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Photography — Lenticular print for changing images — Measurements of image quality

Photographie — Impression lenticulaire pour images changeantes — Mesurages de la qualité des images

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Foreword

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

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This document was prepared by Technical Committee ISO/TC 42, *Photography*.

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

Introduction

Lenticular printing is a technology wherein lenticular lenses are used to produce printed images with an illusion of depth, i.e. three-dimensional (3D) effect, or the ability to change or move as the image is viewed from different angles. Lenticular prints to display changing images are built up with a lenticular lens sheet and a printed sheet that contains at least two images, interleaved with the same spacial frequency as the lenticular lens sheet.

Lenticular lenses are an array of magnifying lenses.

Widespread applications of lenticular printing are signage, display posters, business cards, multilingual message boards and packages with changing images or 3D effects.

It has been reported that the market size of lenticular prints is over 100 million m^2 and that the market is growing. Furthermore, the potential image qualities of lenticular printing have dramatically improved and further improvements are expected in the future. While production of lenticular sheets with a lens frequency of 100 lpi (lines per inch) is routine, products with a 200 lpi frequency are also currently available.

Although the potential image quality of lenticular prints is high as described above, the quality of images is not always good in the market due to various causes, e.g., due to the misalignment of the lenticular lens and lenticular printed images. This is a critical problem for lenticular printing.

To improve the image quality of lenticular prints, image quality measurements are essential. This document provides standard measurement methods and the specifications for the image quality of lenticular prints.

Photography — Lenticular print for changing images — Measurements of image quality

1 Scope

This document specifies the measurement methods and specification of image quality of lenticular prints that are used for changing images. This document does not cover lenticular prints that are used for 3D images.

NOTE Lenticular prints for 3D images can be measured with the same types of procedures. However, it needs more information, such as the dependence of the measurement distance, to evaluate the 3D performance.

This document specifically describes measurement methods for cross-talk, viewing angle range, angular misalignment from the designed viewing angle and the uniformity of the image within the printing area of the lenticular print images. These are critical for the image quality of lenticular prints for changing images.

This document is applicable to lenticular prints produced by printing technologies that include impact and non-impact printing. Examples of the former are off-set, gravure and flexography, while the examples of the latter are silver halide, inkjet, dye diffusion thermal transfer and electrophotography. The multiple laser images (MLI) and changeable laser images (CLI) process of using a laser to write through a lenticular screen at different angles to create multiple images is also used.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5-3, *Photography and graphic technology — Density measurements — Part 3: Spectral conditions*

ISO 5-4, *Photography and graphic technology — Density measurements — Part 4: Geometric conditions for reflection density*

3 Terms and definitions

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

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

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

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

3.1 Terms

3.1.1
lenticular lens
array of magnifying semi-cylindrical lenses, designed to produce a desired perception, such as 3D, motion or morphing, to the underlying interlaced image

EXAMPLE This technique is widely used in lenticular printing, wherein the lenticular lens is used to provide an illusion of depth, change or motion to an underlying interlaced image when viewed from different angles.

[SOURCE: ISO/TS 20328:2016, 3.1, modified — Note 1 to entry has been removed.]

3.1.2
lenticular print
print combined with lenticular lenses which produces printed images with an illusion of depth, i.e. three-dimensional (3D) effect, or the ability to change or move as the image is viewed from different angles

Note 1 to entry: The detailed explanation of lenticular print is provided in Annex A.

Note 2 to entry: Lenticular prints to display changing images are built up with a lenticular lens sheet and a printed sheet that contains at least two images, interleaved with the same special frequency as the lenticular lens sheet.

3.2 Abbreviations

CIE	commission internationale de l'éclairage (International Commission on Illumination)
CTP	computer to plate
LMD	light measuring device
LPS	lenticular print sample
RGB	red, green, blue

4 Standard environmental conditions

4.1 Temperature and humidity

The standard environmental conditions shall be applied for the measurements of lenticular prints. The standard environmental conditions shall be a temperature of 23 °C ± 3 °C and a humidity of 50 % RH ± 15 % RH.

4.2 Ambient illumination conditions

For standard dark room conditions, the ambient illuminance at any position on the lenticular print is below 0,3 lx in all directions or the illuminance shall at least be less than a level that does not influence the measurement results.

When directional illumination is used, standard dark room conditions shall be applied unless the instrumentation used is effective in suppressing background illumination.

When the sample is set in an integrated sphere, dark room may not be required.

5 Measurement conditions

5.1 General

For the measurements, the lenticular print samples shall be illuminated with hemispherical diffuse lighting. Directional illumination can also be used when it is appropriate for simulating the use application.

The reflected light from the print sample shall be measured using a spectroradiometer.

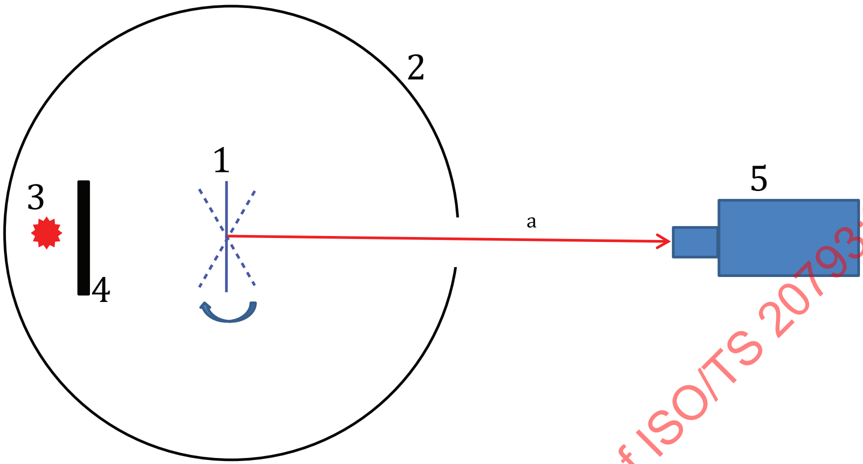
5.2 Geometry of measurements

5.2.1 Standard conditions with hemispherical illumination

Uniform hemispherical diffuse illumination is generally realized by using an integrating sphere. The lenticular print sample (LPS) shall be placed in the centre of an integrating sphere as shown in Figure 1.

