INTERNATIONAL STANDARD

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# Micrographics — ISO resolution test chart No. 2 — Description and use

*Micrographie — Mire de résolution ISO no. 2 — Description et utilisation*

Reference number
ISO 3334:2006(E)

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# 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 3334 was prepared by Technical Committee ISO/TC 171, *Document management applications*, Subcommittee SC 1, *Quality*.

This third edition cancels and replaces the second edition (ISO 3334:1989), which has been technically revised.

# Introduction

Micrographic systems vary in their ability to record fine detail such as alphanumeric characters or closely spaced lines. The method specified in this International Standard involves the measurement of the ability of a given objective, photosensitive material and processing combination to reproduce the image in fine detail and therefore to be able to be applied to define and control this aspect of image quality.

Since microrecording systems can be operated close to limits of legibility, resolution testing provides a safeguard against loss of information, although other factors also contribute to the overall quality of the micro-image.

ISO 3334 describes a method of testing resolution that employs the ISO resolution test chart No. 2, in which the test patterns and their arrangement are shown in Figures 1 and 2.

Attention should be taken when referencing this International Standard in other standards. Some countries do not use this International Standard or they use alternative standards (such as ISO 446).

# Micrographics — ISO resolution test chart No. 2 — Description and use

## 1 Scope

This International Standard specifies a method of determining resolution by measuring the minimum size of detail recognizable in a processed microform. It describes the test patterns and ISO resolution test chart No. 2, and gives the method of expressing resolving power.

ISO resolution test chart No. 2 is designed for use as part of a test target, as required in other International Standards for micrographics.

This International Standard applies to the determination of the resolving power of a camera, film and processing combination used in a microfilming system or the resolution achieved in microforms therefrom. In this form it does not apply to the determination of the resolving power of microform readers, reader-printers or computer output microform (COM) imaging systems.

## 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 3:1973, *Preferred numbers — Series of preferred numbers*

ISO 5-1, *Photography — Density measurements Part 1: Terms, symbols and notations*

ISO 5-2 *Photography — Density measurements — Part 2: Geometric conditions for transmission density*

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

ISO 5-4:1995, *Photography — Density measurements — Part 4: Geometric conditions for reflection density*

ISO 2471, *Paper and board — Determination of opacity (paper backing) — Diffuse reflectance method*

ISO 6196-1, *Micrographics — Vocabulary — Part 1: General terms*

ISO 6196-2, *Micrographics — Vocabulary — Part 2: Image positions and methods of recording*

ISO 6196-3, *Micrographics — Vocabulary — Part 3: Film processing*

ISO 6196-4, *Micrographics — Vocabulary — Part 4: Materials and packaging*

ISO 6196-5, *Micrographics — Vocabulary — Part 5: Quality of images, legibility, inspection*

ISO 6196-6, *Micrographics — Vocabulary — Part 6: Equipment*

# 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6196, parts 1 to 6, apply.

# 4 ISO No. 2 test chart

## 4.1 Base

### 4.1.1 General

The test chart shall be made on either an opaque or a transparent base.

### 4.1.2 Opaque base

The test chart shall be made on a white opaque base with a glossy surface.

Its visual diffuse reflection density, measured in accordance with ISO 5-3 and ISO 5-4, shall be not more than 0,08. Its opacity, measured as specified in ISO 2471, shall be greater than 85 %. This test chart shall be positive-appearing.

### 4.1.3 Transparent base

The test chart shall be made on a non-coloured transparent base having a maximum visual diffuse transmission density of 0,08, measured in accordance with ISO 5-2 and ISO 5-3. This test chart may be positive-appearing or negative-appearing.

## 4.2 ISO No. 2 test pattern

The test pattern shall consist of a numbered group of two sets of five parallel lines at right angles as shown in Figure 1. The lines and spaces between them shall be of equal width.

The dimensions of lines, expressed in millimetres, shall be as shown in Figure 1 where $s$ is the frequency in line pairs/mm. The width of any four line pairs in a pattern shall be $\pm$ 3 % of the nominal width. The ratio of line length to line width shall be 24,0 $\pm$ 1,2. The ratio of line width to space width shall be 1,00 $\pm$ 0,05 for 1 to 10 line pairs/mm and 1,0 $\pm$ 0,1 for 11 to 18 line pairs/mm.

Dimensions shall be measured using a precision microscope equipped with a micrometer, an optical comparator or a computer-controlled co-ordinate measuring machine, calibrated and capable of measuring to 1 µm or smaller, after conditioning at 23 °C $\pm$ 2 °C and relative humidity 50 % $\pm$ 5 % for at least 1 h.

