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**Micrographics — Colour microfilm —  
Application of the exposure technique  
to prepare line originals and  
continuous-tone originals**

*Micrographie — Microfilm en couleurs — Application de la  
technique d'exposition pour préparer des originaux au trait et des  
originaux en demi-ton*

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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 11142 was prepared by Technical Committee ISO/TC 171, *Document management applications*, Subcommittee SC 2, *Application issues*.

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# Micrographics — Colour microfilm — Application of the exposure technique to prepare line originals and continuous-tone originals

## 1 Scope

This International Standard applies the exposure technique to the preparation of line originals and test charts, to their exposure on film including the necessary test originals (see Clause 5) and to the evaluation of test exposures on colour microfilm.

In addition, this International Standard applies to the exposure technique and the evaluation of available continuous-tone originals, ready to be microfilmed (see Annex A).

This International Standard is intended to contribute to a reproducible colour rendition with respect to the original. As far as process control is concerned, the film manufacturer's recommendation should be observed.

This International Standard does not take into account the influences of projection characteristics of microfilm readers on the subjective impression of projected colour microfilms.

NOTE For viewing colour microfilms, the translucent screens of microfilm readers should be neutral grey (see Annex A).

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## 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 5-3:1995, *Photography — Density measurements — Part 3: Spectral conditions*

ISO 105-A01:1994, *Textiles — Tests for colour fastness — Part A01: General principles of testing*

ISO 128, *Technical drawings — General principles of presentation*

ISO 216:1975, *Writing paper and certain classes of printed matter — Trimmed sizes — A and B series*

ISO 446:2004, *Micrographics — ISO character and ISO test chart No. 1 — Description and use*

ISO 2469:1994, *Paper, board and pulps — Measurement of diffuse reflectance factor*

ISO 3334:1989, *Micrographics — ISO resolution test chart No. 2 — Description and use*

ISO 3664:2000, *Viewing conditions — Graphic technology and photography*

ISO 10550:1994, *Micrographics — Planetary camera systems — Test target for checking performance*

CIE 15.2, *Colorimetry*

### 3 Exposure technique

#### 3.1 Introduction to exposure technique

The exposure technique and the copying procedure have great influence on the colour quality of the end product. Therefore, the conditions listed in 3.2 to 3.6 for the colour temperature of the illuminating lamp, the spectral characteristics of the exposure lens, the basic filtration and other influences shall be fulfilled.

#### 3.2 Illumination of the original

The original shall be illuminated by light of constant intensity and having a distribution temperature of 3 200 K to 3 400 K, because colour microfilm is adjusted to a colour temperature of 3 200 K (see also 3.4).

#### 3.3 Exposure lenses

All lenses used for exposing colour microfilms shall be colour-corrected.

#### 3.4 Exposure

The exposure shall only be adjusted by modifying the exposure time, but not by changing the lamp current. Cameras for colour microfilming shall be equipped with a shutter, which allows adjustment of the exposure time.

NOTE Changing the lamp current would result in a shift of the distribution temperature.

#### 3.5 Filtration

The adaptation of the lamps to the distribution temperature specified in 3.2 shall be made by means of correction filters placed over the light source.

If it is necessary to adjust the colour microfilm to the illumination of the original, this can be done by placing suitable conversion filters over the exposure lens.

#### 3.6 Stray light

When exposing colour microfilm, stray light falling on to the original shall be avoided.

NOTE A variety of methods may be used depending on the stray light source; e.g. placing a black curtain around the microfilming installation can aid in avoiding light from sources other than the one used to illuminate the original. Other examples of stray light include light reflected from objects and from the clothing of the personnel operating the microfilming installation.

#### 3.7 Copy board

The copy board to hold the original shall have a dark and non-reflecting surface.

### 4 Originals made on uncoloured material (drafting paper, transparent paper, drafting foils) for recording on colour microfilm

#### 4.1 Colour of the material

##### 4.1.1 General

The selected material shall have a spectral reflectance factor  $R_{457} = (80^{+5}_0) \%$ .

