Quality testing of microfilm

South Carolina Department
of Archives and History
Archives and Records
Management Division

Introduction

You should always inspect microfilm to ensure that it meets minimum quality standards. And if your original records are to be destroyed after being filmed, that inspection is vital. Too often government offices that fail to test their film properly find their film has deteriorated when they need the information it held years later. They can no longer distinguish, perhaps, between the image of a 3 and that of an 8—a problem that could compromise the legal rights of government or citizens. Only testing can ensure the durability of film and the legibility of copies made from it.

Visual inspection

Equipment

Wear white, lint-free, cotton gloves to handle the negative and use a light box, a loupe, a tungsten light, and rewinds—NOT a microfilm reader—to inspect the images.

The check

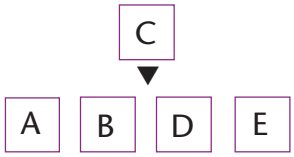
Place the film on the rewinds and advance it over the light box to inspect for content document by document—all documents should have been filmed and all targets should have been included and should be correct. Use the tungsten light and the loupe at ten foot intervals to check the film for both readability and scratches; if you suspect a defect, examine it more often.

The checklist

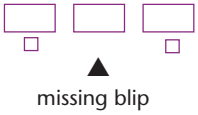
You should look for the following items when you inspect the film:

1) Improper exposure—images too dark or too light

2) Uneven density
3) Light streaks
4) Fine lines and scratches
5) Dark bars across film
6) Improper positioning of documents
7) Irregular spacing of documents
8) Overlapping documents
9) Folded documents
10) Stretched or distorted documents
11) Partial images
12) Blank film
13) Wrong side of document filmed
14) Fogging (large black areas in film)
15) Dirty film
16) Torn or cracked film
17) Omission of identification and certification data
18) Incorrect, misplaced, or omitted finding aid targets:



19) Missing or poor quality indexing mark (blip):



20) Improperly spooled microfilm—carefully mark and refilm unsatisfactory images
21) Hands or other objects that obscure information because they were between the lens and document during filming

Density check

Density measures the contrast between the image and the background.

Measuring density

Density is measured on an instrument called a densitometer

and is expressed as a numerical value. Density is important because it affects legibility. To read the film for density, place it in a densitometer either emulsion side up or down (depending on the manufacturer's specifications).

Variables

Several factors can affect density. They include:

- use of expired film
- fluctuations in the power supply
- dirty mirrors and glass guides in rotary cameras
- lack of control over processing—"Control Strips" should be processed daily to maintain uniformity of the developer
- the age of the film or processing chemicals
- variations in lighting

Required ranges

Density readings generally range between 0.8 and 1.3—the precise reading will depend on the type of document that was filmed. The figures below show the target ranges for various types of documents:

- documents with small, high contrast printing: 1.00 to 1.3
- pencil writing with soft lead, documents with small writing: 0.95 to 1.25
- documents with faded or tiny print: .90 to 1.2
- documents with low contrast, with faded printing, or with poor printing: 0.8 to 1.0
- documents that are badly faded or have poor contrast: 0.7 to 1.00
- non-white documents with black and non-black printing: 0.80 to 1.10
- high contrast drawings or writing on mylar filmed with back lighting: 1.30 to 1.60
- Low contrast writing on mylar filmed with back lighting: 1.00 to 1.30

Minor variations from these acceptable ranges may not always have an adverse effect. It is critical to stay within the given ranges, however, the more important the record is and the greater the problem with legibility. If you have a problem maintaining the density ranges, or if it is technically unfeasible to do so, notify the S.C. Department of Archives and History in writing and request a waiver of the requirements.

Base plus fog density

To produce film that meets standards, you must also control base plus fog density (D-MIN)—the density of film that has not been exposed but has been developed and fixed. You will usually take base plus fog readings from the clear leader or trailer on each roll. The reading should be 0.10 or less.

Resolution

Resolution measures the ability of the microfilm to record fine detail. It is resolution that makes the image on the film either sharp and clear or fuzzy. Resolution is expressed in terms of lines per millimeter.