On an opaque chart the visual reflection density of the lines shall be not less than 1,60 and of the spaces not more than 0,02 greater than that of the base. On a transparent chart the minimum difference in visual diffuse transmission density between the base and lines shall be 3,0.

A level of quality for the appearance of the lines and spaces is discussed in Annex A.

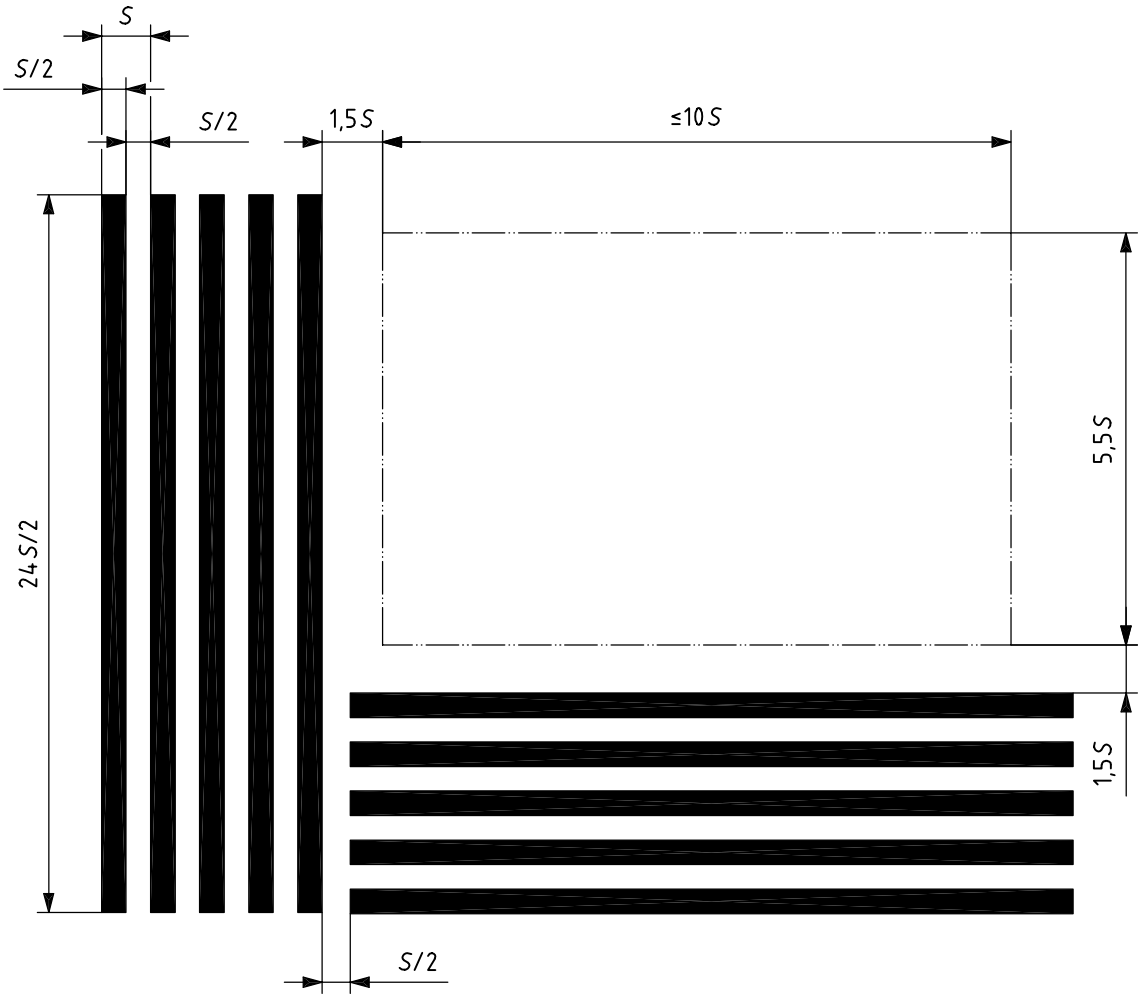



**Figure 1 — ISO No. 2 test pattern**

## 4.3 Spatial frequency of test patterns

The range of test patterns used in the test chart shall be as shown in Figure 2.

The sequence of steps, starting at 1.0, is in accordance with the R 20 series of preferred numbers given in ISO 3, with a first rounding, except for the 1.25 and 12.5 patterns.

