INTERNATIONAL STANDARD

ISO/IEC 15775

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Information technology — Office machines — Method of specifying image reproduction of colour copying machines by analog test charts — Realisation and application

Technologies de l'information — Machines de bureau — Méthode de spécification de la reproduction d'image des copieuses couleur par des organigrammes d'essai analogiques — Réalisation et application

Reference number
ISO/IEC 15775:1999(E)

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

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

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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

International Standard ISO/IEC 15775 was prepared by DIN (as DIN 33866) and was adopted, under a special “fast-track procedure”, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

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

Information technology –– Office machines –– Method of specifying image reproduction of colour copying machines by analog test charts –– Realisation and application

1. Scope

This International Standard applies to implementation and application of test charts for colour copying machines. This International Standard serves for testing of reproduction properties of colour copying machines, in order to help to recognize the possibilities and limits of various machines and for their comparison.

To use this International Standard, make copies of at least two test charts (one achromatic and one chromatic) out of eight test charts using the device to be tested. The resulting copies shall be examined visually and may be compared with the original test charts. Objective measurements may be made for these copies.

Eight ISO-test charts, four in halftone (offset reproduction) and four in continuous tone (photographic reproduction), belonging to this International Standard may be produced by different manufacturers. Information about where to obtain test chart layout and colorimetric *L*a*b** data to produce the charts may be found in Annex M.

All hard copy patterns (analog test charts) produced according to this International Standard should be discarded after three years.

2. Normative References

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

ISO 216:1975, *Writing paper and certain classes of printed matter – Trimmed sizes – A and B series.*

ISO 536:1995, *Paper and board – Determination of grammage.*

ISO 554:1976, *Standard atmospheres for conditioning and/or testing – Specifications.*

ISO 2469:1994, *Paper, board and pulps – Measurement of diffuse reflectance factor.*

ISO 2471:1998, *Paper and board – Determination of opacity (paper backing) – Diffuse reflectance method.*

ISO 2846-1:1997, *Graphic technology – Colour and transparency of ink sets for four-colour-printing – Part 1: Sheetfed and heat-set web offset lithographic printing.*

ISO 5627:1995, *Paper and board – Determination of smoothness (Bekk method).*

ISO 5651:1989, *Paper board and pulps – Units for expressing properties.*

ISO 5737:1983, *Prints – Preparation of standard prints for optical tests.*

ISO 7724-1:1984, *Paints and varnishes – Colorimetry – Part 1: Principles.*

ISO 7724-3:1984, *Paints and varnishes – Colorimetry – Part 3: Calculation of colour differences.*

ISO 8596:1994, *Ophthalmic optics – Visual acuity testing – Standard optotype and its presentation.*

ISO 8597:1994, *Optics and optical instruments – Visual acuity testing – Method of correlating optotypes.*

ISO 12641:1997, *Graphic technology – Prepress digital data exchange – Colour targets for input scanner calibration.*

ISO/CIE 10526:1991, *CIE standard colorimetric illuminants.*

ISO/CIE 10527:1991, *CIE standard colorimetric observers.*

CIE publ. 13.3:1995, *Colour rendering – Method of Measuring and Specifying Colour Rendering Properties of Light Sources.*

CIE publ. 15.2:1986, *Colorimetry.*

DIN 6160:1996, *Anomaloscopes for the diagnosis of red-green colour vision deficiencies (or equivalent).*

DIN 33866-2:1998, *Information technology – Office machines – Colour image reproduction devices – Method of*

specifying image reproduction of colour copying machines by analog test charts.

DIN 58220-5:1996, *Test of visual acuity – Part 5: General test of vision.*

ITU-R BT.709-2:1995, *Parameter Values for the HDTV Standards for Production and International Programme Exchange.*

3. Definitions

For the purposes of this International Standard the following definitions apply.

3.1
colour rendering
relation between the original colour of an object and its reproduction colour either exclusively under other illuminant or additionally after passing through a transfer process

NOTE For calculation with colours of this International Standard see Annex G.

3.2
original colour
the perceived colour of an object in reference condition which is being referred to at the assessment of the colour rendering

3.3
non-luminous (perceived) colour
colour of a non-luminous colour, i. e. an area that requires a reflecting light for its appearance

3.4
standard tristimulus values *X, Y, Z*
describe the psychophysical colour

NOTE 1 Standard tristimulus values are mostly received as an immediate result of a colour measurement

NOTE 2 As standard tristimulus values only allow statements referring to equality of two colours, for statements made beyond that, e. g. concerning the kind and size of colour differences, non-linear transformations of *X, Y, Z* into other colorimetric parameters systems preferably into the colorimetric parameters *L*, a*, b** are necessary.

3.5
colour difference ΔE^*_{ab}
specifies the size of the difference between two colour stimuli

3.6
lightness *L**
the power of a perceived light (inseparably combined with perceived colour)

3.7
chroma *C**
the difference of a colour from the equal light achromatic colour

NOTE The saturation describes the ratio of chroma to lightness *(C* / L*)*.

3.8
Landolt-ring
standard optotype defined by a ring with an open segment which can be in 8 different positions

4. Test Charts

This International Standard identifies the techniques to manufacture test charts. Four test charts are produced by different manufacturers both in halftone and continuous tone. For the tests according to this International Standard two or more out of eight test charts are used, at least one achromatic test chart (1 or 3) and at least one chromatic test chart (2 or 4),

On each test chart there is a picture area and a frame area around it, see Figure 1. Each of the test charts 1, 2, 3 and 4 contains a form (see Annex A, B, C, and D respectively) used for visual tests of the picture area and two forms (see Annex E and F) used for tests of the frame area around it.

At least four forms must be filled out, two for an achromatic test chart (no. 1: form A and E **or** no. 3: form C and E) and two for a chromatic test chart (no. 2: form B and F **or** no. 4: form D and F). The four forms filled out should belong to two test charts both either in halftone or continuous tone.

NOTE Colour copying machines are often used for reproduction of achromatic charts. Therefore an achromatic test chart should also be used for testing colour copying machines.

4.1 Material of test charts

The material of test charts depends on whether the chart is halftone or continuous tone.

4.1.1 Examples of material for halftone test charts available as ISO 15775 test charts.

Test Chart 1: Photographic paper for black and white pictures, glossy, 85 g/m^2
Test Chart 2: Fine art paper, glossy, natural white, non-fading, 100 per cent non-chlorine bleached, 150 g/m^2
Test Chart 3: Fine art paper, glossy, natural white, non-fading, 100 per cent non-chlorine bleached, 150 g/m^2
Test Chart 4: Fine art paper, glossy, natural white, non-fading, 100 per cent non-chlorine bleached, 150 g/m^2
Characteristic of example production see Table L.1. in Annex L.

4.1.2 Examples of materials for continuous tone test charts available as ISO 15775 test charts

Test Chart 1: Photographic paper for colour pictures, glossy, 225 g/m^2
Test Chart 2: Photographic paper for colour pictures, glossy, 225 g/m^2
Test Chart 3: Photographic paper for colour pictures, glossy, 225 g/m^2
Test Chart 4: Photographic paper for colour pictures, glossy, 225 g/m^2
Characteristic of example production seeTable L.2 in Annex L.

4.2 Layout of test charts

The layout of the test charts is defined in the standard format A4 (297 mm x 210 mm) within *PostScript(PS)*-files (or equivalent). The following layout is reduced to half size. One can find the layout in standard format A4 on different web servers (see Annex M). The following figures 1 to 3 show the layout and in figures 4 to 7 the content is shown.

4.2.1 Basic layout of the picture area and the frame area around

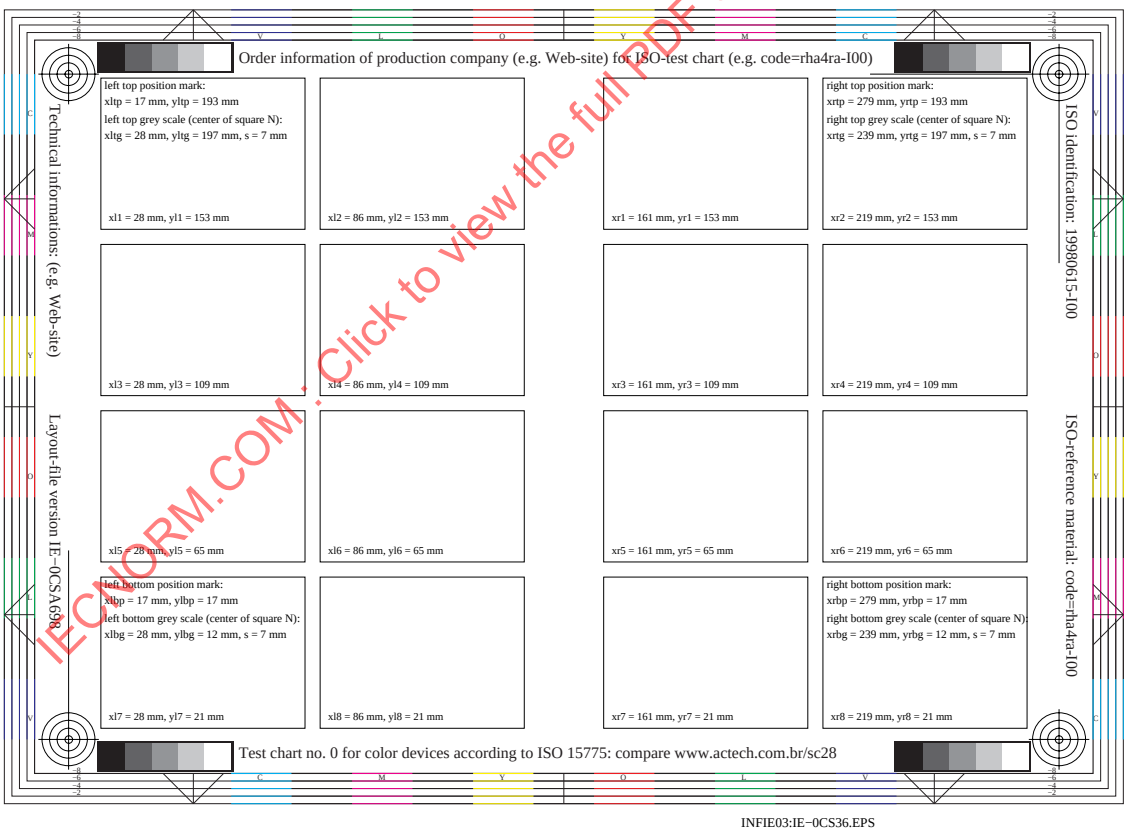

Figure 1: Basic layout of the figures and the frame area around

Figure 1 shows the basic layout of the test charts which includes in the central area the layout of 16 pictures (without content) and in the frame area around text and other elements. The basic format is A4 (297 mm x 210 mm) described by the outer rectangle. The inner rectangle has a thicker line (0,30 mm instead of 0,15 mm) and the size is 282 mm x 194 mm.

Figure 1 includes *x*- and *y*-data in mm for all test elements shown with an arrow point at the left bottom corner of the

format A4. One can find the *x*- and *y*-data of:

- left bottom corner of 16 pictures
- four position marks
- center of four squares with black colours N of a 5-step grey scale
- five rectangles located 2 mm up and to the right compared to the outer one and 4 mm smaller on both sides.

NOTE 1 Arrows help to detect the distance to the outer rectangle of the format A4. There is no visual test based on arrows within this International Standard.

NOTE 2 There are some additional lines dividing the format A4 in four equal formats A6. There is a need to get the pixel picture B1 (equal to D1) in the format A6 and on slide and negative film for special applications. The four parts of the format A6 can be mounted to one part of the format A4 if this is useful for special applications.

NOTE 3 The position marks allow exact positioning of colorimeters to measure the *L*a*b** colorimetric data for the colour samples in the test charts. Figures 2 and 3 includes the position data of all samples in all test charts and simplifies colorimetric measurements.

4.2.2 Layout of the picture area and the frame area around of test charts 1 to 4

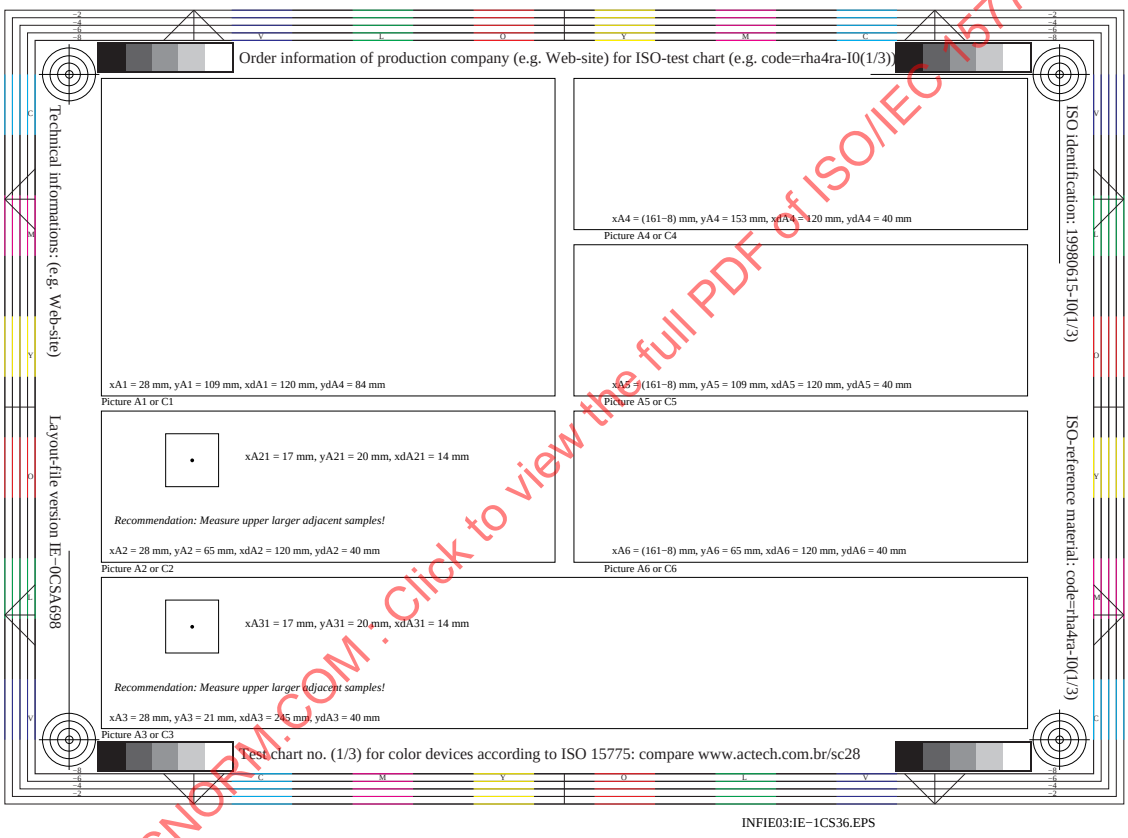

Figure 2: Layout of picture and frame area of test charts 1 and 3

Figure 3: Layout of picture and frame area of test charts 2 and 4

Figure 2 shows the layout of test charts 1 and 3 with six pictures and a frame area around. The layout of the pictures and the frame area is very similar to the basic layout of Figure 1. Instead of 16 there are now six pictures A1 to A6 and C1 to C6 in test charts 1 and 3 respectively.

Within the area of pictures A2 and A3 there is a square which represents the first sample (black) of the 5-step and 16-step grey scales. The *x*- and *y*-data of the square center is given relative to the left bottom corner of pictures A2 and A3. The grey sample distance of the 5- or 16-step grey series is 14 mm.

NOTE There are two additional samples which appear black *(N_0)* and white *(W_1)*. In digital *PS*-files (or equivalent) absolute or relative colorimetric space with lightness L^* **or** $l^*_{relative} = (L^* - L^*_N) / (L^*_W - L^*_N)$ can be used. The colorimetric data $L^* = 0$ and $L^* = 100$ produce the darkest black *(N_0)* and lightest white *(W_1)* on the material used, which may be different compared to L^*_N and L^*_W of the contrast range.

Figure 3 shows the layout of test charts 2 and 4 with seven pictures and a frame area around. The layout of the pictures and the frame area is very similar to the basic layout of Figure 1. Instead of 16 there are now seven pictures B1 to B7 and D1 to D7 in test charts 2 and 4 respectively.

Within the pictures B1 and B3 (or D1 and D3) there are two squares which represent the first CIE-test colour and the black sample of the 16-step grey scale. The *x*- and *y*-data of the square centers are given relative to the left bottom corner of pictures B1 and B3 (D1 and D3). The sample distance of the steps is 7,7 mm.

Within the picture B4 (or D4) there are four squares which represent the first samples of colour series *W–C*, *W–M*, *W–Y*, and *W–N* (or *W–O*, *W–L*, *W–V*, and *W–N*). The sample distance of the steps is 7,0 mm.

4.2.3 Restrictions for layout and content of picture B1

In picture B1 of test chart 2 (which is identical to picture D1 of test chart 4) the subject matter may be chosen by the manufacturer. Any picture which satisfies the following restrictions is allowed for an ISO-test chart manufacturer:

The picture B1 consists of three parts (compare layout of picture B1 in Figure 5).

Restrictions for the three parts of the picture B1:

Part 1: The picture must include a large variety of colours in the upper part (130 mm x 60 mm).
Part 2: 14 CIE-test colours plus black N_0 (darkest black) and white W_1 (whitest white) (130 mm x 11 mm).
Part 3: 16-step equidistant gray scale between black *N* ($L^*_N = 10$) and white *W* ($L^*_W = 94$) (130 mm x 15 mm).

NOTE An ISO-test chart manufacturer can add in part 1 a black and white Siemens-star equal in size and colour (L^*_N and L^*_W) to the Siemens-star *N–W* of picture B2. A user will get important information about the actual resolution of identical Siemens-stars by the pixel image (picture B1) and direct vector based reproduction (picture B2).

The intended colorimetric data for the 14 CIE-test colours and the 16-step equidistant grey samples are equal to the intended data of these colours in picture B3.

NOTE 1 The photographic process (film material, taken illuminant exposure, development) used to take the picture B1 (with the three parts in one exposure) and the scanning process producing the digital image will result in different CIE-test colours and grey samples in pictures B1 and B3.

NOTE 2 By a least squares technique, a transform of the digital image data (e.g. *RGB*) is used to calculate *L*a*b** colorimetric data. If the *L*a*b**-data of picture B1 are equal within 3 CIELAB units to the *L*a*b**-data of picture B3 then the colours in picture B1 and B3 appear equal.

4.2.4 Restrictions for digital image data and resolution of picture B1

ISO-test chart manufacturers must publish *RGB*-image data of the picture B1 in five resolutions:
192 x 128, 384 x 256, 786 x 512, 1536 x 1024, and 3072 x 2048.

NOTE 1 *RGB*-image data in these five resolutions may be (for example) produced by the *KODAK*-Photo-CD-process with the option „Transfer to *EPS (Encapsulated PostScript)* (or equivalent) with 24 bit colour“.

NOTE 2 A transform from *RGB*-image data to *L*a*b**-image data may be recommended by the ISO-test chart manufacturer.

NOTE 3 In ISO-test charts within the header of the *EPS*-file (or equivalent) of the picture B1 numerical data of a 3x4 matrix transform are given. The transformation from *RGB*-image data to *L*a*b**-image data may be (for example) calculated by a *PS*-interpreter (or equivalent).