$R_{457}$  means that the spectral reflectance factor  $R$  is measured at the wavelength 457 nm. This measurement is made with standard illuminant A (see ISO 2469).

#### 4.1.2 Transparent paper or drafting paper

If originals on transparent paper or drafting paper are placed on a sheet of white paper for microfilming in reflected light, it shall be considered that the light passes through the original twice. Thus, the background may reproduce on the colour microfilm with a distinct colour cast.

#### 4.1.3 Glass plate

Frequently the originals curl. Therefore it is necessary to place a glass plate over the original. This can produce a colour shift.

### 4.2 Colour of inks and pencils

To ensure the subjective separation of the individual hues on the colour microfilm, all inks, drafting inks and coloured pencils used to prepare the originals shall be those listed in Table 1, having a colour difference of  $\Delta E^*_{ab} \leq 4$ , in accordance with CIE 15.2.

The same colours shall be used to prepare originals by means of plotters.

The colour rendition of inks, drafting inks and coloured pencils shall be evaluated subjectively, but shall be recorded objectively through measures.

To ensure adequate colour separation even when microfilming at a later date, the colours shall not fade when exposed to light or in dark storage (see also ISO 105-A01).

It is recommended to obtain information on storage properties from the manufacturer of inks, drafting inks and coloured pencils. Currently there is no information available on colour toners used in non-photographic processes and laser printers.

**Table 1 — Colour names and characteristic colour numbers (as guidelines) for illumination with standard illuminant D65 for the 2° standard colorimetric observer**

Parameter	Colour name					
	Blue (B)	Green (G)	Red (R)	Yellow (y)	Magenta (m)	Brown (bn)
	Characteristic colour coordinates <sup>a</sup> $T:S:D$					
	17:5:2	23:5:2	8:6:2	1:6:1	13:3:3	5:3:5
Standard chromaticity <sup>b</sup> $x$	0,188	0,314	0,533	0,426	0,276	0,419
Coordinates <sup>b</sup> $y$	0,202	0,455	0,314	0,48	0,221	0,364
Colorimetric value <sup>b</sup> $Y$	16,6	41,9	16,9	61,9	14,7	9,8
NOTE Although cyan is one of the negative colours in colour photography, it is not used in this International Standard because in reproduction it can easily be mistaken for blue. Cyan was therefore replaced by brown.						
<sup>a</sup> $T$ = hue number; $S$ = saturation degree; $D$ = darkness degree of brightness.						
<sup>b</sup> For definitions, see CIE 15.2.						

#### 4.3 Colours for ink pads

Colours for ink pads may be used if they fulfil the conditions of 4.2.

#### 4.4 Colour ribbons

Colour ribbons used to type text into originals shall be of the single-use type, e.g. one-way carbon ribbons. Fabric ribbons shall not be used.

#### 4.5 Presentation of details in newly prepared continuous-tone originals

Coloured details on newly prepared continuous-tone originals (image elements, writings, etc.) shall be made larger than comparable black-and-white elements in order to ensure legibility.

If this is not the case for a continuous-tone original already present, the legibility may be reduced or the size of the copy made has to be changed, e.g. by microfilming only part of the original.

#### 4.6 Width of lines and characters

The width of lines and characters on originals to be colour microfilmed shall meet the requirements of ISO 128.

#### 4.7 Uniformly coloured areas

Uniform colour areas of the original shall be represented by coloured cross-hatchings.

#### 4.8 Adhesive foils

Adhesive foils with or without information (e.g. cross-hatching, arrows, etc.) may be used.

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### 5 Test charts

#### 5.1 Test chart S for line originals on uncoloured paper

##### 5.1.1 General

The elements of the test chart are specified in 5.1.2 to 5.1.5.

