

or processing laboratory will immediately advise the office of record of substandard test results. Corrections of unacceptable material should be filmed at the earliest possible time. All substandard film shall be corrected before shipping to the State Archives for storage.<sup>17</sup>

### 6.3.2 Density Standards

6.3.2.1 Processed security or preservation negative films with capacity to produce three or more print generations:

D-Min:<sup>18</sup> no greater than 0.10

Background Density:<sup>19</sup>  $1.1 \pm 0.1$

6.3.2.2 Processed working copy films with the capacity to produce two or more print generations:

D-Min: no greater than 0.10

Background Density:  $1.2 \pm 0.3$

**Note: Paper Photostats** or other **reverse-image documents** may not produce an acceptable image if filmed at standard densities. Step tests should be taken and hard copy reproductions made from the step test images before filming such documents. The densities of the best of these reproductions should be established as the filming criteria. Experience indicates that a density greater than 1.0 and as high as 1.5 may be required.

A full and informed review of the issues of resolution and density values is contained in ANSI/AIIM MS23-1991. This bulletin addresses, among other things, the Quality Index Method mentioned above.

## 6.4 Film Processing, Treatments, and Inspection

6.4.1 Film must be processed as expeditiously as possible to insure that images meet density standards. Processing laboratories cannot guarantee proper densities after 14 days.

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<sup>17</sup> Excludes thermoplastic films, for which diffuse density cannot be measured using a transmission type densitometer.

<sup>18</sup> Dmin, or minimum density, is the lowest density obtainable in a processed film as measured in the clear part of the camera negative on which there is no image.

<sup>19</sup> Background density, or Dmax (maximum density), is the highest obtainable density for a particular photosensitive material as measured in the dark part of the camera negative image.

- 6.4.2 The chemical testing of processed film will be required in order to comply with the standards set forth in ANSI/NAPM IT9.17-1993, ANSI/ISO 417-1993 (*American National Standard for Photography--Determination of Residual Thiosulfate and Other Related Chemicals in Processed Photographic Materials--Methods Using Iodine-Amylose, Methylene Blue and Silver Sulfide*). The Methylene Blue Test will be used to meet this requirement (see also 6.4.5 below). Microfilm failing to meet the following minimum standards will be deemed to be unacceptable for its respective intended purpose (security, preservation, or working copy).
- 6.4.2.1 For Security or Preservation Microfilm, the film will be washed to reduce the amount of residual Thiosulfate ion (hypo) to something greater than 0 and less than 0.014 g/m<sup>2</sup>.
- 6.4.2.2 For working copy microfilm, the allowable maximum limit of hypo is 0.014 g/m<sup>2</sup>.
- 6.4.3 Additionally, all silver-halide film must undergo chemical treatment for the conversion of silver images against oxidation, referred to as the polysulfide treatment, or "brown-toning." The effectiveness of this conversion process must be tested daily using the dichromate bleach test, as set forth in ANSI/NAPM IT9.15-1997 (*American National Standard for Imaging Materials –Methods for the Evaluation of the Effectiveness of Chemical Conversion of Silver Images Against Oxidation*), and the solution decomposition test.
- 6.4.4 The minimum acceptable conversion rate of metallic silver into silver sulfide via the polysulfide treatment is 65% when using the dichromate bleach test (or 40% if using a visual density measurement), as outlined in ANSI/NAPM IT9.15-1997. When using a density measurement, it is necessary to use a process control strip with six or more density levels between 0.1 and 1.2.

6.4.5 The Methylene Blue Test. All polysulfide treated film will need to have a Methylene Blue test done to insure that the polysulfide solution has been washed out of the film. The test needs to be conducted daily, if not at the end of each run or batch to verify that the above requirements are met. Testing for residual polysulfide solution may be conducted at the same time as testing for residual Thiosulfate. Other testing methods may be approved by the State Archivist.

6.4.6 Film production or processing laboratories are required to test the processes for limiting residual Thiosulfate and for conversion of silver images (polysulfide treatment) and to provide customers, the State Archivist, or the State Auditor proof of testing upon demand.

**Note:** All film submitted for security storage with the State Archives must undergo polysulfide treatment to acceptable levels. The State Archives will provide polysulfide treatment to security microfilm on a cost-recovery basis if desired. Contact the State Archives for more information regarding the polysulfide treatment and process control tests.