Calculating resolution

An *original* resolution test chart (photocopied charts give inaccurate readings) will be microfilmed at the beginning, in the middle, and at the end of each roll. The chart has various sized groups of five vertical and horizontal lines. You will examine each of those images using a 100X microscope, and you will multiply the number of the smallest pattern in which you can distinguish the horizontal and vertical lines by the reduction to get the number of lines per millimeter and thus establish the resolution.

Variables

A number of factors can affect resolution:

- poor quality lens
- camera vibration during filming
- incorrect focus
- poor film
- poor developing materials

Standards

High-quality resolution is important because images lose quality with each generation of film produced—a duplicate made from the original is not as sharp as the original, and a copy made from the duplicate is not as sharp as the duplicate. The original roll must,

Some recommended reduction ratios for archival records requiring reproduction to four generations

reduction ratio	planetary camera lines per mm	reduction ratio	planetary camera lines per mm
8:1	80	26:1	117
10:1	80	28:1	126
12:1	85	30:1	120
16:1	89	32:1	128
20:1	100	36:1	129
24.1	108		

RESOLUTION TEST—LINE CHART

TEST PATTERNS	SCALE *LINES PER MILLIMETER*																		
10.0	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	400
9.0	108	117	126	135	144	153	162	171	180	189	198	207	216	225	234	243	252	261	360
8.0	96	104	112	120	128	136	144	152	160	168	176	184	192	200	208	216	224	232	320
7.1	85	92	99	106	113	120	127	134	142	149	156	163	170	177	184	191	198	205	284
6.3	75	82	88	94	100	107	113	119	126	132	138	144	151	157	163	170	176	182	252
5.6	67	72	78	84	89	95	100	106	112	117	123	128	134	140	145	151	156	162	224
5.0	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	200
4.5	54	58	63	67	72	76	81	85	90	94	99	103	108	112	117	121	126	130	180
4.0	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	160
3.6	43	47	50	54	57	61	65	68	72	75	79	82	86	90	94	97	101	104	144
3.2	38	42	45	48	51	54	58	61	64	67	70	74	77	80	83	86	90	93	128
2.8	34	36	39	42	45	48	50	53	56	59	62	64	67	70	73	76	78	81	112
2.5	30	32	35	37	40	42	45	47	50	52	55	57	60	62	65	67	70	72	100
2.2	26	29	31	33	35	37	40	42	44	46	48	51	53	55	57	59	62	64	88
2.0	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	80
1.8	21	23	25	27	28	30	32	34	36	37	39	41	43	45	46.8	48.6	50.4	52.2	72
1.6	19	20	22	24	25	27	28	30	32	33	35	36	38	40	41	43	44	46	64
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	40

REDUCTION

therefore, meet high standards to ensure the legibility of successive generations. The "Quality Index Method" of determining desirable resolution values for printed materials is explained in detail in "Quality Standards and Practices for the Microfilming of Public Records," *Code of Laws of South Carolina 1976,* Regulation 12-200-*et. seq.*

Methylene Blue Test

This test is a critical one for archival microfilm. It tests for thiosulfate residue, and you should perform it whenever you microfilm records with a retention period that is permanent or long-term. Although a densitometer (the silver densitometric method) can also be used to test for thiosulfate, this method is less precise. Only the methylene blue test should be used to test archival microfilm.

Why this test?

A brief explanation of the way microfilm is processed will help you to understand why this test is important. Film is processed in three steps: it is first *developed* by being immersed in a chemical solution that changes the exposed silver halide crystals to silver metal; next it is *fixed* by being immersed in a fixer of sodium thiosulfate, which dissolves the unexposed silver halide crystals and removes them from the film; finally, it is *washed* with water to remove the fixer because if too much fixer remains, it can ruin the film. The methylene blue test ensures that most of the fixer has been removed.

Standard

Washing will not remove all the thiosulfate residue, but after washing, no more than 0.7 micrograms per square centimeter should remain on the film. This standard is also expressed as 0.007 grams per square meter (0.007 g/m2).