For the calibration, the reflection standard, i.e. a standard white board, shall be placed at the same position of the LPS. Best practices for integral sphere design and measurements are described in References [2] and [3].

When the viewing direction dependence is measured, the print sample shall be rotated around the axis parallel to the direction of the array of lenticular lens.



Key

1 lenticular print

2 integration sphere

3 light source

4 baffle

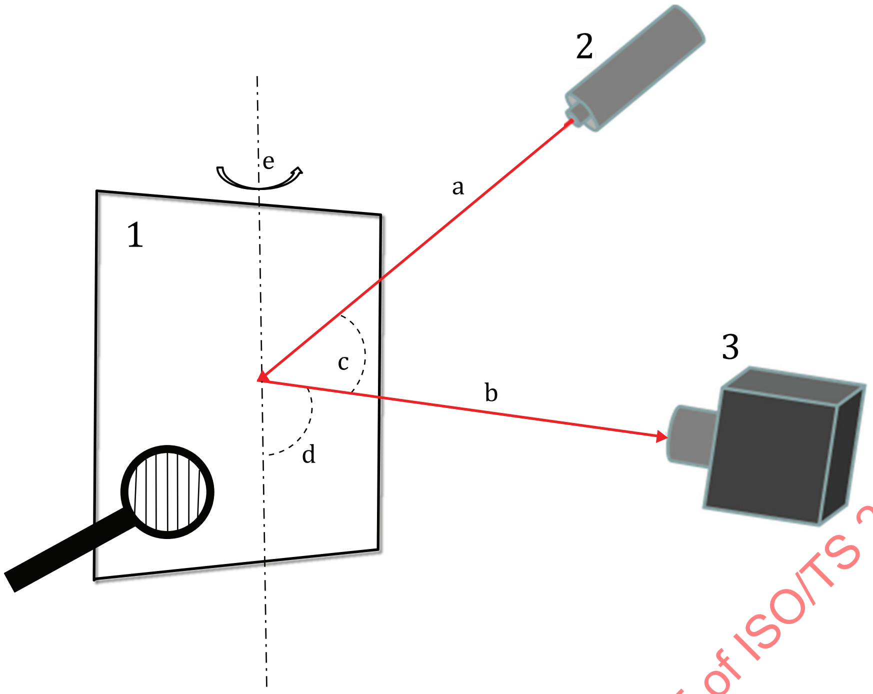
5 light measurement device

a Reflected light from sample.

Figure 1 — Geometry of measurement with hemispherical illumination

5.2.2 Optional conditions with directional illumination

The directional light shall be illuminated at an angle of 45° from the normal, and the reflected light shall be detected from the direction normal to the print as shown in Figure 2. The light source and the detector shall be placed in the same plane. The lenticular print shall first be set normal to the detector, and it shall be rotated from the normal direction in order to measure the viewing angle dependence.



Key

1 lenticular print

2 light source — directional

3 detector

a Incident light.

b Reflected light.

c Angle of the incident light = 45°.

d Angle of the detection = 90°.

e Angle of rotation of the print.

Figure 2 — Geometry of measurement with directional illumination

5.3 Light source

For the standard conditions, hemispherical illumination shall be applied. The illumination spectra shall be a stable and spectrally continuous broadband visible light source, for example, an incandescent lamp defined as CIE Standard Illuminant A.

5.4 Light measuring device (LMD)

The light reflected from the lenticular print shall be measured. Illuminant D50 shall be applied. The following requirements are given for measurement instrument:

a) The spectroradiometer shall be capable of measuring spectral radiance over at least the 380 nm to 780 nm wavelength range, with a maximum bandwidth of 10 nm for smooth broadband spectra.

   Care shall be taken to ensure that the LMD has enough sensitivity and dynamic range to perform the required task. The measured LMD signal shall be at least ten times greater than the dark level (noise floor) of the LMD, and no greater than 85 % of the saturation level.

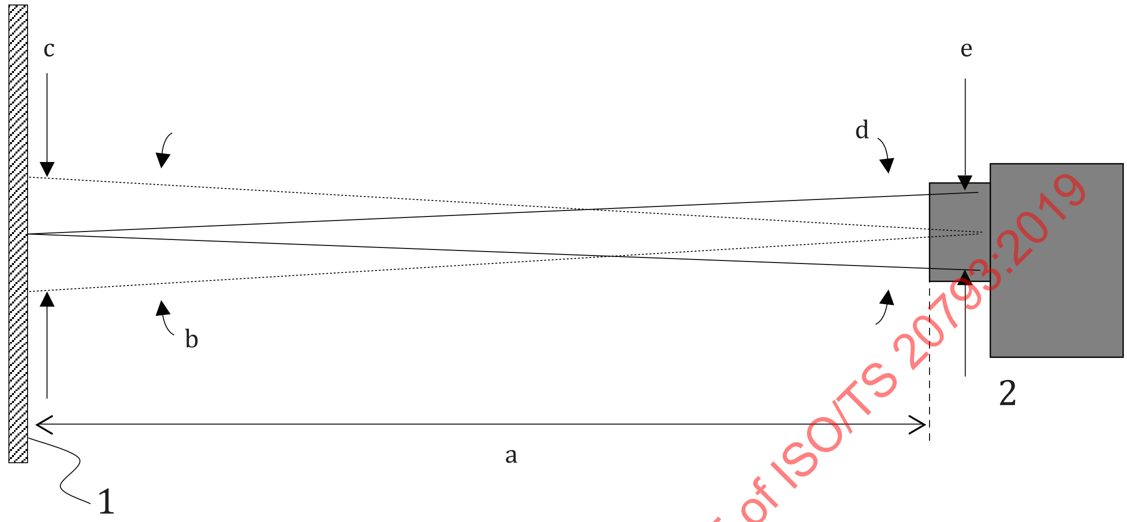
b) The LMD shall be focused on the image plane of the print and aligned perpendicular to its surface, unless stated otherwise.

c) The relative uncertainty and repeatability of all the measuring devices shall be maintained by following the instrument supplier's recommended calibration schedule.

d) The recommended measuring distance is between 35 cm to 60 cm. The measuring distance shall be noted in the report.

e) The angular aperture shall be less than or equal to 5°, and the measurement field angle shall be less than or equal to 2° (see Figure 3).

f) The measurement field of the LMD shall be centred and enclosed within the illuminated measuring spot on the print.



