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**Multimedia systems and equipment – Colour measurement and management –
Part 9: Digital cameras**

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**Systèmes et appareils multimédia – Mesure et gestion de la couleur –
Partie 9: Appareils numériques de prise de vue**

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IEC 61966-9

Edition 2.0 2003-11

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**Systèmes et appareils multimédia – Mesure et gestion de la couleur –
Partie 9: Appareils numériques de prise de vue**

INTERNATIONAL
ELECTROTECHNICAL
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ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX



ICS 33.160.60; 35.040; 37.040

ISBN 978-2-83220-607-2

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MULTIMEDIA SYSTEMS AND EQUIPMENT –
COLOUR MEASUREMENT AND MANAGEMENT –**

Part 9: Digital cameras

FOREWORD

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International Standard IEC 61966-9 has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

This bilingual version (2013-03) corresponds to the monolingual English version, published in 2003-11.

This second edition cancels and replaces the first edition published in 2000. This edition includes the following significant technical changes from the previous edition.

- a) In the light of issuing IEC 61966-2-2, the relevant reference IEC 61966-2-1 in Annex C has been replaced by IEC 61966-2-2 together with sRGB by scRGB.
- b) The previous Annex C has been replaced by the new Annex C where the previous Figure C.1 has been deleted.

The text of this standard was submitted to the national committees for voting under the Fast Track Procedure as the following documents:

CDV	Report on voting
100/666/CDV	100/722/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 61966 consists of the following parts, under the general title *Multimedia systems and equipment – Colour measurement and management*:

- Part 1: General
- Part 2-0: Colour management
- Part 2-1: Colour management – Default RGB colour space – sRGB
- Part 2-2: Colour management – Extended RGB colour space – scRGB
- Part 3: Equipment using cathode ray tubes
- Part 4: Equipment using liquid crystal display panels
- Part 5: Equipment using plasma display panels
- Part 6: Front projection displays
- Part 7-1: Colour printers – Reflective prints – RGB inputs
- Part 7-2: Colour printers – Reflective prints – CMYK inputs
- Part 8: Multimedia colour scanners
- Part 9: Digital cameras
- Part 10: Quality assessment – Colour image in network systems
- Part 11: Quality assessment – Impaired video in network systems

The committee has decided that the contents of this publication will remain unchanged until 2008. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

MULTIMEDIA SYSTEMS AND EQUIPMENT – COLOUR MEASUREMENT AND MANAGEMENT –

Part 9: Digital cameras

1 Scope

This part of IEC 61966 is applicable to the assessment of colour reproduction of digital cameras used in open computer systems and similar applications.

A series of methods and parameters for colour measurements and management for use in multimedia systems and equipment is applicable to the assessment of colour reproduction.

This standard deals with digital cameras to capture colour still images and moving images for use in multimedia applications.

The methods of measurement standardized in this standard are designed to make possible the objective performance assessment and characterization of the colour reproduction of digital cameras which can capture colour still and moving images, and output colour information corresponding to red – green – blue digital image data. The measured results are intended to be used for the purpose of colour management in multimedia systems, typically in the Internet.

This standard defines test charts, measurement conditions and methods of measurement, so as to make possible the colour management in open multimedia systems and comprehensive comparison of the results of measurements for assessment of digital cameras.

Colour control within digital cameras is outwith the scope of this part. It does not specify limiting values for various parameters.

2 Normative references

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

IEC 60050(845):1987, *International Electrotechnical Vocabulary (IEV) – Chapter 845: Lighting*.

IEC 61146-1:1994, *Video cameras (PAL/SECAM/NTSC) – Methods of measurement – Part 1: Non-broadcast single-sensor cameras*

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

ISO 2813:1994, *Paints and varnishes – Determination of specular gloss of non-metallic paint films at 20 degrees, 60 degrees and 85 degrees*

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

CIE 17.4:1987, *International lighting vocabulary*

3 Terms and definitions

For the purposes of this document, the definitions in IEC 60050-845 and CIE 17.4, as well as the following definitions, apply.

