

INDUSTRY STANDARD

MICROFILM READERS
ANSI/NMA MS20-1979
(Revision of ANSI PH5.1-1959
(R1970)
Approved September 13, 1979 as
an American National Standard

Adopted for Use by
the Federal Government



FIPS PUB 84

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Front Cover

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Foreword

[This foreword is not a part of *American National Standard for Microfilm Readers*, ANSI/NMA MS20-1979.]

This standard is a revision of *American National Standard Specification for Microfilm Readers for 16-mm and 35-mm Film on Reels*, PH5.1-1959 (R1970). A number of important changes have been made, including:

1. The Standard Specifications have been rewritten to include all commonly used micro-transparencies and therefore the reference in the title to 16-mm and 35-mm film on reels has been eliminated;

2. A minimum requirement for luminance and evenness of illumination has been added and the *American National Standard Method for Measuring the Screen Luminance, Contrast and Reflectance of Microform Readers*, ANSI/NMA MS12-1977⁶ referenced;

3. A minimum requirement for resolution on the screen has been added and a method for reading this resolution outlined.

However, it is recognized that the following four areas will require more information, based upon measured data and experience, to establish realistic values:

1. Resolving power requirements of readers, based upon the quality index requirements of the film images of documents that will be displayed;

2. Minimum values of screen contrast, based on the ambient light level of the environment;

3. Reevaluation of the method of determining film gate temperature (ANSI PH3.46-1971) and development of a method for measuring the temperature of those reader parts with which users may come in contact;

4. Develop test procedures for measuring the noise generated by readers and establish acceptable noise level values as a function of the environment in which the readers are to be used.

The American National Standards Committee, PH5 on Micrographic Reproduction, had the following members at the time it processed and approved this standard.

Henry C. Frey, Chairman
Lester O. Kruger, Vice Chairman
Robert A. Glotfelty, Secretary

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Microfilm Readers

1. SCOPE

These specifications cover microfilm (micro-transparency) readers with translucent or opaque screens.

2. DEFINITIONS

Reader.

A projection device for viewing a magnified micro-image.

Reader Image Contrast.

The ratio of the screen luminance of the light portion of the image to that of the dark portion of the image of the test object, as described in the *American National Standard Method for Measuring the Screen Luminance, Contrast and Reflectance of Microform Readers*, ANSI/NMA MS12-1977⁶.

Reader Magnification.

The ratio of a linear dimension of the screen image to the corresponding dimension of the image on the film (i.e. 24X).

Reader Resolution.

The ability of the reader optical system to separate close detail on the screen. It is expressed in lines/mm. (Lines and associated spaces). See *Microcopying-ISO Test Chart No. 2—Description and Use in Photographic Documentary Reproduction*, ANSI/ISO 3334-1978¹¹.

Reader Screen Luminance.

The luminous intensity per unit projected area of the reader screen viewed from a given direction, as described in the *American National Standard Method for Measuring the Screen Luminance Contrast and Reflectance of Microform Readers*, ANSI/NMA MS 12-1977⁶.

Image Card.

An aperture card containing processed film with one or more microimages.

Microfiche.

A sheet of microfilm containing multiple microimages in a grid pattern. It usually contains a title which can be read without magnification.

3. GENERAL

3.1 Image Orientation

3.1.1 Roll Film Readers. Roll film readers shall have provision for projecting images right side up and right reading on the screen when the information has been photographed and wound on reels in at least one of the specified sizes and formats, as described in *American National Standard Specifications for 16-mm and 35-mm Microfilms in Roll Form*, ANSI/NMA MS14-1978².

3.1.2 Microfiche Readers. Microfiche readers shall have provision to project images right side up and right reading on the screen when the information has been photographed in at least one of the formats and orientations as described in *American National Standard for Microfiche of Documents*, ANSI/NMA MS5-1975⁵, or *American National Standard Format and Coding for Computer Output Microfilm*, ANSI/NMA MS2-1978⁷.

3.2 Abrasion

3.2.1 Roll Film Readers. The film transport shall be so designed as to minimize abrasions of the film image area during the transport of the film through the reader from spindle to spindle and while it is being moved to and through the projection area.

3.2.2 Image Card and Microfiche Readers. The film carrier shall be so designed as not to cause film abrasion during the film loading and removal operations.