Key

1 lenticular print
2 LMD
a Measuring distance.
b Measurement area angle (measurement field angle).
c Measurement area (measurement field).
d Angular aperture.
e Aperture area.

Figure 3 — Layout diagram of measurement setup

5.5 Working standards and references

The LMD shall be calibrated with a diffuse white reflectance standard sample with a diffuse reflectance of 98 % or more. The reflectance shall be calculated based on the reflectance of the perfect white panel and the black panel.

Diffuse white reflectance standard samples can be obtained with a diffuse reflectance of 98 % or more. They are also available in different shades of grey. A luminance L_{std} measurement from such reflectance standards can be used to determine the illuminance E on the standard for a defined detection geometry and illumination spectra and configuration:

$$E = \frac{\pi L_{std}}{R_{std}} \tag{1}$$

where R_{std} is the calibrated luminous reflectance factor for that measurement configuration. When the illumination configuration is a uniform hemispherical illumination, then R_{std} is equivalent to luminous reflectance ρ_{std}. The luminous reflectance value associated with the standard is only valid for the hemispherical illumination in which it was calibrated. If it is used with a directed source at any angle, there is no reason to expect that the luminous reflectance value will be the correct luminous reflectance factor value for that illumination configuration or spectra.

The terms luminous reflectance and luminous reflectance factor shall be abbreviated to reflectance and reflectance factor, respectively.

Black glass (e.g., BG-1000), or a very high neutral density absorption filter (density of 4 or larger), can be used to determine the luminance of a source L_s from the measured luminance L_{std} of the virtual source image as reflected by the black glass, and the luminous specular reflectance ζ_{std} of the black glass for the measurement configuration used:

$$L_s = \frac{L_{std}}{\zeta_{std}} \tag{2}$$

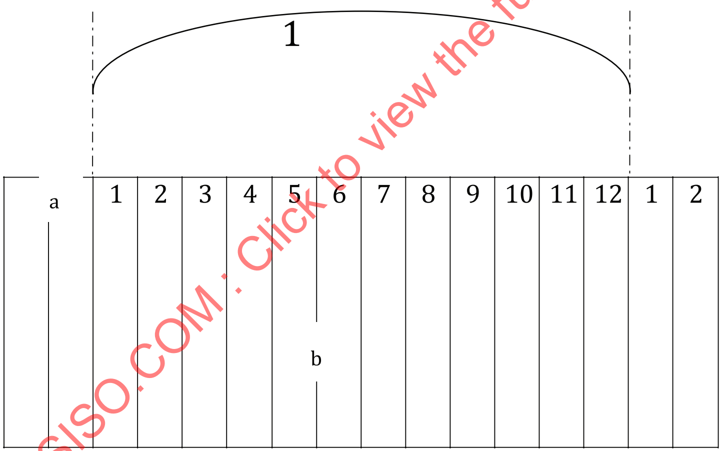
When making specular measurements, the detector is focused on the virtual image of the source. Black glass can be considered as a front surface mirror that has a low specular reflectance of between 4 % and 5 %. A black glass standard can be helpful when the measurement geometry does not allow measuring the source luminance directly, but only by using a mirror. The low specular reflectance of black glass allows measuring the source luminance at about the same order of magnitude as the reflection measurement.

The specular reflectance of black glass is affected by the specular angle, the illumination spectrum, and the cleanliness of its surface. The calibration shall be repeated when the measurement geometry is changed.

6 Preparation of lenticular print samples

6.1 Test pattern

The lenticular images are divided by several picture elements for one lenticular lens width, as shown in Figure 4. For the measurements of this document, striped test patterns shall be used, where each strip element shall be white or black, or other primary colours.



Key

1 lenticular lens

a Number of picture element.

b Picture elements of lenticular print.

Figure 4 — Schematic illustration of the picture elements of a lenticular print

The test pattern shown in Table 1 shall be applied for the measurement. Table 1 is for 12 picture elements in one lenticular lens width. For other cases, an analogical test pattern shall be applied. Table 1 is illustrated with black and white. For the evaluation of colour images, black shall be replaced with a primary colour of yellow, magenta, or cyan, or a secondary colour of red, green, or blue.

Table 1 — Example of test patterns for 12 views

Picture element		1	2	3	4	5	6	7	8	9	10	11	12
All white													
All black		■	■	■	■	■	■	■	■	■	■	■	■
2-way split	1/2	■	■	■	■	■	■						
	2/2							■	■	■	■	■	■
3-way split	1/3	■	■	■	■								
	2/3					■	■	■	■				
	3/3									■	■	■	■
4-way split	1/4	■	■	■									
	2/4				■	■	■						
	3/4							■	■	■			
	4/4										■	■	■
NOTE The black box indicates a black strip and the white box indicates a white strip.													

NOTE The image quality is improved with modification of the printing patterns. For example, the patterns shown in Table 2 are used to improve cross talk. The image quality with these patterns are also used when those technique are used in the printing process.

Table 2 — Additional example of test patterns for 12 views

Picture element		1	2	3	4	5	6	7	8	9	10	11	12
All white													
All black		■	■	■	■	■	■	■	■	■	■	■	■
2-way split	1/2	■	■	■	■	■							
	2/2							■	■	■	■	■	
3-way split	1/3	■	■	■									
	2/3					■	■	■					
	3/3									■	■	■	
4-way split	1/4	■	■										
	2/4				■	■							
	3/4							■	■				
	4/4										■	■	
NOTE The black box indicates a black strip and the white box indicates a white strip.													

