INTERNATIONAL STANDARD

ISO 6198

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Micrographics — Readers for transparent microforms — Performance characteristics

Micrographie — Appareils de lecture de microformes — Caractéristiques

Reference number
ISO 6198:1993(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.

International Standard ISO 6198 was prepared by Technical Committee ISO/TC 171, *Micrographics and optical memories for document and image recording, storage and use.*

Annex A of this International Standard is for information only.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland
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Micrographics — Readers for transparent microforms — Performance characteristics

1 Scope

This International Standard specifies the essential performance characteristics of readers with magnification less than or equal to 50:1 designed for use with black-and-white roll microfilm and strips that have a maximum width of 35 mm. It also specifies the performance of readers for microfilm, microfiche, jackets containing microforms, and image cards. It is not applicable to reader-printers or to devices such as pocket readers.

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 446:1991, *Micrographics — ISO character and ISO test chart No. 1 — Description and use.*

ISO 3272-3:1975, *Microcopying of technical drawings and other drawing office documents — Part 3: Unitized 35 mm microfilm carriers.*

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

ISO 6196-1:1993, *Micrographics — Vocabulary — Part 01: General terms.*

ISO 6196-2:1993, *Micrographics — Vocabulary — Part 02: Image positions and methods of recording.*

ISO 6196-3:1983, *Micrographics — Vocabulary — Part 03: Film processing.*

ISO 6196-4:1987, *Micrographics — Vocabulary — Part 04: Materials and packaging.*

ISO 6196-5:1987, *Micrographics — Vocabulary — Part 05: Quality of images, legibility, inspection.*

ISO 6196-6:1992, *Micrographics — Vocabulary — Part 06: Equipment.*

ISO 6199:1991, *Micrographics — Microfilming of documents on 16 mm and 35 mm silver-gelatin type microfilm — Operating procedures.*

ISO 7565:1993, *Micrographics — Readers for transparent microforms — Measurement of characteristics.*

ISO 7779:1988, *Acoustics — Measurement of airborne noise emitted by computer and business equipment.*

ISO 9878:1990, *Micrographics — Graphical symbols for use in microfilming.*

ISO 9923:—[1], *Micrographics — Transparent A6 microfiche image arrangements.*

IEC 417:1987, *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets — Eighth supplement.*

IEC 950:1991, *Safety of information technology equipment, including electrical business equipment.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 6196 apply.

1) To be published.

4 Measurable characteristics

To comply with this International Standard, a reader shall conform to the following requirements.

4.1 Magnification

Measure the magnification in accordance with ISO 7565. The actual magnification shall be within ± 5 % of the manufacturer's stated magnification.

4.2 Image quality

4.2.1 Resolution

When the image of the microtest chart is positioned on the screen and with the reader at best focus[2], the minimum sized characters or test patterns as shown in table 1 or 2 for the specified magnification shall be resolved at all points within the measurement area of the screen (see figure 1). The resolution test is made with either of the two microtest charts (ISO No. 1 or ISO No. 2). The test image used shall be capable of resolving at least four patterns higher than specified in table 2 for the appropriate magnification.

For readers having a magnification between the values listed in table 1 or 2, the character or pattern to be resolved shall be that of the closest to the listed nominal magnification.

The methods of reading the character or pattern resolved are described in ISO 446 and ISO 3334.

4.2.2 Geometric distortion

When the image of a straight line is projected onto any part of the measurement area (see figure 1) of a flat reader screen, the projected image shall be compared to a straightedge held next to the projected line. When measured in accordance with ISO 7565, the pincushion or barrel distortion shall not exceed 0,5 % and the keystone or skew distortion shall not exceed 2 %. Less distortion may be required for technical drawing applications, whereas more distortion may be allowable for some office applications. Under these circumstances, the allowable distortion shall be agreed between manufacturer and purchaser.

Table 1 — Minimum sized ISO microtest chart No. 1 characters to be resolved in the screen image (values based upon prepared microtest chart)

Nominal magnification	Character of ISO No. 1 microtest chart to be read
10/1	125
15/1	112
20/1	100
25/1	90
30/1	80
35/1	71[1]
40/1	63[1]
45/1	56[1]
50/1	50[1]

1) The difficulty in obtaining such fine characters on the microtest chart can make the measurements incorrect.

