50°	0	8	20	32	43	55	66	77	88	95	99	101	100	98	92	85	72	56	40	20	0
60°	0	7	17	27	37	47	57	67	76	84	91	96	100	102	103	98	90	72	51	26	0
70°	0	6	16	25	34	43	52	60	68	76	83	90	96	100	104	107	109	100	74	37	0
80°	0	6	15	23	32	40	48	57	64	71	78	85	91	97	103	107	110	113	110	70	0
90°	0	6	14	22	30	39	47	55	62	68	75	82	88	95	101	106	112	117	120	123	0
100°	0	6	14	22	30	38	46	54	61	68	74	81	88	94	100	106	109	112	112	92	0
110°	0	6	14	22	31	39	47	55	63	69	76	83	89	96	100	103	106	107	102	75	0
120°	0	6	15	24	32	41	49	58	66	73	80	87	93	98	101	102	99	91	73	50	0
130°	0	6	16	25	35	44	54	63	72	80	87	93	97	101	99	94	86	73	56	34	0
140°	0	7	18	28	38	48	57	67	77	86	95	98	101	97	93	85	75	61	44	26	0
150°	0	7	19	30	40	51	62	72	83	92	97	99	96	91	85	76	66	52	37	22	0
160°	0	7	20	32	44	56	68	80	92	96	99	97	92	87	79	70	59	46	33	19	0
170°	0	8	20	32	43	53	64	75	85	91	96	93	89	82	75	65	55	42	30	17	0
180°	0	8	20	31	41	52	62	72	81	87	92	90	86	79	71	61	52	40	28	15	0
190°	0	8	20	30	40	50	60	68	76	82	87	85	82	76	69	60	50	39	27	14	0
200°	0	8	20	30	38	47	56	63	70	76	82	81	77	72	66	58	49	38	27	14	0
210°	0	8	20	29	37	46	53	60	66	73	79	80	75	70	64	57	49	38	27	14	0
220°	0	8	20	29	37	45	52	59	65	71	76	75	72	68	63	56	48	38	27	14	0
230°	0	9	20	29	38	46	53	59	65	70	75	73	71	66	61	54	46	36	26	13	0
240°	0	10	22	31	40	48	55	61	67	71	74	70	66	61	56	49	41	32	23	12	0
250°	0	11	24	34	43	51	59	65	70	73	71	68	63	58	52	45	38	30	21	11	0
260°	0	14	27	38	48	57	64	69	73	73	70	66	61	56	50	43	35	28	20	10	0
270°	0	17	32	45	55	65	70	75	75	73	70	66	61	55	49	42	34	27	19	10	0
280°	0	21	42	55	68	75	81	80	79	76	72	67	61	55	49	41	34	26	18	9	0
290°	0	26	52	68	83	86	89	87	84	80	75	69	63	57	50	42	35	27	18	10	0
300°	0	25	69	82	95	94	93	91	88	85	79	73	66	59	52	44	36	28	19	10	0
310°	0	21	51	74	91	97	100	98	95	90	84	77	70	63	55	47	39	30	20	10	0
320°	0	18	41	62	79	91	102	101	98	95	89	83	76	68	60	51	42	32	22	11	0
330°	0	16	35	53	71	82	91	100	104	102	98	91	84	76	67	57	47	36	24	12	0
340°	0	14	31	46	61	73	83	92	101	103	99	95	89	80	71	61	50	38	26	13	0
350°	0	12	28	42	55	68	77	86	94	96	93	90	85	77	68	58	48	37	25	13	0

NOTE 1 If the resolution of the data needs to be finer, it would normally be adequate to obtain it by linear interpolation of the quoted data.

NOTE 2 The L^*, C^* and h^* values specified in this table are relative to the reference medium white with a reflectance factor of 0,89. To calculate values relative to a perfect reflecting diffuser it is necessary to convert the table values to *X, Y and Z* values, scale the resulting *X, Y and Z* values by a factor of 0,89, and convert back to L^*, C^* and h^* relative to the perfect reflecting diffuser.