#### **6.4.7 Post-filming inspection<sup>20</sup>**

6.4.7.1 Content Quality As soon after processing as possible, all camera film shall be inspected on a light box for content quality, including inspection for correct targets and target sequence, missing pages/documents/files, incorrect page/document/file order, etc.

6.4.7.2 Physical Quality Additionally, all camera film shall be inspected on a light box for physical quality, including inspection for image orientation/skew, fog, stretched or overlapping documents, scratches, chemical or water stains, finger prints, and other faults as described in ANSI/AIIM MS23-1991.

6.4.7.3 Inspection reports shall be prepared detailing defects and errors, if any, and any corrections which need to be made. Said reports will accompany the film when it is delivered to the customer.

#### **6.4.8 Splicing**

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<sup>20</sup> Ultimately, it is the agency which receives the microfilm after processing, that ensures that the film meets post-filming inspection requirements.

When an error in the film sequence has been detected, the decision must be made as to whether or not the contents will allow for splicing corrections into the film. The recommended criteria are as follows:

1. There should be no splicing into the camera-original film to correct file content errors with documents of legal significance. For example: if an entire legal case file has been filmed and documents are missing, blurred, etc., on the original film, then the entire case file should be re-filmed. Anything less than this could affect court admissibility.
2. If splicing is permitted, an ultrasonic splice is required. Security or preservation microfilm shall not be spliced with tapes, rubber cement, glues, or any other adhesives. Splicing should be done in accordance with guidelines established in ANSI/AIIM MS23-1991 and ANSI/AIIM MS18-1992 (*American National Standard for Information and Image Management--Splices for Imaged Microfilm--Dimensions and Operational Constraints*). Matching densities of the original roll of camera film with the correction is essential for duplication.

## 6.5 Digital to Microfilm Conversion

### Introduction

The Washington State Archives has allowed for and encourages the production of security microfilm copies of permanent records that have been digitally created (born digital) or imaged from paper. The Archives recognizes that the recent development of new hardware and software capable of producing quality archival microfilm, directly from digital images, offers several advantages. Chief among these is that, if done properly, higher levels of quality and economy can be achieved. Archival microfilm still offers the greatest potential for ensuring the durability and permanence of valuable records, thus making a strong case for support from the Archives for this approach. The following guidelines provide the necessary controls to ensure reasonable quality control for digital-to-film technology. The format of the microfilm shall be such that people with access to microfilm readers can readily find items on the film by using the index, in the same way they do now with microfilm created from paper systems. These microfilming procedures shall not be a substitute for normal system backup procedures. Rather, they are regarded as an additional safeguard for permanent records of a critical nature.

### **6.5.1 Quality Monitoring of Scanner**

All operations using the digital-to-film process follow procedures outlined in ANSI/AIIM MS44 Recommended Practice for Quality Control of Image Scanners. The AIIM Scanner Test Chart #2 is scanned weekly on each scanner and included on the front and rear of rolls. The scan chart at the beginning shall correspond to the week of the earliest scanned record on the roll, and the one at the end shall be scanned during the week of the last scanned record on the roll. The date that each chart was scanned must be displayed on the film. Additionally, a control scanned image of AIIM Scanner Test Chart #2 will be created once as a control image and placed directly preceding the weekly test chart on each roll of film. The purpose will be to easily compare variations in quality over long periods of time. It is vital that the test charts being used are scanned on the same equipment that processed the source documents on the film. Charts scanned on one piece of equipment should never be used on reels with images from another scanner.

### **6.5.2 Quality Monitoring of Images**

Each image will be visually compared against its corresponding original document in order to identify and correct the following defects:

1. Missing pages
2. Page skew
3. Text cutoff at edges
4. Double-page feeds
5. Contrast problems
6. Images in a different order than originals

### **6.5.3 Resolution Test Targets**

Computer output microfilm (COM) of scanned or born digital images should include resolution charts as recommended in ANSI/AIIM MS 44 1993 Recommended Practice for COM Recording Systems Having an Internal Electronic Forms Generating System—Operational Practices for Inspection and Quality Control.

### **6.5.4 Density**

The minimum background density on microfilm output must be within the ranges prescribed for the Archive Writer or COM

within the ANSI/AIIM MS 1-1996 ANSI/ISO 5/2 recommended standard.

#### **6.5.5 Print Test**

The Washington State Archives reserves the right to periodically “test” the quality of any given roll of microfilm from scanned or born digital images provided by vendors and service providers. This will be done through film duplication to the generation required for the records schedule application.