6.2 Printing

The test pattern shall be printed using the printing system.

The test patterns should be printed at the position 1 to 9 shown in Figure 7. However, the test patterns can be printed in the opening space between the printing contents or in the external side of the printing contents.

6.3 Construction of a lenticular print

The lenticular print can be produced

a) by printing directly on the back face of a lenticular lens sheet, or

b) by bonding the printed sheet to the lenticular lens sheet.

The precise alignment of the lenticular lens and the printed lenticular image is essential. The procedures for the printing of high quality lenticular images are described in Annex B.

7 Measurements and calculations

7.1 General

This document specifically describes the measurement methods of the density and the evaluation methods for the following critical attributes of lenticular prints for changing images:

a) cross-talk of lenticular images;

b) viewing direction angle range of a lenticular image;

c) divergence from the designed viewing direction angle of the main lenticular image;

d) uniformity of the image within the printing area.

These attributes are critical for high quality lenticular prints for changing images.

These items are measured by changing the angle of the print to the plane of the light measurement device (LMD).

7.2 Measurements of angular dependence

The measurements of the viewing direction dependence of density shall be done using the measurement system described in Clause 5.

For black and white images, all white patches, all black patches, and patches with a micro-striped pattern that are illustrated in Figure 4 and Tables 1 or 2 shall be measured. For colour images, the black striped pattern shall be replaced with a primary colour, i.e. yellow, magenta, or cyan, or with a secondary colour, i.e. red, green, or blue.

The reflected light from the lenticular print shall be measured from the normal direction of the print. Then, the print shall be rotated as shown in Figure 1 or Figure 2. The reflected light shall be measured in intervals of 2° from −45° to +45°.

The visual density shall be calculated with Formula (3), in accordance with ISO 5-3 and ISO 5-4.

$$Dv_{\theta} = -\log\left(Is_{\theta} / Iw_{\theta}\right) \tag{3}$$

Iw_{θ} is the intensity of the reflected light at an angle θ from the standard white board calibrated as described in sub-clause 5.5, and Is_{θ} is the intensity of the reflected light at an angle θ from the sample.

Is_{θ} and Iw_{θ} are calculated from spectrum data with Formula (4) and Formula (5), respectively

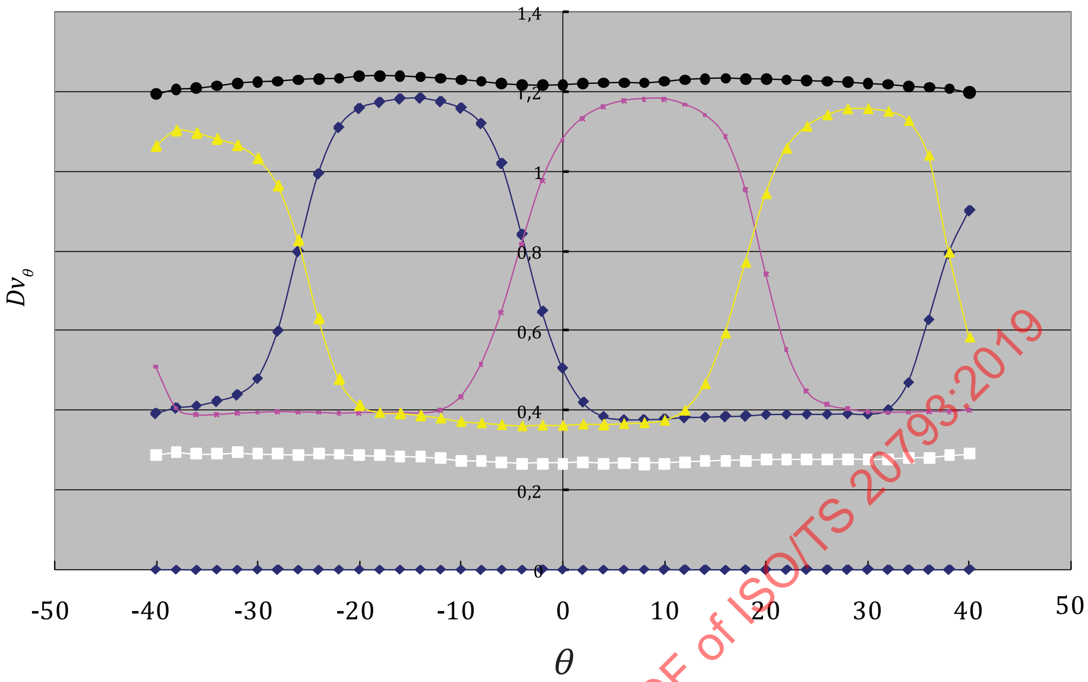
$$Is_{\theta} = \sum_{\lambda=380}^{720} Rs_{\theta}(\lambda) \times \Pi v(\lambda) \tag{4}$$

$$Iw_{\theta} = \sum_{\lambda=380}^{720} Rw_{\theta}(\lambda) \times \Pi v(\lambda) \tag{5}$$

where $Rs_{\theta}(\lambda)$ is the reflection intensity at wavelength λ at an angle θ from the sample, $Rw_{\theta}(\lambda)$ is the reflection intensity at wavelength, λ, at an angle θ from the standard white board, and Πv is the spectral products defined in ISO 5-3.

When R, G, B densities are required, Π_R, Π_G or Π_B shall be used respectively. $\Pi v(\lambda)$.

Examples of the density measurement results of 3-way lenticular prints are shown in Figure 5.