Timing

You must conduct a methylene blue test within 14 days of processing. Any threat thiosulfate may pose to the film's stability can be calculated accurately only within that period; if you wait any longer, the thiosulfate begins to oxidize and the test is no longer accurate.

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Frequency

Ideally, a methylene blue test should be performed each day on samples from the runs from each processor in operation. When a roll from a certain processor fails to meet the standard, all rolls processed since the last acceptable test on that processor must be either washed again or reproduced. Thus, if you sample rolls soon after processing, you will not lose much time. At the very least, you should conduct the test:

- every fifth consecutive day of processing (each machine)
- when repairs that might affect water flow have been made to processing machinery
- when water lines have been disrupted or repaired, when the flow of water has been shut off, or when water pressure fluctuates or drops

Should you test in-house or use a service bureau?

No specific answer can be given to this question because each operation is different. You will have your answer when you compare your costs for buying equipment and training with your costs for using a service bureau. Usually, the equipment needed to inspect film visually costs little and can be borne by the budgets of the smallest micrographics operations. Similarly, the cost of the equipment needed to test for density and resolution is modest and usually falls within the means of small and medium-sized operations. The cost for laboratory equipment to test for thiosulfate and for equipment to process and duplicate film, however, can be significant and would be an outlay that generally only large scale operations could consider.

Equipment for quality testing

If you decide to conduct quality tests in-house, you will need the following equipment:

Cotton gloves: skin oils contain acids that damage silver gelatin film; to protect your original negative microfilm when you handle it, wear lint-free white cotton gloves.

Light box: a light box contains fluorescent lights, is covered by translucent material, and provides diffused light for the visual inspection of original negative microfilm. You should *never* use a reader/printer to inspect a negative because when you run it through a reader you risk damaging the film.

Rewinds: a rewind has a base and a spindle turned by a crank and is used to wind film from one reel to another over the light box. You will need two rewinds to inspect film.

Tungsten light: a tungsten light provides the illumination needed to locate scratches in the film. For best results, you should place the light above the rewinder.

Loupe: a loupe is a magnifying glass. You will use the loupe to locate scratches on the film and to check the images for legibility.

Densitometer: a densitometer measures the density (or contrast) between the image and the background and is expressed as a numerical value.

Microscope: a microscope with a magnification of fifty to 100 power will determine the resolution (sharpness) of the im-

For more information

This leaflet is one of a series of leaflets issued by the Archives and Records Management Division of the South Carolina Department of Archives and History.

The Archives and Records Management Division has statutory responsibility for advising government offices on micrographics. The Archives and Records Management Division also issues publications and provides advice and help on records management and archival administration.

For more information, please contact the South Carolina Department of Archives and History, Archives and Records Management Division, State Record Center, 1919 Blanding Street, Columbia, SC 29201. (803) 734-7914.

Public information leaflets from the Archives

no. 1 *Legal requirements for microfilming public records (1992)*
no. 2 *On choosing records for microfilming (1992)*
no. 3 *Service bureau or in-house microfilming (1992)*
no. 4 *Targeting and certification of microfilm (1996 revised)*
no. 5 *Choosing a microfilm camera (1992)*
no. 6 *Quality testing of microfilm (1992)*
no. 7 *Microfilm and microforms (1992)*
no. 8 *Choosing a micrographics service bureau (1992)*
no. 9 *Choosing microfilm readers and reader/printers (1992)*
no. 10 *Computer assisted retrieval systems (1992)*
no. 11 *Microfilm storage (1992)*
no. 12 *Preservation microfilming (1992)*
no. 13 *Optical Disk: policy statement and recommended practices (1996 revised)*
no. 14 *Storing records in the State Records Center (1993)*
no. 15 *The deposit of security microfilm (1993)*
no. 16 *Disaster preparedness and recovery in state and local government records offices (1993)*
no. 17 *How to conduct a records inventory (1993)*
no. 18 *How to establish records retention schedules (1993)*
no. 19 *Photographic media (to be announced)*
no. 20 *Editing and splicing roll microfilm of long-term or archival value (1994)*
no. 21 *Managing E-Mail (to be announced)*
no. 22 *Standards for microfilm service bureau certification (1996)*