DUPLICATION SPECIFICATIONS
National Archives and Records Administration
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TECHNICAL REQUIREMENTS FOR THE DUPLICATION OF B&W NEGATIVES:
Shadow Normalization Tone Reproduction

1.0 GENERAL DESCRIPTION OF SERVICES

1.1 Background

The contractor shall copy a collection of original nitrate and acetate film negatives from the collection of the contracting institution; approximately _____ to _____ negatives ranging in size from 35mm frames to 8"x10". The total number of images to be copied is approximate, based on the contracting institution's best estimate. Each negative is a valuable and unique archival record of the contracting institution. The negatives shall be duplicated by producing an archival, film positive (i.e., an interpositive) using a continuous tone, black and white, panchromatic film, and by producing duplicate negatives from the interpositives using a continuous tone, black and white film. All interpositives and duplicate negatives shall be housed in enclosures approved by the contracting institution. The contractor shall perform all labor and be responsible for the acquisition or purchase of all necessary equipment and supplies, except those specified in this contract as being provided by the contracting institution.

2.0 SCOPE OF WORK

2.1 Technical and Theoretical Overview

2.1.1 Tone Reproduction Approach: Shadow Normalization

The approach to the tone reproduction for duplicating these negatives is to be the shadow normalization method that was conceived at the National Archives, with input from Library of Congress staff in 1990. With this approach the shadow density of each original negative is measured and the exposure for each interpositive is adjusted to reproduce the shadow portion of the image on the interpositive at a selected aimpoint density near the "shoulder" of the characteristic curve. The duplicate negatives are exposed using a standard exposure. This approach eliminates the problem of loss of detail on the interpositives with very dense negatives and allows for the objective evaluation of the tone reproduction of both the interpositives (IPs) and duplicate negatives (DNs) using a densitometer. An assessment of an entire batch of IPs and DNs can be made from an analysis of a sampling of IPs and DNs, rather than inspecting every single IP and DN. This approach to tone reproduction has been used extensively at both the National Archives and the Library of Congress, and has been used by many other institutions across the country and worldwide.

2.1.2 Variability and Limits

Also, staff at the National Archives has measured the variability of standard photographic duplication systems and has established plus-or-minus limits for both the average shadow density (directly controlled by exposure and indirectly effected by development) and the average contrast (controlled by development) of a batch or roll of IPs and DNs; as well as broader plus-or-minus limits for individual IPs and DNs.

The limits for variability and the percentage of IPs and DNs that should fall within the cited limits, for a system that is in control and has a normal variability, are as follows:

Individual Interpositives and Duplicate Negatives-

	Limits	Max. Standard Deviation	% of IPs and DNs Within Limits for Systems in Control
Shadow Density	± 0.30	0.10	99.7%
Contrast	± 0.30	0.10	99.7%

Average for a Batch or Roll of Interpositives and Duplicate Negatives-

	Limits	Max. Standard Deviation	% of Batches or Rolls Within Limits for Systems in Control
Shadow Density	± 0.12	0.06	95%
Contrast	± 0.12	0.04	99.7%

Normal distribution curves (traditional bell curves) and the standard deviations cited above have been measured for individual interpositives produced on sheet film by contact printing and by using graphic arts cameras, for individual interpositives produced on 5”(126mm) long roll-film and on 70mm long roll-film, and for individual duplicate negatives produced via contact printing on both sheet film and on long roll-film. Also, normal distribution curves and the standard deviations cited above have been measured for batches of and rolls of both interpositives and duplicate negatives produced via all the methods cited above.

Limits for shadow density and contrast of individual interpositives and duplicate negatives and for the average contrast of batches or rolls of interpositives and duplicate negatives have been selected to accommodate 99.7% of all specimens produced in a duplication system that is in control; the limits are equal to three times the average maximum standard deviation (a standard QC control limit in commercial labs).

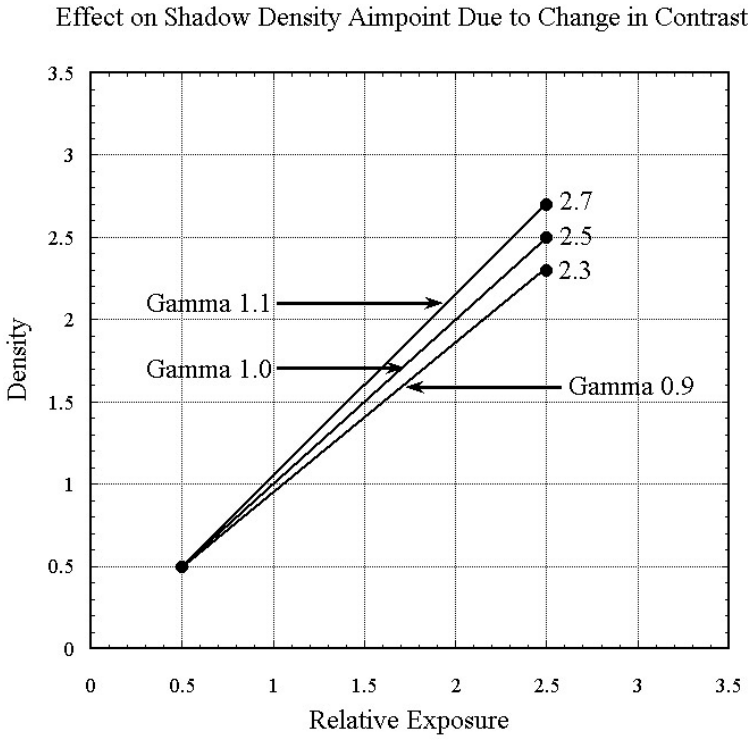
The limit for average shadow density for batches or rolls of interpositives and duplicate negatives has been selected to accommodate 95% of all specimens produced in a duplication system that is in control; the limit is equal to two times the average maximum standard deviation. A larger variability limit would defeat the purpose of the shadow normalization approach, i.e. the production of interpositives and duplicate negatives with uniform shadow density, and is not considered appropriate. For a normal duplication system that is in control, at most no more than 5% of all batches or rolls will have to be redone due to normal variation in the average shadow density to be in compliance with the cited limits. However, it is potentially possible to control the variability for average contrast within closer tolerances, i.e. a lower

standard deviation, and this would eliminate the need to redo any batches or rolls.

Also, for original negatives that have informational value, but low intrinsic value, or are deteriorated, it is appropriate to consider using a broader range for the limit on average shadow density for a batch or roll. In this case, a limit equal to three times the average maximum standard deviation could be used or limits of ± 0.18. Limits larger than those cited in this specification are not considered appropriate, and duplication systems that can not achieve the cited limits are considered to be not in control. This specification requires that all batches or rolls meet the ± 0.12 limit (see Inspection and Acceptance). At the contracting institution's sole discretion the ± 0.18 limit may be used for selected batches or runs of negatives; contracting institution shall indicate that a batch of negatives fall into this category prior to the beginning of the duplication of that batch.

2.1.3 Interpositive Shadow Density Aimpoint and Variability

The average shadow density for a batch of or roll of interpositives is directly controlled by exposure, but is indirectly and highly influenced by changes in contrast. A small change in the average contrast will produce a larger proportional change in the average shadow density.