3.3 Focus. The focus control shall be conveniently located. It should have a minimum of backlash and sufficient fine adjustment to provide for and hold optimum focus. If the reader has provision for image scanning, the focus shall be maintained over the entire screen area without refocusing while scanning one image frame.

3.4 Safety. A reader shall be constructed to conform to *American National Standard for Safety Office Appliances and Business Equipment*, ANSI X4.12-1975¹⁰.

4. FILM ACCOMMODATION

4.1 General. The reader shall accommodate the microforms and the specific film sizes for which it has been designed. (*American National Standard Specifications for 16-mm and 35-mm Microfilms in Roll Form*, ANSI/NMA MS14-1978², *American National Standard Dimensions for Unitized Microfilm Carriers (Aperture, Camera, Copy and Image Cards)*, ANSI PH5.8-1972 (R1978)⁴, *American National Standard for Microfiche of Documents*, ANSI/NMA MS5-1975⁵, *American National Standard Format and Coding for Computer Output Microfilm*, ANSI/NMA MS2-1978⁷).

4.2 Roll Film Readers. Provision shall be made to accommodate at least one of the reels as defined in *American National Standard Dimensions for 100-Foot Reels for Processed 16-mm and 35-mm Microfilm*, PH5.6-1968 (R1974)³, or *American National Standard Dimensions and Operational Constraints for Single-Core Cartridge for 16-mm Processed Microfilm*, ANSI/NMA MS15-1977¹⁴.

4.3 Image Card Readers. An image card reader shall accommodate the image card and project the full image card aperture for which it has been designed, as specified in *American National Standard Dimensions for Unitized Microfilm Carriers (Aperture, Camera, Copy and Image Cards)*, PH5.8-1972 (R1978)⁴.

4.4 Microfiche Readers. A microfiche reader should accommodate and display at least a single image frame of the microfiche for which it has been designed as specified in *American National Standard for Microfiche of Documents*, ANSI/NMA MS5-1975⁵, or *American National Standard Format and Coding for Computer Output Microfilm*, ANSI/NMA MS2-1978⁷.

5. SCREEN SIZE

5.1 Roll Film Readers. In roll film readers without provisions for film scanning, the screen shall be of sufficient size to accommodate the projected image height photographed across the width of the film for which it has been designed as specified in *American National Standard Specifications for 16-mm and 35-mm Microfilms in Roll Form*, ANSI/NMA MS14-1978².

5.2 Other Readers. For all other readers, the screen size should accommodate the full image frames for which it has been designed as specified in *American National Standard Dimensions for Unitized Microfilm Carriers (Aperture, Camera, Copy and Image Cards)*, ANSI PH 5.8-1972 (R1978)⁴, *American National Standard for Microfiche of Documents*, ANSI/NMA MS5-1975⁵, or *American National Standard Format and Coding for Computer Output Microfilm*, ANSI/NMA MS2-1978⁷.

6. OPTICS

6.1 Reader Image Quality

6.1.1 Aberrations. Aberrations, such as chromatic (color), spherical or other distortions shall not affect the reading quality of the image.

6.1.2 Limit of Resolution. Readers shall have a minimum screen resolution of 2.5 lines/mm. (See Appendix A, Table 1, for recommended reader resolution sufficient to read the projected images of actual or effective type sizes).

6.2 Recommended Method for Determining Screen Image Resolution.

6.2.1 Test Image. The micro-transparency shall contain an image frame which will fill the screen when projected at the nominal reader magnification. This image shall contain at least five, preferably nine, NBS 1010a Microcopy Resolution Test Charts as shown in Figure 1. Four charts shall be placed so that one chart appears in each corner of the screen. Each corner chart shall be located at a point on the semi-diagonal so that the decimal point in the pattern number expected to be read is in the 10% position to within $\pm 3\text{mm}$.^{*} In the same manner, when possible, four additional charts shall be placed at the 30% point of the semi-diagonal from the corner. One chart shall be placed with the 0 of the 10 test pattern in the center. Distances to other charts shall be measured from the center of the "0" of the "10" test pattern in the central NBS 1010a Chart. The 1.25, 1.4, 1.6 pattern edge shall be positioned nearest the center of the screen, or upright for the center chart. The reduction used to produce this test image shall be within $\pm 1\%$ of the nominal magnification ratio of the specific reader to be tested. Thus the chart image projected to the reader

^{*}Corner Charts on Small Test Targets such as those for 8½-x11-inches will overhang the edges and must therefore be trimmed.

