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Photography - Overhead projectors - Methods for measuring and reporting performance

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Ta slovenski standard je istoveten z:

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Photography — Overhead projectors — Methods for measuring and reporting performance characteristics

Photographie — Rétroprojecteurs — Méthodes de mesure et de présentation des caractéristiques de fonctionnement

Reference number
ISO 9767:1990(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.

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.

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Photography — Overhead projectors — Methods for measuring and reporting performance characteristics

1 Scope

This International Standard specifies methods of measurement for light output (luminous flux), uniformity of screen illumination, picture outline distortion, maximum available projection elevation and temperature rise on the projection stages of overhead projectors of the types specified in ISO 7943-1. It includes a form of reporting the results of the measurements.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 7329:1989, *Photography — Slide projectors — Determination of temperature rise in the picture area using a glass sandwich test slide.*

ISO 7943-1:1987, *Photography — Overhead projectors — Part 1: Projection stages — Dimensions.*

ISO 7943-2:1987, *Photography — Overhead projectors — Part 2: Transparencies and transparency frames — Dimensions.*

IEC 38:1983, *IEC standard voltages.*

IEC 357:1982, *Tungsten halogen lamps (non-vehicle).*

CIE 15 (E-1.3.1.):1971, *Colorimetry — Official recommendations of the International Commission on Illumination.*

3 Definitions

For definitions of terms related to overhead projectors, see ISO 7943-1 and ISO 7943-2.

4 Information to be supplied

In order to specify appropriate conditions of use and of measurements, and to enable the testing laboratory to describe the equipment sufficiently fully in the test report, the following information shall be provided by the manufacturer or national distributor to the testing laboratory:

a) Name of manufacturer.

b) Name of national distributor.

c) Country of manufacture.

d) Brand name(s) under which the projector is sold:

   1) nationally;

   2) internationally.

e) Model number.

f) Nominal size of projection stage aperture.

g) Projector system (transmissive or reflective).

h) Details of projection lens (number of elements and focal length).

i) Details of rated electrical supply or supplies (see IEC 38).

j) Details of electrical rating of replacement lamps (see IEC 357).

k) Type references of replacement lamps.

5 Measurement conditions

5.1 Environmental conditions

Measurements may be carried out at any temperature within the range 23 °C ± 3 °C.

The ambient temperature at which testing is carried out shall be reported with the test results.

If the manufacturer specifies atmospheric conditions not in accordance with the above, e.g. a smaller range of ambient temperatures, and which might include requirements for relative humidity and air pressure, such conditions should be chosen from those specified in ISO 554. When specified by a manufacturer, measurements shall be made under these conditions which shall be reported with the test results.

5.2 Preconditioning

Before the commencement of any tests, the projector shall be preconditioned by being kept under the environmental conditions of the testing laboratory for at least 24 h.

5.3 Electrical supply

5.3.1 The projector shall be operated with an electrical power supply in accordance with its rated supply.

5.3.2 The voltage of the supply shall be adjusted to within 0,5 % of the value to which the voltage selector of the projector is set or, if no selector is fitted, to within 0,5 % of the rated voltage for the projector.

5.3.3 While adjusting the supply, the voltage shall be measured at the supply socket to which the recommended power supply cord is connected.

5.3.4 A projector designed to operate over a range of voltages without adjustment, by fitting a lamp designed for the local supply voltage, shall be tested with a supply voltage adjusted to within 0,5 % of the voltage marked on the lamp used for the test. If the lamp itself is marked for a range of voltages, the supply voltage shall be adjusted to within 0,5 % of the median voltage of this range.

5.4 Testing of overhead projectors

5.4.1 Before the tests, the projector shall be set up on a firm stand at a suitable distance from a vertical matt white screen to project an image of the picture area[1] with a width and height of 1,5 m, unless the projector manufacturer has specified another size. Alternative sizes of projected image might be necessary when testing a projector which is designed primarily for smaller or larger images than is usual. In order to set up the projector in its optimum condition, the stand needs to be able to be tilted from the horizontal (by at least 30° in order to aid the elevation test in clause 9).

Adjust the projector's elevation control, the angle of the stand, and the distance of the stand from the screen so that

a) the positions of the horizontal and vertical edges of the image of the picture area do not deviate by more than ± 0,025 m on each side from a 1,5 m × 1,5 m (or alternative size as above) square outline drawn on the screen (see figure 1);

b) within the tolerance of ± 0,025 m given in a) above, there is minimum keystone distortion;

c) the projected light beam passes centrally through the objective lens assembly.

When a projected image different from 1,5 m × 1,5 m is used, the size shall be given with the test report.

5.4.2 The lamp alignment and lamphouse adjustment, where provided, shall be set in accordance with the projector manufacturer's recommendations. The focus shall be set, using a general purpose transparency, to give the best overall picture quality, and the transparency shall then be removed.

5.4.3 A projector in which the lamp can be run at a reduced light output, in the interests of increased lamp life, shall be tested in the condition giving normal (non-reduced) light output.