3.1

colour control

conversion of equipment-dependent colour-image data to equipment-independent data for a specific colour space including tone characteristics

3.2

digital camera

electronic imaging equipment which can capture colour still and moving images, and outputs digital image data for red – green – blue channels either by itself or using incorporated colour control software

4 Conditions

4.1 Environmental conditions

All measurements specified in this standard shall be carried out in a dark room.

Electric power to a digital camera under test shall be supplied using an a.c. adapter or batteries recommended by the manufacturer.

The mains voltage and frequency applied to the a.c. adapter shall be at the rated value specified by the manufacturer of the digital camera. When the mains voltage fluctuates, a stabilizer shall be used to attain a stability value of ± 5 % of the rated value.

Other environmental conditions such as temperature and relative humidity shall be reported, together with the results of measurement.

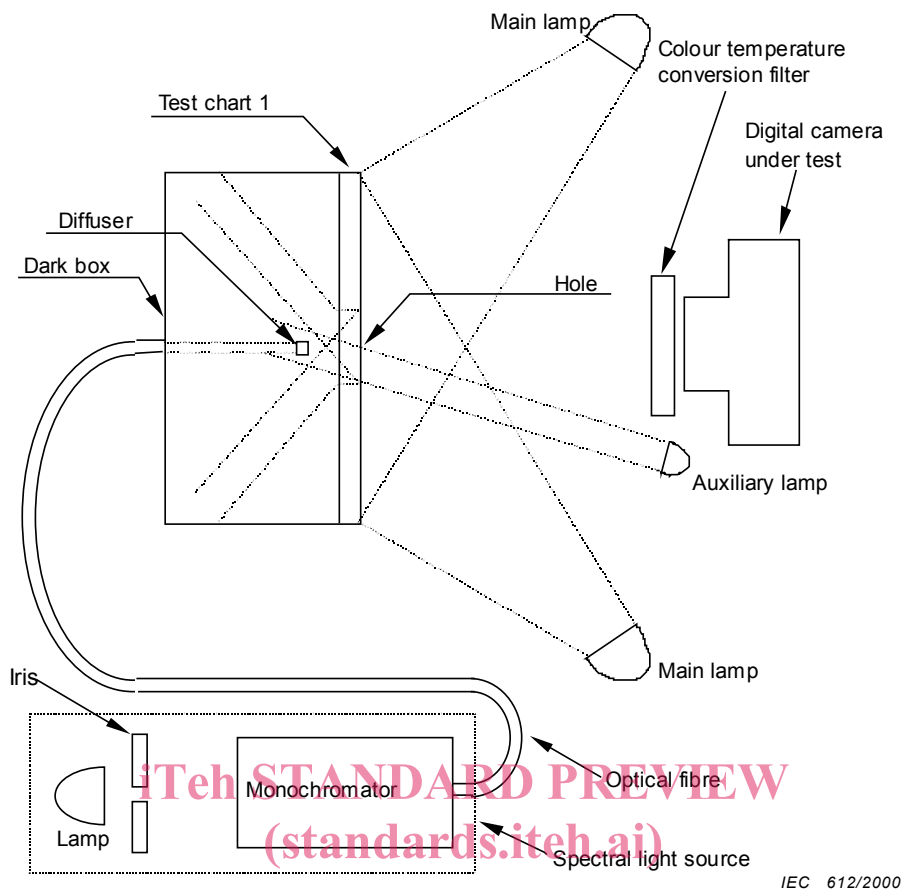
For additional environmental conditions not specified in this subclause, if any, the specifications of the manufacturer of the digital camera shall be taken into account.

4.2 Conditions of measurements

4.2.1 Measurement arrangement

Unless otherwise specified, a shooting object shall be a test chart with the dark box shown in Figure 1. The specifications for the centre hole of the chart are given in Figure 3. Relative positions shall be selected to prevent unnecessary glare from the diffuser.