##### 5.1.2 Size and material

The size of the test chart is A4, in accordance with ISO 216. The spectral reflectance factor  $R_{457}$  of the material is defined in 4.1, the layout in Figure 1. The test chart shall be kept in a dust-free and light-tight sleeve.



Dimensions in millimetres

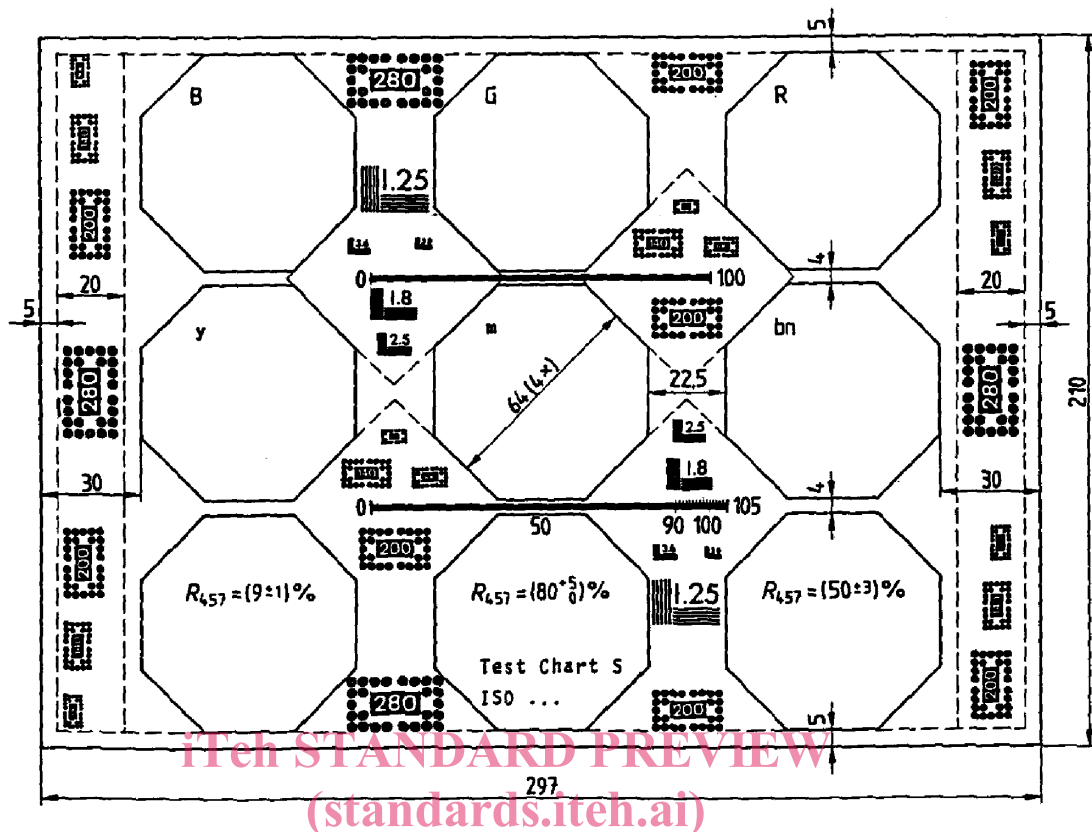


Figure 1 — Original test chart S

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### 5.1.3 Colour patches and grey patches

There are nine patches, each measuring 64 mm, to check colour rendition and contrast.

Six patches are coloured blue (B), green (G), red (R), yellow (y), magenta (m), brown (bn). See also 4.2.

Three patches are neutral grey, having spectral reflectance factors  $R_{457} = (9 \pm 1) \%$ ,  $(50 \pm 3) \%$  and  $(80 \pm 5) \%$ .

At a reduction ratio 1:24, the test patches with the dimension of 64 mm will be reproduced on the microfilm with a dimension of 2,66 mm. In this case, a measuring aperture of 2,4 mm diameter shall be chosen.