Key

θ angle

Dv_θ visual density

NCS

base

1/3 (*W*)

2/3 (*W*)

3/3 (*W*)

black

Figure 5 — Examples of density measurement results — 3-way lenticular image — viewing angle dependence

7.3 Calculation of cross-talk, viewing angle range and angular misalignment

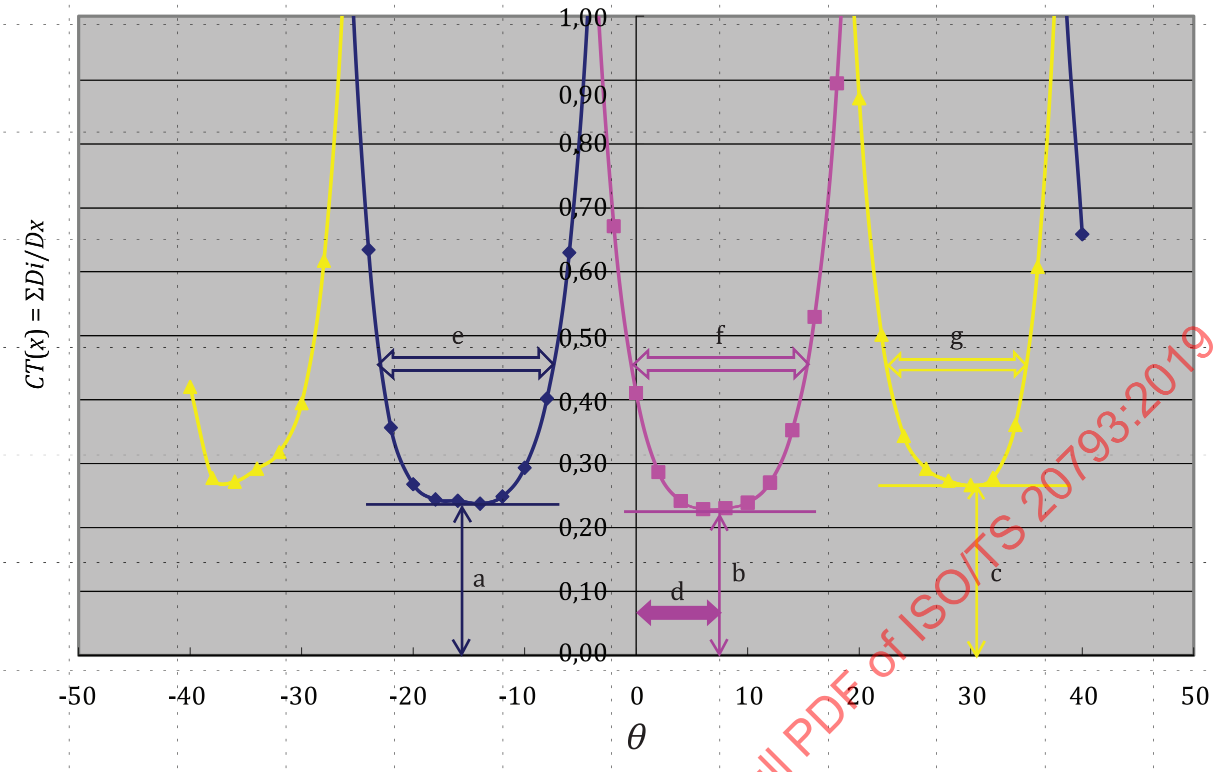
The cross-talk (*CT*) is reduction of image contrast and is defined as the ratio of the unwanted image to the wanted image at the optimum viewing angle for the wanted image. The cross-talk is defined by Formula (4):

$$CT(x) = \left(\sum_{1}^{n} Di / Dw \right) \quad (4)$$

where $CT(x)$ is the cross-talk at the angle that is the optimum viewing angle for the wanted image x, n is the number of picture elements, Di is the density of the unwanted images, and Dw is the density of the wanted images at the optimum viewing angle for the wanted image x.

Examples of the measurement results of $CT(x)$ are shown in Figure 6.

The cross-talk of each image shall be evaluated from the minimum value of $CT(x)$ of each image, defined as $CT(x)$ as shown in Figure 6.



Key

θ angle

$CT(x)$ cross-talk at the angle that is the optimum viewing angle for the wanted image x

1/3 (W)

2/3 (W)

3/3 (W)

a Cross-talk for image 1/3.

b Cross-talk for image 2/3.

c Cross-talk for image 3/3.

d Angular misalignment.

e Viewing angle range for image 1/3.

f Viewing angle range for image 2/3.

g Viewing angle range for image 3/3.

Figure 6 — Examples of measurement result of $CT(x)$ — 3-way lenticular image — viewing angle dependence

The misalignment angle is the divergence of the angle at the minimum point of the cross-talk to the designed viewing angle of the main lenticular image. If the designed viewing angle of the main lenticular image is normal, i.e. θ = 0, then the misalignment angle of the main image (image 2/3) is 'd' in Figure 6.

The viewing angle range is the angle range where the cross-talk is equal to or less than 0,45, as shown in Figure 6.

7.4 Uniformity in the printing area

Uniformity in the printing area shall be measured at the nine points shown in Figure 7, using the same measurement procedures described in sub-clauses 7.2 and 7.3.