NOTE 4 The transformation from *RGB*-image data to *L*a*b**-image data is equal for all image resolutions. The lowest resolution can be used to get a table of the *RGB*-image data of the 32 colours (14 CIE-test colours + N_0 + W_1 and the 16-step grey samples).

NOTE 5 The intended CIE-test and grey colours are known. This allows to calculate an optimized transformation from *RGB*-image data to *L*a*b**-image data.

NOTE 6 For negative film between 2 stops underexposure and 3 stops overexposure the *RGB*-image data are very different. An optimized transform leads to *L*a*b**-image data which produce very similar output.

4.2.5 Restrictions for producing ISO-test charts in halftone technique

A test pattern producer can use any line screen and must disclose the line screen used. The line screen used must be described by a complete definition of the halftone type.

The halftone type definition includes either the entries:

„Width, Height and Threshold“ of „HalftoneType 3“
and/or
„Frequency, Orientation and SpotFunction“ of „HalftoneType 1“

An example of an „HalftoneType 3“-matrix used to produce halftone test charts is given in Annex J.

NOTE 1 This allows repeating the production at any time.

NOTE 2 Copiers often produce different output with test charts of identical colorimetric *L*a*b**-data but with a different halftone type.

4.3 Layout files and *EPS*-picture files (or equivalent)

Standard *PS*- and *PDF*-layout files (or equivalent) produce the A4-layout of the ISO-test charts. The standard layout files produce only the layout without any picture content.

At specific lines within a *PS*-layout file (or equivalent) the content of the pictures is included. The content is defined in „*EPS*-picture files“ (or equivalent).

Each *EPS*-picture file (or equivalent) of test charts 1 and 3 produces only one picture different in size between 120 mm x 40 mm (A2, A4, A5, and A6), 120 mm x 84 mm (A1), 245 mm x 40 mm (A3) (see Figure 2).

Each *EPS*-picture file (or equivalent) of test charts 2 and 4 produces only one picture different in size between 130 mm x 86 mm (B1), 130 mm x 40 mm (B2 and B3), and 112 mm x 40 mm (B4, B5, B6 and B7) (see Figure 3).

One can find the *EPS*-picture files (or equivalent) as „Technical information“. The standard *EPS*-picture files produce the picture content located 25,4 mm in *x*- and *y*-direction from the left bottom corner of the output paper (see Annex M).

4.4 Digital *PS*-files and *PDF*-files (or equivalent) for ISO-test charts

Combined *PS*-files (or equivalent) include both the layout specification and the picture content. These *PS*-files (or equivalent) are called the ***„digital“*** ISO-test charts no. 1 to 4. They are shown in Figure 4 to Figure 7 reduced to half size.

NOTE The output of line rasters in pictures A5, A6, C5, and C6 is often different for *PS*- and *PDF*-files (or equivalent). ISO-test charts 1 and 3 show the reference output with line rasters.

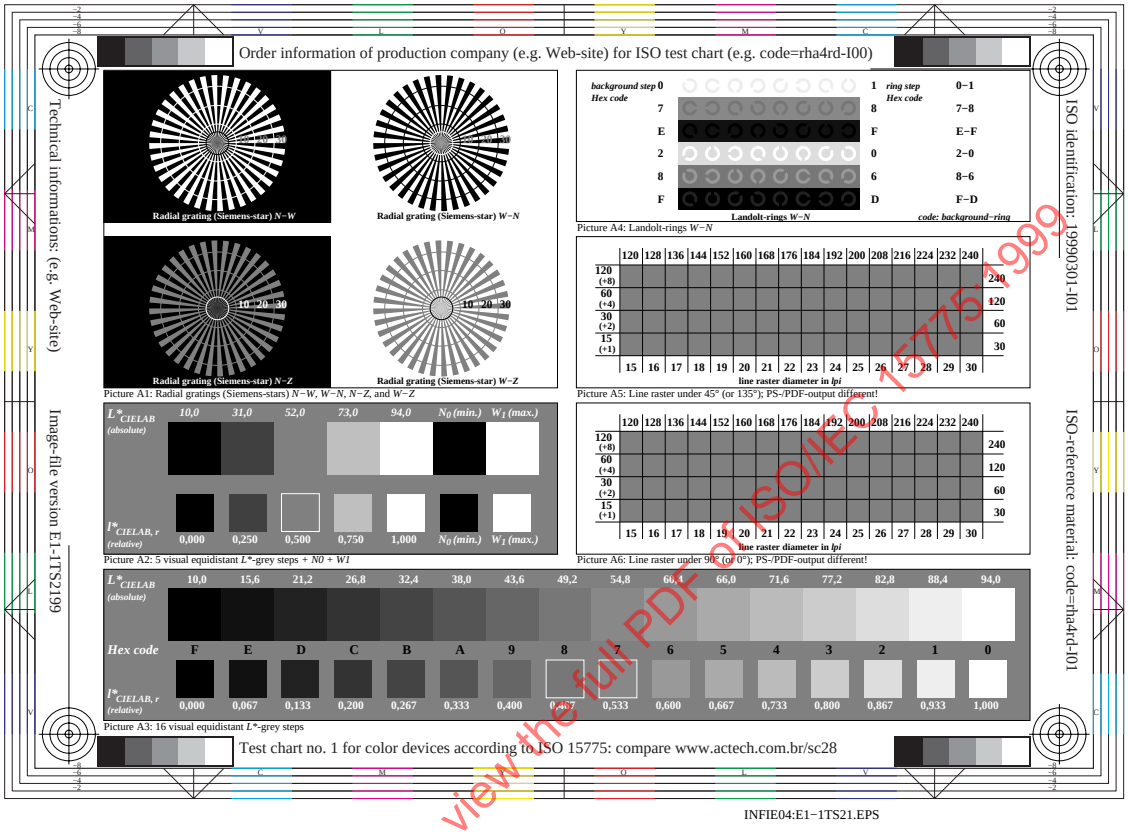

Figure 4: *PS*-file (or equivalent) output of digital ISO-test chart 1 (reduced to half size)

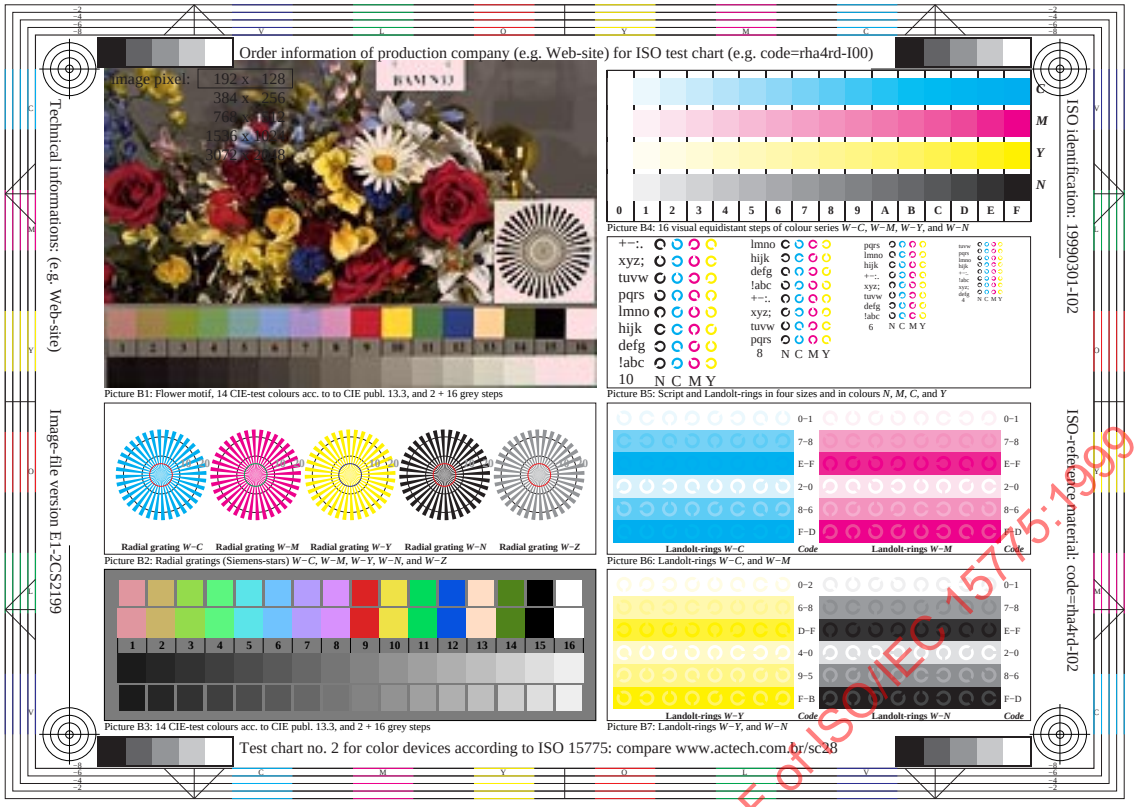

Figure 5: *PS*-file (or equivalent) output of digital ISO-test chart 2 (reduced to half size)

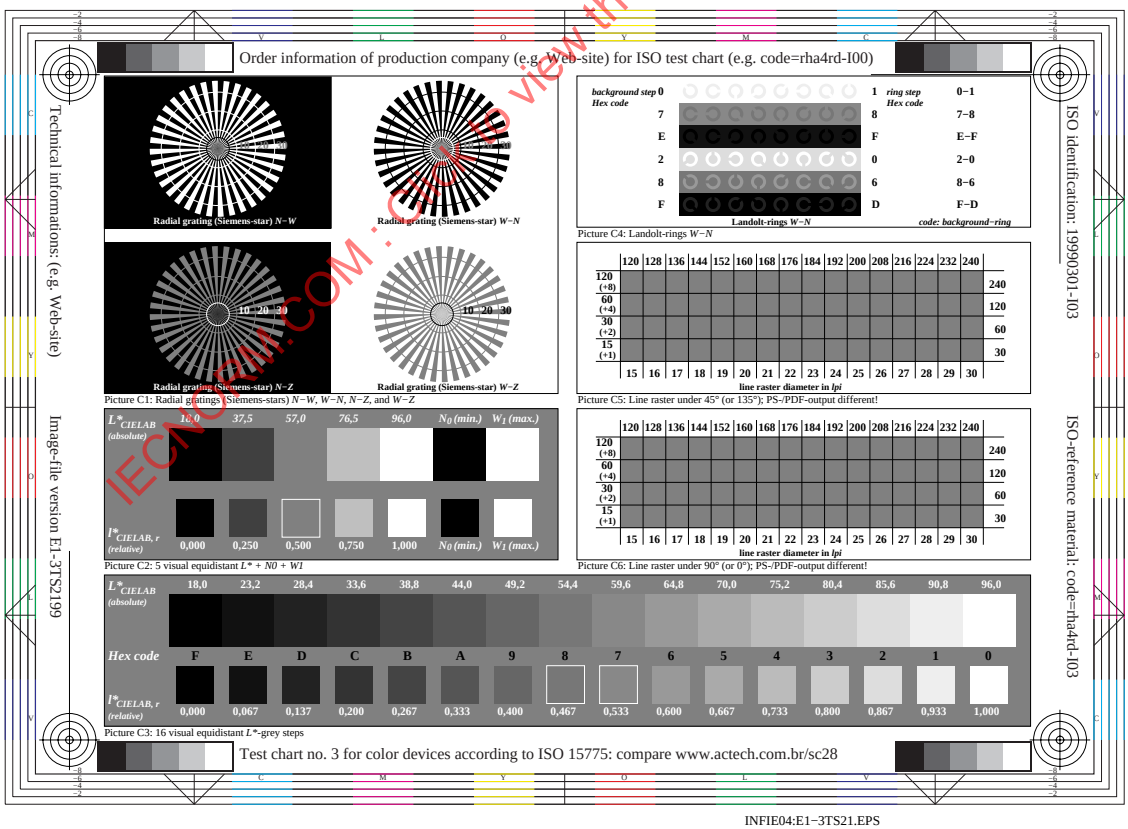

Figure 6: *PS*-file (or equivalent) output of digital ISO-test chart 3 (reduced to half size)

Figure 7: *PS*-file (or equivalent) output of digital ISO-test chart 4 (reduced to half size)

The output of the digital standard *PS*-files (or equivalent) in the format A4 are shown separately on web sites (see Annex M). Manufacturers of ISO-test charts will use these digital *PS*-files (or equivalent) as starting files for the production of analog ISO-test charts 1 to 4.

The digital ISO-test charts include both the layout and the picture content including the colorimetric data of each test sample. Most of the intended colorimetric data one can find in Table 1 and Table 2, and in Annex G and H. The colorimetric agreement of the produced colours of analog test charts and the intended colours of digital test charts can be measured and evaluated by the method given in Annex G and H.

4.5 Production of ISO-test charts

The production of the ISO-test charts by different manufacturers will show colorimetric differences. No colorimetric tolerance is given within this International Standard for the manufacturers. The differences between intended and produced colours with the production of ISO-test charts 1 to 4 are given in Table 3, Table 4 and Tables H.1 to H.11 of Annex H. Differences between intended and produced colours in these tables set an orientation tolerance for a possible ISO-colorimetric tolerance in the future.

All hard copy patterns (analog test charts) produced according to this International Standard should be discarded after three years. Due to time, temperature, and humidity, they change and therefore need replacement. Test charts should be kept in a sealed opaque container when not in use.

The usage of the produced ISO-test charts is limited for a three years time beginning with the ISO identification date.

4.6 Intended printing colours and comparison with produced colours

Table 1: Intended printing colours *CMYOLVNW* and comparison with produced colours

Basic test colour	Intended CIELAB data ISO-2846 (CMYNW) DIN-33866 (OLV)				Produced CIELAB data DIN-33866 (all) ITU-R BT709.2 (all)			CIELAB differences of test colours Difference (o−r)			CIELAB-test colour difference	
name	L^*_r	a^*_r	b^*_r		L^*_o	a^*_o	b^*_o	ΔL^*_{o-r}	Δa^*_{o-r}	Δb^*_{o-r}	ΔE^*_{ab}	
C	58.62	−30.62	−42.74		59.96	−27.8	−43.15	1.34	2.82	−0.4	3.15	
M	48.13	75.2	−6.79		49.19	74.03	−7.4	1.06	−1.16	−0.6	1.69	
Y	90.37	−11.15	96.17		87.12	−5.58	105.61	−3.24	5.57	9.44	11.43	
O	47.94	65.31	52.07		47.94	65.31	52.07	0.0	0.0	0.0	0.01	
L	50.9	−62.96	36.71		50.9	−62.96	36.71	0.0	0.0	0.0	0.01	
V	25.72	31.45	−44.35		25.72	31.45	−44.35	0.0	0.0	0.0	0.01	
N	18.01	0.5	−0.46		17.16	−0.06	−2.71	−0.84	−0.56	−2.24	2.47	
W	95.41	−0.98	4.76		94.98	−0.58	3.28	−0.42	0.4	−1.47	1.59	**2.5**
C	58.62	−30.62	−42.74		86.88	−46.17	−13.56	28.26	−15.54	29.18	43.5	
M	48.13	75.2	−6.79		57.3	94.35	−20.7	9.17	19.15	−13.9	25.38	
Y	90.37	−11.15	96.17		92.66	−20.7	90.75	2.29	−9.54	−5.41	11.22	
O	47.94	65.31	52.07	***(R)***	50.5	76.92	64.55	2.56	11.61	12.48	17.24	
L	50.9	−62.96	36.71	***(G)***	83.63	−82.76	79.9	32.73	−19.79	43.19	57.69	
V	25.72	31.45	−44.35	***(B)***	30.39	76.06	−103.59	4.67	44.61	−59.23	74.31	
N	18.01	0.5	−0.46		1.57	0.0	0.0	−16.43	−0.49	0.47	16.45	
W	95.41	−0.98	4.76		95.41	0.01	0.01	0.0	1.0	−4.74	4.85	**31.5**

INFIE06:IETA011.EPS

Table 1 shows intended colours *CMYOLVNW* compared to produced colours of DIN 33866 in the upper part. The intended colours are additionally compared with television colours acc. to ITU-R BT709.2 in the lower part.

ISO-2846-1: 1997 defines in an *informative* Annex D in Table D.3 the intended colours of offset printing. Five colours $CMYNW_{PR}$ (PR = Print) are given for CIE-standard illuminant D65, the 2°-standard observer and the 45°/0°-standard geometry. Additionally a nonfluorescent reference paper is described. The chromatic colours OLV_{PR} are not given.

The DIN 33866 test charts 2 to 4 are produced on this ISO-reference paper *W* and with chromatic inks $CMYN_{PR}$ acc. to ISO 2846.

The colorimetric data *L*a*b** of reference (r = ISO 2846-1:1977, Table D.3) and the average colorimetric data of production (o = output) are given in the upper part of Table 1. The differences between reference and production (output) are small for the colours $CMYNW_{PR}$. The largest difference is ΔE^*_{ab} = 11,43 for yellow *Y* and the average difference is $\Delta E^*_{ab,m}$ = 2,5. One must have in mind that less than three units between pictural images cannot be detected by human viewers. Therefore we can add the colours *OLV* of production to get the colorimetric *L*a*b**-data for the full intended colour set $CMYOLVNW_{PR}$.

One must remember that this International Standard is used for colour copying machines and only the difference between copy and reference is of importance and not the absolute colorimetric *L*a*b**-data.

In DIN 33866 the short terms *OLV* are used for the colours OLV_{PR}. These short terms help to keep in mind that there are very large differences compared to the colours OLV_{TV} which are in standards usually called *RGB*. The short terms *RGB* used for colours on monitors conflict with the short terms *R*, *G*, and *B* for elementary colours (see Annex K).

In the lower part of Table 1 the printing colours are compared to the television colours defined in ITU-R BT709.2 for CIE-standard illuminant D65 and the 2°-standard observer. The normalization to *L** = 95,41 for white D65 as defined in ISO-2846 for white is used (see tables in DIN 33866-1). This part shows the differences between the colours $CMYOLVNW_{PR}$ and $CMYOLVNW_{TV}$. There are differences up to ΔE^*_{ab} = 74 for the colour violet blue *V* (called blue *B* in television) and the average difference is $\Delta E^*_{ab,m}$ = 31,5.