The above graph illustrates how the interpositive shadow density varies at three different contrast (gamma) levels. The three plots represent the straight line portion of a characteristic curve for a film processed to a contrast of 0.9, 1.0, and 1.1. For a contrast of 1.0, the shadow will be rendered at a density of 2.5 (a typical aimpoint value). If the contrast varies from 1.0 to 0.9, then for the exact same exposure the shadow density will be rendered at 2.3. If the contrast varies from 1.0 to 1.1, then for the exact same exposure the shadow density will be rendered at 2.7. Therefore, if contrast is allowed to vary from 1.0 ±

0.10 (0.9 to 1.1), then the shadow density will vary from 2.5 ± 0.20 (2.3 to 2.7). In theory, this simple relationship predicts that in order to control the average shadow density within a desired range, then the average contrast needs to be controlled within approximately half that range. In practice, the difference in relative variability is less than predicted and the measured values for average shadow density do not vary greater than 50% (1.5 times) greater than the variation for average contrast.

The higher the selected shadow density aimpoint for interpositives, the greater the inherent variability of the average shadow density. Using the simple mathematical model described above, it is possible to predict the variability of the average shadow density at different aimpoints (and the corresponding density ranges accommodated in a duplicate) and different levels of contrast variability.

Aimpoint Density	Approximate Density Range Accommodated	Contrast Variation	Average Shadow Density Variation
2.5	2.0	± 0.05	± 0.10
		± 0.10	± 0.20
		± 0.15	± 0.30
		± 0.20	± 0.40
2.6	2.1	± 0.05	± 0.105
		± 0.10	± 0.21
		± 0.15	± 0.315
		± 0.20	± 0.42
2.7	2.2	± 0.05	± 0.11
		± 0.10	± 0.22
		± 0.15	± 0.33
		± 0.20	± 0.44
2.8	2.3	± 0.05	± 0.115
		± 0.10	± 0.23
		± 0.15	± 0.345
		± 0.20	± 0.46

As can be seen in the chart above, both an increase in the interpositive aimpoint density and an increase in the allowable variation in average contrast will cause a proportional increase in the variability of the average shadow density. In practice, the increased variability of using a higher shadow density aimpoint for the interpositives has been measured; for interpositives with a shadow density of 2.5, the measured standard deviation is 0.06, and for interpositives with a shadow density of 2.2, the measured standard deviation is only 0.04.

In addition to the higher variability associated with higher aimpoint densities, another disadvantage to interpositives with higher shadow density aimpoints is they require substantially more exposure (either higher lamp intensity or longer exposure time- a 0.3 density increase in shadow density aimpoint requires a full stop increase in exposure) to print the duplicate negatives. Most historic gelatin dry-plate glass negatives and historic silver-gelatin film negatives have maximum density ranges of less than 2.0, and only occasionally for both these types of negatives are negatives seen with density ranges of greater than 2.1; higher interpositive shadow density aimpoints which would duplicate larger density ranges are not necessary. Therefore, for all of these reasons it is not necessary, desirable, or recommended to use higher aimpoint densities for the interpositive shadow density; typical interpositive shadow density aimpoints

should range between 2.4 and 2.6.

2.2 Receipt of Original Negatives

All work will be performed at the Contractor's work site. The contracting institution will package the negatives and will deliver the negatives to the contractor or require the contractor to pick up the negatives. Each shipment will be accompanied by an inventory which lists each original negative by item number. The contractor shall validate shipments and receipt for them. A written record shall be made of any deviation(s), and the contracting institution shall be notified immediately. To minimize the potential for loss or damage to negatives, the contracting institution will ship negatives in groups numbering no more than 1,000 at any one time; therefore, it is anticipated that no more than 2,000 original negatives will be on the contractor's premises at any one time. If a batch (shipment of 1,000 negatives) is rejected, the contracting institution will halt further deliveries until corrections are made and the work has been accepted.

2.3 Printing of Interpositives

All interpositives shall be either:

_____ (A) **Contact printed**, from the original negatives, printed emulsion to emulsion, onto uncut sheets of a continuous-tone, black and white, panchromatic polyester-based (7 mil) film, using **Ilford 100 Delta Professional, Agfa Agfatone Pan Film P330p (discontinued),** or equivalent film. Film to be approved by the contracting institution prior to the beginning of production. Or,

_____ (B) **Filmed using a large format camera system**, from the original negatives, filmed emulsion up, at 100% of original size onto uncut sheets of a continuous-tone, black and white, panchromatic polyester-based (7 mil) film, using **Ilford 100 Delta Professional, Agfa Agfatone Pan Film P330p (discontinued),** or equivalent film. Camera system and film to be approved by the contracting institution prior to the beginning of production. Or,

_____ (C) **Filmed using a long roll-film camera system**, from the original negatives, filmed emulsion up, as 6cm x 7cm (or 6cm x 9cm) images on 70mm wide rolls or as 4"x5" images on 5" (or 105mm) wide rolls, using a continuous-tone, black and white, panchromatic polyester-based (4 mil or 5 mil) film, using **Eastman Kodak Panchromatic Separation Film 2238** or equivalent film. Camera system and film to be approved by the contracting institution prior to the beginning of production.

Magnification for Camera Duplication. Generally, all negatives shall be filmed at an appropriate **magnification so the images on the interpositives fill the frame without any cropping** of the images of the original negatives, and images shall **not be reduced to smaller than 50%** of original size as measured by linear magnification. The limit of 50% reduction is a general guideline, there may be specific cases where the duplication film is of high enough resolution and fine enough grain or where the quality of the original negatives is marginal, that more reduction of the image is appropriate. Also, it may be propose to **film groups of similarly sized negatives at standard fixed linear magnifications**; as an example, on 5" wide roll film all negatives equal to or smaller than the modern medium-format of 4.5cm x 6cm could be filmed at a standard linear magnification of 200%, enlarged to twice the normal size, without the image size being maximized for the specific format being filmed. Methods for dealing with the magnification of the images when doing camera duplication shall be proposed to and approved by the contracting institution

prior to the beginning of production.

Sensitometric Tests for Interpositives. Sensitometric tests shall be conducted and a developer/ development time regimen shall be selected that yields a **contrast of 1.0** and **a linear tonal scale that can accommodate the reproduction of a density range of at least 2.0**, and to determine the lower and upper limits of the linear tonal range of the film being used when the previous conditions are met.

Exposure for Interpositives. **Exposure shall be adjusted for each negative, so that the shadow density of each image will be the same on each interpositive**. The aimpoint for the shadow density on the interpositives shall be selected so that the shadow density of the images is reproduced in each case at a density no less than 2.0 density units above the lower limit of the linear tonal range and the aimpoint density shall not be higher than the density of the upper limit of the linear tonal range of the film being used. Typically, the interpositive shadow density aim point will be in the range of densities between 2.4 and 2.6; the preferred aimpoint for the shadow density on the interpositives for this project shall be a density of 2.5, the aimpoint may be changed based on actual testing. (**See Contracting Institution Inspection and Acceptance Procedures.**)

Resolution Tests. Resolution tests shall be conducted to insure uniform contact for contact printed interpositives and to insure accurate focusing for interpositives that are imaged using a camera.

Prior to the beginning of production of contact printed interpositives, **a resolution test chart shall be contact printed onto the film for interpositives using the same printing equipment that will be used during production and submitted for approval**.