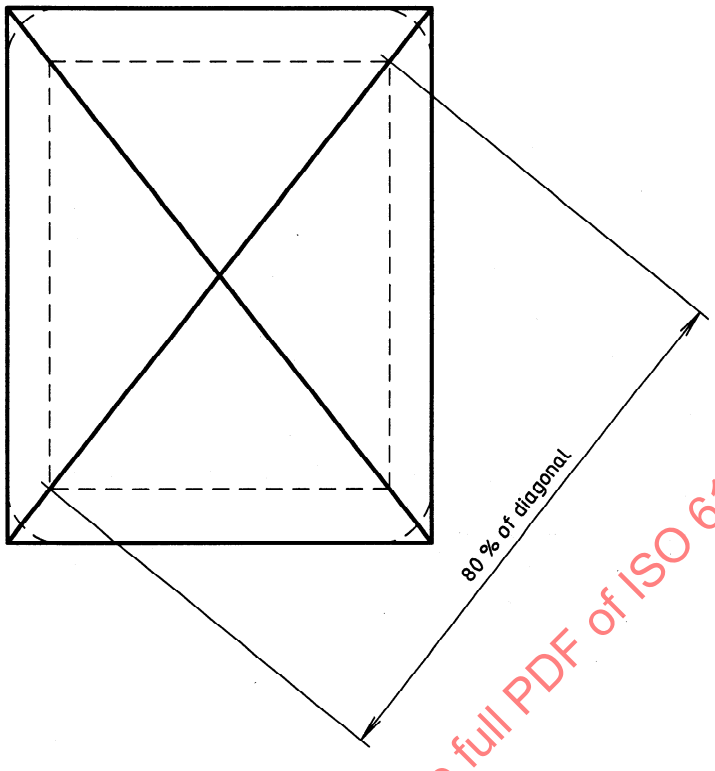
Table 2 — Minimum sized ISO microtest chart No. 2 pattern to be resolved in the screen image (values based upon specifically made microtest charts which may require calculations to give true values)

Nominal magnification	Pattern of ISO No. 2 microtest chart to be read line pairs/mm
10/1	6,3
15/1	4,5
20/1	4,0
25/1	3,6
30/1	3,2
35/1	3,2
40/1	2,8[1]
45/1	2,5[1]
50/1	2,5[1]

NOTE — Calculations involving the reduction used to make the microtest chart may be necessary to determine the actual resolution specified in table 2.

1) The difficulty in obtaining such fine characters on the microtest chart can make the measurements incorrect.

2) The best focus is the setting of the focusing control which is judged to produce the best overall level of screen image resolution within the measurement area. This setting is found experimentally and will usually be somewhere between the setting which produces the highest resolution at the centre of the screen and the settings which produce the highest resolution at the corners.



NOTE — Measurement area of the screen is defined as the central area formed by connecting the points of the diagonals that are located from the corners at a distance of 10 % of the screen diagonal lengths. That is, the area within the dashed rectangle. If the corners of the screen are rounded, the length of the diagonals and the points from which readings are taken shall be calculated from the extrapolated edges of the screen. Screens may be either square or a vertical or horizontal rectangle.

Figure 1 — Measurement area of reader screen

4.3 Screen luminance and contrast

4.3.1 Screen luminance

4.3.1.1 Procedure

Measure screen luminance in accordance with ISO 7565. The procedure outlined gives values of luminance that would be seen by a user when in the normal viewing position (see ISO 7565, annex A).

4.3.1.2 Requirements

At any point within the measurement area of the screen (see figure 1), the luminance shall not be less than 35 cd/m^2. The minimum luminance at the centre of the screen shall not be less than 140 cd/m^2.

4.3.1.2.1 Rear projection readers

The relationship in luminance between the maximum value and the minimum value shall not exceed a ratio of 10, except for those readers with very large screens, i.e. having a diagonal greater than 540 mm where the ratio shall not exceed 15.

4.3.1.2.2 Front projection readers

The relationship in luminance between the maximum value and the minimum value shall not exceed a ratio of 5.

4.3.2 Screen contrast

4.3.2.1 Procedure

Measure screen contrast in accordance with ISO 7565.

4.3.2.2 Requirements

The screen contrast expressed as a luminance ratio shall be a minimum of 10. In general, a higher screen contrast is preferred.

4.4 Safety

4.4.1 Stability of reader

Readers that are designed to stand on a flat and horizontal surface such as a desk, table or floor shall not

tip over when tested in accordance with the method described in IEC 950.

4.4.2 Temperature

4.4.2.1 Film temperature in the film gate

Film gate temperatures shall be measured in accordance with ISO 7565. The temperature of the film in the film gate shall not exceed 70 °C when measured after 60 min of continuous operation with the reader in focus and the lamp operating at the highest brightness setting permitted by the reader.

