DRAWINGS ON 35mm MICROFILM INSPECTION PROCEDURES—SILVER MICROFILM

1. GENERAL

1.01 This practice covers inspection procedures for 35mm silver microfilm used in the AT&T program for engineering drawings. The specific methods of test shall be followed in all cases except where high levels of production exist. Under such conditions, other test methods and facilities that assure the same test results may be employed.

1.02 This practice is reissued primarily to reflect changes due to divestiture, which include:

(a) Reformatting for conversion from a Bell System Practice to an AT&T Practice.

(b) Updating references for test equipment selections.

In addition, a variety of editorial changes and clarifications are incorporated into this reissue.

1.03 Use care in handling microfilm to avoid scratching or otherwise damaging it, particularly the emulsion surface. The use of clean, soft gloves is recommended. All surfaces on which microfilm is placed should be wiped clean with a lint-free cloth.

2. EQUIPMENT, APPARATUS, AND MATERIALS

2.01 The following equipment and materials are required for inspecting silver microfilm:

General

- Soft, white gloves
- Lint-free, soft cloths

General Quality and Reduction Tests

- Light box and rewind unit
- Measuring magnifier

Transmission Density Tests

- Densitometer
- Eastman Kodak No. 3 calibrated photographic step tablet

Resolution Test

- Microscope

Image Centering

- Centering gauge, similar to Fig 3

2.02 For guidance in selecting suitable test equipment and materials, see Corporate Instruction (CI) 48.126, or contact AT&T Reproduction Engineering Control at the Customer Information Center in Indianapolis (PO Box 19901, Indianapolis, IN 46219).

3. GENERAL QUALITY

3.01 *Requirement:* All processed microfilm shall be free of scratches, foreign material, stains, or defects which make drawing information illegible.

3.02 *Method of Test:* Inspect each reel of film for faulty processing. This can be recognized by such defects as stained or discolored areas, excessive curl of film edges, brittleness, and softness or tackiness of the film surface. Check the film on a light box to determine that it is free of scratches or foreign material which may make drawing information illegible. Examine doubtful areas of the film with the magnifier.

4. REDUCTION

4.01 *Requirement:* The reduction test strip appearing in each test frame shall have a length of 0.500 inch +0.002 or -0.10 inch.

4.02 *Method of Test:* Position a test frame on the light box. Place the measuring magnifier over the test frame and adjust the lens for a clear, sharp image. Position the magnifier scale over the reduction test strip (see AT&T 006-110-100) and measure its length. This length should meet the requirement specified in 4.01. Repeat this procedure for each test frame contained on each reel of microfilm.

5. TRANSMISSION DENSITY

5.01 *General:* Transmission density is a measure of the opacity of the film. It is measured with a densitometer, a device that projects a beam of light through a selected area of film to a photoelectric detector, which activates a numeric display. The type of densitometer to be used is one that measures visual diffuse transmission density. The manufacturer's instructions should be followed in setting up the densitometer and preparing it for use. The densitometer should be calibrated for transmission density measurement using the Kodak No. 3 calibrated photographic step tablet as a standard.

> *Caution: Replace the photographic step tablet when it becomes scratched or otherwise damaged.*

Base Plus Fog Density

5.02 *Requirement:* The average base plus fog density shall be maximum 0.12 after the film has been processed.

> *Note:* Base plus fog density is the density of film that has not been exposed but has been developed and fixed.

5.03 *Method of Test:* Measure the transmission density of an unexposed area between two microfilm frames. Take readings on three such areas, one from the beginning, one from the middle, and one from the end of the reel of film. The average of these three readings shall not exceed 0.12. This test should be performed initially and at least once a month thereafter. It also should be performed when changes in chemicals, film type, or significant changes in processing speed or temperature are made.

Drawing Image Background

5.04 *Requirement:* The average transmission density of the drawing image background (the area of the drawing image exclusive of linework, lettering, or other information) shall be minimum 1.00, maximum 1.20.