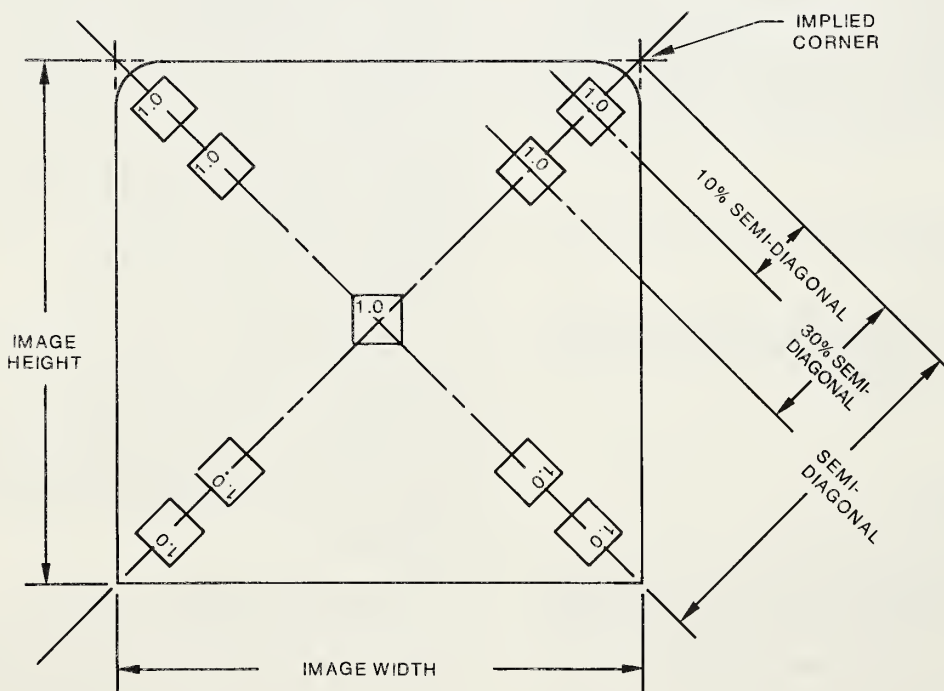


FIGURE 1 Test Target-Resolution Placement of NBS 1010a Charts

screen will be substantially equal to the original size of the test chart. The resolution charts in the test image shall have a minimum background density of 1.7 and a maximum line density of 0.2.

Determine the test pattern resolved by following the method described in paragraph 5.2 in *American National Standard for Microcopying-ISO Test Chart No. 2—Description and Use in Photographic Documentary Reproduction*, ANSI/ISO 3334-1978¹¹, or the illustration in *Recommended Practice for Inspection and Quality Control of First-Generation Silver-Halide Microfilm*, NMA MS104-1972¹². The microscope should have a magnification of 0.5 to 1.0 times the anticipated resolution on the film. A rule of thumb method for determining the magnification of the microscope is 2X to 4X the reduction used in the camera. The pattern resolved in the test image shall read at least four (4) patterns better than the reading expected on the screen.

6.2.2 Screen Reading. Using a micro-transparency for which the reader has been designed, the image shall be located in the film gate so that it appears centered on screen. With a 3X to 7X magnifying glass, the smallest resolved pattern on every chart shall be read. The reader shall be focused for optimum readability over the entire screen, and all charts read at this focus setting. A pattern is resolved only when both sets of lines for the same pattern are distinguished.

6.3 Magnification. The actual magnification of a specific reader shall not vary more than $\pm 5\%$ from the nominal, as stated by the manufacturer.

7. ILLUMINATION

7.1 Stray Light. The leakage of light from the reader shall be restricted so that neither direct nor reflected rays distract the operator.

7.2 Contrast. The screen contrast of a reader is measured by the *American National Standard Method for Measuring the Screen Luminance, Contrast and Reflectance of Microform Readers*, ANSI/NMA MS12-1977⁶. In general, with all other specifications being equal, a reader with high contrast is preferred.