NOTE Rounding of these numbers would have varied the spatial frequency sequence by too large a percentage. This gives an average increment of 12,2 % per step .

## 4.4 Method of numbering test patterns

The number that designates a test pattern shall be its spatial frequency expressed in line pairs per millimetre.

EXAMPLE: In the pattern designated 2.0, each line is 0,25 mm wide so that a line pair of one line and one space is 0,5 mm wide, therefore the pattern's spatial frequency is 2 line pairs/mm.

## 4.5 Test pattern number

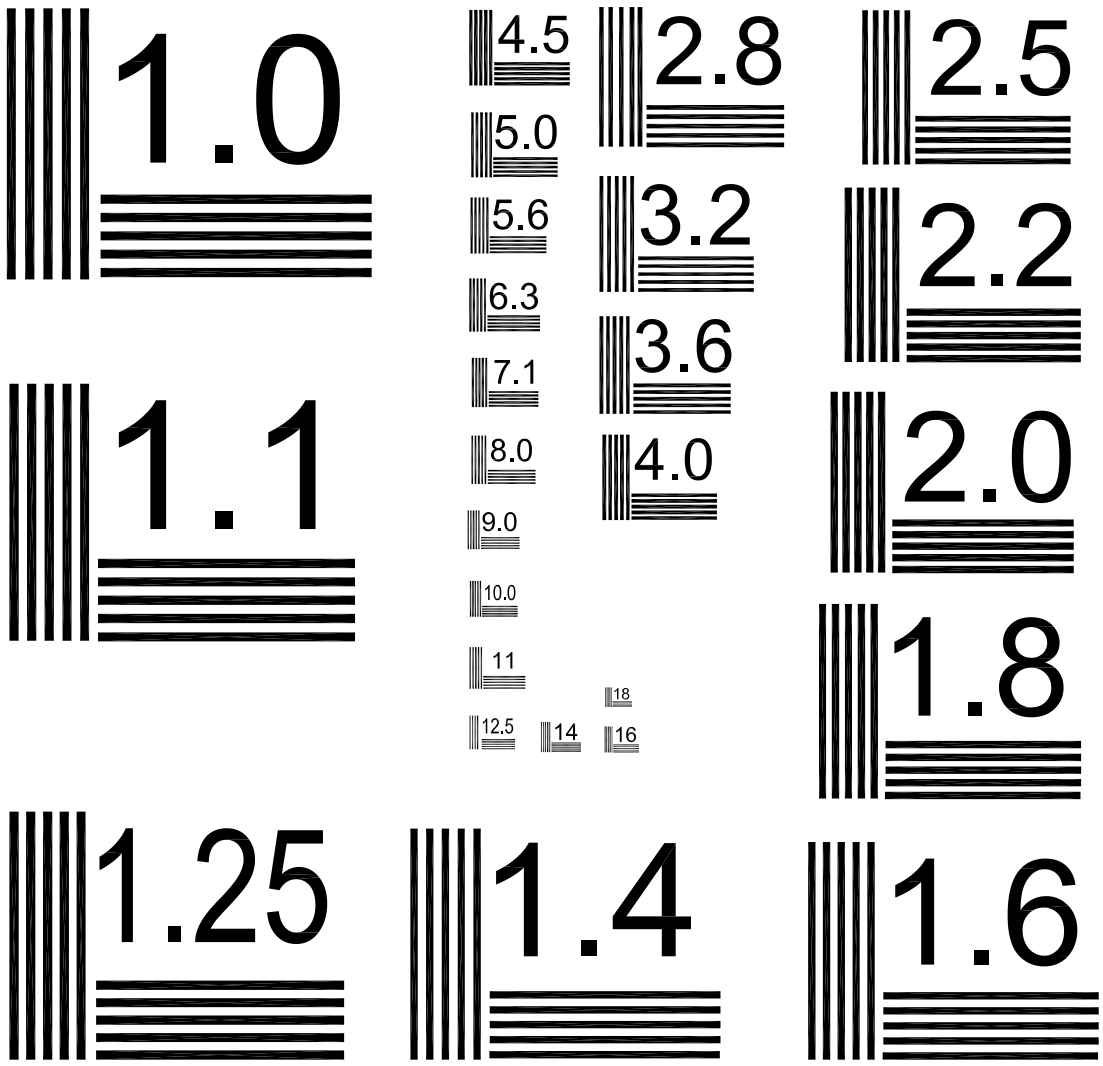
The number of each test pattern shall be placed within the top right-hand quarter of the rectangle formed by the pattern. The size of the number shall be as shown in Figure 1. The typeface used shall be sanserif typeface suitable for photographic reproduction.