NOTE 1 Different samples of the same type of filament lamp may vary in performance. Tests should be made with at least five lamps selected at random and the average test results calculated for light output and for temperature rise. When testing a range of projectors which use the same type of lamp, for the purposes of comparative evaluation, it is desirable to use the same lamp for all the tests. Lamps used for the measurement of light output should be aged prior to their use, in accordance with the lamp manufacturer's recommendations; this will, typically, be for a time equal to about 2 % of the average rated life of the lamp.

1) See ISO 7943-1, clause 2, Definitions.

6 Measurement and calculation of light output

6.1 Measurements for calculating light output shall be made with an illuminance meter having a spectral response characteristic corresponding to the CIE 1931 standard colorimetric observer[2].

6.2 The light sensing element of the meter shall be positioned at the plane of the screen with a tolerance of $^{0}_{+20}$ mm, and parallel to it so as to directly measure the incident projected light.

6.3 The measurement shall be made with no transparency on the projection stage, but with the focus set correctly as specified in 5.4.2.

6.4 Stray light reaching the screen shall be kept to a minimum. With the projector switched on and operating normally, but with an opaque cover obscuring the projection stage aperture, illumination of the screen at any measurement point shall not exceed 1 % of any reading taken in 6.6.

6.5 Before measurements are made, the projector shall be operated with the lamp on for at least 20 min.

NOTE 2 Where there is a switched electrical adjustment of the light level, it may be useful for measurements to be made for each setting.

6.6 Measurements shall be taken of the light reaching each of the nine points on the screen as defined in figure 1. The measurements shall be recorded in lux (lumens per square metre). The total light output shall be calculated as follows:

$$\Phi = E_m \times A$$

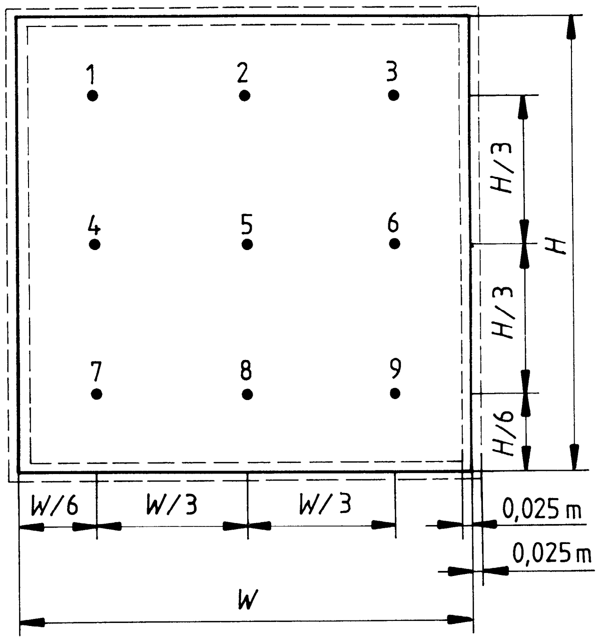
where

Φ is the light output, in lumens;

E_m is the average of the nine readings taken, in lux;

A is the area of the projected image, calculated by multiplying the full width of the projected image of the projection stage aperture by its full height, in square metres.

NOTE 3 Do not deduct the unlighted corner areas from the calculated area.



The black dots indicate the points at which light measurements are made.

Figure 1 — Light measurement points on the screen (for the values of H and W, see 5.4)

7 Calculation of uniformity of screen illumination

7.1 For determining the uniformity of screen illumination, intensities of illuminance at different corner points are set in proportion to the intensity of illuminance at the centre of the screen.

7.2 The corner points are defined as points 1, 3, 7 and 9 (see figure 1).

7.3 For each corner point the illuminance value is calculated as a proportion of the illuminance value at the centre point, 5.

7.4 The average illuminance value of the four corners is also calculated as a proportion of the illuminance value at the centre point.

7.5 The formulae for calculating the uniformity of screen illuminance are

$$U_n = \frac{E_n}{E_5} \times 100\% \quad \text{and} \quad U_m = \frac{E_{nm}}{E_5} \times 100\%$$

2) International Commission on Illumination (CIE) Publication 15 (E-1.3.1.):1971.

where

U_n serves as the indication of the uniformity between centre and corner point, n: n = 1, 3, 7 or 9;

E_n is the illuminance at corner point, n;

E_5 is the illuminance at the centre point, 5;

U_m serves as the indication of the uniformity between centre and the average of the four corners;

E_{nm} is the average illuminance of the four corners.

8 Picture outline distortion

8.1 Place squarely on the projection stage a transparency containing a square, of a size as given in table 1, so that the centre of the square is coincident with the centre of the projection stage aperture.