NOTE The spectral light source consisting of the lamp, the iris, the monochromator, the optical fibre and the diffuser may be configured in other ways, provided that the required specifications are met.



IEC 612/2000

IEC 61966-9:2003
Figure 1 – Equipment arrangement for measurements
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4.2.2 Illumination

Illumination of the test charts shall be performed by two or four main lamps and one auxiliary lamp depending on the characteristics to be measured. Incident lights from the main lamps shall be 45° relative to the surface of the test chart. An auxiliary lamp to illuminate the diffuser in Figure 1 is used only for the measurement specified in Clause 7. The diffuser shall not be directly illuminated by the main lamps. The main lamps and the auxiliary lamp shall be halogen lamps with a well-regulated power supply.

The correlated colour temperature of the lamps shall be 3 100 K ± 100 K as specified in IEC 61146-1. The non-uniformity of illumination shall be less than 5 %. The average illuminance on the test chart shall be 2 000 lx ± 100 lx.

4.2.3 Shooting conditions

The optical axis of the digital camera under test shall coincide with the normal to the test chart.

If the digital camera under test is equipped with a zoom lens, the distance between the test chart and the digital camera under test, unless otherwise specified, shall be approximately 1,5 m. The zooming shall be adjusted so that the horizontal and vertical markers fit within the full frame of an image area.

If the digital camera under test is not equipped with a zoom lens, the distance between the test chart and the digital camera under test, unless otherwise specified, shall be adjusted so that the horizontal and vertical markers fit within the full frame of an image area.

4.2.4 Digital image data

The red – green – blue data necessary for the calculation and characterization of the digital camera under measurement shall be acquired and recorded depending on the cases described below.

- a) If red – green – blue digital image data are obtained direct from the digital camera under test, the values shall be recorded.
- b) If red – green – blue digital image data are not directly obtainable, they should be calculated by the manufacturer's driver software.
- c) If red – green – blue digital image data are calculated by any independent application software on the digital camera under measurement, the name and version of the software shall be reported together with the values.

5 Measurement equipment

5.1 Spectral light source

The spectral light source consists of a halogen lamp powered by a well-regulated d.c. electric power source, an iris, a monochromator and an optical fibre with a diffuser as in Figure 1. Specifications of the constituent parts of the equipment arrangement should be as follows.

- a) Output of spectral light source
 - 1) Diameter of the diffuser: approximately $\frac{1}{45}h$
 - 2) Radiance: more than 10 mW/sr/m²
 - 3) Stability of light output: within $\pm 0,5\%$

NOTE An integrating sphere may be incorporated to increase uniformity.

- b) Monochromator
 - 1) Wavelength range: including from 380 nm to 780 nm
 - 2) Spectral bandwidth: 5 nm (FWHM)¹, triangle
 - 3) Wavelength accuracy: $\pm 0,5$ nm
 - 4) Stray light: less than 10^{-4}

NOTE Higher-order spectra from the monochromator should be removed.

5.2 Colour temperature conversion filter

The amount of reciprocal correlated colour temperature change shall be -140 MK^{-1} in order to achieve $5\,500 \text{ K} \pm 300 \text{ K}$.

5.3 Dark box

The dark box for the measurements should be as shown in Figure 2. The reflectance of the inside of the dark box shall be less than 2 %. The accuracy of the dimensions should be within $\pm \frac{1}{50}h$. The geometrical specification of the holes whose positions are designated by "0" shall be as in Figure 3.

¹ FWHM stands for full-width half maximum.