#### **6.5.6 Microfilm Type**

The microfilm produced must conform to ANSI/AIIM MS 23-1998 standard, and ISO 18901:2002 and ISO 18906:2000 Imaging materials -- Processed silver-gelatin type black-and-white films -- Specifications for stability, which defines physical and chemical properties leading to LE 500 certification.

#### **6.5.7 Reduction Ratio**

The reduction chosen for the microfilm output should be consistent with recommended practices for microfilm of records of permanent retention. Space savings should be secondary to the goal of providing good clarity, sufficient detail, and reproducibility in the duplication process, and in paper prints. As a general rule, lower reductions serve to provide a better quality image.

#### **6.5.8 Indexing**

It may be desirable to include a printed index at the end of the film. The content of all index fields associated with the images on individual rolls should be provided, in a microfilm format, and should be a part of the microfilmed series submitted for deposit.

#### **6.5.9 Document Grouping**

All images will be annotated on the film with corresponding image marks (a.k.a. “blips”) and folder level indexing (Exhibit A).

#### **6.5.10 Order of the Images**

The prevailing method accepted by the user community (book and page for recorded instruments) shall be used. Only one record series will be placed on a roll of microfilm. Requests for exceptions to this provision must be made in writing to the State Archivist.

#### **6.5.11 Film Polarity**

Microfilm used in conventional cameras produces “negative appearing” images (clear characters on a black background) from “positive appearing” source pages (black characters on a white background). For this reason, this first generation camera film has been called the “camera negative”. Raster image recorders are capable of accepting positive or negative appearing digitized images and producing positive or negative appearing images on microfilm. Unless there is a compelling reason to produce positive appearing microfilm, negative is preferred. Negative film more effectively hides dust and other foreign material that can become attached to the film and it does a better job of hiding base side film scratches. Because of this, pages scanned from negative film produce cleaner looking images with smaller file sizes.

#### **6.5.12 Page Size vs. Film Size**

Documents that include letter/A size (8.5”X11”), legal (8.5”X14”) and tabloid/B size (11”X17”) pages are suitable for recording on 16mm film. Larger formats such as C size (17”X22”), D size (34”X22”) or, E size (35”X44”) are best preserved on 35mm film.

#### **6.5.13 Image Resolution**

300 dpi resolution is preferred because it produces sharper lines. Smaller fonts or fonts that contain detailed serifs require resolution in the 400 to 600 dpi range depending on the characteristics in the font that are to be preserved.

#### **6.5.14 Image Contrast**

Sufficient contrast between character and background density is important to producing film that will print or scan clearly. The exposure level in the image writer’s software should be set to produce a 0.95 – 1.05 background density for 300 dpi scanning. Background density is measured in the dark areas of

the image using a properly calibrated transmission densitometer.

#### **6.5.15 Blip Coding**

Critical to an effectively organized microfilm file is the use of a multi-level blip coding strategy. Blips are rectangular marks exposed by the film recorder under each page as they are written on the film. These marks can be programmed to appear in different sizes to identify file level, document level, page level, etc. images. Applying this sequence to recorded documents, a large blip would indicate the beginning of a book, a midsized blip would then indicate the first page of a document within the book, and a small blip would indicate a supporting page within that document.

If a document number rather than book and page system is used, a two-level blipping scheme is sufficient. A large blip designates the first page of a document while small blips indicate supporting pages within the document.

#### **6.5.16 Image Annotation**

Whenever practicable, image annotations should be used to provide an extra measure of organization and document reproducibility. Exhibit A provides several examples of image annotations.

#### **6.5.17 Page Orientation**

Pages can be recorded on microfilm in two ways. In "cine mode" where the text on a page runs perpendicular to the length of the film and in "comic mode" where the text on a page runs parallel to the length of the film. Unless a lower reduction ratio is needed for acceptable image quality, recording letter and legal sized pages in comic mode is preferable. This is accomplished by rotating the images 90° prior to recording or feeding the page "sideways" through the scanner. The advantage of comic mode recording is that more pages can be written on each roll of film saving storage space and promoting more efficient scanning in the event that the film needs to be used to recover lost image data.

#### **6.5.18 Skew**

Skew is defined as having an oblique direction or position; slanting. Images that are tilted to the left or right of

perpendicular are said to be "skewed". Prior to recording on the film, digitized images should be de-skewed to permit maximum packing density on the film and to produce an easily read page when rescanned and displayed on a monitor.