### 4.6 Arrangement of test patterns

The test patterns shall be arranged on the test chart in order of increasing spatial frequency as shown in Figure 2.

### 4.7 Test chart title and source

The words “ISO resolution test chart No. 2” and the certifying agent[1)] or the source of issue shall appear on the test chart below the test patterns.




NOTE This illustration is not suitable for testing.

**Figure 2 — Enlarged sample layout of the arrangement of test patterns in the test chart**

1) Currently, test charts certified to conform to this International Standard can be obtained from the National Institute of Standards and Technology, Office of Standard Reference Materials, Gaithersburg, MD 20899, USA.

# 5 Procedure for using the test chart

## 5.1 Purpose of the test

This test is designed to establish the optimum resolution of a film, camera and processing system. It is not intended to be used under routine production systems. Any use of this procedure outside the conditions specified within this document may yield only indicative results.

## 5.2 Test target

Position the test chart within the filming area of the camera, together with a 50 % reflectance neutral density patch that will result in an image at least 2 mm in diameter on the film.

## 5.3 Exposure

Perform an exposure series extending through the exposure level above that normally used for production documents.

## 5.4 Processing

Process the film under standard on target processing conditions.

# 6 Procedure for reading images of test charts

## 6.1 Selection of frame

Select an exposed and processed frame produced in accordance with Clause 5, in which the 50 % reflectance patch has a visual diffuse density of 1,0 to 1,2 when measured in accordance with ISO 5-1 and 5-2.

## 6.2 Use of microscope

Use a microscope having a good quality achromatic objective. Its magnification shall be between $\times$ 1/3 and $\times$ 1 the expected system's resolving power when the microform is examined; e.g. to view an image produced by a system with a resolving power of 150 line pairs/mm, the magnification shall be between $\times$ 50 and $\times$ 150.

## 6.3 Examination of test pattern

Examine the test patterns on the test chart using the microscope, and note the smallest pattern that can be resolved, that is the pattern in which all five individual lines can be distinguished in both directions.

## 6.4 Spurious resolution

Spurious resolution can result from a number of system problems such as an out of focus camera. It shows as only four line pairs being resolved in a test pattern. Only the last pattern resolved as five line pairs in both directions, before the defect occurs, even if a pattern or patterns smaller than the defective pattern appear resolved, shall be reported as the system resolution.

## 6.5 Lines in one direction unresolved

If the lines in one direction appear resolved while those at right angles do not, it is possible that the eyesight of the examiner is astigmatic. To check for this possibility, the pattern is viewed at 90º to the original direction. If the same set of lines remains unresolved, the fault lies in the film sample or in the camera and not in the examiner.

## 6.6 Expression of resolving power

To express the resolving power of the camera, film and development combination in line pairs per millimetre, multiply the number of the smallest pattern resolved by the inverse of the reduction ratio at which the target was filmed; e.g. if the smallest pattern resolved is numbered 5.0 and the reduction ratio is 1/24 the resolving power is 120 line pairs/mm.