Table 1 — Values of sides of square for 8.1, in millimetres

Type A projector (nominal 250 × 250)	**Type B projector** (nominal 285 × 285)
200 ± 2,0	230 ± 2,0

8.2 Ensure that the focus setting is as specified in 5.4.2.

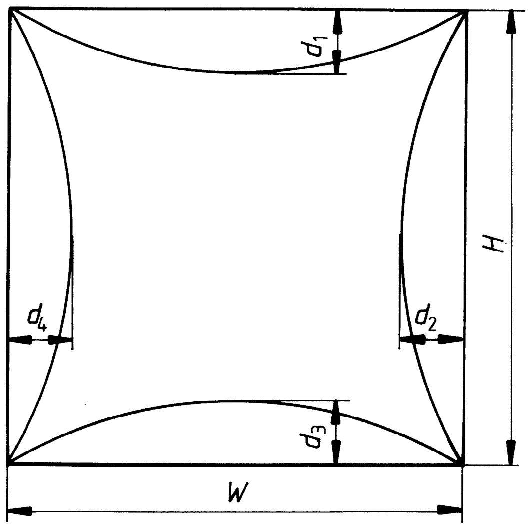
8.3 Measure the deviation of each of the four sides of the image of the square from a straight line on the screen between the ends of each corresponding side (see figure 2); the deviations are d_1, d_2, d_3 and d_4.

8.4 Select the greatest deviation, d_{max}. Using the length of the respective straight line, H or W, calculate the picture outline distortion as a percentage deviation:

$$\text{Picture outline distortion} = \frac{d_{max}}{W} \times 100\%$$

or

$$= \frac{d_{max}}{H} \times 100\%$$



Transparency containing a square as defined in table 1 is placed centrally on the projection stage aperture plate.

Picture outline distortion shown in figure 2 is "pin-cushion distortion". Picture outline distortion where the sides of the projected square bow outwards is "barrel distortion".

Figure 2 — Image on screen from a transparency containing a square (see clause 8)

9 Maximum available projection elevation (tilt)

9.1 With the projector set up standing on a horizontal support and the axis of the projection beam normal to the centre of a vertically orientated screen, focus the image as in 5.4.2.

9.2 By means of the elevation adjustment mechanism, increase the elevation of the projection beam to the limit. This limit is the lower elevation defined by either

a) the maximum setting of the elevation adjustment mechanism; or

b) the loss of the top part of the projected image of the projection stage aperture mask. In this case the limit is passed when a part of the aperture mask can no longer be seen on the screen.

9.3 By tilting the body of the projector, restore the axis of the projection beam to horizontal; i.e. tip the body forward until the image is projected again as in 9.1.

9.4 The maximum available projection elevation can be obtained by measuring the angle of the projection stage with respect to its original position in 9.1.

10 Temperature rise on the projection stage

10.1 Securely place a temperature test slide as specified in ISO 7329 on the object plane of the projector at the centre of the projection stage aperture with the thermocouple junction away from the light source.

NOTES

4 To ensure the secure placement of the temperature test slide on the object plane so that its underside is in good contact with the object plane, the test slide may be loaded with a mass of approximately 0,1 kg, constructed as shown in figure 3. Figure 4 shows an example of how the weight can be used.

5 Care should be taken to ensure that if the hottest part of the object plane is not in the centre part, and if the difference in temperature between these two parts is greater than 4 °C, the temperature measurement should be made in the area of the hottest part.

10.2 Take test-slide temperature readings at 1 min intervals until the rate of increase of temperature becomes less than 0,5 °C per minute.

10.3 Subtract the final ambient temperature from the final test-slide temperature reading and record it as the temperature rise.

Dimensions in millimetres

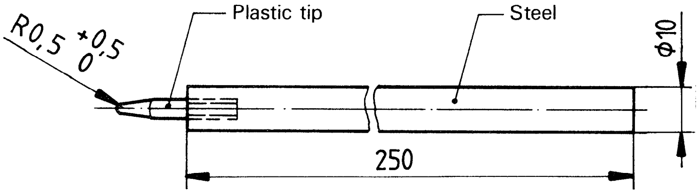


Figure 3 — Mass of approximately 0,1 kg to load the temperature test slide (see clause 10)

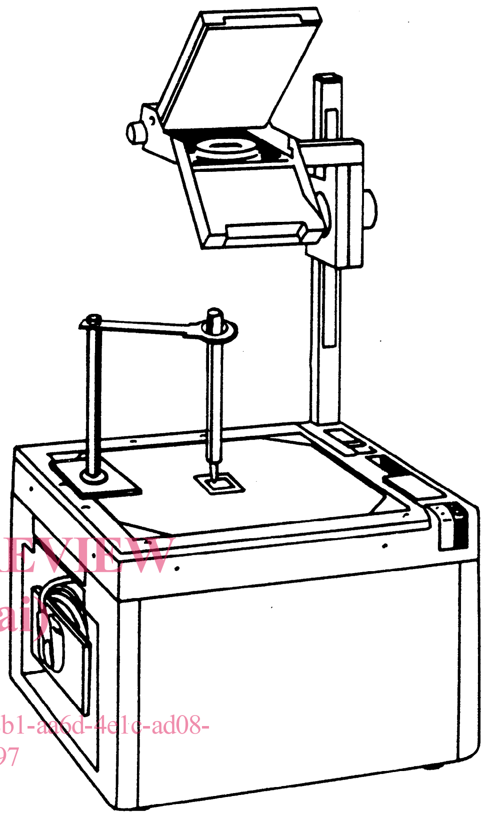


Figure 4 — An example of how the mass shown in figure 3 can be used on an overhead projector with the temperature test slide (see clause 10)