



SLOVENSKI STANDARD  
SIST ISO 4330:1997  
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**Photography - Determination of the curl of photographic film and paper**

Photography -- Determination of the curl of photographic film and paper

Photographie -- Détermination de l'incurvation des films et papiers photographiques

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**Ta slovenski standard je istoveten z: ISO 4330:1994**

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**ICS:**

37.040.20      Photographische Papiere, Filme und Kartuschen  
: 37.040.20      Photographische Papiere, Filme und Kartuschen

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**4330**

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Reference number  
ISO 4330:1994(E)

**ISO 4330:1994(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 4330 was prepared by Technical Committee ISO/TC 42, *Photography*.

This third edition cancels and replaces the second edition (ISO 4330:1987), of which it constitutes a technical revision. It has been modified to include photographic paper and provides a method of measuring the degree of cupping.

Annex A of this International Standard is for information only.

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## Introduction

Curl is a basic property of photographic film and paper which can influence acceptability in many applications. High curl can lead to problems in printing, projection and handling.

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# Photography — Determination of the curl of photographic film and paper

## iTeh STANDARD PREVIEW (standards.iteh.ai)

### 1 Scope

This International Standard specifies methods for determining and expressing quantitatively the curl characteristics of unprocessed and processed photographic film and paper in sheet, roll, or strip forms.

It specifies three measuring methods: method A involves the determination of curl when the specimen is held in a vertical position, methods B and C with the specimen in a horizontal position. Values for the three methods are not comparable because of the differences in specimen configuration and size.

These methods are not intended for use in determining the curl characteristics of photographic materials during processing or drying.

### 2 Definitions

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

**2.1 curl:** Departure from physical flatness and characterized with respect to curl direction (L, T, D or C), curl sign (+ or –) and curl value. This flatness defect is evident by a tendency of film or paper to coil into a cylindrical shape.

**2.2 curl direction:** Means of identifying by letter L, T, D or C the direction of curl about a specific axis of a specimen corresponding to that of the sample from which it is taken.

L represents “lengthwise curl” about the axis perpendicular to the length or machine direction of the specimen for rolls or to the longer specimen dimension for sheets. An alternative approach when the machine direction is not known is to reference the curl direction to a film notch, if present.

T represents “transverse curl” about the axis parallel to the length or machine direction of the specimen.

D represents “diagonal curl” about the diagonal of the specimen.

C represents “cupping” when all four corners of the specimen are raised and bent towards the centre of the specimen.

See figure 1.

**2.3 curl sign:** Mathematical sign, + or –, used to indicate the direction of curl which, if toward the emulsion (sensitized) side (emulsion-in) is + or, if toward the base (emulsion-out), is –. The sign is always plus for materials sensitized on both surfaces.

