# INTERNATIONAL STANDARD

# ISO 12040

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# Graphic technology — Prints and printing inks — Assessment of light fastness using filtered xenon arc light

*Technologie graphique — Impressions et encres d'imprimerie — Évaluation de la solidité à la lumière au moyen d'une lampe à arc au xénon munie d'un filtre*

Reference number
ISO 12040:1997(E)

## Foreword

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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.

International Standard ISO 12040 was prepared by Technical Committee ISO/TC 130, *Graphic technology.*

Annex A of this International Standard is for information only.



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# Introduction

The method for evaluating light fastness described in this International Standard using blue wool references is in technical conformity with the method given in ISO 2835. However, according to the latter, natural daylight shall be used to obtain a valid assessment of light fastness. This International Standard describes an accelerated test method by specifying the light source and filters for daylight simulation as well as exposure of the test samples to artificial daylight.

In addition, this International Standard is partly in agreement with ISO 105-B02. For more information on apparatus and test methods, ISO 105-B02 is recommended as a reference.

# Graphic technology — Prints and printing inks — Assessment of light fastness using filtered xenon arc light

## 1 Scope

This International Standard specifies a method for assessing the light fastness of prints and printing inks, by giving

— the general test requirements for prints;

— the special test requirements for inks.

This International Standard applies to all print substrates such as paper, board, metals (thin metal sheets and plate) and plastic films and to all printing processes.

## 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 105-A02:1993, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-B02:1994, *Textiles — Tests for colour fastness — Part B02: Colour fastness to artificial light: Xenon arc fading lamp test.*

ISO 2834:1981, *Printing inks — Preparation of standardized prints for determination of resistance to physical and chemical agents.*

ISO 3664:1975, *Photography — Illumination conditions for viewing colour transparencies and their reproductions.*

## 3 Definitions

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

**3.1 light fastness of prints to filtered xenon arc light:** Resistance of the print to the effects of a fixed light source (filtered xenon arc light) without direct influence from the weather.

**3.2 light fastness of a printing ink:** Resistance of a standard print assessed in accordance with the instructions given in this International Standard relating to prints.

# 4 Test methods

## 4.1 Principle

A test piece together with blue wool references is exposed to xenon arc light under specified conditions at the same time.

Light fastness is evaluated by noting on the scale of blue wool references the rating of that reference which has undergone a change similar to that of the test print.

## 4.2 Apparatus and materials[1)]

### 4.2.1 Xenon arc lamp apparatus

The instrument chosen may be either air cooled or water cooled and shall be used as indicated by the manufacturer.

### 4.2.2 Blue wool references

The light fastness of prints is estimated by comparison with a standard range of eight blue dyes on wool cloth, their degree of light fastness being in regular steps. These dyes are largely unaffected by variation in temperature and humidity, and constitute an acceptable scale for the determination of the light fastness of all types of prints, whatever their colour, type and intensity.

The light fastness of prints is expressed as the number corresponding to one of the eight blue wool references. The range "1" denotes the lowest degree of light fastness and "8" the highest.

The eight ranges are as follows:

| | | | |
|---|---|---|---|
| 1 | Very poor | 5 | Good |
| 2 | Poor | 6 | Very good |
| 3 | Moderate | 7 | Excellent |
| 4 | Relatively good | 8 | Outstanding |

The range of the blue wool references is that established for textiles (see table 1). The blue wool references shall be protected from light before use.

**Table 1**

| Light-fastness rating | Dye |
|---|---|
| 1 | Acid blue 104 |
| 2 | Acid blue 109 |
| 3 | Acid blue 83 |
| 4 | Acid blue 121 |
| 5 | Acid blue 47 |
| 6 | Acid blue 23 |
| 7 | Solubilized Vat blue 5 |
| 8 | Solubilized Vat blue 8 |

The details shown in the column "Dye" correspond to the specifications given in the same column of the relevant table in ISO 105-B02.

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1) Information on sources of apparatus and reference materials may be obtained by writing to the following address (and including a stamped addressed envelope):

Secretariat of ISO/TC 38/SC 1
British Standards Institution (BSI)
389 Chiswick High Road
LONDON W4 4AL
United Kingdom

#### 4.2.3 Grey scale

A grey scale is used for the determination of colour change in accordance with ISO 105-A02.