7.3 Luminance. A reader designed to be used in an environment of 269 ± 10 lux (25 ± 1 ft-candles) ambient illumination shall have a minimum screen brightness of $109\text{cd}/\text{m}^2$ (32 ft-L) at the center of the screen and a fall-off at the corners to no less than $34\text{cd}/\text{m}^2$ (10 ft-L) as measured by the *American National Standard Method for Measuring the Screen Luminance, Contrast and Reflectance of Microform Readers*, ANSI/NMA MS 12-1977⁶. This requirement shall be met with the reader operated at either (a) rated voltage (if so stated) or (b) the average voltage of any stated voltage range (i.e., 110-130 volts-operate at 120 volts).

8. TEMPERATURE

8.1 Film Temperature. The temperature of the film at the film gate shall not exceed 75°C (167°F) when measured by the testing method specified in *American National Standard Projected-Media Temperature Test for Photographic Still-Projection Equipment*, ANSI PH 3.46-1971¹. This requirement shall be met with the reader operated at either (a) rated voltage (if so stated) or (b) the average voltage of any stated voltage range (i.e., 110-130 volts-operate at 120 volts).

8.2 Reader Temperature. Temperature of reader surfaces shall not exceed the values shown below when tested as specified in *American National Standard Method for Measuring Temperature of Photographic Equipment*, ANSI PH3.69-1977¹³. An appropriate thermocouple device, with the sensing junction taped or cemented to the reader shall be used for measurement of temperature level.

	Metal	Wood and Plastics
(a) Handles or grips for moving (portable devices only), and 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.	50°C	60°C
(b) Areas on the bottom of the readers, within ½-inches of the surface on which reader rests, and other exterior portions of the reader.	50°C	85°C
(c) Areas which may be touched or handled in routine maintenance, lamp changing and cleaning, etc. (Except lamps and lamp removal mechanisms).		
1. If labeled with warning (i.e., "Use Care-HOT").		No limit
2. Not labeled.	60°C	85°C
(d) Lamps, lamp removal mechanism.		Warning label required. (no temp. limit)

9. ACOUSTIC NOISE

The acoustic noise level of the reader when measured on all four sides at 1 meter from unit should not be greater than 60 decibels above the threshold of hearing, i.e., the "A" scale of a sound level meter conforming with *American National Standard Specification for Sound Level Meters*, ANSI S1.4-1971 (R1976)⁹, and *American National Standard Methods for the Measurement of Sound Pressure Levels*, ANSI S1.13-1971 (R1976)⁸.

10. REVISION OF AMERICAN NATIONAL STANDARDS REFERRED TO IN THIS DOCUMENT

When the following standards referred to in this document are superseded by an approved revision, the revision shall apply:

1. *American National Standard Projected-Media Temperature Test for Photographic Still-Projection Equipment*, ANSI PH3.46-1971 (ed. note: this is the update of ANSI Z38.7.5-1948).
2. *American National Standard Specifications for 16-mm and 35-mm Microfilms In Roll Form*, ANSI/NMA MS14-1978.
3. *American National Standard Dimensions for 100-Foot Reels for Processed 16-mm and 35-mm Microfilm*, ANSI PH5.6-1968 (R1974).
4. *American National Standard Dimensions for Unitized Microfilm Carriers (Aperature, Camera, Copy, and Image Cards)*, ANSI PH5.8-1972 (R1978).
5. *American National Standard for Microfiche of Documents*, ANSI/NMA MS5-1975.
6. *American National Standard Method for Measuring the Screen Luminance, Contrast and Reflectance of Microform Readers*, ANSI/NMA MS12-1977.
7. *American National Standard Format and Coding for Computer Output Microfilm*, ANSI/NMA MS2-1978.
8. *American National Standard Methods for the Measurement of Sound Pressure Levels*, ANSI S1.13-1971 (R1976).
9. *American National Standard Specifications for Sound Level Meters*, ANSI S1.4-1971 (R1976).
10. *American National Standard for Safety Office Appliances and Business Equipment*, ANSI X4.12-1975.
11. *American National Standard for Microcopying-ISO Test Chart No. 2—Description and Use in Photographic Documentary Reproduction*, ANSI/ISO 3334-1978.
12. *Recommended Practice for Inspection and Quality Control of First-Generation Silver-Halide Microfilm*, NMA MS104-1972.
13. *American National Standard Method for Measuring Temperature of Photographic Equipment*, ANSI PH3.69-1977.
14. *American National Standard Dimensions and Operational Constraints for Single-Core Cartridge for 16-mm Processed Microfilm*, ANSI/NMA MS15-1977.