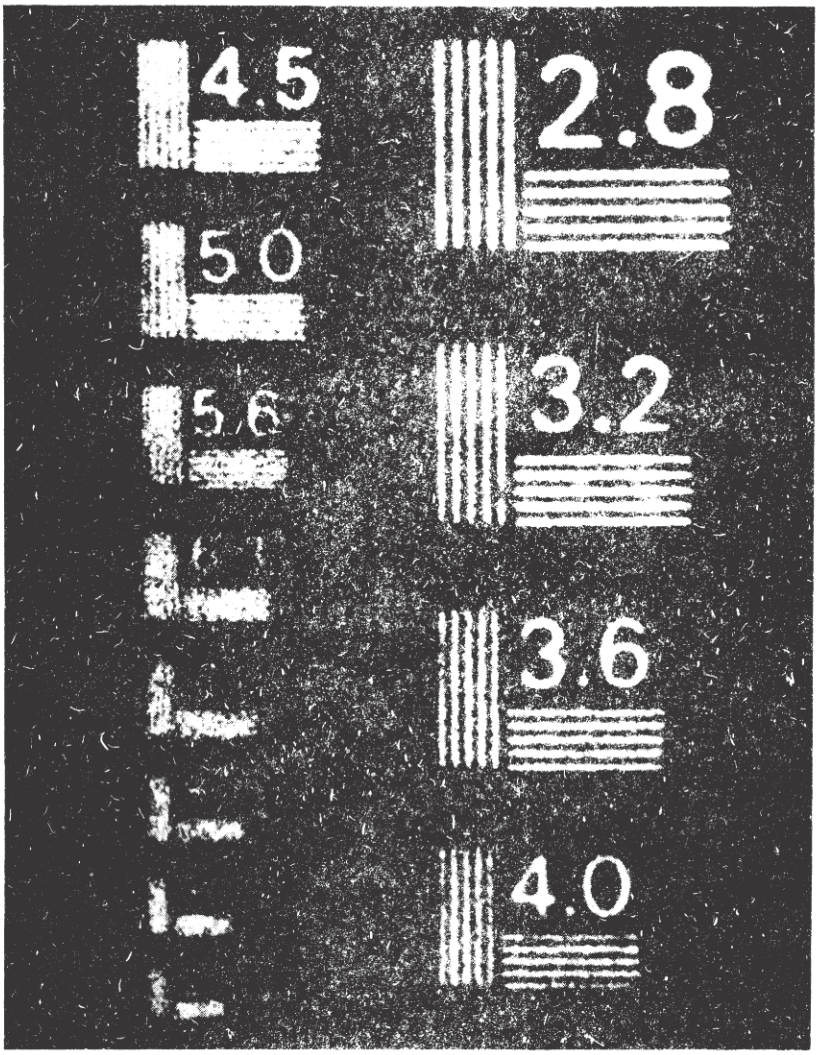



**Figure 3 — Example reproduction of photomicrograph of test patterns on a typical microform**

# Annex A
(informative)

# Defects affecting quality

During manufacture of the test chart, defects can occur in the images of the lines and spaces. The size of the defect relative to the width of the line or space will determine the degree to which the defect will influence the measurement of the resolving power of a microfilming system.

The following description of defects is suggested as guidelines for the rejection of test charts.

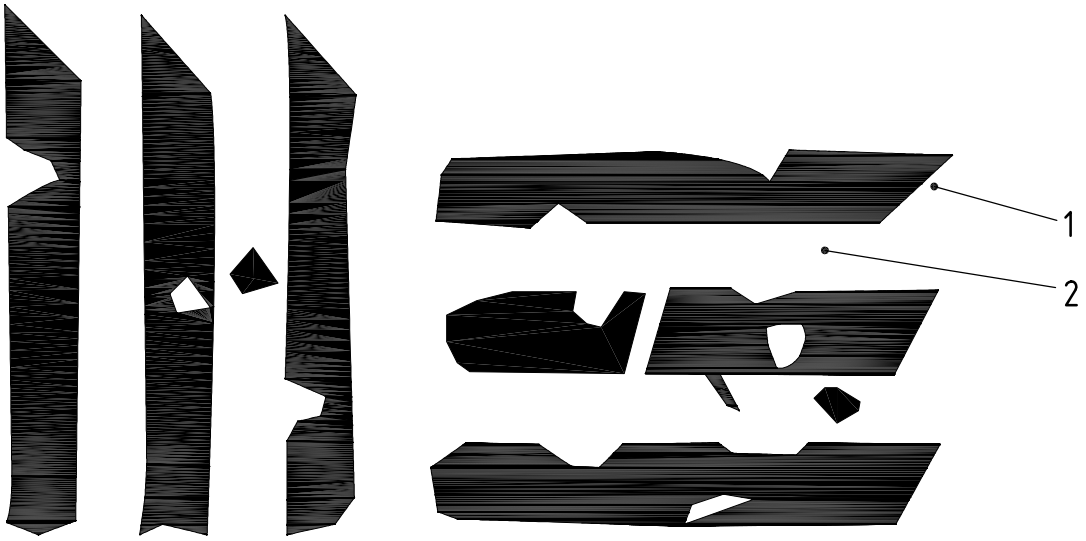
a) Corners not square and edges broken or uneven with the remainder of the line and space.

b) Holes or marks in the line or space area which are larger than one-half of the width of a line or space.

c) Breaks, cuts or marks that are completely through or over one-half the width of the line or space.

d) Cuts or marks along the edges or in the line or space with length greater than one-fourth the length of the line or space.

The main causes of rejection in the test charts are shown in Figure A.1. Notation of printing flaws are for both vertical and horizontal line space patterns.




**Key**
1 line
2 space

**Figure A.1 — Examples of defects**

# Bibliography

[1] ISO 446, *Micrographics — ISO character and ISO test chart No. 1 — Description and use*

**ICS 37.080**

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