Table 2: Reference and production of CIE-test colours

CIE test colour	Intended CIELAB data CIE publ. 13.3 Reference (r)			Produced CIELAB data DIN 33866, Picture B6 Output (o)			CIELAB differences of test colours Difference (o−r)			CIELAB-test colour difference
no.	L^*_r	a^*_r	b^*_r	L^*_o	a^*_o	b^*_o	ΔL^*_{o-r}	Δa^*_{o-r}	Δb^*_{o-r}	ΔE^*_{ab}
1	61.45	17.53	11.74	56.8	12.93	19.6	−4.64	−4.59	7.86	10.23
2	60.69	0.08	28.92	55.0	−2.42	35.85	−5.68	−2.5	6.93	9.31
3	62.02	−20.58	44.41	56.74	−24.61	42.51	−5.27	−4.02	−1.89	6.91
4	61.2	−33.16	17.07	60.9	−48.14	23.62	−0.29	−14.97	6.55	16.35
5	62.4	−17.47	−8.55	58.17	−19.98	−13.31	−4.22	−2.5	−4.75	6.84
6	61.51	−0.36	−28.39	57.44	0.1	−31.83	−4.06	0.47	−3.43	5.35
7	61.12	20.15	−24.55	56.85	18.29	−25.86	−4.26	−1.85	−1.3	4.84
8	62.77	27.42	−13.63	57.87	27.63	−21.75	−4.89	0.21	−8.11	9.49
9	39.92	58.74	27.99	41.87	38.7	33.27	1.95	−20.03	5.28	20.82
10	81.26	−2.89	71.56	75.56	4.2	74.01	−5.69	7.1	2.45	9.43
11	52.23	−42.42	13.6	47.15	−47.28	18.53	−5.07	−4.85	4.93	8.59
12	30.57	1.41	−46.47	34.8	1.37	−28.6	4.23	0.03	17.87	18.36
13	80.23	11.37	21.04	77.59	15.62	29.57	−2.63	4.25	8.53	9.89
14	40.75	−13.8	24.23	36.07	−18.23	23.81	−4.67	−4.42	−0.41	6.46
							Mean CIELAB colour difference:			$\Delta E^*_{ab,m}$ = ***10.2***

INFIE06:IETA021.EPS

Table 2 shows intended CIE-test colours compared to produced CIE-test colours in DIN-test chart 2, picture B6. The mean CIELAB colour difference is $\Delta E^*_{ab,m}$ = 10. The largest colour differences occur for the CIE-test colours red (no. 9) and blue (no. 12) with ΔE^*_{ab} = 20,82 and 18,36 respectively.

The intended and produced colours may differ. The original test charts produced by different manufacturers may be different. Therefore copies from a specific original should only be compared with each other or with the original which was used to produce the copies.

4.7 ISO-identification, ISO-reference material code, and ISO-image file version

Different ISO-codes are useful to manage, sort and distinguish the different ISO-test charts.

The figures 1 to 7 include examples of the following codes:

- ISO-reference material code on the right bottom side
- ISO-identification code on the right top side
- ISO-image version code on the left bottom side

The ISO-reference material code is decribed in the following Table 3.

Table 3: ISO-reference material code and examples for colour copying machines

ISO-Reference materials for colour devices in different sizes and modes

1. Different sizes: A4, A6, 36 mm x 24 mm slide or negative film
2. Different tone techniques: continuous tone or halftone
3. Different modes: reflectance or transmittance mode
4. *PS*-program code (digital) or image to be viewed and measured (analog)

Colour device = Colour copying machine

Example 1: Copy halftone test charts 2 to 3 and compare

Test chart 1	**Test chart 2**	**Test chart 3**	**Test chart 4**
N-photographic	***CMYN-offset***	***N-offset***	***OLVN-offset***
iha4ra = rha4ra	**iha4ra = rha4ra**	**iha4ra = rha4ra**	iha4ra = rha4ra
oha4ra<>rha4ra	**oha4ra<>rha4ra**	**oha4ra<>rha4ra**	oha4ra<>rha4ra

Example 2: Copy continuous tone test charts 1 to 2 and compare

Test chart 1	**Test chart 2**	**Test chart 3**	**Test chart 4**
N-photographic	***CMYN-photogr.***	***N-photographic***	***OLVN-photogr.***
ica4ra = rca4ra	**ica4ra = rca4ra**	*ica4ra = rca4ra*	ica4ra = rca4ra
oha4ra<>rca4ra	**oha4ra<>rca4ra**	*oha4ra<>rca4ra*	oha4ra<>rca4ra

Abbreviation at code-position: (<> compare ... with ...)
Test chart for test mostly used: **bold font**, frequently used: *italic font*

position no. 1:	i=input; o=output; r=reference
position no. 2:	c=continuous tone; h=halftone
position no. 3 and 4:	a4=format A4; a6=A6, sf=slide or nf=negative film
position no. 5:	r=reflectance mode; t=transmittance mode
position no. 6:	a=analog mode; d=digital mode

INFIE06:IETA031.EPS

Table 3 shows the information for the ISO-reference material code and two examples for colour copying machines. In the lower part of Table 3 the abbreviations at code-positions 1 to 6 are given. Example codes for a colour copying machine with different test charts are given in the central part.

The ISO-identification code consists of the date (year, month, day), e. g. 19980615, the letter I (= ISO) and the ISO-test chart number (= 01 to 04). For more details see Annex I.

NOTE The date within the identification code should be the production date of the test pattern. This date helps to decide whether the ISO-test chart can be used or should be discarded after the three years time beginning with the production date.

The ISO-image version code consists of the letter E (for E = english text), the digits 1 to 5 (for 5 different resolutions: 192 x 128 up to 3072 x 2048), the letter T (for text mode) or C (for colour mode), the letter S (for *PostScript*-format) or D (for *PDF*-format), and two digits for a version number. For more details see Annex I.

4.8 Content and purpose of frame area of the test charts

The ISO-test charts 1 to 4 contain a picture area and a frame area around. The frame area is very similar on all test charts and described here. The picture area is described in 4.9 separately for ISO-test charts 1 to 4.

In the frame area there are different text and image elements: text with codes for identification, rectangles, 5-step grey scales, and position marks.

NOTE Some frame area specifications can not work exactly if users place the test charts on the platen-glass inadequately.

Use of text with codes for identification:

Content:
The text in the frame region describes the ISO-test chart number, the ISO-identification code, the ISO-reference material code, the image file version of the test chart, and order information depending and defined by the manufacturer.

Purpose:
The text is for identification of the ISO-test chart. To fill out forms E and F the following informations are necessary: test chart text (bottom text), identification code, material code, and the image file version of test charts (see Annex E and F).

Visual test:
No visual test of text in frame region

Test of copied lines of rectangle:

NOTE An ISO-reference test chart is in accordance with this International Standard if there are at least complete lines for the *inner (thicker line)* rectangle. Therefore there are between 4 and 20 lines on an ISO-test chart.

Content:
On the test charts there are up to five rectangles which are on each side 4 mm smaller. The outer rectangle is defined by the format A4 of the paper (297 mm x 210 mm).

Purpose:
The five frame rectangles help to detect visually how far the copying machine can copy.

Visual Test:
In a visual test a Yes or No decision is to be made how many lines are on the ISO-test chart and how many lines are copied.

Test of 5-step grey scales:

Content:
There are four equidistant grey scales near the four position marks (for exact position see „layout“ 4.2.1).

NOTE The grey samples in test charts 1 and 3 are equal to the 5-step samples of picture A2 or C2 respectively. There is no picture of 5-step gray scales in test charts 2 and 4 for direct comparison.

Purpose:
Agreement test of the four grey scales. Differences can be found by visual comparison of the four grey scales.

Visual test:
In an approximated test a Yes or No decision is to be made if one can clearly see visual differences of the four grey scales. If the four are different a decision must indicate the most different grey scale compared to the average. A decision must indicate the direction of deviation (darker or lighter) compared to the average.

Test of *x*- and *y*-scale factors by position marks:

Content:
The four position marks consist of circular rings (2, 4, 6 and 8 mm diameter) centered at crosses. They are located 17 mm in *x*- and *y*-direction from the corners of the format A4 (297 mm x 210 mm).

Purpose:
The position marks serve to measure the *x*- and *y*-scale factor of the copying machine.

Test: The difference of the position marks is to be measured in *x*- and *y*-direction in mm of both the original and the copy. The *x*- and *y*-scale factor must be calculated.

NOTE 1 The ISO-reference difference of position marks is defined in *PS*-file (or equivalent) as 264 mm in *x*-direction and 176 mm in *y*-direction. For high accuracy of the two scale factors it is recommended to measure both the original and the copy with the same ruler.

NOTE 2 The position marks are often used to position colorimetric instruments for automatic *L*a*b** colorimetric measurements and to position the plates in four colour printing.

Test of shift of colour lines:

NOTE 1 Test charts are usually produced on colour material in colour mode (C). There are productions of test charts 1 and 3 completely in black and white text mode (T), e. g. ISO-test chart 1 on black and white photographic paper.

NOTE 2 In that case the following test is obsolete. For completely black and white production one can omit the following specification of „Test of shift of colour lines“.

Content:
The lines defining the *inner rectangles* are drawn by different colours which alternate in colour between black and the colours *C, M, Y, O, L* and *V*.

Purpose:
The colours of the *inner rectangle* allow visually to decide if there are shifts of the colour lines *C, M, Y, O, L* and *V* compared to the black line in horizontal and vertical direction.

Visual Test:
In an approximated test a Yes- or No- decision is to be made, if the shift of the colour *(C, M, Y, O, L, V)* lines compared to the black *N* line is larger or equal 0,2 mm (more than half of the linewidth defining the *inner rectangle*).

4.9 Content and purpose of picture area of the test charts

4.9.1 Test chart 1 (Achromatic test chart: high lightness contrast)

Picture A1: Radial Gratings (Siemens-stars) *N–W, W–N, N–Z, W–Z*
Content:
Radial gratings (Siemens-stars) in the combination of *N–W*, *W–N*, *N–Z*, *W–Z* with marked rings 6, 10, 20 and 30 mm in diameter.

Purpose:
Resolution test of colour copying machines. Differences can be found by comparison of the test chart with the reproduction of the pictures.

Visual test:
In a rough test it is to decide if the diameter of the blurred area in the radial grating on the reproduction does not exceed the chosen ring size in all directions (Yes or No decision).

For a detailed test the greatest diameter of the blurred area should be examined with an optical aid such as a magnifying glass-6x.

NOTE 1 The rings with a diameter of 6, 10, 20 and 30 mm should be used as guidance.

NOTE 2 In some cases one can not evaluate the inner area of the 6 mm ring. The blurred area of the original may be larger compared to the inner area of the 6 mm ring.

Picture A2 and A3: 5 or 16 visual equidistant *L-grey steps**
Content:
Picture A2 contains five visually equidistant grey steps between white and black in two rows. A black N_0 and white W_1 is added. Picture A3 contains 16 equidistant grey steps also in two rows.

In the upper rows, the grey steps are adjacent, in the lower ones the grey steps are separated by the grey background.

For the sphere and medium picture content a medium grey with a lightness $L^* = 50 \pm 2$ was chosen for both fields (according to CIE publ. 15.2 a reflectance factor of 0,2 and resp. a luminance reflectance of $Y = 20$).

On the upper rows the lightness L^* of the CIELAB-colour system is stated above the individual grey steps. The grey steps of halftone ISO-test chart 1 are produced within the photographic process only from the colour black, and not from the four process colours *CMYN* because for the test chart the colour black cannot be produced with sufficient accuracy from these colours. The grey steps of the continuous ISO-test chart 1 are produced by the three process colours *CMY* of the photographic process.

NOTE 1 The theoretical values $L^* = 0$ and $L^* = 100$ for a black N_0 and white W_1 cannot be reached because there are no completely absorbing or reflecting surfaces. For black *(N)* and white *(W)* in the 5- and 16-step grey series the lightness values are described as L^*_N and L^*_W. In the halftone ISO-test chart 1 they are approximately 10 and 94 respectively. In the continuous tone ISO-test charts they are approximately 7 and 91 respectively.

The mentioned numbers between 0,00 and 1,00 in the respective rows describe the relative lightness $l^*_{relative}$ between black and white for the relevant grey steps.

NOTE 2 $l^*_{relative}$ results of the CIELAB lightness L^*:

$$l^*_{relative} = (L^* - L^*_N) / (L^*_W - L^*_N) \qquad \text{(eq. 1)}$$

Picture A3 shows the hexadecimal values above the individual grey steps of the lower rows.

NOTE 3 In printing technology, where paper white is taken as basis and the amount of black is described, the grey scale begins with white and the hexadecimal coding 0 and ends with black and the hexadecimal coding F.

Purpose:
The reproduction of pictures A2 resp. A3 are useful in deciding whether the device is capable of distinguishing the upper rows. If some greys of the upper rows look equal and cannot be separated then the lower rows are intended for an optional measurement.

NOTE For many fields of application a distinction in five grey steps is sufficient, while a distinction of as many

of the 16 grey steps as possible is desired for the reproduction of photographic pictures.

The human being is capable of distinguishing about 200 grey steps between white and black positioned side by side.

Visual test:
It is to be judged how many of the five (picture A2) resp. 16 grey steps (picture A3) can be distinguished on the reproduction in the upper row.

Picture A4: Landolt-rings *N–W*

Content:
The picture contains 6 lines with 8 Landolt-rings each. For the Landolt-rings and the background (surround) different grey steps of the 16 grey steps of picture A3 have been selected.

NOTE The values of the grey steps of the Landolt-rings and background correspond to the hexadecimal coding definition in picture A3.

Purpose:
The picture A4 allows a judgement concerning the reproduction in light, medium grey and dark areas. The differences between ring and background are in this area and in the upper three rows it is one grey step. In the lower three rows it is two grey steps.

Visual test:
The identification frequency of the Landolt-rings shall be judged by 5.2.2.

Pictures A5 and A6: Different line raster diameter under 45° and 90°

Content:
The pictures contain line-elements with an angle of 45° (picture A5) resp. 90° (picture A6) and raster with diameter of 15 to 240 lines per inch (lpi).

NOTE In the halftone ISO-test chart 1 240 lpi are produced. In continuous tone ISO-test chart 1 there is a technical limit of 75 lpi dependent on the 300 dpi digital image setter used for production.

Purpose:
The pictures A5 and A6 serve to test the line reproduction.

Visual test:
By analogy with the interpretation of the Siemens-stars in picture A1, a rough examination is to be made with the naked eye to determine the highest spatial frequency which is perceptible.

For an exact examination an optical aid such as a magnifying glass-6x could be used to examine which raster unit diameter regular lines can be recognized.

NOTE 1 Colour copying machines have a fixed angle of scanning (normally horizontal or vertical). The reproductions correspond to the angles of the copied pattern whose marked pattern structures are shown, which are known in the printing area as Moiré-patterns and which will be lower by an angle of 45°. Because of this the test chart 1 contains pictures with two different angles.

NOTE 2 The line rasters diameter 80 to 240 lpi can normally only be distinguished by using optical aids, such as a magnifying glass.

NOTE 3 In pictures A5 and A6 the one with the greatest lpi (lines per inch) for which the lines and spaces can be distinguished is a measure of the copier resolution.

NOTE 4 Defects in copies made with the test patterns A5 und A6 for areas with greater than 60 lpi may not be important.

NOTE 5 It is recommended that rotating and moving the test patterns A5 and A6 to different locations on the imaging platen may uncover additional reproduction defects.

4.9.2 Test chart 2 (Chromatic test chart: *CMYN* colours)

Picture B1:
The content of this picture can be chosen by the manufacturer of the ISO-test charts. This content should include the 14 CIE-test colours plus N_0 and white W_1 and a 16-step grey scale. In DIN 33866 a flower image was chosen in test chart 2 and 14 CIE-test colours in ISO-test chart 4. The purpose of the flower image is described here as an example.

NOTE Picture B1 is identical to picture D1 of test chart 4.

Picture B1: Flower image, 14 CIE-test colours plus black N_0 and white W_1, and 16-step grey scale.

Content:

The flower image of the chromatic test chart represents especially the colours which are found in nature against a neutral grey background. This serves to judge the true reproduction of these colours. Furthermore the colours gold and silver have been included in the picture as metallic balls. The additional CIE-test colours plus black N_0 and white W_1, and 16-step grey scale may help to judge the fidelity of reproduction (see 4.2.4).

Purpose:

Picture B1 serves to compare colour fidelity of the test chart and its reproduction. The neutral grey background helps to recognize colour shifts. The mainly neutral grey background has various shadows.

NOTE 1 The test chart is not for judgement of individual preference colours and body tones, which may be judged differently in different countries.

NOTE 2 An optional radial grating (Siemens-star *N–W)* used in ISO-test chart 4 helps to get some information on pixel image resolution.

Visual test:

Clear (immediately conspicuous) differences between the original and the reproduction should be judged.

Picture B2: Radial gratings (Siemens-stars) *W–C, W–M, W–Y, W–N* and *W–Z*

Content:

Radial gratings (Siemens-stars) in the combinations *W–C*, *W–M*, *W–Y*, *W–N* and *W–Z* with marked rings of 6, 10 and 20 mm in diameter.

Purpose:

Picture B2 serves for the judgement of resolution. The rings with a diameter of 6, 10 and 20 mm serve as guide.

Visual test:

In a rough test it is to decide if the diameter of the blurred area in the radial grating on the reproduction does not exceed the chosen ring size in all directions (Yes or No decision).

For a detailed test the greatest diameter of the blurred area should be examined with an optical aid such as a magnifying glass-6x.

NOTE 1 The rings with a diameter of 6, 10 and 20 mm should be used as guidance.

NOTE 2 In some cases one can not evaluate the inner area of the 6 mm ring. The blurred area of the original may be larger compare to the inner area of the 6 mm ring.

NOTE 3 The lowest resolution is usually the one for the radial grating *W–Y* due to the low contrast between white and yellow.

Picture B3: 14 CIE-test colours, black N_0 and white W_1, 16 equidistant grey steps

NOTE Picture B3 is identical to picture D3 of test chart 4.

Content:

In the upper two rows the picture contains 14 CIE-test colours according to CIE publ.13.3 and black N_0 and white W_1, in the lower row the picture contains 16 equidistant grey steps.

In the upper rows, the colours and grey steps are right adjacent, in the lower ones the colours and grey steps are separated by the grey background.

For the sphere and medium picture content a medium grey with a lightness $L^* = 50 \pm 2$ was chosen for both fields (according to CIE publ. 15.2 a reflectance factor of 0,2 and resp. a luminance reflectance of $Y = 20$).

Purpose:

Picture B3 serves for the jugement of colour fidelity of the reproduction.

Visual test:

Clear (immediately conspicuous) differences of the 14 colours between the test chart and the reproduction are being judged (Yes or No decision). Should this not be the case, the number of distinguishable steps should be stated.

Clear (immediately conspicuous) differences of the 16 grey colours between the test chart and the reproduction are being judged (Yes or No decision). Should this not be the case, the number of distinguishable steps should be stated.

NOTE The test colours reproduced in the test chart show small colour differences compared to the test colours defined in CIE publ. 13.3. This fact can be ignored for the visual judgement as here the colour difference between the original and a copy is assessed.

Picture B4: 16 visual equidistant steps with the colours *W–C, W–M, W–Y* and *W–N*

Content:

The picture contains four rows with 16 colour steps each, using the colours *C, M, Y* and *N*, starting with white and the hexadecimal coding zero up to the colour with the hexadecimal coding F.

Purpose:

Picture B4 serves for the judgement of different colour steps.

Visual test:

For each of the four colours one should examine visually, whether all 16 colour steps of the rows are different (Yes or No decision). Should this not be the case, the number of distinguishable steps should be stated.

NOTE 1 For a reproduction of photographic pictures the differentiation of as many of the 16 colour steps as possible of the individual colours is desired.

NOTE 2 In the *W–Y* row of the test chart 2 not all of the 16-steps may be distinguished by testing persons.

Picture B5: Script and Landolt-rings in four sizes

Content:

The picture contains (in four groups with the relative sizes 10, 8, 6 and 4) 32 black characters and 8 Landolt-rings in the colours *N, C, M* and *Y* in each group.