APPENDIX A

Table I. Reader Resolution for Different Type Sizes

(This Appendix is not a part of American National Standard for Microfilm Readers, ANSI/NMA MS20-1979.)

Type Size	Maximum Type Size in Original Document		Example	Reader Resolution (lines/mm)		
	Upper Case	Lower Case		Center	Corner	Overall
5	1.15mm	.8mm	N.Y. Times Stock quotations	5	4.5	≥ 4
6	1.37mm	.95mm	average footnotes	4.5	4	≥ 3.6
8	1.72mm	1.2mm	book type	4	3.6	≥ 3.2
10	2.3mm	1.6mm	periodicals, book type, typewriters	3.6	3.2	≥ 2.8
12	2.76mm	1.92mm	periodicals, computer print-out	3.2	2.8	≥ 2.5

Note: Center and corner reading specified are minimum individually focused readings.

APPENDIX B

(This Appendix is not a part of *American National Standard for Microfilm Readers*, ANSI/NMA MS20-1979.)

Introductory Statement

The American National Standards Institute believes that the needs of consumers should be given full consideration in the development of technical standards. In 1970 the ANSI PH5 Committee, which deals with micrographic reproduction, established an Ad Hoc Committee on consumer aspects of standards. It was agreed by PH5 that the standard for *Microfilm Readers for 16- and 35-mm Film on Reels . . . PH5.1*, then in process of revision, would be a suitable vehicle for the incorporation of consumer-oriented provisions. The Ad Hoc Committee unanimously agreed that the consumer-oriented provisions that they developed and unanimously approved should either be incorporated into the standard or attached to the standard as an Appendix. Although some of the consumer-oriented provisions are covered by this standard it was felt that the inclusion of all of the consumer-oriented provisions as a separate Appendix would be most helpful to the consumer.

CONSUMER NEEDS

1. A reader should be sturdily constructed and capable of withstanding hard usage.
2. Its base should be stable.
3. It should operate on standard 120 volts AC, 60 cycles. The male plug on the electric connection should fit a standard outlet.
4. The lamp, preferably, should be of common design.
5. The lamp should be readily accessible so that a relatively unskilled person may change it without tools.
6. Replacement lamps should be commercially available.
7. The lamp should have a high life expectancy. The rated life expectancy should be stated in the literature accompanying each reader.
8. When in use the reader should create a minimum of noise from the operation of motors and fans.
9. It would be desirable to have a dimmer control to enable the user to increase or decrease the illumination from the light source on the screen.
10. The magnification factor of the lens should bring the projected image back to the size of, or, preferably, to a larger size than the original. Preferably, also, an entire or a full image should fit onto the screen.
11. Variable magnification is desirable. When this is

achieved by changing lenses the changing should be relatively simple yet the misappropriation of the lenses by casual readers should be very difficult.

12. The film loading operation should be readily understandable after the first explanation and demonstration.

13. The screen should be, preferably, unbreakable or shatterproof. It should be non-glare and capable of minimizing the effect of artificial or natural light sources in a room.

14. Both horizontal and vertical screen readers may require a hood or other device to lessen the effect of ambient light.

15. The screen should preferably be tilted or capable of being tilted at such an angle that the viewer may see the image easily and comfortably no matter what his height or the type of optical reading aid employed.

16. All controls should be readily accessible to both left and right handed users. The user should be able to use them without standing or changing his position at the reader. All of them should be clearly visible and labeled.

17. A reader should be simple to use and easy to clean, maintain, and repair.

18. Simple instructions and diagrams explaining the operation, loading and unloading, cleaning and repair should accompany each reader. A loading or threading guide that is permanently affixed to the housing in plain view is desirable.

19. The reader must conform to all UL and other safety requirements. There should be no hazardous electrical current leakage. No external part of the reader should be capable of burning a user. All surfaces, corners, and edges of the reader should be free of burrs and rough spots.

20. An extra light bulb in a storage device preferably attached to the inside of the reader or to its hood as well as a dustproof cover for the reader when not in use should be supplied.