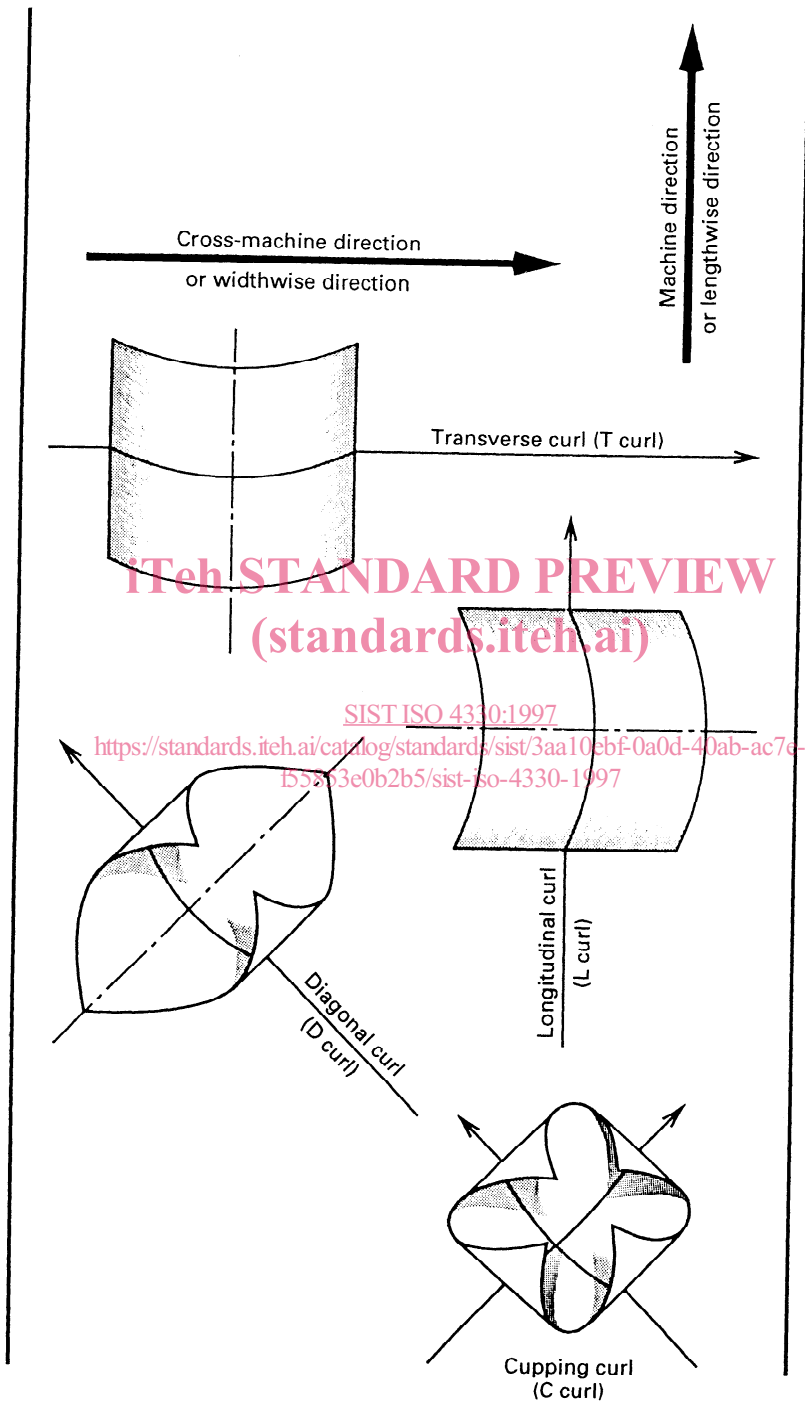


Figure 1 — Curl direction



### 3 Sampling and conditioning

#### 3.1 Selection of samples

Material intended for curl tests shall be representative of the whole of the samples being tested, exhibit no obvious physical defects, be handled in the same manner as in actual use, and be treated uniformly. When different materials are to be compared, they shall have been subjected to the same relative humidity history for similar times. The machine direction shall be indicated, if known, by crayon or ink marking.

#### 3.2 Handling of specimens

Prepare specimens under controlled relative humidity conditions, and then separate them into groups which are to be subjected to different atmospheric conditions. Wear cotton or other suitable gloves or use pincers while handling specimen. Moisture from hands or fingers will reduce accuracy of test data. The operator shall take care not to breathe on the specimens.

#### 3.3 Conditioning of specimen

Condition specimens at the chosen relative humidity until practical moisture equilibrium has been reached. In most instances, this time will be about 2 h for photographic films, one day for photographic fibre-base papers and 7 days for RC (resin coated) papers.<sup>1)</sup>

Excessive conditioning times may result in a curl decrease due to relaxation effects.

Suspend the specimens freely by means of a hook or a rod through a hole close to the centre of one edge, and separate enough to prevent contact with each other. Hang square specimens with the axis of curl vertical to avoid producing distortion. An alternative method of support is to place specimens horizontally on net-covered or screen-covered racks spaced so that there is free circulation of air.

#### 3.4 Test conditions

A temperature of  $23\text{ °C} \pm 2\text{ °C}$  is specified. Relative humidities of 15 %, 30 %, 50 %, 70 % and 85 % are

suggested but are not mandatory. Tests can be conducted in glove boxes or in conditioned rooms; the latter are preferable since they can provide better humidity control.

Curl value may be influenced by the moisture history of the material. This may be standardized by an initial preconditioning step at 50 % relative humidity.

### 4 Test method A

#### 4.1 Field of application

This method is intended mainly for samples of film or paper in sheet form or in rolls which do not show cupping but curl in only L, T or D directions.

#### 4.2 Specimen size

Prepare at least three square specimens measuring from 50 mm × 50 mm to 100 mm × 100 mm from each sample to be tested. Alternatively, circular specimens measuring from 50 mm to 100 mm in diameter can be used. Indicate the machine direction, if known.

For analytical purposes, or for specimens which show cupping or varying curl along the length or width, specimens measuring 50 mm × 5 mm can be used, with specimen cut in both the L and T directions.

#### 4.3 Unit of curl measurement

The curl values are expressed as  $1/R$ , where  $R$  is the radius of curvature in metres.

#### 4.4 Apparatus

**4.4.1 Curl board template**, marked off with curves corresponding to various values of reciprocal radius. It may be one of several formats (see figure 2).

**4.4.2 Specimen clamp**, consisting of two vertical members of which the one facing the concave side of the specimen shall be approximately 3 mm in radius. In no case shall this radius exceed the radius of the curled specimen.

1) At relative humidities of 70 % and above, films and papers sometimes undergo an irreversible change in curl with time. For this reason, the conditioning time must be standardized for comparison purposes.