#### 4.2.4 Black-Panel-Thermometer

The Black-Panel-Thermometer is used as a standard reference to assess the temperature of the test sample due to the absorption of black body radiation. It shall include a metal plate with dimensions of not less than 45 mm × 100 mm, whose temperature is measured by means of a thermometer or a thermocouple (see 4.3.2). The sensitive part of this thermometer shall be in good contact with the centre of the metal plate. The part of the metal plate facing the light source shall be covered with a black coating, which has an infrared reflection of less than 5 % of the amount of light which strikes the test pieces. The side which is not facing the light source shall be thermally insulated.

#### 4.2.5 Light source

The light source is a xenon arc lamp with a colour temperature of 5 500 K to 6 500 K.

#### 4.2.6 Filter

A plane glass plate shall be placed between the light source and the test pieces and/or blue wool references in order to reduce constantly the ultraviolet radiation from the xenon arc lamp. This filter should completely absorb radiation at wavelengths below 310 nm. The transparency of the glass filters shall be at least 90 % in the range of wavelengths from 380 nm to 700 nm (simulating sunlight behind window glass).

### 4.3 Procedure

#### 4.3.1 Preparation for testing

The test pieces and the blue wool references are mounted together and partly covered by opaque board, the thickness of which is at least 0,5 mm (for example board rendered impervious to infrared radiation by being covered with a sheet of aluminium).

#### 4.3.2 Illumination and test conditions

The test pieces and blue wool references are mounted together as closely as possible in a well-ventilated test chamber and shall be exposed to the same amount of radiation.

The temperature of the test pieces shall not exceed 45 °C as measured by the Black-Panel-Thermometer. If glass or water filters are used to avoid high temperatures resulting from infrared radiation, they shall be cleaned frequently in order to avoid filtering of the light caused by dirt. Furthermore, the instructions from the supplier concerning lifetime of lamps and exchange of filters shall be respected.

### 4.4 Light fastness of prints

#### 4.4.1 Exposure

The test is carried out as follows.

Expose the samples to the light in a prescribed manner for a time sufficient to cause a distinct change.

A distinct change is defined as equal to or less than grade 3 of the grey scale referenced in 4.2.3. The operator should take precautions to make sure that he does not experience light fatigue during the operation and that standard graphic arts viewing conditions (see ISO 3664) are used for the visual checks.

Determine which of the blue wool references has changed to an extent equal to that of the test piece.

NOTE 2 For a simultaneous and systematic examination of a series of prints, the following method is recommended for a single test:

— Expose all prints until reference 3 of the range of blue wool references shows a distinct change (grade 3 of the grey scale).

— Cover approximately a quarter of the exposed part of the print and of the reference and continue exposure to light until reference 5 shows a distinct change.

— Cover a quarter of the remaining exposed part and continue to expose to light until a clearly visible change corresponding to grade 3 of the grey scale is noted in reference 6.

— Cover once more and continue exposure to the point where a change in reference 7 becomes just visible (grade 4 of the grey scale).

This process of exposure by successive coverings makes it possible to assess prints with very different degrees of light fastness in a single test.

#### 4.4.2 Evaluation

Give the test piece a light-fastness rating that corresponds to the number of the blue wool reference that has a distinct change (grade 3) at the same time that the test piece shows a distinct change. Should the change in the test piece fall between the changes of two successive references, the test piece should be given the two corresponding ratings (e.g. 6-7). This method of grading shall not be used below rating 5. If the test piece's colour darkens, the light fastness is followed by the letter "N".

### 4.5 Light fastness of the substrate

Optionally, the light fastness of the substrate may be assessed, in which case it shall be tested according to the procedure described in this International Standard.

Time required for the test piece to show a distinct change (see 4.4.2).

## 5 Testing of inks

Inks shall be tested by first preparing standardized prints on a reference paper as specified in ISO 2834. The standard prints shall then be tested and evaluated as specified in clause 4 of this International Standard.

## 6 Test report

The test report shall include the following information:

a) Reference to this International Standard;

b) Light-fastness rating;

c) Indication if specific humidity and temperature conditions[2)] have been used;

d) Test conditions (see 4.3.2);

e) Type and model of light-fastness test instrument and an indication if any form of light-dark cycling was used;

f) If the light fastness of the substrate was tested (see 4.5), the above information on this test.

2) Normally, it is sufficient to carry out testing of light fastness under general climate conditions. Otherwise, see ISO 105-B02.

# Annex A
(informative)

# Bibliography

[1] ISO 2835:1974, *Prints and printing inks — Assessment of light fastness.*

**ICS 87.080**

**Descriptors:** graphic technology, prints, printing inks, tests, artificial light tests, xenon lamps, estimation, colour fastness, grey scale.

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