Prior to the beginning of production of interpositives imaged using a sheet film camera or a long-roll film camera system, **a resolution test chart shall be filmed onto the film for interpositives using the same camera equipment that will be used during production and submitted for approval; all resolution tests shall be filmed at the same magnification as the original negatives will be filmed**. During production of interpositives using a long-roll film camera system, **a target with a resolution test chart shall be filmed at the beginning of each roll and at the end of each roll to verify the accuracy of focus and to insure uniformity of focus throughout the roll; all resolution tests shall be filmed at the same magnification as the original negatives will be filmed**. The target shall include a roll identification.

Deteriorated Negatives. For optical printing of interpositives onto 70mm or 5”(126mm)/105mm long roll-film, all deteriorating or delaminated acetate negatives shall be duplicated and kept in the normal sequence of negatives.

For contact printing of interpositives, the contractor must, before copying, re-inspect each negative for deterioration. Delaminated acetate negatives shall be duplicated in a vacuum easel to ensure good contact between the original deteriorated negative and the film producing the interpositive. It is acknowledged that using a vacuum easel may cause physical damage to the delaminated original negatives. All delaminated original negatives shall be kept in original sequence with the other negatives.

Stained Negatives. Negatives that are stained (yellow staining being the most common) shall be duplicated. Appropriate measures shall be taken to compensate for stains. These measures, which are subject to approval in advance, may include the use of appropriate colored filters over the exposing light source to minimize the effect of any staining. The method used shall have minimal influence on the tonal scale and contrast reproduction of the negatives as interpositives. Offeror’s proposed measures shall be

addressed in their technical proposal.

Cleaning of Original Negatives. On an as needed basis only, dusting of negatives is permitted using clean soft brushes, blower bulbs, anti-static brushes, and compressed air when approved in advance by the contracting institution; vacuum cleaners or mini vacs shall not be used. All other cleaning methods and procedures shall be approved by contracting institution prior to award of contract and shall be carried out only in cases where the image quality of the duplicates will be compromised if not cleaned.

2.4 Printing of Duplicate Negatives

All duplicate negatives shall be either:

_____ (A) **Contact printed**, from the interpositives, printed emulsion to emulsion, onto uncut sheets of a continuous-tone, black and white film, using **Eastman Kodak Aerographic RA Duplicating Film 4425, Ilford 100 Delta Professional, Eastman Kodak Commercial Film 4127 (discontinued),** or equivalent polyester-based (7 mil) film to be approved by the contracting institution prior to the beginning of production. Or,

_____ (B) **Contact printed on a roll-to-roll contact printer,** from the rolls of interpositives (if a long roll-film camera systems is used to produce the interpositives), emulsion to emulsion, on 70mm wide rolls or on 5" (or 105mm) wide rolls, using a continuous-tone, black and white film, using **Eastman Kodak Aerographic RA Duplicating Film 2425** or equivalent polyester-based film (4 mil or 5 mil) to be approved by the contracting institution prior to the beginning of production.

Sensitometric Tests for Duplicate Negatives. Sensitometric tests shall be conducted and a developer/ development time regimen shall be selected that yields a **contrast of 1.0** and **a linear tonal scale that can accommodate the reproduction of a density range of at least 2.0**, and to determine the lower limit of the linear tonal range of the film being used when the previous conditions are met.

Exposure for Duplicate Negatives. **A standard exposure shall be selected for all duplicate negatives so that the shadow density of the images will be placed at the lower limit of the linear tonal scale**. All duplicate negatives will be printed at one standard exposure. Typically, the duplicate negative shadow density aim point will be in the range of densities between 0.4 and 0.6; the preferred aimpoint for the shadow density on the duplicate negatives for this contract shall be a density of 0.5, the aimpoint may be changed based on actual testing. (**See Contracting Institution Inspection and Acceptance Procedures.**)

Resolution Tests. Resolution tests shall be conducted to insure uniform contact for contact printed duplicate negatives. Prior to the beginning of production of contact printed duplicate negatives, sheet-to-sheet printing and roll-to roll printing, **an interpositive of a resolution test chart (produced for the resolution test for the interpositives, imaged in the same manner as normal production interpositives) shall be contact printed onto the film for duplicate negatives using the same printing equipment that will be used during production and submitted for approval**.

2.5 Processing of Interpositives and Duplicate Negatives

In order to produce the most accurate reproduction of the original negatives possible, interpositives and duplicate negatives shall be processed to a contrast (gamma) of 1.0.

Tonal Scale Tests. As a separate production standard demonstrating adherence to this requirement and objective, the contractor shall use a gray scale (step-wedge) to model the response of the film/developer/development time combination for the film being used to produce the interpositives and the film being used to produce the duplicate negatives. The contractor shall supply tonal scale tests before beginning production of interpositives and duplicate negatives and upon the completion of every 1,000 interpositives and every 1,000 duplicate negatives.

The tests shall consist of an interpositive of the gray scale and a gray scale duplicate negative contact printed from the interpositive test, each developed **to illustrate the idealized response of the duplicating film for the negatives being duplicated**. The interpositive gray scale shall be imaged in the same way as the interpositives and the duplicate negative grayscale shall be contact printed in the same way as the duplicate negatives. Each test shall be accompanied by a **graph of the characteristic curve** (d-log E curve, H + D curve) of the film/developer/development time combination, **for verification that the linear tonal scale can accommodate the reproduction of a density range of at least 2.0 and to illustrate the idealized response of the film when images are processed to a gamma of 1.0**. The characteristic curves shall be submitted for approval prior to the beginning of production.

Film Washing. All film shall be thoroughly fixed and thoroughly washed. The level of residual thiosulfate (fixer, hypo) ions shall be measured using a methylene blue test, ISO 417 or ANSI/NAPM IT9.17-1993. **The level of residual thiosulfate ions in all processed and washed interpositives and duplicate negatives shall not exceed 0.014 g/m^2** (grams per square meter) (equivalent to 1.4 micrograms per square centimeter) as per ISO 10602 or ANSI/NAPM IT9.1-1996. This test shall be done before production begins and shall be performed on a biweekly basis (once every two weeks) for the processor(s) used to process film for this contract. The results of the biweekly methylene blue tests shall be submitted on a monthly schedule and shall be provided to contracting institution within 2 working days of obtaining the final results. Should any given test fail, processing will halt until a new test is performed that passes, and any affected shipments shall be reprocessed by rewashing the interpositives or duplicate negatives at the contractor's expense.

Contractor(s) shall submit clear samples of processed film from the same processor that is being used for the production for this contract, both the film for the interpositives and film for the duplicate negatives. Film samples shall be forwarded to the contracting institution for confirmation testing by methylene blue test, shall be provided within 2 working days of processing, and shall be submitted on a monthly basis.

2.6 Splicing for IPs and DNs on Roll-film

For interpositives on 70mm wide, 5" wide, or 105mm wide long roll-film, all interpositives that the contractor or the contracting institution finds to be defective shall be edited out of each roll by the contractor and all remakes shall be spliced into the roll in the original order by the contractor. All splicing shall be done using an ultrasonic splicer only, no tape splicing shall be allowed. Enough space shall be left on either side of a splice to allow good contact during printing, this can be achieved by cutting a poor quality image in half and splicing at the point in the middle of the image.

2.7 Storage Enclosures and Arranging Enclosures

Interpositives and duplicate negatives produced by contact printing shall be sleeved in individual archival paper enclosures/envelopes and placed in archival storage boxes. All interpositives and duplicate negatives shall be placed in the sleeves with the emulsion side facing away from the glued seam of the sleeve, and all original negatives shall be replaced in their sleeves in the same manner.