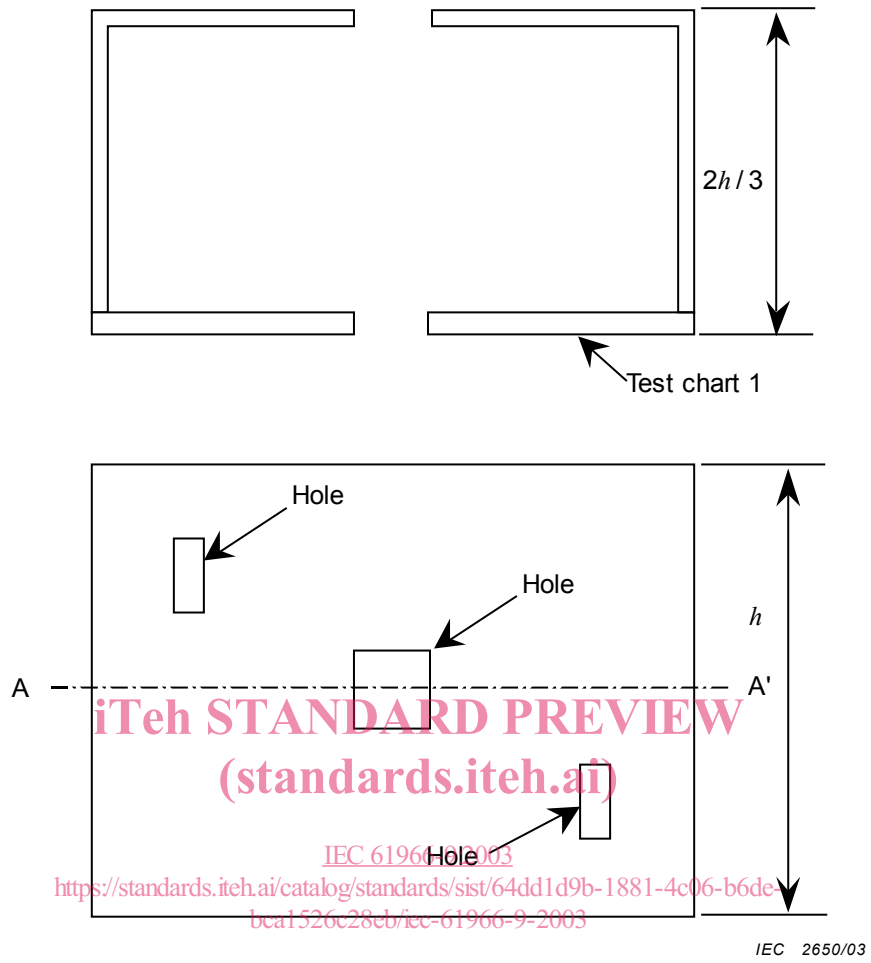