5.05 *Method of Test:* Measure the transmission density of the drawing image background with the densitometer. Take readings through at least three separate background areas on each of the three drawing images, one from the beginning, one from the middle, and one from the end of each reel of film. The images chosen should contain sufficient background area to accommodate the full light beam. The average of the three readings taken on each image shall be minimum 1.00, maximum 1.20.

> *Note:* When selecting measurement areas, avoid obvious blotches caused by variations in the drawing background.

Microfilm Frame Background

5.06 *Requirement:* The transmission density of the microfilm frame background (any dark area beyond the drawing image area) shall be minimum 0.8.

5.07 *Method of Test:* Measure the transmission density of the microfilm frame background of each of three microfilm frames checked for drawing image background density (per 5.05). The transmission density of each frame shall be minimum 0.8.

6. RESOLUTION

6.01 *General:* Resolution is a measure of the sharpness of an image and is expressed in the number of lines (or spatial cycles) per millimeter that can be subjectively distinguished. To ensure uniform test conditions in making resolution readings, make the readings on frames in which the density of the 50-percent reflectance target is between 1.00 and 1.20. Resolution is measured by examining a microfilmed resolution test chart (see Fig 1) under a microscope to

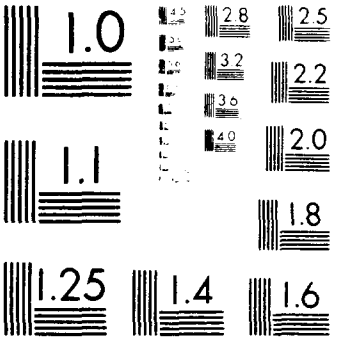

Fig 1—Resolution Test Chart

determine which of the patterns on the test chart is the smallest in which lines can be distinguished both horizontally and vertically. The number adjacent to this pattern multiplied by the reduction ratio at which it was photographed indicates the resolution in number of lines per millimeter.

6.02 *Requirement:* The processed microfilm shall have a minimum resolution in lines per millimeter as shown below.

Reduction	×	Test Chart Pattern	=	Resolution
16X		7.1		113.6
24X		5.0		120
30X		4.5		135

6.03 *Method of Test:* Using a microscope of approximately 60X magnification, check the resolution of each of the five resolution test charts that appear on the test frames on each reel of film. Place one of the test frames on the stage of the microscope and position it so that one of the five resolution test charts is centered in the stage. Adjust the microscope to obtain a clear, sharp image and determine the smallest pattern in which lines can be distinguished both horizontally and vertically. This test should be repeated on each of the other four resolution test charts in the test frame. The lowest resolution obtained from the five resolution test charts should meet the requirement specified in 6.02. The test should then be repeated on each of the other test frames on each reel of film.

7. LEGIBILITY

7.01 *Requirement*

(a) A nominal 15X enlarged print prepared from a silver microfilm that will be furnished to a customer shall be legible in its entirety.

(b) If the silver microfilm is to be used to produce *file master duplicate microfilm to be furnished to customers,* a nominal 15X enlarged print prepared from a duplicate microfilm made from the silver microfilm shall be legible in its entirety.

7.02 *Method of Test*

(a) To determine that the drawing information is legible, view the drawing image on a nominal 15X enlarged print made from the silver microfilm on an approved printer. Prior to making the print, the printer should be adjusted to the optimum setting for focus and exposure. Information shall be considered legible if complete intelligence can be extracted without reference to other information. In rare instances, the following may be deemed legible:

(1) Characters illegible alone but included in a recognizable series such as AA, AB, AC or 101, 102, 103.

(2) Letters illegible alone but recognizable in context (eg, the "E" in "KEY").

(3) Piece part number in a stock list illegible but repeated, legibly, in an equipment view or figure on the same sheet of the drawing.

(b) Prepare a diazo duplicate of the silver microfilm and inspect for legibility in accordance with AT&T 006-115-500.