The rolls of interpositives produced by filming the negatives on 70mm-wide film shall be left on an uncut roll and stored on a metal reel in an approved polypropylene or metal film can. Duplicate negatives produced on rolls of 70mm wide film shall be cut into strips of three images and placed in high-density polyethylene or polypropylene pages (referred hereafter as poly pages) by the contractor. Also, the vendor shall place the pages of duplicate negatives in folders and boxes.

The interpositives produced on 5”(126mm) or 105mm wide roll-film may be left on the roll and stored on a metal reel in an approved metal can, or can be cut into individual interpositives and stored in individual paper enclosures/envelopes and placed in archival storage boxes. Duplicate negatives produced on rolls of 5”(126mm) or 105mm wide film shall be cut and sleeved in individual paper enclosures/envelopes and placed in archival storage boxes.

All housing supplies and storage enclosures described in this, or any other paragraph in this specification, shall meet ANSI IT9.2-1998; including passing the Photographic Activity Test, ANSI IT9.16-1993. All materials used by the vendor to store the interpositives and duplicate negatives created by the contractor to fulfill the requirements of this contract, shall be approved by the contracting institution prior to the beginning of production.

Sleeve, Film Can, and Storage Box Identification. Before the interpositives and duplicate negatives are placed in the new sleeves, all alpha-numeric identifications on the old sleeves of the corresponding original negatives shall be copied onto the new envelope either by hand using a pencil. The information shall appear on the front of the envelope, the back of the envelope being the side with the glued seam. Holding an envelope with the open side up, the information shall be written or photocopied along the top edge of the envelope. Generally, there will not be a problem determining which information is to be transferred, the identification will consist of two parts, the original negative series code and an individual item number. It is the responsibility of the contractor to insure that negative numbers on the sleeves match those appearing on the negatives and interpositives. If the number and identification on an original negative differs from the number and identification on its envelope the contracting institution shall be contacted immediately to help resolve the discrepancy. The contracting institution will provide examples of each sleeve to the contractor showing the placement of series and item codes. For interpositives that are produced on long roll film, the contractor shall label the film can with the range of negative numbers of the images on the roll of film and shall provide an itemized list of all negative numbers on each roll of film.

Contractor Identification on the Sleeves, Film Cans, and Storage Boxes. Each interpositive and duplicate negative sleeve, film can, and storage box shall be stamped with the name of the contractor and the month and year in which the interpositive/duplicate negative was produced (for example, the stamp might say “Interpositive Produced by XXX, 10/91”). Exact wording of such a stamp shall be addressed in the technical proposal and subject to approval by the contracting institution after contract award. The placement of this stamped marking shall be on the seam (verso) of each interpositive sleeve. The ink for the stamp shall be approved prior to use, shall be non-reactive with photographic materials, shall be the equivalent of the GPO stamp pad ink, and shall be applied lightly. All film cans of rolled interpositives and storage boxes shall be marked in a similar manner.

2.8 KEY PERSONNEL

For purposes of this contract, key personnel roles are defined as the project manager and designated alternate, darkroom technician(s), and inspector(s). The contractor's project manager or designated alternate shall have full authority to represent the contractor in all matters regarding the contract. The project manager/designated alternate shall be available within a period of 24 hours after receipt of notification (telephone, fax, or in writing) from the contracting institution to discuss any technical or contractual matter.

3.0 QUALITY CONTROL PROCEDURES

3.1 Contractor Responsibility

A quality control program peculiar to this contract shall be initiated, documented, and maintained throughout the life of this contract. The Quality Control Plan shall address all specification and reporting requirements associated with each phase of contract performance beginning with receipt of the original negatives through delivery and approval (acceptance) by the contracting institution. The contractor shall be responsible for performing all inspections or evaluations of the quality of all interpositives and duplicate negatives during production to ensure the quality of the interpositives and duplicate negatives. Inspection equipment shall be of appropriate quality, accuracy, and quantity to ensure that all requirements of this contract are met (**See Contracting Institution Inspection**). The program shall also include procedures addressing the packaging/marking requirements and delivery requirements.

Contractor(s) shall submit a quality control report or summary with each batch of original negatives, interpositives, and duplicate negatives. At a minimum, the quality control report shall document all inspections performed and remakes produced for the specific batch. Also, a quality control report shall be submitted with every batch that is redone by the contractor after being returned by the contracting institution for having failed inspection.

3.2 Contractor Facilities

While on-site at the contractor's facilities, all the contracting institution property shall be stored in a locked vault, except during periods of the actual contractual work, and secured from theft or damage. The contractor's facility shall be protected by a fire alarm and by a security system. Storage vaults shall be temperature and humidity controlled; the temperature shall be 55 to 72 degrees F and the relative humidity between 30 and 50 percent. Verification that these conditions exist must be certified and submitted in writing prior to start of production. Thereafter, on a monthly basis and within 2 working days of obtaining the final reading, the contractor shall provide to the contracting institution a written record of the daily high and low temperature and humidity readings in the storage areas for that period. Should any deviation from the required conditions arise, the contractor shall immediately initiate corrective measures to ensure the safety of the negatives, and notify the contracting institution of the situation.

3.3 Reports

The contractor shall document all quality control procedures and actions taken and the following specific reports shall be submitted. The reports below are expected to be submitted to the contracting institution on time, and the vendor must notify the contracting institution immediately, if reports listed below cannot

be submitted according the schedule.

Receipt of Materials Form: Report due no later than five (5) days after the arrival of shipment of original negatives to contractor premises.

Temperature and Relative Humidity Records: Daily readings (either as a daily record or as a weekly record) will be taken beginning the day of receipt of the first shipment of negatives and the results shall be forwarded to the contracting institution on a monthly basis and within 2 working days of the last reading.

Methylene Blue Tests Results and Film Samples: First results due on first day of production and tests to be performed on a biweekly basis, once every two weeks, thereafter. Methylene blue tests results to be submitted on a monthly basis and shall be provided to the contracting institution within 2 working days of obtaining the final test results. Film samples to be submitted to the contracting institution on a monthly basis and within 2 working days of processing.

Tonal Scale Tests and Characteristic Curves: First results due on first day of production, and submitted after production of every 1,000 interpositives and for production of every 1,000 duplicate negatives.

Resolution Tests: First results due on first day of production, and for roll-film duplication submitted as a target at the beginning and end of each roll of interpositives and duplicate negatives.

Quality Control Summary: Report shall be included with each batch of interpositives and duplicate negatives and for each batch of reduplicated negatives previously rejected as unacceptable by the contracting institution.

3.4 PACKING AND MARKING

The interpositives, duplicate negatives, the copied original film negatives, and the uncopied deteriorated original negatives shall be packaged separately in cartons for return to the contracting institution.

Each shall be packed in separately labeled cartons and sealed to provide protection against dirt, water, exposure to light, and physical damage. Each carton shall contain no more than 500 negatives, interpositives, and duplicate negatives; and all original negatives, interpositives, and duplicate negatives shall be in numerical order. The quantity and the sequence of interpositives in a carton shall be matched exactly with the quantity and the sequence of duplicate negatives and original negatives in the other corresponding cartons. the contractor shall provide the contracting institution with a complete list of negative numbers and a total for each carton of original negatives and corresponding cartons of interpositives and cartons of duplicate negatives. (See **Safeguarding Contracting Institution Material** for the delivery and insurance requirements of the interpositives, duplicate negatives, copied original negatives, and uncopied deteriorated negatives).