NOTE 1 The sequence B-G-R should be respected because colour-densitometric evaluations are usually performed in this sequence and the colours are not always mentioned when quoting colour values.

NOTE 2 When selecting the reduction ratio of the microfilm reproduction (see also 5.1.5), it should be remembered that the diameter of the measuring aperture of the colour densitometer must, for technical reasons, be somewhat smaller than the patch to be measured on the microfilm.

### 5.1.4 Groups of test symbols

#### 5.1.4.1 General

There are two ISO characters available for measuring the quality produced on the microfilm, ISO character No. 1 and ISO character No. 2.

**5.1.4.2 ISO character No. 1**

Ten groups of ISO characters are arranged on the test original for subjectively assessing the sharpness of the microfilming (see Figure 2). These are combinations of the ISO character No. 1 specified in ISO 446.

Each group of characters is identified by a characteristic number for the ISO character No. 1 specified in ISO 446. The sizes are arranged according to  $1:\sqrt{2}$ .

280 - 200 - 140 - 100 - 71

**5.1.4.3 ISO character No. 2**

Two groups of resolution test patterns are arranged on the test original for objective measurements of the resolution. These are combinations of the ISO resolution test pattern No. 2 in accordance with ISO 3334.

Each group of resolution test patterns is identified by a characteristic number for the ISO resolution test pattern No. 2. The sizes are arranged close to  $1:\sqrt{2}$ .

1,25 - 1,8 - 2,5 - 3,6 - 5

**5.1.4.4 Relationship between the two groups of test symbols**

The structure of ISO character No. 1 contains 3,5 line pairs (LP). Table 2 gives the relationship between characteristic numbers of ISO character No. 1 and ISO resolution test pattern No. 2.

The steps in the range of ISO test symbols with different dimensions in ISO character No. 1 and ISO resolution test pattern No. 2 are adapted to each other. (ISO character No. 1 is equal to 3,5 LP, see Table 2.)

**Table 2 — Relationship between the two groups of ISO test symbols**

Characteristic numbers of ISO character No. 1	Characteristic numbers of ISO resolution test pattern No. 2
280	1,25
200	1,8
140	2,5
100	3,6
71	5,0

**5.1.4.5 Determining resolution**

Resolution can be determined using the quality index method. (See Annex A.)

Table 3 contains the sizes of ISO characters No. 1 and ISO resolution test pattern No. 2 and the number of line pairs (LP) per millimetre on the colour microfilm for a microfilming reduction ratio of 1:24.

**Table 3 — Characteristic numbers of the ISO characters No. 1 and ISO resolution test pattern No. 2 and corresponding line pairs per millimetre**

	Test original	Colour microfilm	
	Number of the ISO characters No. 1 in accordance with ISO 446	Size of the test symbol mm	Corresponds to the line pairs (LP)/mm
ISO character No. 1	280	0,116 6	30
	200	0,083 3	42
	140	0,058 3	60
	100	0,041 6	84
	71	0,0291 6	120
ISO resolution test pattern No. 2	Characteristic number of the ISO resolution test pattern No. 2	Size of the test symbol mm	Corresponds to the line pairs (LP)/mm
	1,25	0,033 3	30,03
	1,8	0,023 1	43,22
	2,5	0,016 7	59,8
	3,6	0,011 8	84,7
	5,0	0,008 3	120,5

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**5.1.5 Ruler**

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The upper ruler measuring 100 mm serves to determine the reduction ratio when microfilming (see Figure 1). The lower ruler has 1 mm subdivisions between 90 mm and 105 mm, thus the exact ratio of enlargement can be determined (see also 6.1.5).

**5.2 Test chart H for continuous-tone originals made on uncoloured paper**

**5.2.1 Size and material**

The size of the test chart is A4, in accordance with ISO 216. The spectral reflectance factor  $R_{457}$  of the material is defined in 4.1, the layout in Figure 2. The test chart shall be kept in a dust-free and light-tight sleeve.