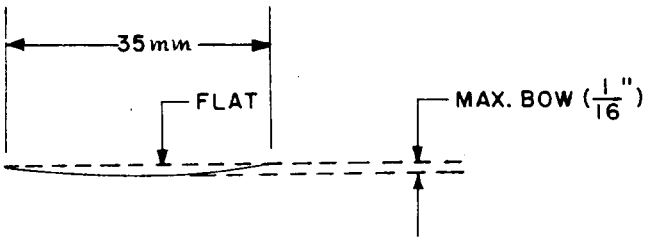

Fig 2—Checking Reel Film for Bow

8. FILM BOW

8.01 *Requirement:* Film bow (departure from physical flatness) shall not exceed 1/16 inch across width of exposed and developed reel film.

8.02 *Method of Test:* From each reel of film, cut a 2-inch piece straight across the 35mm width, perpendicular to the edges. Place cut end on Fig 2. The bow in the film shall not exceed the bow indicated in Fig 2.

9. IMAGE CENTERING

9.01 *Requirement (KS-20560 Cards)*

(a) *Single Frame Drawings:* Microfilm shall be mounted completely within the card aperture. No portion of the drawing image shall be under the mounting tape. The center of the drawing image shall be located minimum 1.568 inches, maximum 1.588 inches, from the short dimension edge of the card nearest the aperture.

(b) *Multiple Frame Drawings:* Microfilm shall be mounted completely within the card aperture. No portion of the drawing image, except the unnecessary portion beyond the hold-down bar, shall be under the mounting tape.

9.02 *Method of Test*

(a) *Single Frame Drawings:* Examine each card to determine that the requirement specified in 9.01(a) has been met. Use a precision gauge to ascertain that the distance from the centering arrow at the lower border of the drawing image to the short dimension card edge nearest the aperture is minimum 1.568 inches and maximum 1.588 inches. Alternatively, a custom gauge conforming to the design depicted in Fig 3 may be constructed for use in expediting the checking of image centering. With the gauge, the microfilm card is inserted tape side up, with the edges against the stops. The stem of the centering arrow in the film image must fall within the space between hairlines.

(b) *Multiple Frame Drawings:* Examine the card to determine that the requirement specified in 9.01(b) has been met.

10. DRAWING IMAGE ORIENTATION

10.01 *Requirement*

(a) *Single-Frame Drawings:* The long edges of the drawing image shall be parallel to the long edges of the microfilm frame except for drawing sizes 1S, A, and P1, in which case the short edges of the drawing image shall be parallel to the long edges of the microfilm frame. In addition, the top edge of the drawing image shall be oriented either with the top edge or the leading edge of the microfilm frame. (The top edge of the drawing image is the edge appearing uppermost when the main information on the drawing is read from left to right; the leading edge is the edge to the left of this right-reading frame.)

(b) *Multiple-Frame Drawings:* Where the height of the multiple-frame drawing is less than 29 inches (24X reduction) or 36 inches (30X reduction), the drawing image shall be oriented so that the long edges of the drawing are parallel to the long edges of the microfilm frame and the top drawing edge shall appear near the top of the film frame. Where the drawing height exceeds these dimensions, the drawing image shall be oriented so that the short edges of the drawing are parallel to the long edges of the microfilm frame, and the main information on the drawing reads from left to right or bottom to top.

10.02 *Method of Test:* Examine each card in an approved reader to determine that the requirements specified in 10.01(a) and (b) are met.