#### **6.5.19 Page Spacing**

Pages need to have sufficient separation to allow a film scanner to reliably differentiate adjacent pages on the film. There should be a minimum separation of 0.06" (1.5mm) between adjacent pages. Pages that touch each other at any point may preclude them from being captured separately by a microfilm scanner. If splicing must occur within a film roll, additional space between frames will be required to accommodate the splicing process.

**Important Note:** Although maximizing packing density improves scanning efficiency, documents recorded on film should not span rolls.

#### **6.5.20 Splicing**

The convergence of document scanning and raster image recording has created a unique opportunity to abandon the practice of splicing. When all legibility/completeness checks and edits are done on the electronic image file, any problems found are easily corrected prior to creating film. When this practice is followed, microfilm is not only capable of preserving the documents it holds but it can also add a measure of insurance against document fraud. Because of the reasons stated above, it is strongly recommended that the practice of splicing be eliminated in favor of digitized image file editing as the preferred process for correcting mistakes. If splicing cannot be avoided, splicing procedures should follow the recommendations found in ANSI/AIIM MS18-1992 (R1998)

#### **6.5.21 Targets**

The following targets must be eye-readable (without magnification) and included on each reel in the order below:

##### **Beginning Targets**

1. Beginning of Roll
2. Control Resolution Chart
3. Week Resolution Chart
4. Density Sheets (3x)

### Ending Targets

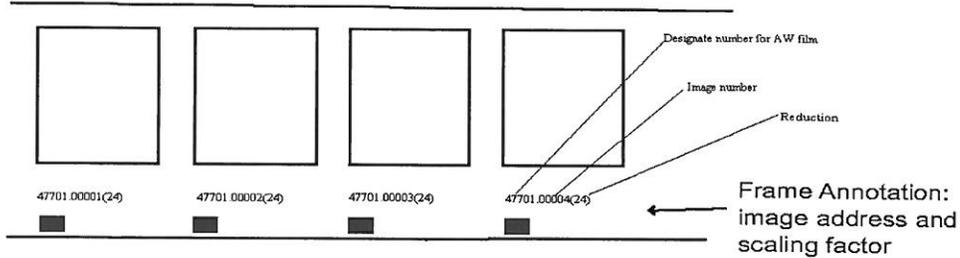
1. Control Resolution Chart
2. Weekly Resolution Chart
3. Density Sheets (3x)
4. The Certificate of Authenticity (Appendix 1) shall be signed by the scanner operator, and included at the end of each roll. This document must include the following information:
  - a. Name of agency/office
  - b. Name of scanner operator
  - c. Records series title
  - d. Date span of records
  - e. Date scanned
  - f. Disposition Authority Number (DAN)

End of Roll

## Exhibit A – Document Grouping

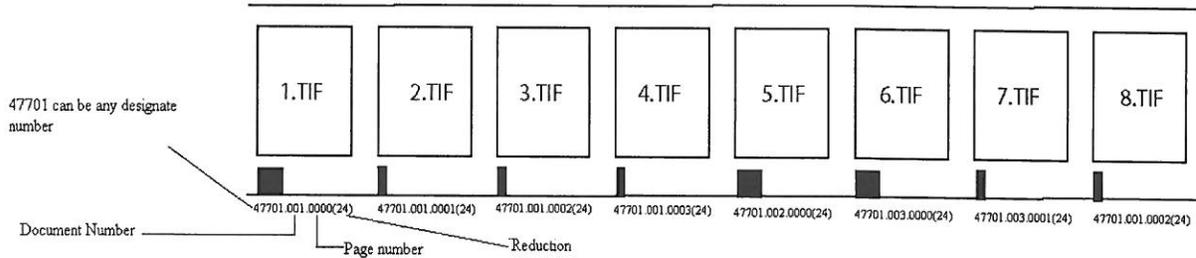
Page-level: Images are not grouped. Every frame is written with a small image mark.

**Example 1:** One channel, 24X reduction with frame annotation.



Document-level: Images are grouped using a document level hierarchy. The first frame within each group is written with a medium image mark. Subsequent frames within the group are written with a small image mark. Retrievals can be made of an entire group or individual images.

### Example 2: 2 level offset on film



Folder-level: images are grouped using a folder-level hierarchy. The first frame within each group is written with a large image mark. Subsequent frames within the group are written with a medium or small image mark depending on the image level specified via the input method. Retrievals can be made of an entire group, document-level subgroup, or individual images.