4.4.2.2 Temperature of reader

Temperatures of the exposed surfaces of a reader shall be measured in accordance with IEC 950. The temperature of reader surfaces shall not exceed the values given after the reader has been operated in an area with an ambient temperature of 23 °C ± 2 °C for 1 h. The voltage used shall be equal to 1,06 times the highest rated voltage (if it is known) or 1,06 times the average voltage of the stated voltage range.

4.4.3 Fire hazard

Readers shall be constructed in accordance with the appropriate requirements of IEC 950. Resistance to spread of flames and nonemission of toxic fumes are particularly important.

4.5 Noise

Airborne noise emitted by readers shall be measured while the reader is operated at its rated voltage under two operating modes:

— during normal viewing conditions;

— during microform changing or transport such as rewinding roll film, changing cartridges or microfiche in the carrier.

The airborne noise shall be measured in accordance with ISO 7779.

The A-weighted sound power level obtained by using the procedures specified in ISO 7779 shall be used for comparison of the airborne noise emitted by different readers. Sound power level data may be supplemented by the A-weighted sound pressure level measured at the operator's position(s) or bystander's position(s) as defined in ISO 7779.

For each mode of operation, the appropriate statements of ISO 7779 shall be used to indicate the sound pressure level.

For readers that are to be used in a quiet area such as a library reading room, the A-weighted sound pressure level during normal viewing conditions shall not exceed 50 dB, and during any rapid motion shall not exceed 60 dB. Impulsive noise for the equipment should not exceed 75 dB.

5 Additional required characteristics

When applicable, a reader shall comply with the following requirements.

5.1 Image handling

5.1.1 Image orientation

5.1.1.1 Roll film readers

Roll film readers shall display on the screen, upright and right-reading, at least one of the image formats on reels as specified in ISO 6199.

Table 3 — Temperature of different parts of the reader

Part of reader	Maximum temperature
Handles or grips for moving (portable devices), all controls, areas in front of readers, surfaces near controls, film loading, handling or positioning areas, and any other areas normally touched during operation of the reader	35 °C
Areas on the bottom of the readers, and other exterior portions not included above	55 °C
Internal areas that may be touched or handled in routine maintenance, lamp changing and cleaning, etc. (except lamps and lamp removal mechanisms), under the following conditions:	
— If labelled with warning i.e., "Use care — HOT"	No limit specified
— Not labelled	60 °C
Lamps, lamp removal mechanism	Warning label required (no temperature limit)

5.1.1.2 Readers for microfiche and image card

Microfiche readers shall display on the screen, upright and right-reading at least one of the frame formats specified in ISO 9923. Image card readers shall display the format specified in ISO 3272-3.

5.1.2 Loading of microforms

Readers shall be designed to facilitate the loading of the microform. For roll microfilm readers, the correct method shall be indicated by a threading diagram. Microfiche or image card readers shall be provided with a means of locating a particular image and properly displaying it with a tolerance of no more than one frame. The indexing device shall be clearly identified.

5.1.3 Changing components for different microform formats

If a reader is designed to accept more than one type of microform, e.g. roll microfilm and microfiche, no tools shall be needed to change optical or mechanical components (carrier, lens, condenser).

5.1.4 Motor-driven roll film devices

The speed of motor-driven roll film shall be controllable in both directions.

5.2 Optical characteristics

5.2.1 Focus

A suitable and easily accessible means shall be provided for adjusting the focus of the image for any of the microforms for which the reader is designed. Refocusing of an image shall not be necessary after changing from one frame to another frame of the same microform. If the reader has provision for image scanning (movement from top to bottom), focus shall be maintained over the entire screen area without refocusing while scanning an image frame.

An exception to this requirement is the time during which roll film readers are transporting film at high speed. When the film is stopped at an image, the newly displayed image shall be in best focus.

5.2.2 Internal light interference

The screen image shall show no discernible impairment by any light or interference arising from the design or construction of the reader.

5.2.3 Optical aberrations

The image quality shall show minimum discernible impairment by chromatic aberrations.

5.2.4 Screen size

5.2.4.1 Roll film readers

The screen size of roll film readers shall be large enough to accommodate the image frame size for which they were designed. When no scanning device is provided, the screen shall be large enough to accommodate the full image photographed across the width of the film for any film width used.

5.2.4.2 Microfiche and image card readers

For readers to be used with microfiche or image cards, the screen size shall be large enough to accomodate the image frame for which the reader was designed.

5.2.4.3 Readers with image rotation devices

For readers equipped with an image rotating device, the screen shall be of sufficient size to allow projection of the full image frame in both horizontal and vertical positions, unless equipped with a scanning device.