Purpose:

Picture B5 serves for testing of reproduction by recognition of characters depending on their size and colour.

Visual test:

Each vertical line in every individual group should be judged if the frequency of recognition for the letters, Landolt-ring resp. is more than 50% (see 5.2.2).

NOTE For the decreasing relative sizes 10, 8, 6 and 4 the recognition is more difficult. The Landolt-ring *Y* with size 10 of the original test chart may not being recognized by some testers.

Picture B6 and B7: Landolt-rings *W–C, W–M, W–Y* and *W–N*

Content:

The pictures contain a block with 6 lines and 8 Landolt-rings each for each of the four colours *C, M, Y* and *N*. For the Landolt-rings and the background different colour steps of the 16 colour steps of the corresponding colours in picture B4 have been selected in each case. They differ by one resp. two colour steps in the blocks *W–C*, *W–M* and *W–N* and by two resp. four colour steps in the block *W–Y*.

NOTE The value of the colour steps of the Landolt-rings and the background corresponds to the hexadecimal value in picture B4.

Purpose:

Pictures B6 and B7 shall also allow a judgement of how the reproduction of characters on different backgrounds depends on the difference of the chromatic steps of characters and the background.

Visual test:

For tests the recognition frequency of the Landolt-rings has to be judged according to 5.2.2.

4.9.3 Test chart 3 (Achromatic test chart: medium lightness contrast)

Picture C1: Radial Gratings (Siemens-stars) *N–W, W–N, N–Z, W–Z*

Content:

Radial gratings (Siemens-stars) in the combination of *N–W, W–N, N–Z, W–Z* with marked rings 6, 10, 20 and 30 mm in diameter.

Purpose:

Resolution test of colour copying machines. Differences can be found by comparison of the test chart with the reproduction of the pictures.

Visual test:

In a rough test it is to decide if the diameter of the blurred area in the radial grating on the reproduction does not exceed the chosen ring size in all directions (Yes or No decision).

For a detailed test the greatest diameter of the blurred area should be examined with an optical aid such as a magnifying glass-6x.

NOTE 1 The rings with a diameter of 6, 10, 20 and 30 mm should be used as guidance.

NOTE 2 In some cases one can not evaluate the inner area of the 6 mm ring. The blurred area of the original may be larger compared to the inner area of the 6 mm ring.

Picture C2 and C3: 5 or 16 visual equidistant *L-grey steps**

Content:

Picture C2 contains five visually equidistant grey steps between white and black in two rows. A black N_0 and white W_1 is added. Picture C3 contains 16 equidistant grey steps also in two rows.

In the upper rows, the grey steps are adjacent, in the lower ones the grey steps are separated by the grey background.

For the sphere and medium picture content a medium grey with a lightness $L^* = 50 \pm 2$ was chosen for both fields (according to CIE publ. 15.2 a reflectance factor of 0,2 and resp. a luminance reflectance of $Y = 20$).

On the upper rows the lightness L^* of the CIELAB-colour system is stated above the individual grey steps. The grey steps of halftone ISO-test chart 1 are produced within the photographical process only from the colour black, and not from the four process colours *CMYN* because for the test chart the colour black cannot be produced with sufficient accuracy from these colours. The grey steps of the continuous ISO-test chart 3 are produced by three process colours *CMY* of the photographic process.

NOTE 1 The theoretical values $L^* = 0$ and $L^* = 100$ for black N_0 and white W_1 cannot be reached because there are no completely absorbing or reflecting surfaces. For black *(N)* and white *(W)* in the 5- and 16-step grey series the lightness values are described as L^*_N and L^*_W. In the halftone ISO-test chart 3 they are approximately 18 and 96 respectively. In the continuous tone ISO-test charts they are approximately 7 and 91 respectively.

The mentioned numbers between 0,00 and 1,00 in the respective rows describe the relative lightness $l^*_{relative}$ between black and white for the relevant grey steps.

NOTE 2 $l^*_{relative}$ results of the CIELAB lightness L^*:

$$l^*_{relative} = (L^* - L^*_N) / (L^*_W - L^*_N) \qquad \text{(eq. 1)}$$

Picture C3 shows the hexadecimal values above the individual grey steps of the lower rows.

NOTE 3 In printing technology, where paper white is taken as basis and the amount of black is described, the grey scale begins with white and the hexadecimal coding 0 and ends with black and the hexadecimal coding F.

Purpose:

The reproduction of pictures C2 resp. C3 are useful in deciding whether the device is capable of distinguishing the upper rows. If some greys of the upper rows look equal and cannot be separated then the lower rows are intended for an optional measurement.

NOTE For many fields of application a distinction in five grey steps is sufficient, while a distinction of as many of the 16 grey steps as possible is desired for the reproduction of photographic pictures.

The human being is capable of distinguishng about 200 grey steps between white and black positioned side by side.

Visual test:

It is to be judged how many of the five (picture C2) resp. 16 grey steps (picture C3) can be distinguished on the reproduction in the upper row.

Picture C4: Landolt-rings *N–W*

Content:

The picture contains 6 lines with 8 Landolt-rings each. For the Landolt-rings and the background (surround) different grey steps of the 16 grey steps of picture C3 have been selected.

NOTE The values of the grey steps of the Landolt-rings and background correspond to the hexadecimal coding definition in picture C3.

Purpose:

The picture C4 allows a judgement concerning the reproduction in light, medium grey and dark areas. The differences between ring and background are in this area and in the upper three rows it is one grey step. In the lower three rows it is two grey steps.

Visual test:

The identification frequency of the Landolt-rings shall be judged by 5.2.2.

Pictures C5 and C6: Different line raster diameter under 45° and 90°

Content:

The pictures contain line-elements with an angle of 45° (picture C5) resp. 90° (picture C6) and raster with diameter of 15 to 240 lines per inch (lpi).

NOTE In the halftone ISO-test chart 3 240 lpi are produced. In continuous tone ISO-test chart 3 there is a technical limit of 75 lpi dependent on the 300 dpi digital image setter used for production.

Purpose:

The pictures C5 and C6 serve to test the line reproduction.

Visual test:

By analogy with the interpretation of the Siemens-stars in picture C1, a rough examination is to be made with the naked eye to determine the highest spatial frequency which is perceptible.

For an exact examination an optical aid such as a magnifying glass-6x could be used to examine for which raster unit diameter regular lines can be recognized.

NOTE 1 Colour copying machines have a fixed angle of scanning (normally horizontal or vertical). The reproductions correspond to the angles of the copied pattern whose marked pattern structures are shown, which are known in the printing area as Moiré-patterns and which will be lower by an angle of 45°. Because of this the test chart 1 contains pictures with two different angles.

NOTE 2 The line rasters diameter 80 to 240 lpi can normally only be distinguished by using optical aids, such as a magnifying glass.

NOTE 3 In pictures C5 and C6 the one with the greatest lpi (lines per inch) for which the lines and spaces can be distinguished is a measure of the copier resolution.

NOTE 4 Defects in copies made with the test patterns C5 und C6 for areas with greater than 60 lpi may not be important.

NOTE 5 It is recommended that rotating and moving the test patterns C5 and C6 to different locations on the imaging platen may uncover additional reproduction defects.

4.9.4 Test chart 4 (Chromatic test chart: *OLVN*-colours)

Picture D1: The content of this picture can be chosen by the manufacturer of the ISO-test charts. This content should include the 14 CIE-test colours plus black N_0 and white W_1 and a 16-step grey scale. In DIN 33866 a flower image was chosen in test chart 2 and 14 CIE-test colours in ISO-test chart 4. The purpose of the flower image is described here as an example.

NOTE Picture D1 is identical to picture B1 of test chart 2.

Picture D1: Flower image, 14 CIE-test colours plus black N_0 and white W_1, and 16-step grey scale.

Content:

The flower image of the chromatic test chart represents especially the colours which are found in nature against a neutral grey background. This serves to judge the true reproduction of these colours. Furthermore the colours gold and silver have been included in the picture as metallic balls. The additional CIE-test colours plus black N_0 and white W_1, and the 16-step gey scale may help to judge the fidelity of reproduction (see 4.2.4).

Purpose:

Picture D1 serves to compare colour fidelity of the test chart and its reproduction. The neutral grey background helps to recognize colour shifts. The mainly neutral grey background has various shadows.

NOTE 1 The test chart is not for judgement of individual preference colours and body tones, which may be judged differently in different countries.

NOTE 2 An optional radial grating (Siemens-star *N–W)* used in ISO-test chart 4 helps to get some information on pixel image resolution.

Visual test:

Clear (immediately conspicuous) differences between the original and the reproduction should be judged.

Picture D2: Radial gratings (Siemens-stars) *W–O, W–L, W–V, W–N* and *W–Z*

Content:

Radial gratings (Siemens-stars) in the combinations *W–O*, *W–L*, *W–V*, *W–N* and *W–Z* with marked rings of 6, 10 and 20 mm in diameter.

Purpose:
Picture D2 serves for the judgement of resolution. The rings with a diameter of 6, 10 and 20 mm serve as guide.

Visual test:
In a rough test it is to decide if the diameter of the blurred area in the radial grating on the reproduction does not exceed the chosen ring size in all directions (Yes or No decision).

For a detailed test the greatest diameter of the blurred area should be examined with an optical aid such as a magnifying glass-6x.

NOTE 1 The rings with a diameter of 6, 10 and 20 mm should be used as guidance.

NOTE 2 In some cases one can not evaluate the inner area of the 6 mm ring. The blurred area of the original may be larger compare to the inner area of the 6 mm ring.

Picture D3: 14 CIE-test colours, black N_0 and white W_1, 16 equidistant grey steps

NOTE Picture D3 is identical to picture B3 of test chart 2.

Content:
In the upper two rows the picture contains 14 CIE-test colours according to CIE publ.13.3 and black N_0 and white W_1, in the lower row the picture contains 16 equidistant grey steps.

In the upper rows, the colours and grey steps are right adjacent, in the lower ones the colours and grey steps are separated by the grey background.

For the sphere and medium picture content a medium grey with a lightness $L^* = 50 \pm 2$ was chosen for both fields (according to CIE publ. 15.2 a reflectance factor of 0,2 and resp. a luminance reflectance of $Y = 20$).

Purpose:
Picture D3 serves for the judgement of colour fidelity of the reproduction.

Visual test:
Clear (immediately conspicuous) differences of the 14 colours between the test chart and the reproduction are being judged (Yes or No decision). Should this not be the case, the number of distinguishable steps should be stated.

Clear (immediately conspicuous) differences of the 16 grey colours between the test chart and the reproduction are being judged (Yes or No decision). Should this not be the case, the number of distinguishable steps should be stated.

NOTE The test colours reproduced in the test chart show small colour differences compared to the test colours defined in CIE publ. 13.3. This fact can be ignored for the visual judgement as here the colour difference between the original and the copy is assessed.

Picture D4: 16 visual equidistant steps with the colours *W–O, W–L, W–V* and *W–N*

Content:
The picture contains three rows with 16 colour steps each, using the colours *O, L, V* and *N*, starting with white and the hexadecimal coding zero up to the colour with the hexadecimal coding F.

Purpose:
Picture D4 serves for the judgement of different colour steps.

Visual test:
For each of the four colours one should examine visually, whether all 16 colour steps of the rows are different (Yes or No decision). Should this not be the case, the number of distinguishable steps should be stated.

NOTE For a reproduction of photographic pictures the differentiation of as many of the 16 colour steps as possible of the individual colours is desired.

Picture D5: Script and Landolt-rings in four sizes

Content:
The picture contains (in four groups with the relative sizes 10, 8, 6 and 4) 32 black characters and 8 Landolt-rings in the colours *N, O, L,* and *V* and in each group.

Purpose:
Picture D5 serves for testing of reproduction by recognition of characters depending on their size and colour.

Visual test:
Each vertical line in every individual group should be judged if the frequency of recognition for the letters, Landolt-ring resp. is more than 50% (see 5.2.2).

NOTE For the decreasing relative sizes 10, 8, 6 and 4 the recognition is more difficult.

Picture D6 and D7: Landolt-rings *W–O, W–L, W–V* and *W–N*

Content:

The pictures contain a block with 6 lines and 8 Landolt-rings each for each of the four colours *O, L, V* and *N* . For the Landolt-rings and the background different colour steps of the 16 colour steps of the corresponding colours in picture D4 have been selected in each case. They differ by one resp. two colour steps in the blocks *W–O*, *W–L*, *W–V* and *W–N*.

NOTE The value of the colour steps of the Landolt-rings and the background corresponds to the hexadecimal value in picture D4.

Purpose:

Pictures D6 and D7 shall also allow a judgement of how the reproduction of characters on different backgrounds depends on the difference of the chromatic steps of characters and the background.

Visual test:

For tests the recognition frequency of the Landolt-rings has to be judged according 5.2.2.

5. Tests

5.1 General

The tests according to this International Standard are to be made on a set of two copies of one achromatic and one chromatic ISO-test chart with a reproduction scale of 1: 1. These copies are to be made from the test charts 1, 2, 3 and 4 in series by unchanged adjustments of the colour copying machine.

One achromatic test chart (1 or 3) and one chromatic (2 or 4) either both halftone type or continuous tone type must be used.

Operating conditions such as media and attachments (paper; colour inks) given by individual manufacturers of colour copying machines are to be met. The copies are to be tested immediately after production. Two procedures are available for testing:

- visual test, if necessary with optical aid such as a magnifying glass-6x.
- colorimetric specification (for interpretation see Annex G).

For the summary of the results the forms in Annex A, B, C and D have to be used for the visual evaluation of the reproduction of the test charts 1 to 4. The pictures of these test charts are numbered A1 - A6, B1 - B7 etc. and assigned to the individual pictures of the test charts (see 4.9).

Annex E and F have to be used for writing down text and codes of the frame area of ISO-test charts and for visual tests of line, 5-step grey scale, and scale factor reproduction (see 4.8).

5.2 Visual test

The visual test has been already described in 4.8 and 4.9 in conjunction with the definition of the individual pictures on the test charts.

5.2.1 Testing conditions

The following conditions are to be met when testing:

- Lighting of the testing object under 45° with a minimum of 1000 lux nominal illumination
- Observation of the testing object on an opaque white base (3 sheets of white paper underneath the testing object).

The testing persons must have normal colour vision and visual acuity.

TEST „Measure colour vision and visual acuity using any of available standard tests“

- For testing normal colour vision the colour vision deficiencies may be tested (for example with an "Anomaloscop" acc. to DIN 6160 or equivalent).
- The visual acuity (also with seeing aid) is to be checked (for example acc. to DIN 58220-5 or equivalent).

5.2.2 Recognition frequency for use of Landolt-rings

The eight rings of the Landolt-ring groups in the different pictures represent the different orientations of the Landolt-rings acc. to ISO 8596. Test criteria for the visual evalution of each group is the recognition frequency of the Landolt-rings.

The recognition must be analog to ISO 8597 over 50%. The recognition frequency of at least 5 of 8 rings is above 50%.

5.3 Colorimetric specification

A colorimetric specification includes data for (see Annex G):

- Regularity g^*
- Lightness gamut f^*
- Mean lightness difference ΔL^*_m
- Mean colour difference $\Delta E^*_{ab,m}$
- Mean colour reproduction index $R^*_{ab,m}$

5.3.1 Colorimeter

The colorimeter must permit the determination of the CIELAB colorimetric parameters L^*, a^*, b^* (or of the colorimetric tristimulus values X, Y and Z) acc. to CIE publ. 15.2 (and ISO/CIE 10526 and 10527) for the CIE-2°-standard observer, the CIE-standard illuminant D65 and the CIE-standard geometry 45°/0°.

5.3.2 Measurements

On the copy and the test chart the lightness L^* of the five achromatic test colours of pictures A2 (or C2) and the 14 chromatic CIE-test colours of picture B6 (or D6) as well as the chromaticness a^* and b^* of these colour surfaces are to be measured.

NOTE 1 It is recommended to measure both the ISO-test chart and the copy with the same instrument. A *PS*-file (or equivalent) (see Table G.2 and file name INFIE07/ IEAG021.*EPS* (or equivalent) on web servers) can be used to include the measured data by any editor. Any *PS*-interpreter (or equivalent) will produce a formatted table similar to Table G.2.

NOTE 2 Measured data of other colour series can be used to get similar tables shown in Annex H for all colour series of the DIN-test charts. The filename (e.g. INFIE08/IEAH011.EPS) below the $L^*a^*b^*$-tables is given to find the corresponding file on the Web-server.

5.3.3 Evaluation

According to Annex G for each colorimetric parameter the procedures for calculation resulting from the colorimetric measurement data are described together with an example.

6. Test report

The test report shall contain at least the following:

- statement of the colour copying machine model
- selected copying mode and/or specification of the selected adjustment

  Warning: Results with monochrome test pattern may depend on colour copier mode of operation or setting, for example whether Auto text, Auto Black and White mode, or Full colour mode is chosen
- description of copying paper used
- description of other materials used
- Testing method
- 4 forms filled out for the visual interpretation of the reproduction of test charts 1, 2, 3 and 4 for colour copying machines acc. to ISO 15775 (Annex A **or** C and E, and B **or** D and F).
- The normal colour visual acuity and normal visual acuity of the testing persons acc. to 5.2.1 are to be stated.

Annex A: (informative) Form A

The reproduction of this form is allowed

Test of the radial grating acc. to picture A1

N–W-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with magnifying glass (e.g. 6x)	resolution diameter:	.....mm
W–N-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with magnifying glass (e.g. 6x)	resolution diameter:	.....mm
N–Z-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with magnifying glass (e.g. 6x)	resolution diameter:	.....mm
W–Z-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with magnifying glass (e.g. 6x)	resolution diameter:	.....mm

Test of 5 visual equidistant *L-grey steps acc. to picture A2**

Are the 5-steps on the upper rows distinguishable?		Yes/No
If No: How many steps can be distinguished?	of the given 5 steps:	.....Steps

Test of 16 visual equidistant *L-grey steps acc. to picture A3**

Are the steps on the upper rows distinguishable?		Yes/No
If No: How many steps can be distinguished?	of the given 16 steps:	.....Steps

Test of the Landolt-rings *N–W* acc. to picture A4

Is the recognition frequency of the Landolt-rings > 50% (5 of 8 at least)?

background —ring	
0 — 1	Yes/No
7 — 8	Yes/No
E — F	Yes/No
2 — 0	Yes/No
8 — 6	Yes/No
F — D	Yes/No

Test of the line screen under 45° acc. to picture A5

Can equally spaced lines be seen?		
Visual testing: for lines from 15 to 60 lpi		Yes/No
Test with a magnifying glass (e.g. 6x):	- from 15 lpi:	to ..... lpi

Test of the line screen under 90° acc. to picture A6

Can equally spaced lines be seen?		
Visual testing: for lines from 15 to 60 lpi		Yes/No
Test with a magnifying glass (e.g. 6x):	- from 15 lpi:	to ..... lpi

Form A for the visual interpretation of the ISO-test chart 1 reproduction for colour copying machines acc. to ISO 15775

Annex B: (informative) Form B

The reproduction of this form is allowed

Test of the (flower) image acc. to picture B1

Are there clear (immediately conspicuous) differences between reproduction and test chart? Yes/No

Subjective remarks about the colour reproduction of the (flower) image, the CIE-test colours and the 16 grey steps:

.....