4.0 CONTRACTING INSTITUTION INSPECTION/ACCEPTANCE

4.1 Contractor Facilities

The contracting institution reserves the right to inspect the contractor's facilities during the actual production of interpositives and duplicate negatives, including all laboratories, work areas, and storage areas.

4.2 Inspection of Interpositives and Duplicate Negatives

A quality control program shall be initiated, documented, and maintained throughout all phases of the duplication project. The quality control plan shall address all specifications and reporting requirements associated with each phase of the duplication project. The contractor shall be responsible for performing all inspections or evaluations of the quality of the interpositives and duplicate negatives during production to ensure the quality of the duplicates.

The contracting institution shall require three (3) weeks for the testing, and approval procedures prior to acceptance. Upon receipt of a shipment of interpositives and duplicate negatives, the contracting institution staff will survey and test a sampling of the interpositives and duplicate negatives. The contractor shall not be held responsible for damage to the interpositives or duplicate negatives caused by the inspection or handling by the contracting institution. The overall quality of the interpositives and duplicate negatives will be evaluated using the following procedures:

4.3 Methylene Blue Tests

The contracting institution shall conduct methylene blue tests to determine the level of residual thiosulfate ions present in the film of interpositives and duplicate negatives. The contracting institution reserves the right to reject interpositives and duplicate negatives based on the result of inspections and of the methylene blue tests.

4.4 Visual Examination

At a minimum, 10% of each batch or one hundred interpositives and one hundred duplicate negatives, whichever quantity is smaller, and no less than fifty IPs and DNs, will be randomly selected out of each batch and inspected under 4X to 8X magnification on a light table (transmitted light) and with raking light (reflected light) for any one of the following defects:

- nicks or gouges
- scratches or abrasions
- buckling
- the presence of dirt or foreign matter
- “pinholes”
- finger prints
- stains
- water spots
- flow marks
- processing roller marks
- static marks
- uneven density
- interference patterns (Newton’s rings)
- cracking or breakage of negatives
- overexposed or underexposed interpositives/duplicate negatives
- contrast of interpositives/duplicate negatives too high or too low
- lack of sharpness and resolution
- interpositive/duplicate negative printed backwards
- incomplete image (including cropping or absence of negative number)
- image not centered and square, no more than 10° rotation from square
- missing notch code

- defective enclosures- such as failed or puckered seams, excessive adhesive, etc.
- incorrect labeling of paper negative IP and DN enclosures and boxes, IP cans, DN pages, folders, or boxes
- overstuffed boxes
- image is numbered incorrectly or the frame number is illegible
- dust, dirt, "pinholes" or foreign matter imaged on the interpositives or duplicate negatives will be evaluated using the following guidelines:
  -- it is unacceptable if the foreign matter is reproduced in an area of the photographic image that obscures information, detail or other content of the image that is conspicuous or important.
  -- it is unacceptable if it is obtrusive in terms of contrast, size, or excessive number of occurrences on a single copy.
  -- it is unacceptable if it is repeated from one interpositive/duplicate negative to the next.
  -- it is unacceptable if it is introduced during preparation or duplication process, such as glove lint, hair, etc.

4.5 Surface Imperfections

Final evaluation of any surface imperfections, such as scratches, marks, blemishes, etc., that are visible under reflected light, but not clearly visible via transmitted light, shall be made by printing the interpositive(s) to produce a duplicate negative or by printing the duplicate negative(s) onto photographic paper to see if the imperfections are reproduced on the next generational copy. Printing shall be done using a diffuse light source, such as a diffuse color enlarger head. If the imperfections are photographically reproduced, then the interpositive(s) or duplicate negative(s) shall be rejected.

4.6 Accuracy and Completeness of Frame Numbering and Labeling of Enclosures

The contracting institution shall inspect the accuracy and completeness of the frame numbering of the 10% sampling of interpositives and duplicate negatives. The contracting institution shall inspect the accuracy and completeness of the labeling of the storage envelopes or cans for interpositives, envelopes or storage pages and folders for duplicate negatives, and storage boxes; any groups of materials found to be mislabeled will be returned to the contractor for correction.

4.7 Densitometer Apertures

The densitometer apertures used to measure the density values of original negatives, interpositives (IPs) and duplicate negatives (DNs), shall be sized in proportion to the linear magnification of the IPs and DNs in comparison to the original negatives. The following chart specifies the apertures for different linear magnifications:

Linear Magnification	Aperture to Measure Original Negatives	Aperture to Measure IPs and DNs
2X enlargement	2mm	4mm
1.5X enlargement	2mm	3mm
1.3X enlargement	3mm	4mm
1X for small negs.- 35mm	2mm	2mm
1X for med. to large negs.- 2 ¼" to 8"x10"	3mm	3mm
1X for large negs.- 8"x10"	4mm	4mm
0.75X reduction	4mm	3mm
0.67X reduction	3mm	2mm
0.5X reduction	4mm	2mm

4.8 Densitometric Evaluation of Interpositives

In order to insure that all interpositives are processed to the proper contrast and the aimpoint density is achieved for the shadow density, the following qualitative, evaluative procedure shall be used by the contracting institution.

Of the random sample group examined for defects, ten original negatives (1% of one lot) and their corresponding interpositives shall be measured using a transmission densitometer (X-Rite Model 310 or equivalent color densitometer with appropriate apertures as cited above) to determine the following information:

density ranges of the original negative (Dmax-Dmin) and the interpositive (corresponding Dmax-Dmin),

contrast of the interpositive (contrast = density range of IP divided by the density range of the original), and

shadow density of the interpositive (corresponding to the shadow density on the original negative).

The sensitometric calculations and densitometric measurements shall be averaged and the standard deviation calculated. The results shall be evaluated in the following manner:

Contrast- As a sample group, the mean (average) contrast of the 1% random sample of interpositives shall be 1.0 ± 0.12. Therefore, the allowable range of contrast for the sample group shall be between 0.88 and 1.12.

Additionally, the contrast for individual interpositives shall be 1.0 ± 0.30. Therefore, any one interpositive within the sample group may have a contrast between 0.70 and 1.30.

Shadow Density- As a sample group, the mean (average) shadow density of the 1% random sampling of interpositives shall be the approved aim point density 2.5 ± 0.12. Therefore, the allowable range for the shadow density for the sample group shall be between 2.38 and 2.62.

Additionally, the shadow density for individual interpositives shall be a the approved aim point density 2.5 ± 0.30. Therefore, the actual range of acceptable shadow density of any one interpositive within the sample group shall be between 2.2 and 2.8.

4.9 Densitometric Evaluation of Duplicate Negatives

In order to insure that all duplicate negatives are processed to the proper contrast and the aimpoint density is achieved for the shadow density, the following qualitative, evaluative procedure shall be used by the contracting institution. Of the random sample group examined for defects, ten original negatives (1% of one lot) and their corresponding duplicate negatives shall be measured using a transmission densitometer (X-Rite Model 310 or equivalent color densitometer with an appropriate aperture as cited above) to determine the following information:

density ranges of the original negatives (Dmax-Dmin) and the duplicate negatives (corresponding Dmax-Dmin),

contrast of the duplicate negatives (contrast = density range of DN divided by the density range of the original), and

shadow density of the duplicate negatives (corresponding to the shadow density on the original negative).