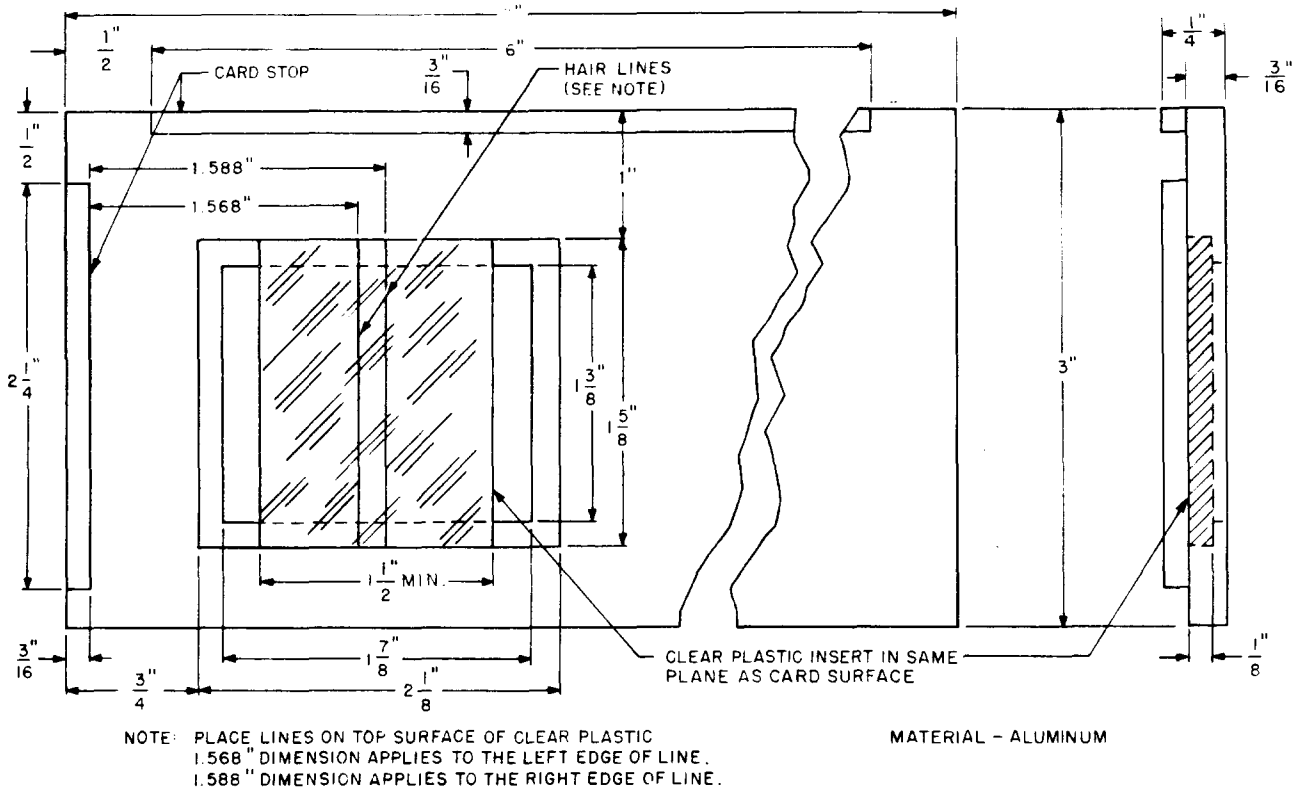

Fig 3—Centering Guage

11. ARCHIVAL QUALITY

11.01 *General:* Archival quality is a characteristic that refers to the permanence of the image on the film. Image permanence is adversely affected if excess ammonium or sodium thiosulphate (hypo) remains on the processed film. In view of the complexity of the archival quality test and since it involves the use of poisonous solutions, it is suggested that a testing laboratory or a commercial film processor perform this test and certify that the processed microfilm meets the archival quality requirement specified herein.

11.02 *Requirement:* The residual thiosulphate content of exposed and processed silver microfilm shall not exceed 0.005 milligram per square inch of film. The test of archival quality shall be performed within 24 hours after the microfilm has been processed. These requirements and the method of test are specified in American National Standards PH 1.28 and PH 4.8. This test should be performed initially and at least once a month thereafter. It also should be performed when changes in chemicals or film type, or significant changes in processing speed or temperature are made.

12. DRAWING IDENTIFICATION

12.01 *Requirement:* The interpreted (printed) information on a card must be in agreement with the drawing number, sheet, section (if any) size, issue number, and distribution code (if applicable) that appear on the microfilm image. Except for cards retained for local use, no information shall be keypunched or interpreted in columns 45 through 52.

12.02 *Method of Test:* When mounting, examine each microfilm image on the mounter viewing screen and determine (by comparing the information on the screen image with the interpreted information on the card) that the requirement specified in 12.01 has been met. Also, visually inspect cards to ensure that no information has been keypunched or interpreted in columns 45 through 52.