.....

.....

Test of the resolution in the radial gratings *W–C, W–M, W–Y, W–N* and *W–Z* acc. to picture B2

	W–C	***W–M***	***W–Y***	***W–N***	***W–Z***
Visual testing: Is the resolution diameter < 6 mm?	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Test with magnifying glass: Resolution diameter	..... mm	.....mm	..... mm	..... mm	.....mm

Test of the 14 CIE-test colours acc. to picture B3

Are clear (immediately conspicuous) differences recognized between reproduction and test chart? Yes/No

If Yes: How many colours have clear differences? of the given 14 colours: .....Colours

Test of 16 visual equidistant *L-grey steps acc. to picture B3**

Are the steps on the upper rows distinguishable? Yes/No

If No: How many steps can be distinguished of the given 16 steps: .....Steps

Test of 16 visual equidistant steps of the colour rows *W–C, W–M, W–Y* and *W–N* acc. to picture B4

W–C White—Cyanblue: Are all steps distinguishable? Yes/No

If No: How many steps can be distinguished? of the given 16 steps: .....Steps

W–M White—Magentared: Are all steps distinguishable? Yes/No

If No: How many steps can be distinguished? of the given 16 steps: .....Steps

W–Y White—Yellow: Are all steps distinguishable? Yes/No

If No: How many steps can be distinguished? of the given 16 steps: .....Steps

W–N White—Black: Are all steps distinguishable? Yes/No

If No: How many steps can be distinguished? of the given 16 steps: .....Steps

Test of characters and Landolt-rings in four sizes acc. to picture B5

Is the recognition frequency >50% for letters (17 from 32 at least) and for Landolt-rings (min. 5 of 8)?

Relative size	Letters	Rings ***N***	Rings ***C***	Rings ***M***	Rings ***Y***
10	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
8	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
6	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
4	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No

Test of the recognition frequency of the Landolt-rings *W–C, W–M, W–Y* and *W–N* acc. to pictures B6 and B7

Is the recognition frequency of the Landolt-rings >50% (min. 5 of 8 at least)?

Colour rows ***W–C*** background — ring		Colour rows ***W–M*** background — ring		Colour rows ***W–Y*** background — ring		Colour rows ***W–N*** background — ring	
0 — 1	Yes/No	0 — 1	Yes/No	0 — 2	Yes/No	0 — 1	Yes/No
7 — 8	Yes/No	7 — 8	Yes/No	6 — 8	Yes/No	7 — 8	Yes/No
E — F	Yes/No	E — F	Yes/No	D — F	Yes/No	E — F	Yes/No
2 — 0	Yes/No	2 — 0	Yes/No	4 — 0	Yes/No	2 — 0	Yes/No
8 — 6	Yes/No	8 — 6	Yes/No	9 — 5	Yes/No	8 — 6	Yes/No
F — D	Yes/No	F — D	Yes/No	F — B	Yes/No	F — D	Yes/No

Form B for the visual interpretation of the ISO-test chart 2 reproduction for colour copying machines acc. to ISO 15775

Annex C: (informative) Form C

The reproduction of this form is allowed

Test of the radial grating acc. to picture C1

N–W-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with magnifying glass (e.g. 6x)	resolution diameter:	.....mm
W–N-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with magnifying glass (e.g. 6x)	resolution diameter:	.....mm
N–Z-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with magnifying glass (e.g. 6x)	resolution diameter:	.....mm
W–Z-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with magnifying glass (e.g. 6x)	resolution diameter:	.....mm

Test of 5 visual equidistant *L-grey steps acc. to picture C2**

Are the 5-steps on the upper rows distinguishable?		Yes/No
If No: How many steps can be distinguished?	of the given 5 steps:	.....Steps

Test of 16 visual equidistant *L-grey steps acc. to picture C3**

Are the steps on the upper rows distinguishable?		Yes/No
If No: How many steps can be distinguished?	of the given 16 steps:	.....Steps

Test of the Landolt-rings *N–W* acc. to picture C4

Is the recognition frequency of the Landolt-rings > 50% (5 of 8 at least)?

background —ring	
0 — 1	Yes/No
7 — 8	Yes/No
E — F	Yes/No
2 — 0	Yes/No
8 — 6	Yes/No
F — D	Yes/No

Test of the line screen under 45° acc. to picture C5

Can equally spaced lines be seen?

Visual testing: for lines from 15 to 60 lpi		Yes/No
Test with a magnifying glass (e.g. 6x):	- from 15 lpi:	to ..... lpi

Test of the line screen under 90° acc. to picture C6

Can equally spaced lines be seen?

Visual testing: for lines from 15 to 60 lpi		Yes/No
Test with a magnifying glass (e.g. 6x):	- from 15 lpi:	to ..... lpi

Form C for the visual interpretation of the ISO-test chart 3 reproduction for colour copying machines acc. to ISO 15775

Annex D: (informative) Form D

The reproduction of this form is allowed

Test of the (flower) image acc. to picture D1

Are there clear (immediately conspicuous) differences between reproduction and test chart? Yes/No

Subjective remarks about the colour reproduction of the (flower) image, the CIE-test colours and the 16 grey steps:

.....

.....

.....

Test of the resolution in the radial gratings *W–O, W–L, W–Y, W–V* and *W–Z* acc. to picture D2

	W–O	***W–L***	***W–V***	***W–N***	***W–Z***
Visual testing: Is the resolution diameter < 6 mm?	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Test with magnifying glass: Resolution diameter	..... mm	.....mm	..... mm	..... mm	.....mm

Test of the 14 CIE-test colours acc. to picture D3

Are clear (immediately conspicuous) differences recognized between reproduction and test chart? Yes/No

If Yes: How many colours have clear differences? of the given 14 colours: .....Colours

Test of 16 visual equidistant *L-grey steps acc. to picture D3**

Are the steps on the upper rows distinguishable? Yes/No

If No: How many steps can be distinguished of the given 16 steps: .....Steps

Test of 16 visual equidistant steps of the colour rows *W–O, W–L, W–V* and *W–N* acc. to picture D4

W–O White—Orangered: Are all steps distinguishable? Yes/No

If No: How many steps can be distinguished? of the given 16 steps: .....Steps

W–L White—Leafgreen: Are all steps distinguishable? Yes/No

If No: How many steps can be distinguished? of the given 16 steps: .....Steps

W–V White—Violetblue: Are all steps distinguishable? Yes/No

If No: How many steps can be distinguished? of the given 16 steps: .....Steps

W–N White—Black: Are all steps distinguishable? Yes/No

If No: How many steps can be distinguished? of the given 16 steps: .....Steps

Test of characters and Landolt-rings in four sizes acc. to picture D5

Is the recognition frequency >50% for letters (17 from 32 at least) and for Landolt-rings (min. 5 of 8)?

Relative size	Letters	Rings ***N***	Rings ***O***	Rings ***L***	Rings ***V***
10	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
8	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
6	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
4	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No

Test of the recognition frequency of the Landolt-rings *W–O, W–L, W–V* and *W–N* acc. to pictures D6 and D7

Is the recognition frequency of the Landolt-rings >50% (min. 5 of 8 at least)?

Colour rows ***W–O*** background — ring		Colour rows ***W–L*** background — ring		Colour rows ***W–V*** background — ring		Colour rows ***W–N*** background — ring	
0 — 1	Yes/No	0 — 1	Yes/No	0 — 1	Yes/No	0 — 1	Yes/No
7 — 8	Yes/No	7 — 8	Yes/No	7 — 8	Yes/No	7 — 8	Yes/No
E — F	Yes/No	E — F	Yes/No	E — F	Yes/No	E — F	Yes/No
2 — 0	Yes/No	2 — 0	Yes/No	2 — 0	Yes/No	2 — 0	Yes/No
8 — 6	Yes/No	8 — 6	Yes/No	8 — 6	Yes/No	8 — 6	Yes/No
F — D	Yes/No	F — D	Yes/No	F — D	Yes/No	F — D	Yes/No

Form D for the visual interpretation of the ISO-test chart 4 reproduction for colour copying machines acc. to ISO 15775

Annex E: (informative) Form E

The reproduction of this form is allowed

Please fill out or mark by **(x)**:

Testing „halftone (h)“ test charts ( ) or „continuous tone (c)“ test charts ( )

Testing achromatic test chart (1 or 3):

ISO-test chart: e. g. Test chart 3 for colour devices according to ISO 15775 (write text from bottom of ISO-test chart)

.....

ISO identification:	e. g. 19980615-I0(1/3)	(write code from top right side)	.....
ISO-reference material:	e. g. r(h/c)a4ra-I0(1/3)	(write code from bottom right side)	.....
File-name:	e. g. E2-(1/3)CS2198	(write code from bottom left side)	.....

Test of copying lines acc. to lines defining rectangles in the frame region:

NOTE An ISO-reference test chart is in accordance with this International Standard if there are at least complete lines for the *inner (thicker line)* rectangle. Therefore there are between 4 and 20 lines on an ISO-test chart.

How many lines are on the ISO-test chart? of max. 20 lines: .... lines are given

How many lines of ISO-test chart are copied? of given .... lines: .... lines are copied

Are the four *(inner thicker)* lines of the inner rectangle fully copied? Yes/No

If No: How many *inner* lines are fully copied? of given 4 lines: .... lines are copied

Test of agreement of the four 5-step grey scales acc. to the grey scales in the frame region:

NOTE There are four 5-step grey scales near the four corners of the frame region. In the test chart 1and 3 they are equal to the 5-step grey scale in picture A2 and C2 respectively. The agreement can be additionally tested by measurement.

Are there clearly seen differences between the four 5-step grey scales near the four corners? Yes/No

If Yes: Indicate the one grey scale in the corners which deviates most from the average of the four grey scales. Indicate if this grey scale is darker or lighter compared to the average.

Mark by **(x)** which grey scale (only one **(x)**) deviates most and if this grey scale is darker or lighter

top left	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?
top right	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?
bottom left	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?
bottom right	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?

Test of the scaling factors acc. to position marks in the frame region:

The difference of the position marks is to be measured in *x*- and *y*-direction in mm of both the reference ISO-test chart (Δx_r and Δy_r) and the copy (output Δx_o and Δy_o). The scaling factors in *x*- and *y*-direction must be calculated by the ratios using 3 digits in mm and rounding like the example, e. g. $s_x = 1{,}01$ and $s_y = 0{,}98$:

$s_x = \Delta x_o / \Delta x_r$ $s_y = \Delta y_o / \Delta y_r$

NOTE The ISO-reference difference of position marks is defined in *PS*-file (or equivalent) as 264 mm in *x*-direction and 176 mm in *y*-direction. To get high accuracy of the two scaling factors it is recommended to measure both the original and the copy with the same ruler.

Test of the shift of the colour lines compared to black acc. to the lines of inner rectangle of the frame:

Are on the test chart colour lines ***(C, M, Y, O, L, V)*** belonging to the inner rectangles? Yes/No

If Yes: (answer only in that case the following questions)

NOTE The lines of the inner rectangle have a linewidth of 0,3 mm. A shift of more than half of this linewidth (≥0,2 mm) can be clearly seen.

Choose one of the two *horizontal* lines and mark bottom or top line by x :

bottom horizontal line **( )** top horizontal line **( )**

Is there a clearly seen (≥0,2 mm) shift of a colour line ***(C, M, Y, O, L, V)*** compared to black line ***N*** ?

	C	***M***	***Y***	***O***	***L***	***V***
	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
If Yes:	0,. mm	0,. mm	0,. mm	0,. mm	0,. mm	0,. mm

Choose one of the two *vertical* lines and mark left or right line by x:

left vertical line **( )** right vertical line **( )**

Is there a clearly seen (≥0,2 mm) shift of a colour line ***(C, M, Y, O, L, V)*** compared to the black line ***N*** ?

	C	***M***	***Y***	***O***	***L***	***V***
	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
If Yes:	0,. mm	0,. mm	0,. mm	0,. mm	0,. mm	0,. mm

Form E for the visual interpretion of *achromatic* ISO-test chart (1 or 3) reproduction for colour copying machines acc. to ISO 15775

Annex F: (informative) Form F

The reproduction of this form is allowed

Please fill out or mark by **(x)**:

Testing „halftone (h)“ test charts ( ) or „continuous tone (c)“ test charts ( )

Testing achromatic test chart (2 or 4):

ISO-test chart: e. g. Test chart 3 for colour devices according to ISO 15775 (write text from bottom of ISO-test chart)

.....

ISO identification:	e. g. 19980615-I0(1/3)	(write code from top right side)	.....
ISO-reference material:	e. g. r(h/c)a4ra-I0(1/3)	(write code from bottom right side)	.....
File-name:	e. g. E2-(1/3)CS2198	(write code from bottom left side)	.....

Test of copying lines acc. to lines defining rectangles in the frame region:

NOTE An ISO-reference test chart is in accordance with this International Standard if there are at least complete lines for the *inner (thicker line)* rectangle. Therefore there are between 4 and 20 lines on an ISO-test chart.

How many lines are on the ISO-test chart?	of max. 20 lines: .... lines are given
How many lines of ISO-test chart are copied?	of given .... lines: .... lines are copied
Are the four *(inner thicker)* lines of the inner rectangle fully copied?	Yes/No
If No: How many *inner* lines are fully copied?	of given 4 lines: .... lines are copied

Test of agreement of the four 5-step grey scales acc. to the grey scales in the frame region:

NOTE There are four 5-step grey scales near the four corners of the frame region. In the test chart 1and 3 they are equal to the 5-step grey scale in picture A2 and C2 respectively. The agreement can be additionally tested by measurement.

Are there clearly seen differences between the four 5-step grey scales near the four corners? Yes/No

If Yes: Indicate the one grey scale in the corners which deviates most from the average of the four grey scales. Indicate if this grey scale is darker or lighter compared to the average.

Mark by **(x)** which grey scale (only one **(x)**) deviates most and if this grey scale is darker or lighter

top left	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?
top right	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?
bottom left	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?
bottom right	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?

Test of the scaling factors acc. to position marks in the frame region:

The difference of the position marks is to be measured in *x*- and *y*-direction in mm of both the reference ISO-test chart (Δx_r and Δy_r) and the copy (output Δx_o and Δy_o). The scaling factors in *x*- and *y*-direction must be calculated by the ratios using 3 digits in mm and rounding like the example, e. g. s_x = 1,01 and s_y = 0,98:

$s_x = \Delta x_o / \Delta x_r$ $s_y = \Delta y_o / \Delta y_r$

NOTE The ISO-reference difference of position marks is defined in *PS*-file (or equivalent) as 264 mm in *x*-direction and 176 mm in *y*-direction. To get high accuracy of the two scaling factors it is recommended to measure both the original and the copy with the same ruler.

Test of the shift of the colour lines compared to black acc. to the lines of inner rectangle of the frame:

Are on the test chart colour lines ***(C, M, Y, O, L, V)*** belonging to the inner rectangles? Yes/No

If Yes: (answer only in that case the following questions)

NOTE The lines of the inner rectangle have a linewidth of 0,3 mm. A shift of more than half of this linewidth (≥0,2 mm) can be clearly seen.

Choose one of the two *horizontal* lines and mark bottom or top line by x :

bottom horizontal line **( )** top horizontal line **( )**

Is there a clearly seen (≥0,2 mm) shift of a colour line ***(C, M, Y, O, L, V)*** compared to black line ***N*** ?

	C	***M***	***Y***	***O***	***L***	***V***
	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
If Yes:	0,. mm	0,. mm	0,. mm	0,. mm	0,. mm	0,. mm

Choose one of the two *vertical* lines and mark left or right line by x:

left vertical line **( )** right vertical line **( )**

Is there a clearly seen (≥0,2 mm) shift of a colour line ***(C, M, Y, O, L, V)*** compared to the black line ***N*** ?

	C	***M***	***Y***	***O***	***L***	***V***
	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
If Yes:	0,. mm	0,. mm	0,. mm	0,. mm	0,. mm	0,. mm

Form F for the visual interpretion of *chromatic* ISO-test chart (2 or 4) reproduction for colour copying machines acc. to ISO 15775

Annex G: (informative) Colorimetric specification

Guidance for the colorimetric specification of the ISO-test chart 1, 2, 3 and 4 reproduction for colour copying machines acc. to ISO 15775

G.1 Grey scale acc. to picture A2 (or C2): Regularity *g**

The visual lightness difference between adjacent grey steps in picture A2 (or C2) of the test charts 1 (or 3) are equal (visually "equally" spaced grey steps). This does not normally occur for the difference of the grey steps on the copies. The differences of these lightness steps are specified by the measure *g**. It describes the regularity of the lightness reproduction.

Calculation G.1: Regularity *g**

For the specification of the regularity *g** the CIELAB lightness *L** of the five grey steps 1 to 5 on the copy L^*_{K1} to L^*_{K5} should be measured.

NOTE 1 The grey step 1 is the copy of the black colour (*N* = "Noir"), the grey step 5 is the copy of the white colour (*W* = White). It follows from this:

$L^*_{K1} = L^*_{KN}$ and $L^*_{K5} = L^*_{KW}$

Afterwards the lightness differences (ΔL^*_{K1} ... ΔL^*_{K4}) to the next lighter step are calculated:

$$\Delta L^*_{K1} = | L^*_{K2} - L^*_{K1} | = | L^*_{K2} - L^*_{KN} | \quad \text{(eq. 1)}$$
$$\Delta L^*_{K2} = | L^*_{K3} - L^*_{K2} | \quad \text{(eq. 2)}$$
$$\Delta L^*_{K3} = | L^*_{K4} - L^*_{K3} | \quad \text{(eq. 3)}$$
$$\Delta L^*_{K4} = | L^*_{K5} - L^*_{K4} | = | L^*_{KW} - L^*_{K4} | \quad \text{(eq. 4)}$$

The regularity *g** of the lightness scale is defined by the quotient of the smallest and greatest lightness difference (ΔL^*_{min} resp. ΔL^*_{max}) multiplied by a factor 100:

$$g^* = 100\ \Delta L^*_{min} / \Delta L^*_{max} \quad \text{(eq. 5)}$$

NOTE 2 Ideally the regularity has the value *g** = 100. In the case where the two steps are identical the value is *g** = 0.

Example G.1: Regularity *g**

$L^*_{K1} = L^*_{KN} = 24$; $L^*_{K2} = 40$; $L^*_{K3} = 56$; $L^*_{K4} = 74$; $L^*_{K5} = L^*_{KW} = 90$

$\Delta L^*_{K1} = | L^*_{K2} - L^*_{K1} | = | L^*_{K2} - L^*_{KN} | = 16 = \Delta L^*_{min}$
$\Delta L^*_{K2} = | L^*_{K3} - L^*_{K2} | = 16 = \Delta L^*_{min}$
$\Delta L^*_{K3} = | L^*_{K4} - L^*_{K3} | = 18 = \Delta L^*_{max}$
$\Delta L^*_{K4} = | L^*_{K5} - L^*_{K4} | = | L^*_{KW} - L^*_{K4} | = 16 = \Delta L^*_{min}$
$g^* = 100\ \Delta L^*_{min} / \Delta L^*_{max} = 100 \times (16 / 18) = 89$

G.2 Grey scale acc. to picture A2 (or C2): Lightness gamut *f**

Differences result in the lightness of black and white for the copy compared to the original. The lightness gamut *f** is specified with the lightness difference between white and black.