The densitometric measurements shall be averaged and the standard deviation calculated. The results shall be evaluated in the following manner:

Contrast- As a sample group, the mean (average) contrast of the 1% random sample of duplicate negatives shall be 1.0 ± 0.12. Therefore, the allowable range of contrast for the sample group shall be between 0.88 and 1.12.

Additionally, the contrast for individual duplicate negatives shall be 1.0 ± 0.30. Therefore, any one duplicate negative within the sample group may have a contrast between 0.70 and 1.30.

Shadow Density- As a sample group, the mean (average) shadow density of the 1% random sampling of duplicate negatives shall be the approved aim point density 0.5 ± 0.12. Therefore, the allowable range for the shadow density for the sample group shall be between 0.38 and 0.62.

Additionally, the shadow density for individual duplicate negatives shall be at the approved aim point density 0.5 ± 0.30. Therefore, the actual range of acceptable shadow density of any one duplicate negative within the sample group shall be between 0.2 and 0.8.

4.10 Packaging

In addition to the above, the contracting institution will visually inspect deliverables for the following packaging defects: defective enclosures, incorrect labeling of poly pages, folders or boxes, and overstuffed boxes.

4.11 Testing Results, Acceptance and Rejection

If more than 5% of a batch of interpositives or 5% of a batch of duplicate negatives, based on their respective sample, are found to be defective, for any of the reasons listed in Visual Examination and Labeling, the entire lot of 1,000 will be returned to the contractor for re-inspection and reduplication

of defective items and correction of labeling errors at the contractor's expense. When calculating the 5% limit, to avoid rounding errors the specific number shall always be rounded up to the next higher whole number. If it is necessary to return a lot to the contractor for correction of defective items, the contractor shall maintain a list of the interpositives or duplicate negatives selected for reduplication upon this re-inspection process. This list shall be included with the lot when it is returned to the contracting institution for the second time. If fewer than 5% of the interpositives or 5% of the duplicate negatives from a batch are found to be defective, then only those found to be defective shall be returned to the contractor for correction. Individual IPs or DNs found to be defective, using the $\pm$ 0.30 limit, as part of the densitometric evaluation shall be returned to the contractor for correction.

In instances where incorrect shadow density (indicating a pervasive exposure or processing problem) or incorrect contrast (indicating a pervasive processing problem) is determined using the evaluation procedure described in Densitometric Evaluation, the entire lot of 1,000 will be returned for reduplication of the entire lot at contractor's expense. In order to confirm that the limits cited above have been exceeded, if the calculated average contrast or average shadow density value(s) for a batch of or roll of interpositives or duplicate negatives exceeds the limits, an additional 10 images shall be randomly selected from the batch or roll and the average contrast and average shadow density shall be recalculated using the total of 20 images or a 2% sample.

5.0 Deliveries or Performance

5.1 Performance Schedule

The contracting institution requires delivery of 1,000 interpositives, 1,000 duplicate negatives, the copied original film negatives, and the uncopied deteriorated original negatives every four (4) weeks after the start of production, and continuing thereafter until all the interpositives and duplicate negatives have been completed.

The contracting institution will evaluate equally, as regards time of delivery, offers that propose delivery of each quantity within the applicable delivery period specified above. Offers that propose delivery that will not clearly fall within the applicable required delivery period specified above, will be considered non-responsive and rejected. The contracting institution reserves the right to award under either the required delivery schedule or the proposed delivery schedule, when an offeror offers an earlier delivery schedule then required above. If the offeror proposes no other delivery schedule, the required delivery schedule above will apply.

5.2 Safeguarding Material

The archival nature of these records requires extreme care in handling the original negatives, the interpositives, and the duplicate negatives. Original negatives and corresponding interpositives and duplicate negatives will be transported in separate shipments from the contractor to the contracting institution via an accepted overnight carrier or in a vehicle with an ambient temperature of between 55 and 72 degrees F. If the latter conveyance is used, during transportation the materials shall be under the personal surveillance and in the custody of a representative of the contractor at all times. The interpositives and duplicate negatives shall be shipped first, the contractor(s) shall not ship the original negatives until the contracting institution acknowledges receipt of the interpositives and duplicate negatives. All materials shall be packaged in an appropriate manner to insure that no materials will be damaged during transit. Containers shall not be placed one on top of another. Cartons shall be placed in the vehicle in a manner that will prevent them from tipping over; this is to prevent spillage which might result in the materials being mixed

together, being lost, or damaged.

Insurance coverage on the original negatives, interpositives, and duplicate negatives shall be provided by the contractor on a 'door to door' basis; i.e., from time the shipment leaves the contracting institution until the receipt of the finished work and originals returned to the contracting institution. The insurance value of each negative shall be $_____.

5.3 Scheduling Delivery

It is the responsibility of the contractor to insure that arrival of shipments at the contracting institution occurs between the hours of 8:30 a.m. and 4:00 p.m., Monday through Friday, excluding State and Federal holidays.

6.0 SPECIAL CONTRACT REQUIREMENTS

The contracting institution requires that the successful offeror provide insurance to cover the loss of or damage to each original negative (valued at $ _____ per negative) to be furnished to the contractor in performance of this contract. The insurance shall be provided by specific policy(ies) or by inclusion of the risks in the contractor's existing policy(ies), and shall be issued for the duration of contract performance. A copy of the insurance policy(ies) shall be sent to the contracting institution not later than thirty (30) days after contract award.

7.0 RECEIPT OF MATERIALS

Please fill out this form and return to the contracting institution, immediately upon receipt of the items listed in the attached inventory.

I am in receipt of the following materials or objects:

Shipment Number:

First and Last Item Numbers (for general collection identification):

Missing Items (please itemize, or describe individual items or shipment variations as they differ from attached inventory):

Signature of Staff Member Responsible for Inventory Control:

_____

Name of Institution or Company:

_____

Date:

_____

8.0 CONTRACTOR PROPOSALS

Offerors shall provide the following information to the contracting institution in conjunction with a price quotation for the duplication of the negative collection.

8.1 Technical/Managerial Proposal

Comprehensive responses to the following requirements are necessary to enable the contracting institution to evaluate the offeror's understanding of, capabilities, and approaches to accomplish the stated requirements. General statements that the offeror understands the problem, and can or will comply with the requirements, will be considered to be inadequate. Clarity and completeness are essential.

Section 1 - Interpositive and Duplicate Negative Production Requirements:

Offerors shall address each of the requirements as listed in **Scope of Work**, set forth in **Receipt of Original Negatives**, **Printing of Interpositives**, **Printing of Duplicate Negatives**, **Processing of Interpositives and Duplicate Negatives**, **Storage of Interpositives and Duplicate Negatives**, etc. A detailed response shall provide an explanation indicating offeror's ability and methodology to be utilized to meet each requirement.

Section 2 - Work Site/Equipment:

Offerors shall submit detailed information regarding their in-house copying capabilities, including but not limited to the security and environmental conditions (i.e. the levels and range of variation of temperature and relative humidity) in work and storage facilities, etc. Offerors shall describe in detail all processing and inspection equipment to be utilized in the creation and inspection of interpositives and duplicate negatives.