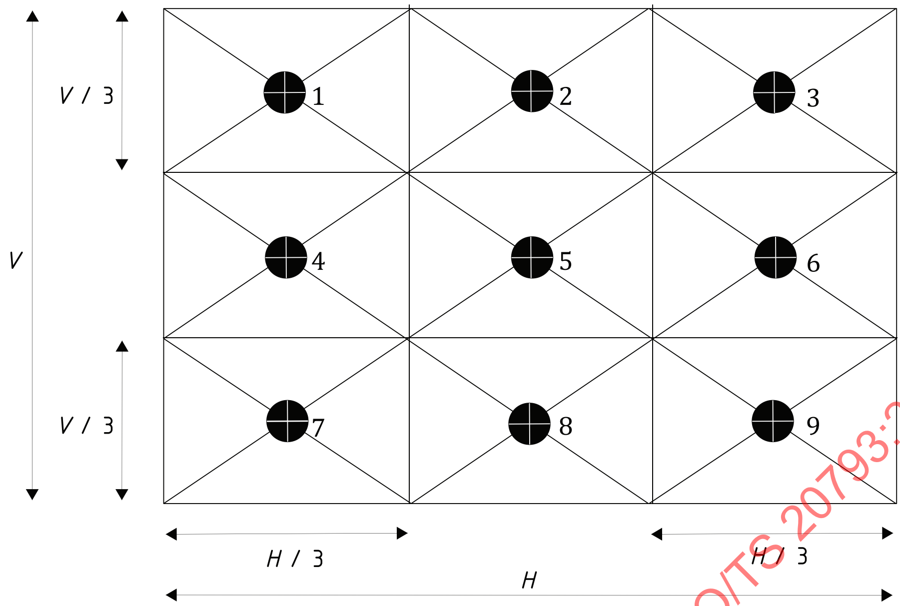


Figure 7 — Standard measurement positions with nine measurement positions equally spaced in the printing image area

8 Classifications

8.1 General

Cross-talk, viewing direction angle range, angular misalignment, and uniformity in printing area shall be reported. The importance of each item depends on the use application. For example, for a business card, which shows different images and text, cross talk may be bothering but the viewing angle range may not be critical because it is viewed by properly adjusting the angle. For a poster, both cross-talk and the viewing angle range may be critical. The guidelines of the classification are described in this clause.

8.2 Cross-talk

Cross-talk value, $CT(x)$, shall be reported as described in 7.3. The level of the cross-talk shall be classified as shown in Table 3. Cross-talk shall be reported as described in 7.3

Table 3 — Classification of the level of cross-talk

Class	Classification	Cross-talk $CT(x)$
Aa	Very high differentiation	<0,30
A	High differentiation	0,30 to 0,45
B	Low differentiation	0,45 to 0,60
C	Very low differentiation	>0,60

8.3 Viewing angle range

The viewing angle range shall be reported in degrees (°) as described in 7.3. The level of the viewing angle range shall be classified as shown in Table 4.

Table 4 — Classification of the level of the viewing angle range

Class	Classification	Viewing angle range
Aa	Very wide	>20°
A	wide	10° to 20°
B	Narrow	5° to 10°
C	Very narrow	<5°

8.4 Angular misalignment

Angular misalignment shall be reported in degrees (°) as described in 7.3. The level of angular misalignment shall be classified as shown in Table 5.

Table 5 — Classification of the level of angular misalignment

Class	Classification	Angular misalignment
Aa	Very accurate	<5°
A	Accurate	5°to 10°
B	Fair	10°–20°
C	Not accurate	>20°
NOTE Continuous binning can be used when it is required.		

8.5 Uniformity in the printing area

For uniformity in the printing area, the cross talk $CT(x)$ of position 1 to 9 shown in Figure 7 shall be reported.

Annex A
(informative)

Explanation of a lenticular lens print

A.1 General

A lenticular lens comprises an array of magnifying lenses which are designed so that when the underlying interlaced images are viewed from slightly different angles, different images are magnified. When used in lenticular printing, this technology provides an illusion of depth, morph, or motion as the underlying composite image is viewed from different angles.

A.2 Structure of a lenticular lens print

A photograph of a typical lenticular lens sheet is shown in Figure A.1.

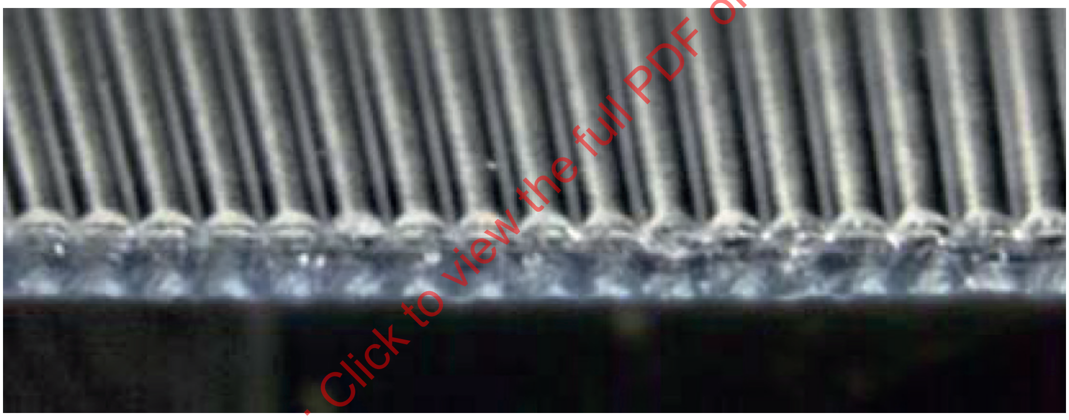
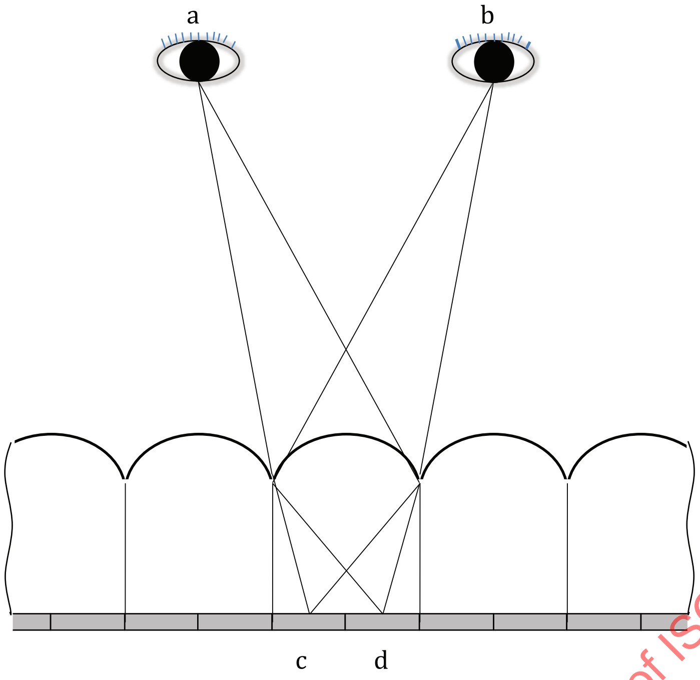


Figure A.1 — Image of a lenticular lens sheet

A.3 Mechanism for changing images

The mechanism for changing images is illustrated in Figure A.2.



a Viewing position a).
b Viewing position b).
c Image element for position a).
d Image element for position b).