Calculation G.2: Lightness gamut *f**

The CIELAB-lightness *L** of black *(N)* and white *(W)* in the test chart *(V)* and copy *(K)* serve for calculation of the lightness gamut *f**.

For the lightness gamut *f** the following applies:

$$f^* = 100\ (L^*_{KW} - L^*_{KN}) / (L^*_{VW} - L^*_{VN}) \quad \text{(eq. 6)}$$

NOTE Ideally, when white and black are reproduced on the copy with the same lightness as in the test chart, the following values apply: $L^*_{VW} = 94$ and $L^*_{VN} = 10$.

$f^* = 100\ (L^*_{KW} - L^*_{KN}) / (L^*_{VW} - L^*_{VN}) = 100\ (94 - 10) / (94 - 10) = 100$

On devices *f** is normally smaller than 100.

Example G.2: Lightness gamut *f**

$L^*_{K1} = L^*_{KN} = 24$; $L^*_{K5} = L^*_{KW} = 90$; $L^*_{VN} = 10$; $L^*_{VW} = 94$

$f^* = 100\ (L^*_{KW} - L^*_{KN}) / (L^*_{VW} - L^*_{VN}) = 100\ (90 - 24) / (94 - 10) = 79$

G.3 Grey steps acc. to picture A2 (or C2): Mean lightness difference ΔL^*_m

The five equidistant grey steps normally show various lightness differences in the copy and the test chart. From this a mean lightness difference ΔL^*_m for the achromatic test charts 1 (or 3) can be calculated.

Calculation G.3: Mean lightness difference ΔL^*_m

The CIELAB-lightness L^* of the five grey steps of the test chart *(V)* and copy *(K)* serve for the calculation of the mean lightness difference ΔL^*_m. The lightness L^*_K of the five grey steps of the copy must be centered on the lightness gamut of the test chart to receive the centered lightness L^*_{KZ}.

$$L^*_{KZ} = L^*_K - 0{,}5\ [\ (\ L^*_{KN} - L^*_{VN}\ ) - (L^*_{VW} - L^*_{KW}\ )\ ] \qquad \text{(eq. 7)}$$

The mean lightness difference ΔL^*_m is calculated from the five lightness differences on the copy L^*_{KZ} and the test chart L^*_V .

$$\Delta L^*_m = 0{,}2\ (\ |\ L^*_{KZ1} - L^*_{V1}\ |\ +\ |\ L^*_{KZ2} - L^*_{V2}\ |\ +\ \ldots\ +\ |\ L^*_{KZ5} - L^*_{V5}\ |\ ) \qquad \text{(eq. 8)}$$

NOTE 1 Ideally the mean lightness difference has the value $\Delta L^*_m = 0$.

NOTE 2 A pure regular shift of the lightness of the copy compared to the test charts (L^*_{VN} = 10 or 7, L^*_{VW} = 94 or 91) has no influence visually and will not change the calculated mean lightness difference ΔL^*_m (compare Table G.3).

Example G.3: Mean lightness difference ΔL^*_m

$L^*_{V1} = L^*_{VN} = 10$; $L^*_{V2} = 31$; $L^*_{V3} = 52$; $L^*_{V4} = 73$; $L^*_{V5} = L^*_{VW} = 94$
$L^*_{K1} = L^*_{KN} = 24$; $L^*_{K2} = 40$; $L^*_{K3} = 56$; $L^*_{K4} = 74$; $L^*_{K5} = L^*_{KW} = 90$

$L^*_{KN} - L^*_{VN} = 24 - 10 = 14$

$L^*_{VW} - L^*_{KW} = 94 - 90 = 4$

Centralization:

$L^*_{KZ1} = L^*_{K1} - 0{,}5\ [\ (L^*_{KN} - L^*_{VN}) - (L^*_{VW} - L^*_{KW})\ ]$
$L^*_{KZ1} = 24 - 0{,}5\ (14 - 4) = 19$
$L^*_{KZ2} = 40 - 0{,}5\ (14 - 4) = 35$
$L^*_{KZ3} = 56 - 0{,}5\ (14 - 4) = 51$
$L^*_{KZ4} = 74 - 0{,}5\ (14 - 4) = 69$
$L^*_{KZ5} = 90 - 0{,}5\ (14 - 4) = 85$

Lightness difference and mean lightness difference:

$\Delta L^*_1 = L^*_{KZ1} - L^*_{V1} = 19 - 10 = 9$
$\Delta L^*_2 = L^*_{KZ2} - L^*_{V2} = 35 - 31 = 4$
$\Delta L^*_3 = L^*_{KZ3} - L^*_{V3} = 52 - 51 = 1$
$\Delta L^*_4 = L^*_{KZ4} - L^*_{V4} = 69 - 73 = -4$
$\Delta L^*_5 = L^*_{KZ5} - L^*_{V5} = 85 - 94 = -9$

$\Delta L^*_m = 0{,}2\ (\ |\ L^*_{KZ1} - L^*_{V1}\ |\ +\ |\ L^*_{KZ2} - L^*_{V2}\ |\ +\ \ldots\ +\ |\ L^*_{KZ5} - L^*_{V5}\ |\ )$
$= 0{,}2\ (9 + 4 + 1 + 4 + 9) = 5{,}4$

G.4 Test colours acc. to picture B6 (or D6): Mean colour difference $\Delta E^*_{ab,m}$

The 14 test colours of a copy normally show different colour differences compared to the colours of the test chart. These differences are characterized by the mean colour difference $\Delta E^*_{ab,m}$.

Calculation G.4: Mean colour difference $\Delta E^*_{ab,m}$

For the calculation of the mean colour difference $\Delta E^*_{ab,m}$ the CIELAB-lightness L^* and the red-green chromaticness a^* and yellow-blue chromaticness b^* of the 14 CIE-test colours of the test chart *(V)* and copy *(K)* in picture B6 (or D6) are measured.

From this the 14 special colour differences $\Delta E^*_{ab,i}$ (i = 1, 2, ... , 14) of copy and test chart are calculated as follows.

$$\Delta E^*_{ab,i} = [\ (L^*_{Ki} - L^*_{Vi}\ )^2 + (a^*_{Ki} - a^*_{Vi}\ )^2 + (b^*_{Ki} - b^*_{Vi}\ )^2\ ]^{1/2} \qquad \text{(eq. 9)}$$

The special colour differences $\Delta E^*_{ab,i}$ are used to define the mean colour difference $\Delta E^*_{ab,m}$:

$$\Delta E^*_{ab,m} = 0{,}0714\ (\Delta E^*_{ab,1} + \Delta E^*_{ab,2} + \Delta E^*_{ab,3} + \ldots + \Delta E^*_{ab,14}) \qquad \text{(eq. 10)}$$

NOTE Ideally the mean colour difference has the value $\Delta E^*_{ab,m} = 0$.

Example G.4: Mean colour difference $\Delta E^*_{ab,m}$

The mean colour difference $\Delta E^*_{ab,m}$ is calculated from the colorimetric parameters $L^*a^*b^*$ of the test chart *(V)* and copy *(K)* with 14 special colour differences $\Delta E^*_{ab,i}$ (i = 1, 2, ... ,14).

Table G.1: Colorimetric parameters of CIE-test colours in ISO-test chart and the copied test chart

CIE test colour	Intended CIELAB data CIE publ. 13.3 Original (V)			Produced CIELAB data of copied colours Copy (K)			CIELAB differences of test colours Difference (K−V)			CIELAB-test colour difference
no.	L^*_V	a^*_V	b^*_V	L^*_K	a^*_K	b^*_K	ΔL^*_{K-V}	Δa^*_{K-V}	Δb^*_{K-V}	ΔE^*_{ab}
1	61.45	17.53	11.74	60.71	18.5	9.5	−0.73	0.97	−2.23	2.55
2	60.69	0.08	28.92	58.84	3.24	23.57	−1.84	3.16	−5.34	6.48
3	62.02	−20.58	44.41	61.79	−21.49	44.33	−0.22	−0.9	−0.07	0.94
4	61.2	−33.16	17.07	62.06	−35.43	19.12	0.86	−2.26	2.05	3.18
5	62.4	−17.47	−8.55	61.7	−15.02	−10.62	−0.69	2.45	−2.06	3.28
6	61.51	−0.36	−28.39	60.17	2.47	−29.72	−1.33	2.84	−1.32	3.41
7	61.12	20.15	−24.55	63.11	17.05	−23.55	1.99	−3.09	1.0	3.82
8	62.77	27.42	−13.63	62.66	27.66	−13.57	−0.1	0.24	0.06	0.27
9	39.92	58.74	27.99	39.37	55.26	24.74	−0.54	−3.47	−3.24	4.79
10	81.26	−2.89	71.56	82.06	−2.84	81.13	0.8	0.05	9.57	9.6
11	52.23	−42.42	13.6	53.43	−44.12	16.49	1.2	−1.69	2.89	3.56
12	30.57	1.41	−46.47	29.63	4.84	−42.36	−0.93	3.43	4.11	5.44
13	80.23	11.37	21.04	78.28	12.32	20.43	−1.94	0.95	−0.6	2.25
14	40.75	−13.8	24.23	41.47	−12.47	24.78	0.72	1.33	0.55	1.61
									Mean CIELAB colour difference:	$\Delta E^*_{ab,m}$ = ***3.7***

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Table G.1 shows the *L*a*b** data of intended and copied CIE-test colours and their CIELAB-differences.

G.5 Mean Colour reproduction Index $R^*_{ab,m}$

The copies of the five equidistant grey steps (pictures A2 and C2) and the 14 test colours (picture B6 and D6) indicate different colour differences compared to the corresponding steps of the test chart. These differences are characterized by the mean colour reproduction Index $R^*_{ab,m}$. It considers the mean lightness difference ΔL^*_m (for the grey steps) as well as the mean test colour difference $\Delta E^*_{ab,m}$ (for the chromatic colours).

Calculation G.5: Mean Colour reproduction Index $R^*_{ab,m}$

The mean lightness difference ΔL^*_m according to Annex G.3 and the mean test colour difference $\Delta E^*_{ab,m}$ acc. to Annex G.4 serve for the calculation of the mean colour reproduction index.

$$R^*_{ab,m} = 100 - 4{,}6\ (\ 0{,}263\ \Delta L^*_m + 0{,}737\ \Delta E^*_{ab,m}\ ) \qquad \text{(eq. 11)}$$

NOTE Ideally the mean colour reproduction index has the value $R^*_{ab,m} = 100$. It becomes smaller when lightness and test colour differences grow.

Example G.5: Mean Colour reproduction Index $R^*_{ab,m}$

For the mean lightness difference ΔL^*_m according to example G.3 and for the mean test colour difference $\Delta E^*_{ab,m}$ according to example G.4 the following applies:

$$R^*_{ab,m} = 100 - 4{,}6\ (0{,}263\ \Delta L^*_m + 0{,}737\ \Delta E^*_{ab,m})$$

$$= 100 - 4{,}6\ (0{,}263 \times 5{,}4 + 0{,}737 \times 3{,}7) = 100 - (\ 4{,}6 \times 4{,}12\ ) = 81 \qquad \text{(eq. 12)}$$

NOTE Results in G.1 to G.5 are to be rounded down to two significant digits.

G.6 Tables produced by *PS*-files (or equivalent)

Table G.2: *L*a*b-Example of this annex, compare data in Table G.1 and Example G.3**

i	LAB*ref			LAB*out			LAB*ouc			ΔE*
1	61.45	17.53	11.74	60.71	18.5	9.5	60.71	18.5	9.5	2.55
2	60.69	0.08	28.92	58.84	3.24	23.57	58.84	3.24	23.57	6.48
3	62.02	−20.58	44.41	61.79	−21.49	44.33	61.79	−21.49	44.33	0.94
4	61.2	−33.16	17.07	62.06	−35.43	19.12	62.06	−35.43	19.12	3.18
5	62.4	−17.47	−8.55	61.7	−15.02	−10.62	61.7	−15.02	−10.62	3.28
6	61.51	−0.36	−28.39	60.17	2.47	−29.72	60.17	2.47	−29.72	3.41
7	61.12	20.15	−24.55	63.11	17.05	−23.55	63.11	17.05	−23.55	3.82
8	62.77	27.42	−13.63	62.66	27.66	−13.57	62.66	27.66	−13.57	0.27
9	39.92	58.74	27.99	39.37	55.26	24.74	39.37	55.26	24.74	4.79
10	81.26	−2.89	71.56	82.06	−2.84	81.13	82.06	−2.84	81.13	9.6
11	52.23	−42.42	13.6	53.43	−44.12	16.49	53.43	−44.12	16.49	3.56
12	30.57	1.41	−46.47	29.63	4.84	−42.36	29.63	4.84	−42.36	5.44
13	80.23	11.37	21.04	78.28	12.32	20.43	78.28	12.32	20.43	2.25
14	40.75	−13.8	24.23	41.47	−12.47	24.78	41.47	−12.47	24.78	1.61
15	10.0	0.01	0.01	24.0	0.0	0.0	24.0	0.0	0.0	14.0
16	94.0	0.01	0.01	90.0	0.0	0.0	90.0	0.0	0.0	4.0
17	10.0	0.01	0.01	24.0	0.0	0.0	19.0	0.0	0.0	9.0
18	31.0	0.01	0.01	40.0	0.0	0.0	35.0	0.0	0.0	4.0
19	52.0	0.01	0.01	56.0	0.0	0.0	51.0	0.0	0.0	1.0
20	73.0	0.01	0.01	74.0	0.0	0.0	69.0	0.0	0.0	4.0
21	94.0	0.01	0.01	90.0	0.0	0.0	85.0	0.0	0.0	9.0
							Mean colour reproduction index:			

Specification according to ISO 15775 Annex G

Regularity

***g** = 88.9*

Lightness gamut

***f** = 78.6*

Mean color difference (14 samples)

ΔE^*_{CIELAB} = *3.7*

Mean lightness difference (5 steps)

ΔL^*_{CIELAB} = *5.4*

$R^*_{ab,m}$ = *81*

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Table G.3: *L*a*b-Example with reference data in halftone and output data in continuous tone technique**

i	LAB*ref			LAB*out			LAB*ouc			ΔE*
1	10.0	0.0	0.0	7.0	0.0	0.0	7.0	0.0	0.0	3.0
2	15.6	0.0	0.0	12.6	0.0	0.0	12.6	0.0	0.0	3.0
3	21.2	0.0	0.0	18.2	0.0	0.0	18.2	0.0	0.0	3.0
4	26.8	0.0	0.0	23.8	0.0	0.0	23.8	0.0	0.0	3.0
5	32.4	0.0	0.0	29.4	0.0	0.0	29.4	0.0	0.0	3.0
6	38.0	0.0	0.0	35.0	0.0	0.0	35.0	0.0	0.0	3.0
7	43.6	0.0	0.0	40.6	0.0	0.0	40.6	0.0	0.0	3.0
8	49.2	0.0	0.0	46.2	0.0	0.0	46.2	0.0	0.0	3.0
9	54.8	0.0	0.0	51.8	0.0	0.0	51.8	0.0	0.0	3.0
10	60.4	0.0	0.0	57.4	0.0	0.0	57.4	0.0	0.0	3.0
11	66.0	0.0	0.0	63.0	0.0	0.0	63.0	0.0	0.0	3.0
12	71.6	0.0	0.0	68.6	0.0	0.0	68.6	0.0	0.0	3.0
13	77.2	0.0	0.0	74.2	0.0	0.0	74.2	0.0	0.0	3.0
14	82.8	0.0	0.0	79.8	0.0	0.0	79.8	0.0	0.0	3.0
15	88.4	0.0	0.0	85.4	0.0	0.0	85.4	0.0	0.0	3.0
16	94.0	0.0	0.0	91.0	0.0	0.0	91.0	0.0	0.0	3.0
17	10.0	0.0	0.0	7.0	0.0	0.0	10.0	0.0	0.0	0.01
18	31.0	0.0	0.0	28.0	0.0	0.0	31.0	0.0	0.0	0.01
19	52.0	0.0	0.0	49.0	0.0	0.0	52.0	0.0	0.0	0.01
20	73.0	0.0	0.0	70.0	0.0	0.0	73.0	0.0	0.0	0.01
21	94.0	0.0	0.0	91.0	0.0	0.0	94.0	0.0	0.0	0.01
							Mean colour reproduction index:			

Specification according to ISO 15775 Annex G

Regularity

***g** = 100.0*

Lightness gamut

***f** = 100.0*

Mean colour difference (16 samples)

ΔE^*_{CIELAB} = *3.0*

Mean lightness difference (5 steps)

ΔL^*_{CIELAB} = *0.0*

$R^*_{ab,m}$ = *89*

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Table G.4: *L*a*b-Example with reference data in continuous and output data in continuous tone technique**

i	LAB*ref			LAB*out			LAB*ouc			ΔE*
1	7.0	0.0	0.0	7.0	0.0	0.0	7.0	0.0	0.0	0.01
2	12.6	0.0	0.0	12.6	0.0	0.0	12.6	0.0	0.0	0.01
3	18.2	0.0	0.0	18.2	0.0	0.0	18.2	0.0	0.0	0.01
4	23.8	0.0	0.0	23.8	0.0	0.0	23.8	0.0	0.0	0.01
5	29.4	0.0	0.0	29.4	0.0	0.0	29.4	0.0	0.0	0.01
6	35.0	0.0	0.0	35.0	0.0	0.0	35.0	0.0	0.0	0.01
7	40.6	0.0	0.0	40.6	0.0	0.0	40.6	0.0	0.0	0.01
8	46.2	0.0	0.0	46.2	0.0	0.0	46.2	0.0	0.0	0.01
9	51.8	0.0	0.0	51.8	0.0	0.0	51.8	0.0	0.0	0.01
10	57.4	0.0	0.0	57.4	0.0	0.0	57.4	0.0	0.0	0.01
11	63.0	0.0	0.0	63.0	0.0	0.0	63.0	0.0	0.0	0.01
12	68.6	0.0	0.0	68.6	0.0	0.0	68.6	0.0	0.0	0.01
13	74.2	0.0	0.0	74.2	0.0	0.0	74.2	0.0	0.0	0.01
14	79.8	0.0	0.0	79.8	0.0	0.0	79.8	0.0	0.0	0.01
15	85.4	0.0	0.0	85.4	0.0	0.0	85.4	0.0	0.0	0.01
16	91.0	0.0	0.0	91.0	0.0	0.0	91.0	0.0	0.0	0.01
17	7.0	0.0	0.0	7.0	0.0	0.0	7.0	0.0	0.0	0.01
18	28.0	0.0	0.0	28.0	0.0	0.0	28.0	0.0	0.0	0.01
19	49.0	0.0	0.0	49.0	0.0	0.0	49.0	0.0	0.0	0.01
20	70.0	0.0	0.0	70.0	0.0	0.0	70.0	0.0	0.0	0.01
21	91.0	0.0	0.0	91.0	0.0	0.0	91.0	0.0	0.0	0.01
							Mean colour reproduction index:			

Specification according to ISO 15775 Annex G

Regularity

g** = 100.0

Lightness gamut

f** = 100.0

Mean colour difference (16 samples)

ΔE^*_{CIELAB} = *0.0*

Mean lighness difference (5 steps)

ΔL^*_{CIELAB} = *0.0*

$R^*_{ab,m}$ = *100*

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Table G.2 shows *L*a*b**-Example of this annex, compare data in Table G.1and Example G.3.