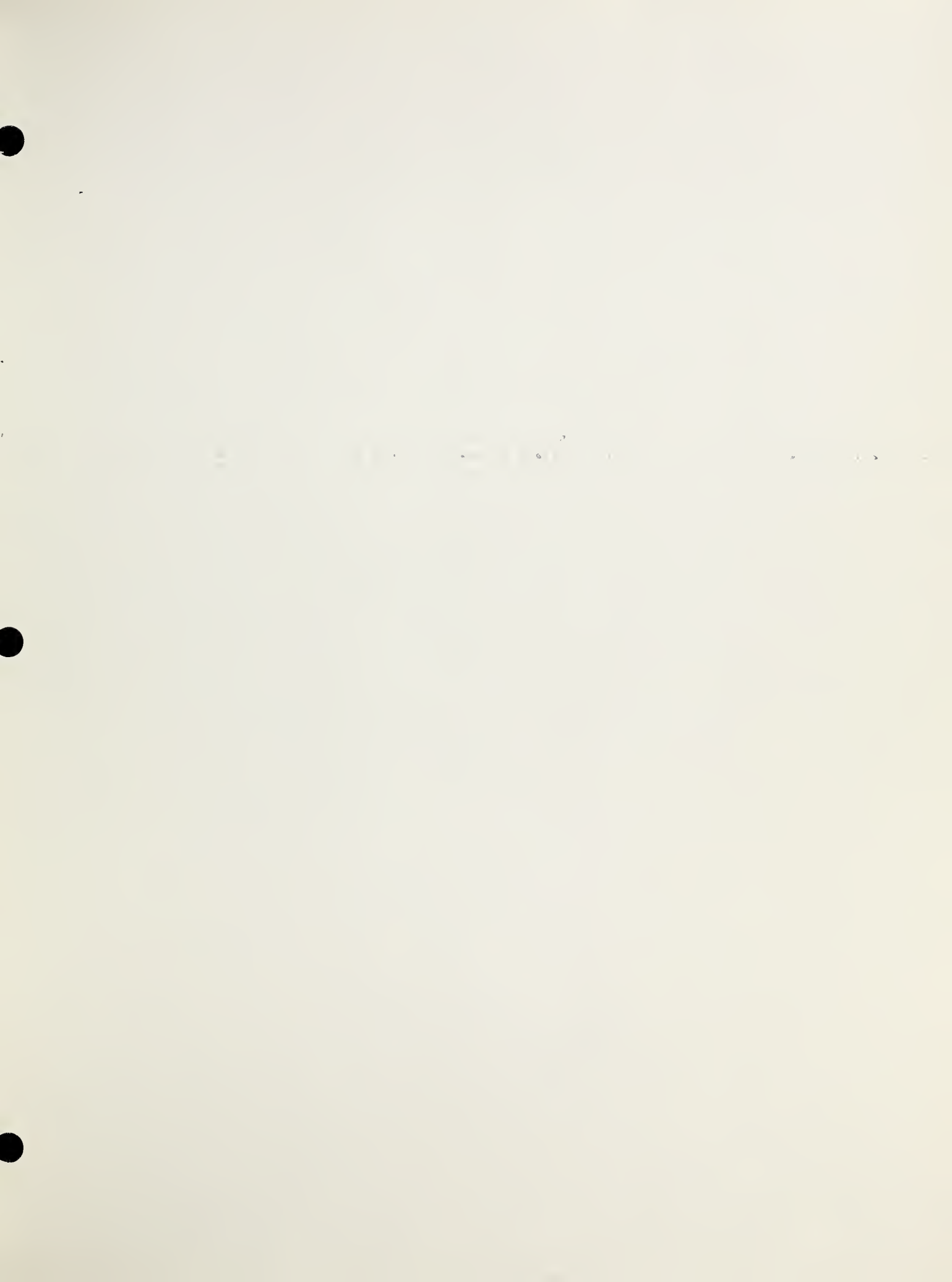
21. When properly maintained and operated the reader shall not abrade, scratch, or otherwise damage the film.

22. A one-year written warranty covering replacement of defective parts and free service for a minimum of ninety days should be provided.

23. Service facilities should be readily available. The location of the nearest of these should be provided.

24. Readers designed for archival and research library use should have:

- a. Provisions for rotating the image on the reader 360°.
- b. A screen large enough to project an entire 35-mm film image.





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