Section 3 - Qualifications/Experience of Personnel:

The personnel proposed by the offeror and accepted by the contracting institution are considered critical to the successful performance of this procurement. The offeror shall identify and provide resumes of all key personnel in sufficient detail to determine their qualifications, education, availability, and relevant experience working with similar materials or on similar projects. (**See Key Personnel**)

Section 4 - Quality Control:

The offeror shall submit a detailed Quality Control Plan. In the plan, the offeror shall describe the methods to be utilized to maintain the quality and safety of the negatives. The description shall demonstrate complete compliance with all requirements of this solicitation document as they apply from the contractor's receipt of the negatives through delivery and acceptance by the contracting institution. (**See Quality Control Procedures**)

Section 5 - Previous Experience:

Offerors shall submit a list of three (3) previous projects similar in nature to this requirement that have been performed in the past four (4) years. A brief description of contract work scope and responsibilities is to be provided along with the date of award, period and place of performance, name, address and telephone number of contact.

Section 6 - Use of Subcontractors:

Offerors must identify all subcontractors and their responsibility in the project. Similar information as required to determine the responsibility of the prime contractor must be submitted for all subcontractors.

Section 7 - Questions/Problems:

Offeror is to provide a list of questions and/or problems which must be addressed prior to contract award and beginning of performance. If the offeror takes exception to a particular task or condition, it must be clearly identified in this section.

Section 8 - Managerial Capabilities:

Provide a description of the offeror's proposed plan for project management, including staffing and scheduling. Offeror shall describe the size of the company and must submit information to support their ability to be financially responsible. This may be in the form of an annual report, letters of credit from a bank, or profit and loss statements certified by a public accountant.

All information submitted should be marked confidential if applicable.

9.0 EVALUATION FACTORS FOR AWARD

9.1 Evaluation Criteria

Contractor selection will be based on the evaluation of proposals in accordance with the responses received to the criteria outlined in **Contractor Proposals**, with the award to be made to the offeror with the combination of technical and price proposals which is most advantageous to the contracting institution. Emphasis will be on selecting the most effective technical proposal which is within the available resources of the contracting institution.

The contracting institution also reserves the right to reject any or all proposals received and/or request clarification or modification of proposals. The contracting institution reserves the right to determine a competitive range for negotiation based upon the technical and cost acceptability of proposals. In addition, the contracting institution reserves the right to award a contract without discussions.

Technical evaluators will not have access to cost data until such time as a final technical ranking of all proposals is completed. A merger of the two evaluations, cost and technical, will then be conducted to select the optimum proposal or proposals on which further negotiations will be conducted.

Cost evaluation will include analysis of the total cost and cost element, (if applicable) to perform the required work. The total cost, as derived by the evaluators or supplied by the offeror, shall be submitted by the offeror and shall constitute the total firm-fixed unit price for that service or deliverable.

9.2 EVALUATION FACTORS

The acceptability of the technical proposal will be evaluated with respect to four (4) major factors. Technical factors are listed in descending order of importance. The technical proposal is worth more than the cost proposal, and when technical proposals are relatively equal in technical merit, cost will increase in importance.

9.2.1 Technical Factors

Factor 1 Overall technical approach, proposed methodology, and demonstrated understanding of requirements.

Factor 2 Quality control plan and procedures.

Factor 3 Previous production experience and qualifications of key personnel.

Factor 4 Adequacy of equipment.

9.2.2 Costs

Factor 1 Reasonableness of cost.

Appendix A:

Approaches to the Tone Reproduction for the Duplication of Historic Negatives by the Interpositive/ Duplicate Negative Method

By Steven Puglia, Preservation and Imaging Specialist
National Archives and Records Administration

There are several approaches to the tone reproduction that are used by photographic labs that duplicate historic collections. I call the traditional approach the "Standardized Exposure Method," where each original negative is exposed using the same "standard" settings to produce the interpositives. In this case, the density of the interpositives (IPs) will vary proportionally to the overall density of each original negative. The duplicate negatives (DNs) are exposed at a "standard" exposure from the interpositives. The problem with this approach is that very dense original negatives or negatives with very large density ranges may cause the highlight portion of the image to be rendered on the "toe" of the film's characteristic curve causing a loss of detail in the image on the interpositive. One solution to this problem was conceived by Doug Munson at Chicago Albumen Works, he developed the technique of producing a "shadow mask" or a second less-dense interpositive that is sandwiched with the normal interpositive when printing the duplicate negative to extend the tonal scale and minimize loss of detail. The shadow mask method works well, particularly for collodion wet-plate negatives, but is more expensive and requires an extra sheet of film. Another disadvantage of the "Standard Exposure Method" approach is that it is very hard to evaluate the tone reproduction of IPs and DNs produced. Since the overall density of each IP and DN varies, it is impossible to perform an objective measurement using a densitometer.

Another approach was conceived at the National Archives, with input from staff at the Library of Congress. This second approach to tone reproduction I call the "Shadow Normalization Method." With this approach the shadow density of each original negative is measured and the exposure for each interpositive is adjusted to reproduce the shadow portion of the image on the interpositive at a selected aimpoint density near the "shoulder" of the characteristic curve. The duplicate negatives are exposed using a "standard" exposure. This approach eliminates the problem of loss of detail on the interpositive with very dense negatives and allows you to objectively evaluate the tonal reproduction of both the interpositives (IPs) and duplicate negatives (DNs) using a densitometer. An assessment of an entire batch of IPs and DNs can be made from an analysis of a sampling of IPs and DNs, rather than inspecting every single IP and DN. Also, the staff at the National Archives measured the variability of standard photographic duplication systems and was able to establish plus-or-minus limits for both the average shadow density of a batch (directly controlled by exposure and indirectly effected by development) and the average contrast of a batch (controlled by development) of IPs and DNs; as well as broader plus-or-minus limits for individual IPs and DNs. The disadvantage to this approach is that production of the IPs is a little more complex, because of having to measure the shadow density of each negative, and the quality control measurements take some time.

The final approach also was conceived at the National Archives, which I call the "Hybrid Standardized Exposure with Highlight Normalization Method," combines aspects of the two previous approaches. In this approach, the interpositives from normal density negatives are exposed at a "standard" exposure and the exposure is adjusted only for very dense negatives by measuring the highlight density and placing the image at an aimpoint near the "toe" of the curve. Again, the duplicate negatives are all exposed at a "standard" exposure. This approach somewhat simplifies the production of the IPs, measurements are only made on negatives that are very dense based on a simple visual evaluation, and eliminates the problem with the "Standard Exposure Method" of loss of highlight detail from very dense original negatives. However, the hybrid

method only allows for the measurement of the average contrast for a batch of IPs and DNs; since there is no consistent aimpoint for exposure, the average aimpoint density for a batch is not meaningful.

Appendix B: Sample QC Sheet- Special Media Preservation Lab- National Archives

B&W Negative Duplication Project- Interpositive Quality Control Sheet- 70mm Camera System

IP Roll #: Date Started: Date Completed:

RG: Series:

1st Frame/Neg #: Last Frame/Neg #:

1st Target Density (Aim 2.5, Range 2.38 to 2.62): End Target Density (Aim 2.5, Range 2.38 to 2.62):

1st Resolution Target (Patch or higher): End Resolution Target (Patch or higher):

VISUAL EXAMINATION: This roll has been inspected for the following defects, all criteria checked pass insp.