5.2.5 Screen reflections

The screen shall be treated so that reflections of the usual lights in a room will not interfere with the legibility of the image.

5.3 Risk of film damage in roll film readers

Roll film readers shall be so designed that they shall minimize abrasion of the film image area during the transport of the film through the reader. The film carrier or other film positioning mechanism shall be so designed that it will not abrade the film.

5.4 Safety

5.4.1 Risk of operator injury

The reader shall comply with all the relevant requirements of IEC 950 assuring that there is no risk to the operator when the reader is being operated under the severest conditions for which it was designed. All corners and edges of the reader shall be rounded, smooth, or protected to prevent any risk of injury (see IEC 950). The frame and enclosure shall be constructed to be sufficiently strong and rigid to resist collapse.

5.4.2 Electrical

The reader shall be constructed to meet the requirements of IEC 950 for electrical safety.

5.4.3 Screen

The screen shall be break-resistant or shatterproof in accordance with IEC 950.

5.5 Controls

All operator controls shall be readily accessible and easy to use from the normal operating position.

5.6 Markings

The information listed below shall be accessible and legibly displayed on the reader in a durable manner when tested as specified in IEC 950. These markings shall be in the language which is acceptable to the country in which the reader will be sold. ISO/IEC standard symbols (see IEC 417) shall be used where appropriate.

a) manufacturer's or supplier's name or trademark;

b) model or type or reader;

c) voltage, wattage and if necessary, the frequency of the electricity supply;

d) controls such as on/off, focus, lamp intensity, etc., shall be clearly marked either by symbols or text;

e) other controls, if not obvious;

f) instructions, symbols or a simple diagram showing the loading of the microform into the reader;

g) caution to disconnect the reader before opening the basic reader enclosure;

h) for readers with interchangeable lenses, the lenses shall be identified, for example, marked with their focal length, and there shall be a label on the reader giving the magnification for the various lenses according to the identification marks. When lenses and condensers are interchangeable, all shall bear clear instructions for matching the lenses and condensers for optimum image quality;

i) lamp identification specifications shall be in the area of the lamp housing;

j) fuse specifications shall be adjacent to the fuse holder.

5.7 Maintenance

5.7.1 Operator maintenance

Normal operator maintenance shall be easy to perform. In particular, access to all optical components for cleaning shall be simple and straightforward.

5.7.2 Lamp

Access to the lamp shall be easy. Adequate space shall be provided so that changing the lamp is simple and straightforward. This is particularly important for tungsten-halogen lamps having quartz bulbs that the operator should not touch. Such lamps normally have protective sleeves, which are removed after the lamps have been installed.

5.8 Operator's manual

A manual giving simple operator instructions for proper loading of the microform, focusing, frame changing, cleaning the optical parts, replacing the lamp, precautions, etc., shall accompany each reader. These instructions shall be written on eye-readable hard copy (i.e. not on a microform) in the language which is acceptable to the country in which the reader will be sold. A list of commonly required replacement parts with identification numbers, if used, shall accompany or be a part of the operator's manual.

If alternative components, e.g. lenses giving different magnifications, different colour screens, gates for different microforms, or alternative voltages are available, the means for obtaining such components and information shall be stated in the operator's manual.

6 Optional characteristics

The following recommendations deal with characteristics that are optional or desirable but not necessarily suitable for precise specification.

6.1 Magnification

It can be desirable for the reader to have several magnifications (see 5.1.3).

6.2 Image rotation

In certain applications, it can be necessary to provide a means for rotating the image on the screen so that all microimages can be oriented in the right-reading position (see also 5.2.4.3).

6.3 Screen luminance control

A brightness controller or bilevel switch should be provided to enable the operator to increase or decrease the level of screen luminance.

NOTE 1 A voltage control cannot be used on certain lamps that require a specified voltage. Also by varying the voltage on incandescent lamps, the spectral distribution is changed and can affect colours on the screen when projecting coloured microimages.

6.4 Hood

Readers can require a hood or other device to reduce the amount of ambient light falling on the screen.

6.5 Reversing direction of travel of microfilm

In roll microfilm readers, there should be minimum lost motion or backlash when reversing the direction of travel of the microfilm.

6.6 Lamps and fuses

Replacement lamps and fuses should be of types that are readily available commercially. A spare lamp and fuse should be supplied with each reader.

6.7 Protection of the reader

A dustproof cover to protect the reader when not in use is desirable. Portable readers should have a dust cover or an additional cover/hood provided to protect the reader when it is in transport or storage.