Table G.3 shows *L*a*b**-Example with reference data in halftone reproduction and (ideal) output data in continuous tone reproduction. There is a shift in lightness data to centered lightness data for colours 17 to 21(see calculation G.3). This leads to a mean lightness difference of $\Delta L^*_m = 0$.

Table G.4 shows *L*a*b**-Example with reference data in continuous tone reproduction and output data for continuous tone reproduction. There is no shift in lightness data to centered lightness data for colours 17 to 21. This leads to a mean lightness difference of $\Delta L^*_m = 0$.

Table G.1 to G.4 are designed by *PS*-files (or equivalent). The terms regularity *g**, lightness gamut *f**, mean colour difference $\Delta E^*_{ab,m}$ and mean lightness difference ΔL^*_m, and mean colour reproduction index $R^*_{ab,m}$ are computed by the *PS*-file (or equivalent) code.

NOTE 1 One can include the *L*a*b** colorimetric data with a text editor normally at the beginning in the *EPS*-program files (or equivalent). The *PS*-file (or equivalent) can be send to a *PS*-printer (or equivalent) which formats the tables and calculate the results (regularity, mean lightness difference, mean colour difference, mean colour reproduction index).

NOTE 2 This *PS*-formatting and the *PS*-calculations (or equivalent) are done also by free *PS*-Viewers on monitors and by *Display-PostScript* systems (or equivalent). The results seen on monitors or as output on printers are similar to many Tables G.2 to G.4, and H.1 to H.11 within this International Standard. Under each table there is a filename which helps to find the corresponding file for a user application.

NOTE 3 The *PS*-files (or equivalent) producing useful formatted tables are given as „Technical information“ on different web servers (see Annnex M).

NOTE 4 The software *Adobe Acrobat Distiller* can transform the format *PS* or *EPS* (or equivalent) into the format *PDF* (or equivalent). *PDF*-files can be displayed and printed by the software *Adobe Acrobat Reader* which is license free available for nearly any operating system *(Mac, Unix, Windows)*.

Annex H: (informative) Intended and produced colours

Purpose of Annex H: Give information about intended colours and the average CIELAB colorimetric data for the actual test charts no. 1, 2, 3 and 4 produced.

This Annex H gives information about intended colours and the average CIELAB colorimetric data for the actual DIN-test charts no. 1, 2, 3 and 4 produced. In the pictures there are 14 CIE-test colours and different 16-step colour series *W–N*, *W–C*, *W–M*, *W–Y*, *W–O*, W–*L*, and *W–V*. There is only one 5-step grey series in test chart 1 (or 3).

NOTE The colorimetric *L*a*b**-data of the 5-step series are linearly interpolated from the 16-step data within the *PS*-file (or equivalent) which produces the following Tables H.1 to H.11. There is no significant difference for the calculation of the mean colour difference (5 samples) using the interpolated data of the 16-step and the 5-step data measured in picture A2 (maximum variation about 2 CIELAB-units). Therefore interpolated data can be used.

In actual printing the 5-step colour series were additionaly printed outside the test DIN-test chart 2 area. For the 5-step series a comparison of these measured data with the interpolated data show no significant differences (maximum variation about 2 CIELAB-units). Therefore interpolated data can be used.

Table H.1 shows data for the 16-step and 5-step series White–Black *W–N* of achromatic DIN-test chart 1, picture A3. The mean (average) colour and lightness differences (see Annex G) are given on the right side. These numbers are computed using the method given in Annex G.

Tables H.2 to H.4 show data for the 16-step and 5-step series White–Cyan *W–C*, White–Magenta *W–M*, and White–Yellow *W–Y* of chromatic DIN-test chart 2, picture B2. The mean (average) colour differences for 16 and 5 samples (see Annex G) are given on the right side. These numbers are computed using the method given in Annex G.

NOTE Picture B2 of DIN-test chart 2 includes only the 16-steps series and no 5 step series.

Table H.5 shows data for the 14 CIE-test colours of DIN-test chart 2, picture B6 and the 5-step series White–Black *W–N* of DIN-test chart 1, picture A2. In Table H.5 for the colours *i* = 15 and 16 Black and White (no. 17 and 21) are used again. The mean (average) colour and lightness differences (see Annex G) of 14 CIE-test colours and 5 achromatic colours are given on the right side. These numbers are computed using the method given in Annex G.

Table H.6 shows data for the 16-step and 5-step series White–Black *W–N* of achromatic DIN-test chart 3, picture A3 (offset). The mean (average) colour and lightness differences (see Annex G) are given on the right side. These numbers are computed using the method given in Annex G.

Tables H.7 to H.9 show data for the 16-step and 5-step series White–Orangered *W–O*, White–Leafgreen W–*L*, and White–Violetblue *W–V* of chromatic DIN-test chart 4, picture C2. The mean (average) colour differences for 16 and 5 samples (see Annex G) are given on the right side. These numbers are computed using the method given in Annex G.

NOTE Picture C2 of DIN-test chart 4 includes only the 16-steps series and no 5 step series.

Table H.10 shows data for the 14 CIE-test colours of DIN-test chart 4, picture C6 and the 5-step series White–Black *W–N* of DIN-test chart 3, picture A2 (offset). In Table H.10 for the colours *i* = 15 and 16 Black and White (no. 17 and 21) are used again. The mean (average) colour and lightness differences (see Annex G) of 14 CIE-test colours and 5 achromatic colours are given on the right side. These numbers are computed using the method given in Annex G.

Table H.11 shows data for the 14 CIE-test colours of DIN-test chart 4, picture C1 (pixel image) and the 5-step series White–Black *W–N* of DIN-test chart 1, picture A2. In Table H.11 for the colours *i* = 15 and 16 Black and White (no. 17 and 21) are used again. The mean (average) colour and lightness differences (see Annex G) of 14 CIE-test colours and 5 achromatic colours are given on the right side. These numbers are computed using the method given in Annex G.

NOTE 1 Users can find on the web sites (see Annex M) *PS*-files (or equivalent) which uses the data of Annex G and H and calculates the results of Annex G and H within a *PS*-Printer (or equivalent) or by a *PS*-interpreter (or equivalent) or by the *Adobe Acrobat* Software (or equivalent). User may calculate colour differences for different applications with these *PS*-files (or equivalent).

NOTE 2 The software *Adobe Acrobat Distiller* can transform the format *PS* or *EPS* (or equivalent) into the format *PDF* (or equivalent). *PDF*-files (or equivalent) can be displayed and printed by the software *Adobe Acrobat Reader* (or equivalent) witch is license free available for nearly any operating system *(Mac, Unix, Windows)*.

Table H.1: Colorimetric data of series *W–N*, DIN 33866 test chart no. 1, picture A3

i	LAB*ref			LAB*out			LAB*ouc			ΔE*	
1	10.0	0.0	0.0	10.12	1.8	4.51	10.12	1.8	4.51	4.86	**Specification according to ISO 15775 Annex G**
2	15.6	0.0	0.0	14.89	1.26	3.34	14.89	1.26	3.34	3.64	
3	21.2	0.0	0.0	20.63	0.73	2.2	20.63	0.73	2.2	2.39	
4	26.8	0.0	0.0	26.45	0.47	1.18	26.45	0.47	1.18	1.32	
5	32.4	0.0	0.0	32.27	0.3	0.48	32.27	0.3	0.48	0.58	
6	38.0	0.0	0.0	36.67	0.22	0.09	36.67	0.22	0.09	1.35	**Regularity**
7	43.6	0.0	0.0	41.1	0.18	−0.33	41.1	0.18	−0.33	2.53	***g** = 82.2***
8	49.2	0.0	0.0	46.45	0.15	−0.75	46.45	0.15	−0.75	2.86	
9	54.8	0.0	0.0	52.06	0.12	−1.14	52.06	0.12	−1.14	2.97	**Lightness gamut**
10	60.4	0.0	0.0	57.79	0.13	−1.49	57.79	0.13	−1.49	3.01	***f** = 99.3***
11	66.0	0.0	0.0	63.85	0.14	−1.71	63.85	0.14	−1.71	2.76	
12	71.6	0.0	0.0	69.73	0.21	−1.77	69.73	0.21	−1.77	2.59	
13	77.2	0.0	0.0	75.19	0.27	−1.74	75.19	0.27	−1.74	2.68	
14	82.8	0.0	0.0	80.74	0.37	−1.57	80.74	0.37	−1.57	2.62	
15	88.4	0.0	0.0	88.06	0.54	−1.45	88.06	0.54	−1.45	1.59	**Mean colour difference (16 samples)**
16	94.0	0.0	0.0	93.54	0.66	−1.45	93.54	0.66	−1.45	1.67	ΔE^*_{CIELAB} = ***2.5***
17	10.0	0.0	0.0	10.12	1.8	4.51	10.29	1.8	4.51	4.86	
18	31.0	0.0	0.0	30.82	0.34	0.66	30.99	0.34	0.66	0.74	
19	52.0	0.0	0.0	49.26	0.14	−0.95	49.43	0.14	−0.95	2.75	
20	73.0	0.0	0.0	71.1	0.23	−1.76	71.27	0.23	−1.76	2.49	**Mean colour difference (5 samples)**
21	94.0	0.0	0.0	93.54	0.66	−1.45	93.71	0.66	−1.45	1.63	ΔL^*_{CIELAB} = ***2.5***
											Mean colour reproduction index: $R^*_{ab,m}$ = ***89***

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Table H.2: Colorimetric data of series *W–C*, DIN 33866 test chart no. 2, picture B2

i	LAB*ref			LAB*out			LAB*ouc			ΔE*	
1	58.62	−30.62	−42.74	59.96	−27.81	−43.16	59.96	−27.81	−43.16	3.14	**Specification according to ISO 15775 Annex G**
2	61.07	−28.64	−39.57	63.24	−27.48	−39.6	63.24	−27.48	−39.6	2.46	
3	63.53	−26.67	−36.41	67.36	−25.2	−34.41	67.36	−25.2	−34.41	4.57	
4	65.98	−24.69	−33.24	70.03	−23.12	−30.98	70.03	−23.12	−30.98	4.9	
5	68.43	−22.72	−30.07	71.43	−21.85	−29.08	71.43	−21.85	−29.08	3.28	
6	70.88	−20.74	−26.9	73.73	−20.17	−25.99	73.73	−20.17	−25.99	3.04	**Regularity**
7	73.34	−18.76	−23.74	75.98	−18.49	−22.98	75.98	−18.49	−22.98	2.76	***g** = 63.5***
8	75.79	−16.79	−20.57	78.81	−15.97	−19.01	78.81	−15.97	−19.01	3.5	
9	78.24	−14.81	−17.4	81.34	−13.97	−15.66	81.34	−13.97	−15.66	3.65	**Lightness gamut**
10	80.69	−12.84	−14.23	83.36	−12.12	−12.58	83.36	−12.12	−12.58	3.22	***f** = 41.9***
11	83.15	−10.86	−11.07	85.7	−10.37	−9.91	85.7	−10.37	−9.91	2.85	
12	85.6	−8.88	−7.9	87.13	−9.15	−8.02	87.13	−9.15	−8.02	1.56	
13	88.05	−6.91	−4.73	90.94	−5.11	−2.55	90.94	−5.11	−2.55	4.04	
14	90.5	−4.93	−1.56	92.49	−3.34	−0.39	92.49	−3.34	−0.39	2.8	
15	92.96	−2.96	1.59	93.79	−1.93	1.59	93.79	−1.93	1.59	1.32	**Mean colour difference (16 samples)**
16	95.41	−0.98	4.76	95.14	−0.6	3.26	95.14	−0.6	3.26	1.57	ΔE^*_{CIELAB} = ***3.0***
17	58.62	−30.62	−42.74	59.96	−27.81	−43.16	59.43	−27.81	−43.16	2.95	
18	67.82	−23.21	−30.86	71.08	−22.17	−29.56	70.55	−22.17	−29.56	3.2	
19	77.02	−15.8	−18.98	80.07	−14.97	−17.34	79.54	−14.97	−17.34	3.13	
20	86.21	−8.39	−7.11	88.08	−8.14	−6.65	87.55	−8.14	−6.65	1.43	**Mean colour difference (5 samples)**
21	95.41	−0.98	4.76	95.14	−0.6	3.26	94.61	−0.6	3.26	1.74	ΔL^*_{CIELAB} = ***2.5***
											Mean colour reproduction index: $R^*_{ab,m}$ = ***87***

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Table H.3: Colorimetric data of series *W–M*, DIN 33866 test chart no. 2, picture B2

i	LAB*ref			LAB*out			LAB*ouc			ΔE*
1	48.13	75.2	−6.79	49.19	74.03	−7.41	49.19	74.03	−7.41	1.7
2	51.28	70.12	−6.02	53.16	66.88	−9.5	53.16	66.88	−9.5	5.11
3	54.43	65.04	−5.25	57.04	59.38	−9.11	57.04	59.38	−9.11	7.33
4	57.59	59.96	−4.48	61.14	51.84	−8.47	61.14	51.84	−8.47	9.72
5	60.74	54.88	−3.71	63.23	47.81	−7.82	63.23	47.81	−7.82	8.55
6	63.89	49.8	−2.94	65.47	44.4	−7.62	65.47	44.4	−7.62	7.32
7	67.04	44.72	−2.17	68.64	38.96	−6.82	68.64	38.96	−6.82	7.58
8	70.19	39.64	−1.4	71.98	33.83	−5.92	71.98	33.83	−5.92	7.58
9	73.35	34.57	−0.62	75.23	28.99	−4.99	75.23	28.99	−4.99	7.33
10	76.5	29.49	0.14	78.16	24.54	−3.99	78.16	24.54	−3.99	6.66
11	79.65	24.41	0.91	81.06	20.35	−3.26	81.06	20.35	−3.26	5.99
12	82.8	19.33	1.68	83.97	15.51	−2.19	83.97	15.51	−2.19	5.57
13	85.95	14.25	2.45	88.52	9.34	−0.22	88.52	9.34	−0.22	6.15
14	89.11	9.17	3.22	91.58	4.61	1.42	91.58	4.61	1.42	5.49
15	92.26	4.09	3.99	93.12	2.03	2.31	93.12	2.03	2.31	2.79
16	95.41	−0.98	4.76	94.78	−0.6	3.36	94.78	−0.6	3.36	1.58
17	48.13	75.2	−6.79	49.19	74.03	−7.41	48.98	74.03	−7.41	1.57
18	59.95	56.15	−3.9	62.71	48.82	−7.98	62.49	48.82	−7.98	8.77
19	71.77	37.11	−1.01	73.61	31.41	−5.46	73.39	31.41	−5.46	7.4
20	83.59	18.06	1.87	85.11	13.97	−1.7	84.89	13.97	−1.7	5.59
21	95.41	−0.98	4.76	94.78	−0.6	3.36	94.57	−0.6	3.36	1.68

Specification according to ISO 15775 Annex G

Regularity

g** = 71.6

Lightness gamut

f** = 54.3

Mean colour difference (16 samples)

ΔE^*_{CIELAB} = ***6.0***

Mean colour difference (5 samples)

ΔL^*_{CIELAB} = ***5.0***

Mean colour reproduction index: $R^*_{ab,m}$ = ***73***

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Table H.4: Colorimetric data of series *W–Y*, DIN 33866 test chart no. 2, picture B2

i	LAB*ref			LAB*out			LAB*ouc			ΔE*
1	90.37	−11.15	96.17	87.12	−5.59	105.61	87.12	−5.59	105.61	11.43
2	90.71	−10.47	90.08	87.68	−6.88	101.04	87.68	−6.88	101.04	11.93
3	91.04	−9.79	83.98	88.13	−7.59	94.37	88.13	−7.59	94.37	11.01
4	91.38	−9.12	77.89	88.6	−7.93	86.35	88.6	−7.93	86.35	8.98
5	91.71	−8.44	71.79	89.06	−7.88	76.07	89.06	−7.88	76.07	5.06
6	92.05	−7.76	65.7	89.78	−7.7	68.8	89.78	−7.7	68.8	3.84
7	92.39	−7.08	59.61	90.06	−7.22	59.16	90.06	−7.22	59.16	2.37
8	92.72	−6.4	53.51	90.32	−7.3	55.33	90.32	−7.3	55.33	3.14
9	93.06	−5.73	47.42	90.95	−7.04	49.91	90.95	−7.04	49.91	3.52
10	93.39	−5.05	41.32	91.52	−6.57	43.07	91.52	−6.57	43.07	2.98
11	93.73	−4.37	35.23	92.41	−6.0	35.41	92.41	−6.0	35.41	2.11
12	94.07	−3.69	29.14	92.75	−5.3	28.29	92.75	−5.3	28.29	2.24
13	94.4	−3.01	23.04	93.46	−4.32	21.25	93.46	−4.32	21.25	2.41
14	94.74	−2.34	16.95	94.4	−2.86	13.19	94.4	−2.86	13.19	3.81
15	95.07	−1.66	10.85	94.65	−2.02	9.31	94.65	−2.02	9.31	1.64
16	95.41	−0.98	4.76	95.32	−0.58	3.35	95.32	−0.58	3.35	1.47
17	90.37	−11.15	96.17	87.12	−5.59	105.61	88.79	−5.59	105.61	11.07
18	91.63	−8.61	73.32	88.95	−7.89	78.64	90.62	−7.89	78.64	5.47
19	92.89	−6.07	50.47	90.63	−7.17	52.62	92.3	−7.17	52.62	2.49
20	94.15	−3.52	27.61	92.93	−5.06	26.53	94.6	−5.06	26.53	1.93
21	95.41	−0.98	4.76	95.32	−0.58	3.35	96.99	−0.58	3.35	2.16

Specification according to ISO 15775 Annex G

Regularity

g** = 70.6

Lightness gamut

f** = 9.8

Mean colour difference (16 samples)

ΔE^*_{CIELAB} = ***4.9***

Mean colour difference (5 samples)