B.6 Primaries and secondaries

When undertaking gamut mapping for colour reproduction purposes, it is desirable to have a definition of the primary and secondary colours associated with a colour gamut. Although not directly relevant to this document, it is anticipated that the reference colour gamut defined in this annex can be used for colour re-rendering and gamut mapping purposes. For this reason, a possible set of primary and secondary colours for this gamut, which can be useful for such tasks as re-rendering and gamut mapping, are given in Table B.5.

Table B.5 — L^*_{ab}, C^*_{ab} and h_{ab} values of the nominal primary and secondary colours for the reference colour gamut

Component	Red	Yellow	Green	Cyan	Blue	Magenta
L^*_{ab}	41	95	60	50	21	42
C^*_{ab}	98	123	100	76	95	102
h_{ab}	29	90	140	220	300	340

Annex C
(normative)

Checksum data

The checksums given in Table C.1 may be used to check the data integrity. These values are calculated by summing each image plane (CIE L, A and 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 checksums apply only to the image data and exclude any headers.

Table C.1 — Checksum

Image	Decimal				Hex			
	L	A	B	T	L	A	B	T
Bride and groom	220	190	16	170	DC	BE	10	AA
People	126	122	85	77	7E	7A	55	4D
Cashew nuts	154	98	41	37	9A	62	29	25
Meal	14	220	113	91	0E	DC	71	5B
Mandolin	6	174	143	67	06	AE	8F	43
Tailor	14	0	167	181	0E	00	A7	B5
Wool	78	91	13	182	4E	5B	0D	B6
Fruits	56	208	116	124	38	D0	74	7C

Annex D
(informative)

Typical TIFF file headers used for image data

This annex shows an example of the TIFF file header for the CIELAB file of image N1, “Bride and groom”, of CIELAB/SCID image set.

The TIFF file header encoding of the colour picture file named “N1.TIF” in the CIELAB set of CIELAB/SCID is shown in Figure D.1. This encoding uses tags defined in TIFF 6.0. The **PhotometricInterpretation** tag is set to 8 (CIELAB) in this file.

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

Table D.1 — Default fields for TIFF file headers

Field	Value	Interpretation
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	000F					Number of entries in this IFD: 15 entries in this IFD
	Tag#	Type	Count	Value -offset		
0000000A	0100	0003	00000001	0C00xxxx	256	ImageWidth: 2056 pixels/line
00000016	0101	0003	00000001	1000xxxx	257	ImageLength: 2048 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:8 (CIELAB)
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	01E00000	279	StripByteCounts: 31,457,280 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	0002xxxx	296	ResolutionUnit: dot/inch
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	00000000					Pointer to next IFD: None
		Value area				
00000200	0010	0010	0010			BitsPerSample: 16,16,16,(16 -bits/sample for each separation)
00000206	42 52 49 44 45 20 41 4E 44 20 47 52 4F 4F 4D 4C 41 42 00 xx xx xx xx xx xx					ImageDescription: “BRIDE AND GROOMLABn”
00000220	49 53 4F 20 54 43 31 33 30 2F 57 47 32 00 xx xx					Make(Vendor name): “ISO TC130/WG2n”
00000230	002DC6C0 00002710					XResolution: 3000000/10000 (300 dpi)
00000238	002DC6C0 00002710					YResolution: 3000000/10000 (300 dpi)
00000240	32 30 30 35 3A 30 37 3A 30 31 20 31 30 3A 30 30 3A 30 30 00 xx xx xx xx					DateTime: “2005:07:01 10:00:00n” (July 1, 2005 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 – 01E003FF						Image data area is from 00000400h to 01E003FFh

Figure D.1 — TIFF file header encoding of the colour picture file named “N1.TIF”

Annex E
(informative)

Text insertion

Each image has a label consisting of a text identifier on a rectangular background inserted into the image. Pixels representing this text have an L^* value of 100, representing the reference medium white point. The label background has an L^* value of 3, corresponding to the reference medium black point. This label serves to distinguish between images of this part and images of the other parts of ISO 12640.

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 E.1. The position of the text in each image (in terms of number of pixels) is given in Table E.1.