Figure A.2 — Illustration displaying the mechanism for changing images

Annex B
(informative)

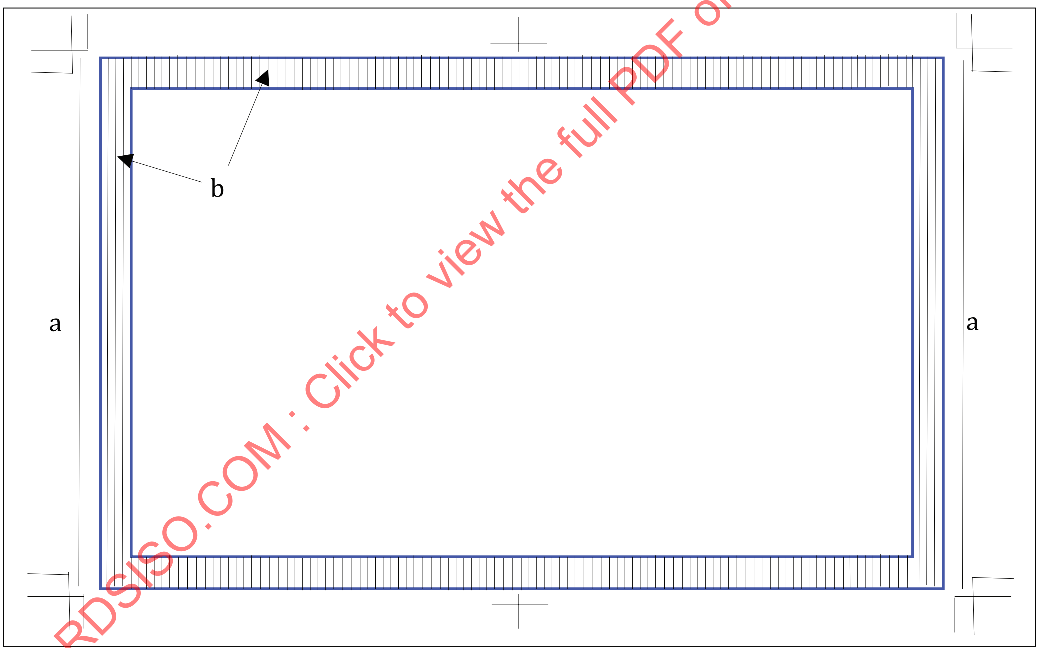
Procedures of lenticular printing

B.1 Marker

It is critical to print accurately and precisely by aligning the lenticular images relative to lenticular lenses. Markers are used for aligning the position. An example of the markers is shown in Figure B.1.

The striped lines are used to make adjustments in the inclination of the lenses. The striped lines are also used to check the pitch or the width of the lenticular lens.

The reference line is used to make precise adjustments of the inclination and the position of the printing position relative to the lenticular lens. The reference line is also used to adjust the colour register. In the latter case, a broken line is used to easily see the colour.



a Reference line.

b Striped line.

Figure B.1 — An example of markers

B.2 Printing procedures

B.2.1 Outline

The outline for printing is as follows;

a) print on waste paper (lens sheet) for colour and density adjustments;

b) print on a lens sheet or actual printing stock:

   1) adjustment of the inclination;

   2) adjustment of the colour register;

   3) checking the pitch;

   4) proofing;

   5) production printing.

B.2.2 Adjustment of the inclination of the lens sheet

First, the striped lines of both the right and left sides are used to adjust the inclination of the lens sheet. The front guide at the feeder of the printer is adjusted so that each striped line of both the right and left sides is seen as a straight white line or a straight black line, as shown in Figure B.2 a) and b). If a skew gradation of black and white is seen as shown in Figure B.2 c) and d), the lens is inclined. If the pattern shown in Figure B.2 c) is observed, the printing is slanted to the extent equivalent to one lens pitch, and if the pattern shown in d) is observed, the printing is slanted to the extent equivalent to two lens pitches. The inclination should be adjusted for printing.