ΔL^*_{CIELAB} = ***4.6***

Mean colour reproduction index: $R^*_{ab,m}$ = ***78***

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Table H.5: Colorimetric data of CIE-colours (DIN 33866 no. 2, B6) and series *W–N* (DIN 33866 no. 1, A2)

i	LAB*ref			LAB*out			LAB*ouc			ΔE*	
1	61.45	17.53	11.74	56.8	12.93	19.6	56.8	12.93	19.6	10.23	**Specification according to**
2	60.69	0.08	28.92	55.0	−2.42	35.85	55.0	−2.42	35.85	9.31	**ISO 15775 Annex G**
3	62.02	−20.58	44.41	56.74	−24.61	42.51	56.74	−24.61	42.51	6.91	
4	61.2	−33.16	17.07	60.9	−48.14	23.62	60.9	−48.14	23.62	16.35	
5	62.4	−17.47	−8.55	58.17	−19.98	−13.31	58.17	−19.98	−13.31	6.84	
6	61.51	−0.36	−28.39	57.44	0.1	−31.83	57.44	0.1	−31.83	5.35	**Regularity**
7	61.12	20.15	−24.55	56.85	18.29	−25.86	56.85	18.29	−25.86	4.84	***g** = 90.5*
8	62.77	27.42	−13.63	57.87	27.63	−21.75	57.87	27.63	−21.75	9.49	
9	39.92	58.74	27.99	41.87	38.7	33.27	41.87	38.7	33.27	20.82	**Lightness gamut**
10	81.26	−2.89	71.56	75.56	4.2	74.01	75.56	4.2	74.01	9.43	***f** = 99.2*
11	52.23	−42.42	13.6	47.15	−47.28	18.53	47.15	−47.28	18.53	8.59	
12	30.57	1.41	−46.47	34.8	1.37	−28.6	34.8	1.37	−28.6	18.36	
13	80.23	11.37	21.04	77.59	15.62	29.57	77.59	15.62	29.57	9.89	**Mean colour difference (14 samples)**
14	40.75	−13.8	24.23	36.07	−18.23	23.81	36.07	−18.23	23.81	6.46	ΔE^*_{CIELAB} = *10.2*
15	10.0	0.0	0.0	10.07	1.83	4.48	10.07	1.83	4.48	4.84	
16	94.0	0.0	0.0	93.39	0.76	−1.63	93.39	0.76	−1.63	1.91	
17	10.0	0.0	0.0	10.07	1.83	4.48	10.34	1.83	4.48	4.85	
18	31.0	0.0	0.0	29.99	0.35	0.8	30.26	0.35	0.8	1.14	
19	52.0	0.0	0.0	50.74	0.15	−1.23	51.01	0.15	−1.23	1.59	
20	73.0	0.0	0.0	71.39	0.27	−1.88	71.66	0.27	−1.88	2.33	**Mean colour difference (5 samples)**
21	94.0	0.0	0.0	93.39	0.76	−1.63	93.66	0.76	−1.63	1.84	ΔL^*_{CIELAB} = *2.4*
							Mean colour reproduction index:				$R^*_{ab,m}$ = *63*

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Table H.6: Colorimetric data of series *W–N*, DIN 33866 test chart no. 3, picture A3 (offset)

i	LAB*ref			LAB*out			LAB*ouc			ΔE*	
1	18.01	0.5	−0.46	17.16	−0.07	−2.72	17.16	−0.07	−2.72	2.48	**Specification according to**
2	23.17	0.4	−0.11	24.07	−0.15	−2.75	24.07	−0.15	−2.75	2.84	**ISO 15775 Annex G**
3	28.33	0.3	0.23	30.85	−0.23	−2.54	30.85	−0.23	−2.54	3.79	
4	33.49	0.2	0.58	38.41	−0.43	−2.3	38.41	−0.43	−2.3	5.74	
5	38.65	0.1	0.92	42.77	−0.48	−2.13	42.77	−0.48	−2.13	5.17	
6	43.81	0.0	1.27	47.15	−0.74	−1.64	47.15	−0.74	−1.64	4.5	**Regularity**
7	48.97	−0.09	1.62	52.89	−0.79	−1.44	52.89	−0.79	−1.44	5.03	***g** = 69.2*
8	54.13	−0.19	1.97	56.25	−0.79	−1.25	56.25	−0.79	−1.25	3.91	
9	59.29	−0.28	2.32	61.07	−0.8	−1.07	61.07	−0.8	−1.07	3.87	**Lightness gamut**
10	64.45	−0.38	2.67	66.47	−0.74	−0.63	66.47	−0.74	−0.63	3.89	***f** = 92.6*
11	69.61	−0.48	3.02	70.36	−0.79	−0.12	70.36	−0.79	−0.12	3.25	
12	74.77	−0.58	3.37	75.35	−0.7	0.4	75.35	−0.7	0.4	3.02	
13	79.93	−0.68	3.71	79.87	−0.71	0.98	79.87	−0.71	0.98	2.73	
14	85.09	−0.78	4.06	87.58	−0.66	2.11	87.58	−0.66	2.11	3.17	
15	90.25	−0.88	4.41	91.78	−0.6	2.74	91.78	−0.6	2.74	2.28	**Mean color difference (16 samples)**
16	95.41	−0.98	4.76	94.98	−0.59	3.28	94.98	−0.59	3.28	1.59	ΔE^*_{CIELAB} = *3.6*
17	18.01	0.5	−0.46	17.16	−0.07	−2.72	17.8	−0.07	−2.72	2.34	
18	37.36	0.13	0.84	41.68	−0.47	−2.17	42.32	−0.47	−2.17	5.84	
19	56.71	−0.24	2.15	58.66	−0.8	−1.16	59.3	−0.8	−1.16	4.24	
20	76.06	−0.61	3.45	76.48	−0.7	0.55	77.12	−0.7	0.55	3.1	**Mean colour difference (5 samples)**
21	95.41	−0.98	4.76	94.98	−0.59	3.28	95.62	−0.59	3.28	1.54	ΔL^*_{CIELAB} = *3.4*
							Mean colour reproduction index:				$R^*_{ab,m}$ = *84*

INFIE08:IEAH061.EPS

Table H.7: Colorimetric data of series *W–O*, DIN 33866 test chart no. 4, picture C2

i	LAB*ref			LAB*out			LAB*ouc			ΔE*
1	47.94	65.31	52.07	47.94	65.31	52.07	47.94	65.31	52.07	0.01
2	51.1	60.89	48.92	50.89	59.79	54.27	50.89	59.79	54.27	5.47
3	54.27	56.47	45.76	54.06	53.38	54.48	54.06	53.38	54.48	9.25
4	57.43	52.05	42.61	58.01	45.94	51.53	58.01	45.94	51.53	10.83
5	60.6	47.63	39.45	60.4	41.71	46.8	60.4	41.71	46.8	9.44
6	63.76	43.21	36.3	62.24	38.64	42.92	62.24	38.64	42.92	8.19
7	66.93	38.79	33.15	65.28	33.73	39.02	65.28	33.73	39.02	7.93
8	70.09	34.37	29.99	68.69	28.62	35.04	68.69	28.62	35.04	7.78
9	73.26	29.95	26.84	71.86	23.14	32.75	71.86	23.14	32.75	9.13
10	76.42	25.53	23.68	74.86	19.22	29.35	74.86	19.22	29.35	8.62
11	79.59	21.11	20.53	78.27	15.77	24.44	78.27	15.77	24.44	6.75
12	82.75	16.69	17.38	81.66	11.94	20.14	81.66	11.94	20.14	5.6
13	85.92	12.27	14.22	86.43	6.51	16.02	86.43	6.51	16.02	6.06
14	89.08	7.85	11.07	90.57	2.64	11.3	90.57	2.64	11.3	5.42
15	92.25	3.43	7.91	93.09	0.6	8.22	93.09	0.6	8.22	2.97
16	95.41	−0.98	4.76	95.49	−0.59	3.2	95.49	−0.59	3.2	1.61
17	47.94	65.31	52.07	47.94	65.31	52.07	47.9	65.31	52.07	0.04
18	59.81	48.74	40.24	59.8	42.77	47.98	59.76	42.77	47.98	9.77
19	71.68	32.16	28.42	70.28	25.88	33.9	70.24	25.88	33.9	8.46
20	83.54	15.58	16.59	82.85	10.58	19.11	82.81	10.58	19.11	5.65
21	95.41	−0.98	4.76	95.49	−0.59	3.2	95.45	−0.59	3.2	1.61

Specification according to ISO 15775 Annex G

Regularity

g* = ***82.9***

Lightness gamut

f* = ***56.6***

Mean colour difference (16 samples)

ΔE^*_{CIELAB} = ***6.6***

Mean colour difference (5 samples)

ΔL^*_{CIELAB} = ***5.1***

Mean colour reproduction index: $R^*_{ab,m}$ = ***71***

INFIE08:IEAH071.EPS

Table H.8: Colorimetric data of series *W–L*, DIN 33866 test chart no. 4, picture C2

i	LAB*ref			LAB*out			LAB*ouc			ΔE*
1	50.9	−62.96	36.71	50.9	−62.96	36.71	50.9	−62.96	36.71	0.01
2	53.87	−58.83	34.58	54.71	−59.34	42.44	54.71	−59.34	42.44	7.92
3	56.83	−54.7	32.45	59.18	−51.75	45.69	59.18	−51.75	45.69	13.77
4	59.8	−50.56	30.32	62.76	−45.88	44.85	62.76	−45.88	44.85	15.55
5	62.77	−46.43	28.19	64.73	−42.59	39.37	64.73	−42.59	39.37	11.98
6	65.74	−42.3	26.06	66.92	−39.23	36.48	66.92	−39.23	36.48	10.93
7	68.7	−38.17	23.93	70.03	−34.38	30.48	70.03	−34.38	30.48	7.68
8	71.67	−34.04	21.8	73.49	−29.69	29.08	73.49	−29.69	29.08	8.67
9	74.64	−29.9	19.67	76.75	−25.35	26.21	76.75	−25.35	26.21	8.24
10	77.61	−25.77	17.54	79.78	−21.49	23.54	79.78	−21.49	23.54	7.69
11	80.57	−21.64	15.41	82.5	−18.23	19.56	82.5	−18.23	19.56	5.71
12	83.54	−17.51	13.28	84.87	−15.16	15.06	84.87	−15.16	15.06	3.23
13	86.51	−13.38	11.15	89.33	−9.27	14.69	89.33	−9.27	14.69	6.11
14	89.48	−9.24	9.02	91.64	−5.89	9.61	91.64	−5.89	9.61	4.04
15	92.44	−5.11	6.89	93.68	−3.38	7.81	93.68	−3.38	7.81	2.32
16	95.41	−0.98	4.76	95.43	−0.63	3.31	95.43	−0.63	3.31	1.49
17	50.9	−62.96	36.71	50.9	−62.96	36.71	50.89	−62.96	36.71	0.01
18	62.03	−47.47	28.72	64.24	−43.41	40.74	64.23	−43.41	40.74	12.87
19	73.16	−31.97	20.74	75.12	−27.52	27.65	75.11	−27.52	27.65	8.45
20	84.28	−16.48	12.75	85.99	−13.69	14.97	85.98	−13.69	14.97	3.95
21	95.41	−0.98	4.76	95.43	−0.63	3.31	95.42	−0.63	3.31	1.49

Specification according to ISO 15775 Annex G

Regularity

g* = ***70.8***

Lightness gamut

f* = ***53.0***

Mean colour difference (16 samples)

ΔE^*_{CIELAB} = ***7.2***

Mean colour difference (5 samples)

ΔL^*_{CIELAB} = ***5.4***

Mean colour reproduction index: $R^*_{ab,m}$ = ***69***

INFIE08:IEAH081.EPS

Table H.9: Colorimetric data of series *W–V*, DIN 33866 test chart no. 4, picture C2

i	LAB*ref			LAB*out			LAB*ouc			ΔE*	
1	25.72	31.45	−44.35	25.72	31.45	−44.35	25.72	31.45	−44.35	0.01	**Specification according to ISO 15775 Annex G**
2	30.37	29.29	−41.08	31.69	26.38	−42.58	31.69	26.38	−42.58	3.53	
3	35.01	27.12	−37.8	37.74	24.19	−38.7	37.74	24.19	−38.7	4.11	
4	39.66	24.96	−34.53	42.72	21.13	−35.99	42.72	21.13	−35.99	5.12	
5	44.3	22.8	−31.25	45.93	19.37	−33.83	45.93	19.37	−33.83	4.59	
6	48.95	20.64	−27.98	49.58	18.09	−31.26	49.58	18.09	−31.26	4.2	**Regularity**
7	53.6	18.47	−24.7	53.47	16.15	−28.52	53.47	16.15	−28.52	4.47	***g** = 81.8***
8	58.24	16.31	−21.43	58.97	14.32	−24.7	58.97	14.32	−24.7	3.9	
9	62.89	14.15	−18.15	63.03	12.58	−22.12	63.03	12.58	−22.12	4.27	**Lightness gamut**
10	67.53	11.99	−14.88	67.84	10.83	−18.83	67.84	10.83	−18.83	4.13	***f** = 82.8***
11	72.18	9.82	−11.6	71.85	9.27	−15.8	71.85	9.27	−15.8	4.25	
12	76.83	7.66	−8.33	75.7	6.71	−13.31	75.7	6.71	−13.31	5.19	
13	81.47	5.5	−5.05	83.0	5.1	−7.0	83.0	5.1	−7.0	2.51	
14	86.12	3.34	−1.78	88.02	1.7	−3.1	88.02	1.7	−3.1	2.83	
15	90.76	1.17	1.49	91.95	0.59	0.34	91.95	0.59	0.34	1.75	**Mean colour difference (16 samples)**
16	95.41	−0.98	4.76	95.31	−0.59	3.3	95.31	−0.59	3.3	1.51	ΔE^*_{CIELAB} = ***3.5***
17	25.72	31.45	−44.35	25.72	31.45	−44.35	25.77	31.45	−44.35	0.05	
18	43.14	23.34	−32.07	45.13	19.81	−34.37	45.18	19.81	−34.37	4.68	
19	60.57	15.23	−19.79	61.0	13.45	−23.41	61.05	13.45	−23.41	4.06	
20	77.99	7.12	−7.51	77.52	6.31	−11.73	77.57	6.31	−11.73	4.32	**Mean colour difference (5 samples)**
21	95.41	−0.98	4.76	95.31	−0.59	3.3	95.36	−0.59	3.3	1.51	ΔL^*_{CIELAB} = ***2.9***
						Mean colour reproduction index:					$R^*_{ab,m}$ = ***84***

INFIE08:IEAH091.EPS

Table H.10: Colorimetric data of CIE-colours (DIN 33866 no. 4, C6) and series *W–N* (DIN 33866 no. 3, A2)

i	LAB*ref			LAB*out			LAB*ouc			ΔE*	
1	61.45	17.53	11.74	56.8	12.93	19.6	56.8	12.93	19.6	10.23	**Specification according to ISO 15775 Annex G**
2	60.69	0.08	28.92	55.0	−2.43	35.85	55.0	−2.43	35.85	9.31	
3	62.02	−20.58	44.41	56.74	−24.62	42.51	56.74	−24.62	42.51	6.91	
4	61.2	−33.16	17.07	60.9	−48.15	23.62	60.9	−48.15	23.62	16.36	
5	62.4	−17.47	−8.55	58.17	−19.99	−13.32	58.17	−19.99	−13.32	6.86	
6	61.51	−0.36	−28.39	57.44	0.1	−31.84	57.44	0.1	−31.84	5.36	**Regularity**
7	61.12	20.15	−24.55	56.85	18.29	−25.87	56.85	18.29	−25.87	4.84	***g** = 79.4***
8	62.77	27.42	−13.63	57.87	27.63	−21.76	57.87	27.63	−21.76	9.49	
9	39.92	58.74	27.99	41.87	38.7	33.27	41.87	38.7	33.27	20.82	**Lightness gamut**
10	81.26	−2.89	71.56	75.56	4.2	74.01	75.56	4.2	74.01	9.43	***f** = 90.8***
11	52.23	−42.42	13.6	47.15	−47.29	18.53	47.15	−47.29	18.53	8.59	
12	30.57	1.41	−46.47	34.8	1.37	−28.61	34.8	1.37	−28.61	18.35	
13	80.23	11.37	21.04	77.59	15.62	29.57	77.59	15.62	29.57	9.89	**Mean color difference (14 samples)**
14	40.75	−13.8	24.23	36.07	−18.24	23.81	36.07	−18.24	23.81	6.46	ΔE^*_{CIELAB} = ***10.2***
15	18.01	0.5	−0.45	18.88	−0.06	−2.96	18.88	−0.06	−2.96	2.72	
16	95.41	−0.97	4.76	95.12	−0.58	3.29	95.12	−0.58	3.29	1.55	
17	18.01	0.5	−0.45	18.88	−0.06	−2.96	18.59	−0.06	−2.96	2.64	
18	37.36	0.13	0.84	41.13	−0.54	−2.28	40.84	−0.54	−2.28	4.73	
19	56.71	−0.23	2.15	59.1	−0.76	−1.09	58.81	−0.76	−1.09	3.91	
20	76.06	−0.6	3.45	76.76	−0.78	0.8	76.47	−0.78	0.8	2.69	**Mean colour difference (5 samples)**
21	95.41	−0.97	4.76	95.12	−0.58	3.29	94.83	−0.58	3.29	1.63	ΔL^*_{CIELAB} = ***3.1***
						Mean colour reproduction index:					$R^*_{ab,m}$ = ***62***

INFIE08:IEAH101.EPS

Table H.11: Colorimetric data of 14 CIE and 5 grey colours in pixel image, DIN 33866 no. 4, picture C1

i	LAB*ref			LAB*out			LAB*ouc			ΔE*
1	61.45	17.53	11.74	61.99	9.42	8.41	61.99	9.42	8.41	8.78
2	60.69	0.08	28.92	62.81	−4.14	24.41	62.81	−4.14	24.41	6.54
3	62.02	−20.58	44.41	65.47	−29.58	56.54	65.47	−29.58	56.54	15.49
4	61.2	−33.16	17.07	65.59	−28.55	8.96	65.59	−28.55	8.96	10.31
5	62.4	−17.47	−8.55	63.63	−4.23	−27.12	63.63	−4.23	−27.12	22.84
6	61.51	−0.36	−28.39	61.65	3.93	−26.69	61.65	3.93	−26.69	4.63
7	61.12	20.15	−24.55	63.43	15.43	−20.52	63.43	15.43	−20.52	6.62
8	62.77	27.42	−13.63	70.22	33.52	−7.18	70.22	33.52	−7.18	11.59
9	39.92	58.74	27.99	49.61	64.68	27.38	49.61	64.68	27.38	11.38
10	81.26	−2.89	71.56	87.46	−7.54	99.25	87.46	−7.54	99.25	28.75
11	52.23	−42.42	13.6	55.78	−21.39	4.93	55.78	−21.39	4.93	23.02
12	30.57	1.41	−46.47	45.57	5.17	−38.81	45.57	5.17	−38.81	17.26
13	80.23	11.37	21.04	80.85	13.33	19.86	80.85	13.33	19.86	2.37
14	40.75	−13.8	24.23	47.09	−18.99	29.83	47.09	−18.99	29.83	9.92
15	18.01	0.5	−0.45	27.31	−9.94	4.37	27.31	−9.94	4.37	14.8
16	95.41	−0.97	4.76	94.38	0.33	3.53	94.38	0.33	3.53	2.07
17	18.01	0.5	−0.45	27.31	−9.94	4.37	23.18	−9.94	4.37	12.62
18	37.36	0.13	0.84	37.43	−7.88	4.38	33.3	−7.88	4.38	9.66
19	56.71	−0.23	2.15	56.85	−2.21	2.12	52.72	−2.21	2.12	4.46
20	76.06	−0.6	3.45	71.03	3.56	−12.1	66.9	3.56	−12.1	18.53
21	95.41	−0.97	4.76	94.38	0.33	3.53	90.25	0.33	3.53	5.47
										Mean colour reproduction index:

Specification according to ISO 15775 Annex G

Regularity

g** = 43.3

Lightness gamut

f** = 79.8

Mean colour difference (14 samples)

ΔE^*_{CIELAB} = ***12.8***

Mean colour difference (5 samples)

ΔL^*_{CIELAB} = ***10.1***

$R^*_{ab,m}$ = ***44***

INFIE08:IEAH111.EPS