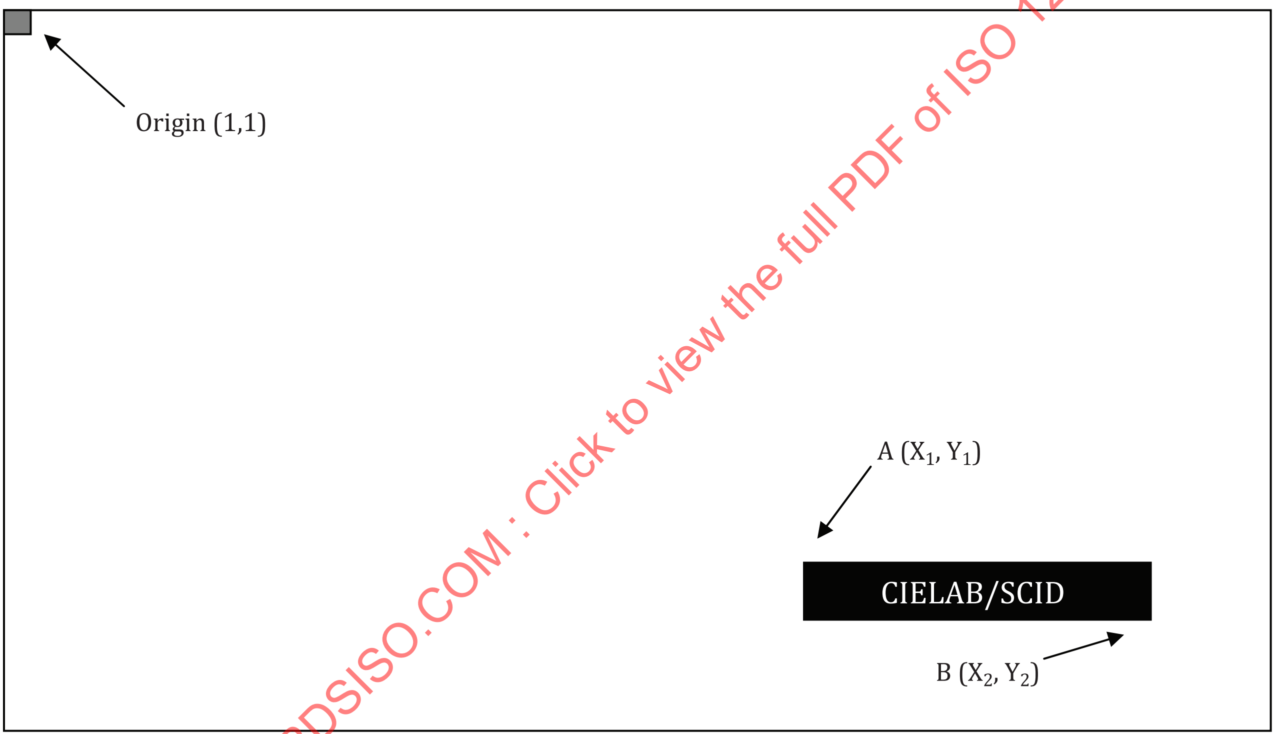


Figure E.1 — Definition of the co-ordinates of the text insertions

Table E.1 — Position of the text in each image

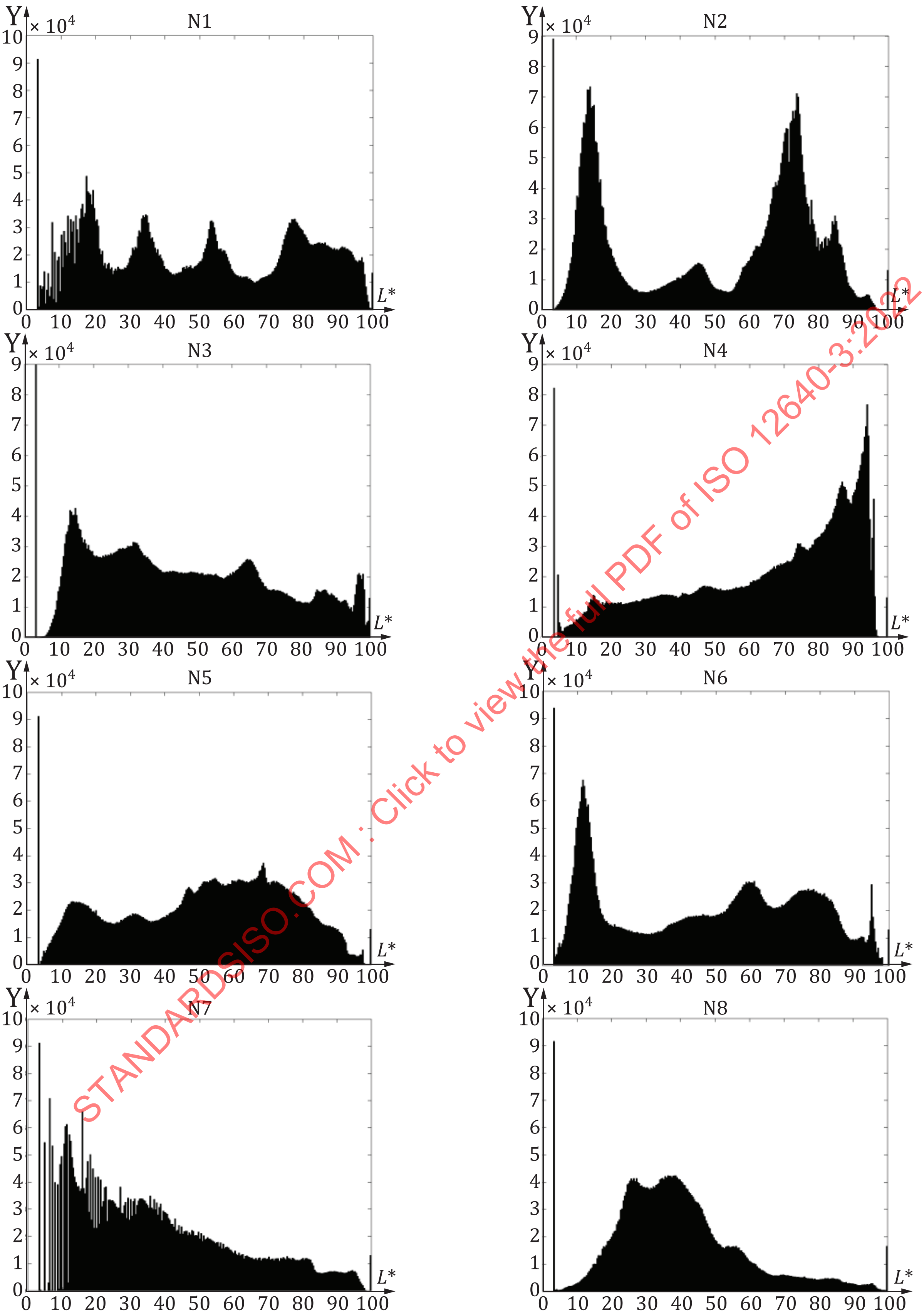
Image	Name	A (X_1, Y_1)	B (X_2, Y_2)
N1	Bride and groom	(1 601, 1 870)	(2 560, 1 982)
N2	People	(1 225, 1 753)	(2 184, 1 865)
N3	Cashew nuts	(1 089, 2 448)	(2 048, 2 560)
N4	Meal	(1 601, 1 936)	(2 560, 2 048)
N5	Mandolin	(1 046, 2 411)	(2 005, 2 523)
N6	Tailor scene	(1 583, 1 900)	(2 542, 2 012)
N7	Wool	(1 601, 1 936)	(2 560, 2 048)
N8	Fruits	(1 065, 1 912)	(2 024, 2 024)

Annex F
(informative)

Histogram and gamut plots

F.1 Histograms

Histograms of the L^* values for each natural image, are shown in Figure F.1.



Key

Y counts

N1 bride and groom

N2 people

N3 cashew nuts
N4 meal
N5 mandolin
N6 tailor scene
N7 wool
N8 fruits

Figure F.1 — Histograms of the L^* values for each natural image

F.2 Gamut plots

a^* versus b^* plots, for each natural image, are shown in Figure F.2.