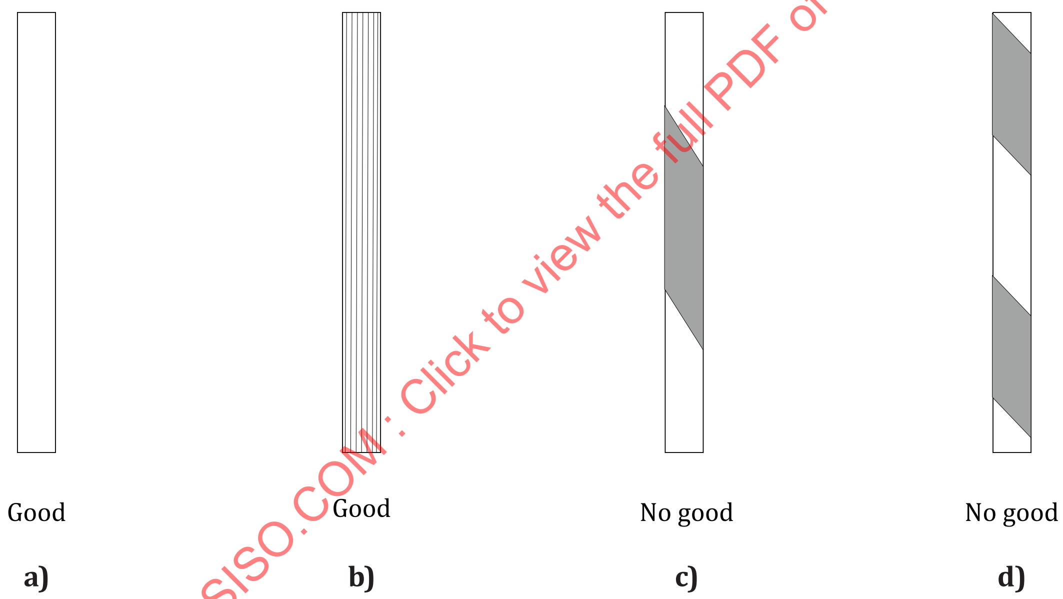
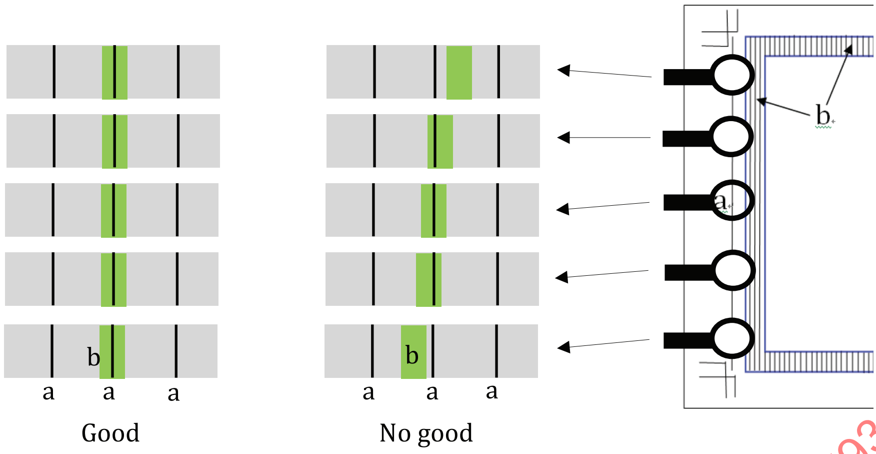


Figure B.2 — Assessment of the inclination of lenses

For precise observation, the print should be rotated 90°, and the striped lines should be viewed horizontally.

Next, the reference lines for both the right and left sides are used to adjust the inclination of the lens sheet more precisely. The positions of the lens channel and the reference line are checked for at least five points on the reference line. Fine adjustment is done so that the reference line is parallel to the lens channel, as shown in Figure B.3.



a Lens channel.

b Reference line.

Figure B.3 — Assessment of the inclination of lenses

B.2.3 Adjustment of colour register

The colour register is checked for yellow, magenta and cyan using the reference line. The lines of yellow, magenta and cyan should be precisely overlapped.

B.2.4 Adjustment of the pitch

B.2.4.1 Outline

The printing images interlace according to the pitch value of the lenticular lenses. The adjustment of the pitch is essential to ensure an optimal viewing experience.

The mechanical pitch of the lenticular lens is measured precisely before printing. The pitch of the lens can vary from lot to lot of the production of a lenticular lens sheet. Furthermore, a lenticular lens sheet expands or contracts with humidity and/or temperature swings. Therefore, it is preferable to place the lenticular lens sheet for a couple of days in the atmosphere of the printing environment; also, it is desirable to measure the pitch just before printing.

NOTE Measurements and classifications of the dimensions of a lenticular lens sheet are stipulated in ISO/TS 20328[1].

A test chart for the pitch measurements is printed on a plate which is dimensionally stable. The test chart includes a sequence of patterns which have slightly incremental pitches around the nominal pitch. Then, the lenticular lens sheet is superimposed on the printed test chart. The test chart is visually inspected through the lens sheet, and the pattern with the best image quality is selected. The pitch value of the lenticular lens is the pitch of the pattern.

When the nominal pitch of the lenticular lens sheet is not indicated and unknown, the approximate pitch is estimated beforehand. For that purpose, a coarse test chart with the wider range of the pitches is used.

B.2.4.2 Creation of a test chart for pitch measurements

A test chart for the pitch measurement includes patterns which have slightly incremental pitches around the nominal pitch value of the lenticular lens. For example, if the nominal pitch value is 75 lpi, patterns of ..., 74,085 lpi, 74,090 lpi, 74,095 lpi, 75,000 lpi, 75,005 lpi, 75,010 lpi, 75,015 lpi, ... are included in the test chart. An example of a test chart is illustrated in Figure B.4.

Figure B.4 — An example of a test chart for the measurement of the lens pitch

NOTE These types of test charts are easily created with commercially available software.

The test chart shown in Figure B.4 is LentiDotManager® provided by RittaiGiken Inc. The other examples of software are shown below;

— Rittai Giken, Inc., EasyLentiStudio (https://www.rittaigiken.co.jp/en/software/els.html)

— Humaneyes, Creative3D, Producer 3D (http://ga.humaneyes.com/products/creative-3D)

— Photo Illusion, Power Illusion (http://www.usefulbyte.com/piproducts.html)

— Shenzhen Ok3d Co., Ltd., PSDTO3D99, PSDTO3D101 (http://www.made-in-china.com/showroom/lenticularsofftware/product-detailqblEmLAJuehR/China-2D-to-3D-Software-PSDTO3D99-.html)

— Softnic, Lenticular Effects 4.1 (https://en.softonic.com/s/lenticular-effects-4.1)

B.2.4.3 Printing of the test chart for pitch measurements

The test chart described in B.2.4.2 is printed on a CTP plate with laser beam.

B.2.4.4 Estimation of the pitch of a lenticular lens

The lenticular lens sheet is placed over the printed test chart. The inclination of the lens sheet and printed images is adjusted as described in B.2.2.

The lens sheet is adjusted horizontally in such a way that the pattern of the left column is clearly observed, as shown in Figure B.5.

Then, the line for which the patterns are clearly observed from the left (column 1) to right (column 8) is searched for, as shown in Figure B.6. The number indicated in the line is the pitch of the lens sheet.

