



# SLOVENSKI STANDARD

## SIST ISO 12646:2010

01-maj-2010

Nadomešča:  
SIST ISO 12646:2005

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**Grafična tehnologija - Zasloni za barvno preskušanje - Značilnosti in pogoji za vizualno opazovanje**

Graphic technology - Displays for colour proofing - Characteristics and viewing conditions

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Technologie graphique - Affichages pour la réalisation d'épreuves en couleur -  
Caractéristiques et conditions d'examen visuel

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**Ta slovenski standard je istoveten z: ISO 12646:2008**

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**ICS:**

17.180.20	Barve in merjenje svetlobe	Colours and measurement of light
37.100.10	Reprodukcijska oprema	Reproduction equipment

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**Graphic technology — Displays for  
colour proofing — Characteristics and  
viewing conditions**

*Technologie graphique — Affichages pour la réalisation d'épreuves en  
couleur — Caractéristiques et conditions d'examen visuel*

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Published in Switzerland

## Contents

Page

Foreword.....	iv
Introduction .....	v
<b>1 Scope .....</b>	<b>1</b>
<b>2 Normative references .....</b>	<b>1</b>
<b>3 Terms, definitions and abbreviated terms .....</b>	<b>1</b>
3.1 Terms and definitions.....	1
3.2 Abbreviated terms .....	3
<b>4 Requirements .....</b>	<b>3</b>
4.1 Resolution .....	3
4.2 Size .....	3
4.3 Refresh rate (CRTs only).....	4
4.4 Uniformity of luminance.....	4
4.5 Geometric accuracy (CRTs only) .....	4
4.6 Convergence (CRTs only).....	4
4.7 Ambient illumination, surroundings and environment.....	4
4.8 Chromaticity, luminance of the white and black points, and tracking (channel balance) .....	5
4.9 Gamma .....	6
4.10 Colorimetric accuracy and grey balance .....	6
4.11 Directional variation of luminance and chroma (FPDs only) .....	7
<b>5 Test methods.....</b>	<b>7</b>
5.1 Preparation and instrument set-up.....	7
5.2 Resolution (CRTs only) .....	7
5.3 Uniformity .....	8
5.4 Geometric accuracy (CRTs only) .....	9
5.5 Convergence (CRTs only).....	10
5.6 Measurement conditions .....	10
<b>Annex A (informative) Characterization and calibration .....</b>	<b>14</b>
<b>Bibliography .....</b>	<b>18</b>

**ISO 12646:2008(E)****Foreword**

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 12646 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

This second edition cancels and replaces the first edition (ISO 12646:2004), which has been extensively revised to include the particular requirements of flat panel displays.

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## Introduction

The ability to match colour images displayed on colour monitors to the images produced when the same digital file is rendered by proofing and printing systems (commonly referred to as “soft” proofing) is increasingly expected in graphic arts. Obtaining such a match is not simple and to be fully accurate requires careful control of many aspects of the process. The primary purpose of this International Standard is to make recommendations with respect to the soft proof viewing conditions. If these are controlled, it is then possible for users to exchange meaningful calibration (3.1.1) and characterization (3.1.2) data such that a consistent and, possibly, accurate colour match to the hard copy proof is achieved. In the case of visual display devices, the RGB device values are related to CIE tristimulus values.

The appearance of a colour image on a colour display is influenced by many physical factors other than controlled ambient viewing conditions. Among the most important of these are uniformity, convergence, size and resolution (in order to permit rendition of the proof at close to its normal size and with the finest detail visible on the hard copy at normal viewing distances), variation of electro-optical properties with viewing direction, freedom from flicker and glare (specular reflections with distinct images), the opto-electronic calibration of the display and the settings of its display driver software. So, to be acceptable as a proofing system which provides a reasonable level of image quality, the display must also exhibit these properties at an acceptable quality. This International Standard is based on the use of the flat panel display (FPD) and cathode ray tube display (CRT) technologies. It specifies the requirements for factors such as uniformity, convergence, refresh rate, size and spatial resolution. However, since these parameters are subject to improvement as display technology changes, this International Standard only defines minimum requirements for these parameters. It is assumed that displays used for this purpose will always conform to accepted industry “standards” for computer-aided design (CAD), and generally provide quality levels considered acceptable for this purpose, where they offer an improvement over the specifications herein.

[SIST ISO 12646:2010](#)

Note that, even for displays of the highest quality, the appearance of the displayed image will be limited by the accuracy of the colour transformation used for converting the digital file from its encoded colour space to that required for display purposes. This International Standard provides no formal specifications for these transformations, although the issues are discussed in an informative annex (Annex A), together with recommendations for achieving an acceptable colour transformation.