_____Nicks/Gouges	_____Scratches	_____Buckling	_____Dirt/Dried Chemicals
_____Pinholes	_____Fingerprints	_____Stains	_____Water Spots
_____Flow Marks	_____Roller Marks	_____Static Marks	_____Uneven Density
_____Newton's Rings	_____Images Reversed	_____Incomplete Images	_____Images Not Centered
_____Images Skewed	_____Images Out of Focus		

DENSITOMETRIC EVALUATION: Ten interpositives (five selected from the beginning of the roll and five from the end of the roll) have been inspected for accuracy of the tone reproduction. This represents approx. a 3% sample.

	High Density (IP: shad. 2.2-2.8) (Neg: highlight)	Low Density (IP: highlight) (Neg: shadow)	Den. Range (high – low)	IP Contrast (D-range IP / D-range Orig. Neg) (Range for ind. IPs 0.7 to 1.3)
IP (1st on roll)	*			
Original Neg.				
IP (5th on roll)	*			
Original Neg.				
IP (10th on roll)	*			
Original Neg.				
IP (15th on roll)	*			
Original Neg.				
IP (20th on roll)	*			
Original Neg.				
IP (last frame on roll)	*			
Original Neg.				
IP (5th from end)	*			
Original Neg.				
IP (10th from end)	*			
Original Neg.				
IP (15th from end)	*			
Original Neg.				
IP (20th from end)	*			
Original Neg.				
Average Shadow Density of IPs	* (Range 2.38 to 2.62)		Average Contrast of Interpositives:	(Range 0.88 to 1.12)

TONE REPRODUCTION STANDARD: These interpositives have been produced using a normalized shadow density approach to the tone reproduction on polyester-based Kodak Panchromatic Separation Film 2238. The film has been developed to produce a contrast (gamma) of 1.0. Exposure for each interpositive has been adjusted individually so that the shadow is rendered on the interpositives at an aimpoint density of approximately 2.5; all images are rendered on the straight-line of the film's characteristic curve.

FILM PROCESSING: These interpositives have been processed to meet all appropriate archival standards for B&W silver gelatin film. Residual hypo is below the allowable limit of 0.014 grams per sq. meter, as per ISO 10602/ ANSI IT9.1-1996. A methylene blue test is conducted on a daily basis for this type of film from the processor used to process this roll.

ROLL INSPECTED BY: DATE:

Appendix C: Sample QC Sheet- Special Media Preservation Lab- National Archives

B&W Negative Duplication Project- Duplicate Negative Quality Control Sheet- 70mm Format

DN Roll #: Date Printed: Date Processed:

RG: Series:

1st Frame/Neg #: Last Frame/Neg #:

1st Target Density (Aim 0.5, Range 0.38 to 0.62) End Target Density (Aim 0.5, Range 0.38 to 0.62):

1st Resolution Target (Patch or higher): End Resolution Target (Patch or higher):

VISUAL EXAMINATION: This roll has been inspected for the following defects, all criteria checked pass insp.

_____Nicks/Gouges	_____Scratches	_____Buckling	_____Dirt/Dried Chemicals
_____Pinholes	_____Fingerprints	_____Stains	_____Water Spots
_____Flow Marks	_____Roller Marks	_____Static Marks	_____Uneven Density
_____Newton's Rings	_____Images Reversed	_____Incomplete Images	_____Images Not Centered
_____Images Skewed	_____Images Out of Focus		

DENSITOMETRIC EVALUATION: Ten duplicate negatives (five selected from the beginning of the roll and five from the end of the roll) have been inspected for accuracy of the tone reproduction. This represents approx. a 3% sample.

	High Density (DN: highlight) (Neg: highlight)	Low Density (DN: 0.2 to 0.8) (Neg: shadow)	Den. Range (high - low)	DN Contrast (D-range DN / D-range Orig. Neg) (Range for ind. DNs 0.7 to 1.3)
DN (1st on roll)	_____	*_____	_____	
Original Neg.	_____	_____	_____	_____
DN (5th on roll)	_____	*_____	_____	
Original Neg.	_____	_____	_____	_____
DN (10th on roll)	_____	*_____	_____	
Original Neg.	_____	_____	_____	_____
DN (15th on roll)	_____	*_____	_____	
Original Neg.	_____	_____	_____	_____
DN (20th on roll)	_____	*_____	_____	
Original Neg.	_____	_____	_____	_____
DN (last frame on roll)	_____	*_____	_____	
Original Neg.	_____	_____	_____	_____
DN (5th from end)	_____	*_____	_____	
Original Neg.	_____	_____	_____	_____
DN (10th from end)	_____	*_____	_____	
Original Neg.	_____	_____	_____	_____
DN (15th from end)	_____	*_____	_____	
Original Neg.	_____	_____	_____	_____
DN (20th from end)	_____	*_____	_____	
Original Neg.	_____	_____	_____	_____
Average Shadow Density of DNs		*_____	Average Contrast of Dupe Negs:	_____
	(Range 0.38 to 0.62)			(Range 0.88 to 1.12)

TONE REPRODUCTION STANDARD: These duplicate negatives have been produced using a normalized shadow density approach to the tone reproduction on polyester-based Kodak Aerographic RA Duplicating Film 2425. The film has been developed to produce a contrast (gamma) of 1.0. Exposure for the roll of duplicate negatives has been adjusted so that the shadow is rendered on the duplicate negatives at an aimpoint density of approximately 0.5; all images are rendered on the straight-line of the film's characteristic curve.

FILM PROCESSING: These duplicate negatives have been processed to meet all appropriate archival standards for B&W silver gelatin film. Residual hypo is below the allowable limit of 0.014 grams per sq. meter, as per ISO 10602/ ANSI IT9.1-1996. A methylene blue test is conducted on a daily basis for this type of film from the processor used to process this roll.

ROLL INSPECTED BY: DATE:

Appendix D: Variability for 70mm Roll-film Interpositives Produced at the National Archives

The Still Photography Section of the Special Media Preservation Laboratory (NWTS) produced a total of 139 rolls of preservation quality interpositives, approximately 41,700 interpositives, during the six month period between October 1997 and March 1998.

The interpositives were produced by three different operators using three different Maron 70mm duplication cameras and Eastman Kodak Panchromatic Duplicating Film SO-202. During the six month time period, at least three different emulsion numbers of the SO-202 were used. One photographer processed all film, in an Allen Products deep-tank continuous-strand processor, and performed all inspections. The variability of the average shadow density and average contrast for each roll was calculated from results reported on the inspection sheets for each roll of film. The shadow density aimpoint for the interpositives was a density value of 2.60 and the contrast aimpoint was a value of 1.0.

Variability of Individual Interpositives-

	# of IPs	Average Shadow Density	Standard Deviation	Average Contrast	Standard Deviation
Camera #1	68	2.62	0.11	1.04	0.09
Camera #2	112	2.63	0.09	1.05	0.09
Camera #3	96	2.62	0.08	1.03	0.08
Overall:	276	2.62	0.09	1.04	0.09

Variability of Rolls of Interpositives-

	# of Rolls	Average Shadow Density	Standard Deviation	Average Contrast	Standard Deviation
Camera #1	35	2.62	0.06	1.04	0.04
Camera #2	56	2.63	0.05	1.05	0.04
Camera #3	48	2.63	0.06	1.04	0.04
Overall:	139	2.62	0.06	1.04	0.04