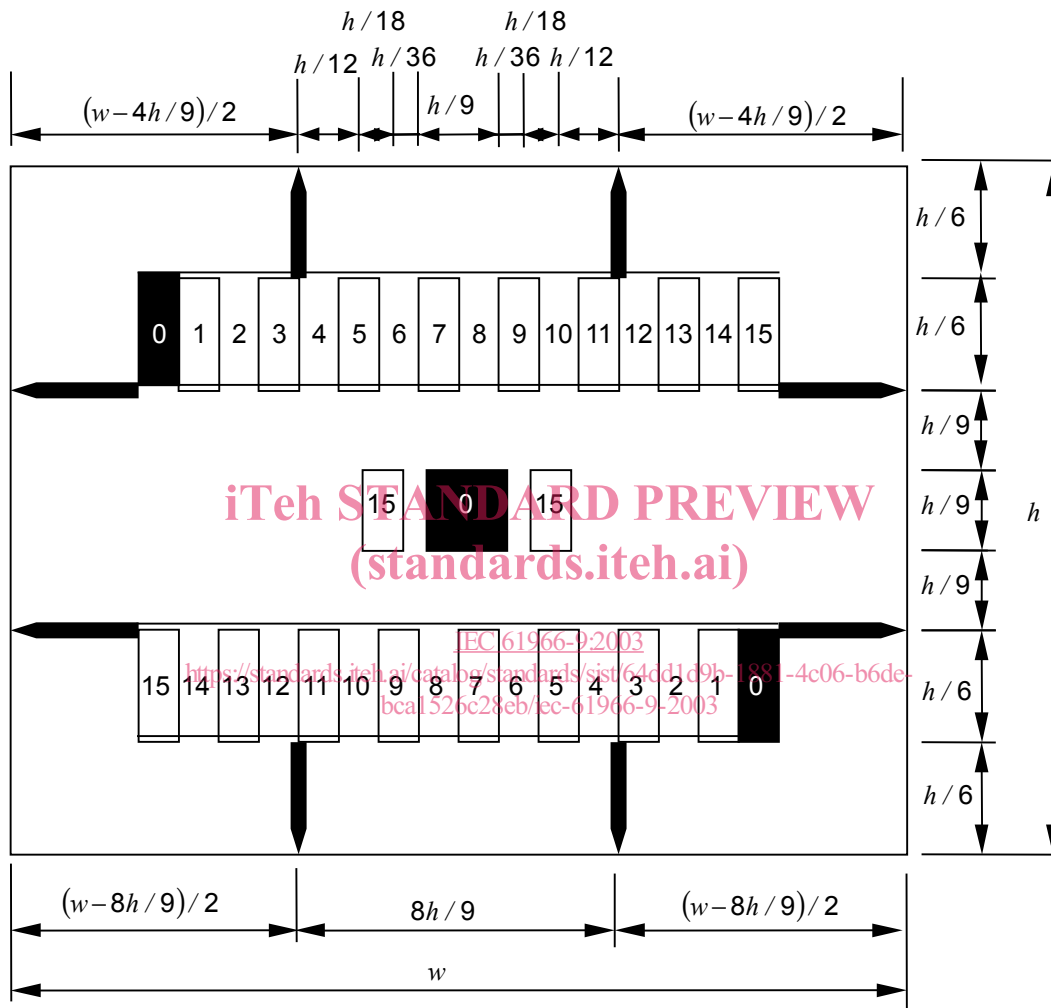