This International Standard only considers the setting up of colour displays as “soft” proofing devices. It primarily focuses on applications where the displayed image will be directly compared to a hard copy. However, in some practical situations, the image on the screen is evaluated in the absence of a hard copy. In this International Standard examples of two practical use cases are described. The first concerns the comparison of a soft proof with a hard copy proof; the second concerns the viewing of displayed images independently of any hard copy image. For the viewing of displayed images independently of any hard copy image, less restrictive requirements are sufficient, and they are stated separately in this International Standard. This viewing is therefore concerned with modifying the “hard” and “soft” controls of the display to enable it to simulate a proof. In this sense, it can be looked on as a “slave” device. However, it is in the interests of a CAD user, where the colour display in a real sense “originates” from the image, to set up the display in a similar way. This will enable simpler optimization of the colour transformation to the selected hard copy system used for rendering the image, in order to produce an accurate reproduction, if this is an important requirement. However, it is possible to undertake image processing to modify the image when rendered to make it look like the displayed image (colour gamuts permitting) whatever the opto-electronic calibration of the display. This is briefly discussed in Annex A.

Users of this International Standard will also benefit from CIE Publication 122<sup>[14]</sup>. Those unfamiliar with the judgement of displays may also find it helpful to read IEC 61223-2-5<sup>[9]</sup> which contains much useful detailed information about evaluation and testing of image display devices.

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# Graphic technology — Displays for colour proofing — Characteristics and viewing conditions

## 1 Scope

This International Standard specifies the minimum requirements for the characteristics of displays to be used for soft proofing of colour images. Included are requirements for uniformity, convergence, refresh rate, display diagonal size, spatial resolution and glare of the screen surface. The dependence of colorimetric properties on the electrical drive signals and viewing direction, especially for flat panel displays, is also specified.

## 2 Normative references

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

ISO 3664, *Graphic technology and photography — Viewing conditions*

ISO 13655:—<sup>1)</sup>, *Graphic technology — Spectral measurement and colorimetric computation for graphic arts images*

ISO 15790, *Graphic technology and photography — Certified reference materials for reflection and transmission metrology — Documentation and procedures for use, including determination of combined standard uncertainty*

CIE Publication 15, *Colorimetry*

## 3 Terms, definitions and abbreviated terms

### 3.1 Terms and definitions

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

#### 3.1.1

##### **calibration**

operation of establishing that the measured values agree with the values specified by a standard or a characterization process

#### 3.1.2

##### **characterization**

process of relating device-dependent colour values to device-independent colour values

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1) To be published. (Revision of ISO 13655:1996)

**ISO 12646:2008(E)****3.1.3****convergence**

ability of the three electron beams (R, G and B) to come together at a single spot on the surface of the CRT (see 3.2)

NOTE Not applicable to FPDs (see 3.2).

**3.1.4****DVD****design viewing direction**

direction for which specific electro-optical characteristics of the display have been optimized

NOTE Examples of important electro-optical characteristics are maximum luminance and maximum contrast.

**3.1.5****gamma**

$\gamma$

best-fit parameter which relates the monitor normalized output luminance to a normalized input digital value presented to the monitor system including its hardware and software components as given in Equation (1):

$$L = S^\gamma \quad (1)$$

where

$L$  is the normalized output luminance;

$S$  is the normalized input digital value

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NOTE This definition is traditionally used in graphic technology for work with CRTs (see 3.2). It ignores offset and gain and thus differs from that in CIE Publication 122<sup>[14]</sup>. See also target gamma (3.1.12).

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**3.1.6****hard copy proofing system**

system for simulating a printed image using a printing device which may be different from that used for production

**3.1.7****OFF-state**

condition in which the display is switched off

**3.1.8****ON-state**

condition in which the display is switched on

NOTE This definition is important for light-valve-like displays, which might emit a significant light intensity even when displaying the darkest image (R = G = B = 0) in the ON-state.

**3.1.9****opto-electronic transfer function**

relationship between the input values provided to, and the luminance values produced by, a display device

**3.1.10****refresh rate**

frequency with which the image on the screen is redrawn

NOTE The refresh rate is expressed in Hertz (Hz).

**3.1.11****RGB**

additive process colour model where the channels are called Red, Green and Blue

[ISO 15930-7:2008, definition 3.29]

**3.1.12****target gamma**

gamma value specified by the vendor either as a single number characterizing the total range or piecewise as a look-up table for inputs from 0 to  $2^n-1$  ( $n$ -bit)

NOTE The target gamma characterizes the intended input-output relation. The target gammas of all channels are assumed to be identical.

**3.1.13****tracking****channel balance**

process of ensuring (by adjustment of the amplifiers) that the relationship between the three channels of a display is balanced, so that for all levels equal values in each channel produce a neutral sensation

**3.1.14****viewing cone****VC**

conical space, originating at the display surface, that includes all viewing directions with a specified angle of inclination  $\theta$

**3.1.15****surround**

area adjacent to the border of an image, which, upon viewing the image, may affect the local state of adaptation of the eye

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**3.2 Abbreviated terms**

CRT cathode ray tube display

FPD flat panel display

LCD liquid crystal display

**4 Requirements****4.1 Resolution**

The display resolution shall be sufficient for displaying an image of 1 280 pixels  $\times$  1 024 pixels without interpolation. When a test image with dimensions as defined in 5.2 is displayed by a CRT, all specified lines shall be visible at a normal viewing distance (defined as 0,5 m for the purposes of this International Standard).

To avoid issues associated with interpolation, it is important to operate all displays at their intrinsic native resolution.

**4.2 Size**

The display shall be capable of displaying an image having a diagonal measurement of at least 43 cm and a height of at least 22 cm.