Figure 2 – Dark box

5.4 Test charts

- a) The specular gloss at 60° shall be less than 2,5 %, according to ISO 2813, for all test charts. The geometric specification of the test charts shall be as shown in Figures 3, 4 and 5. The accuracy of the dimensions should be within $\pm \frac{1}{50} h$.



IEC 614/2000

Figure 3 – Test chart 1

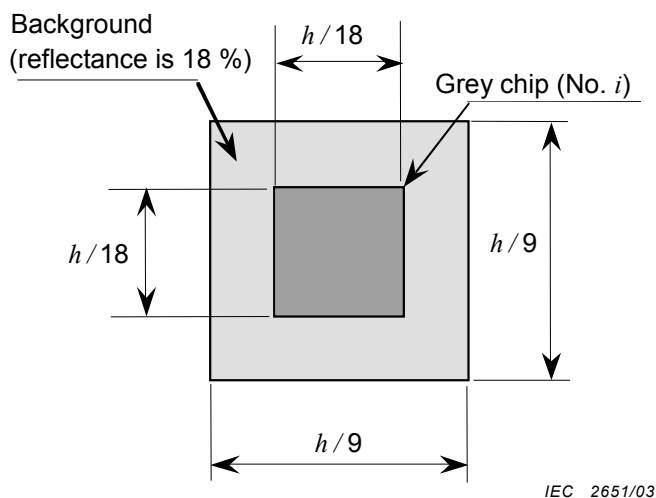


Figure 4 – Test chart 2 with replaceable chip *i*

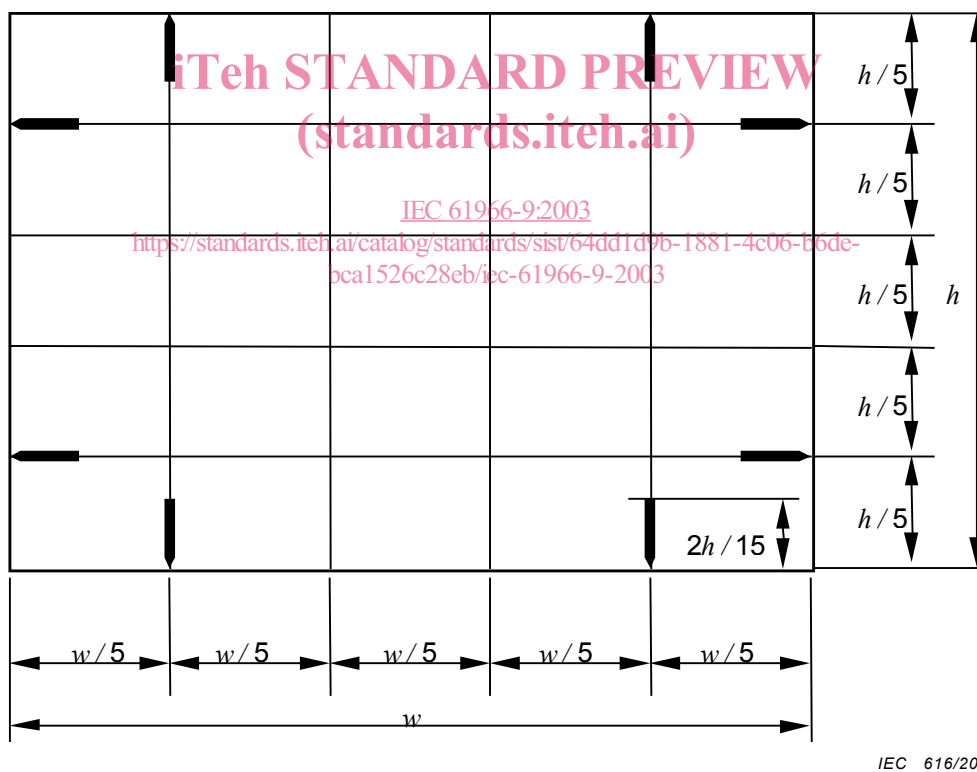


Figure 5 – Test chart 3

- b) Test chart 3 in Figure 5 shall be the white chart with a nominal reflectance of 88,1 %. It shall be superimposed with a rectangular grid. The designation of position *j* in Figure 5 shall be numbered from the top left to the bottom right for the centre of each rectangular area as *j* = 1 to 25.
- c) The reflectances of the grey steps in test chart 1 shall have the values specified in Table 1, where the positions designated by "0" are holes.

Table 1 – Nominal reflectances of the grey-scale section and the grey chips

<i>i</i>	Reflectance (%)
0	0,0(hole)
1	2,0
2	4,0
3	6,0
4	8,0
5	10,3
6	14,7
7	19,8
8	25,8
9	32,5
10	39,9
11	48,1
12	57,0
13	66,6
14	77,0
15	88,1
Background	18,0

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5.5 Radiance meter

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A radiance meter with the following specification should be used for the measurements of the output from the spectral light source.

- a) Wavelength range: from 380 nm to 780 nm
- b) Measurable range: from 1 $\mu\text{W}/\text{sr}/\text{m}^2$ to 1 $\text{W}/\text{sr}/\text{m}^2$
- c) Relative accuracy: $\pm 5\%$ (from 380 nm to 780 nm)
- d) Linearity: $\pm 2\%$
- e) Measurement resolution: less than 0,5 %

NOTE 1 Radiance can be measured with an irradiance meter at a known distance from a source. A spectroradiometer in radiance geometry can also be used to measure radiance.

NOTE 2 If a wavelength range beyond the specification in a) is required from the results reported in Clause 7, the wavelength range should be from 360 nm up to a wavelength where a response of less than 5 % of the maximum is observed.