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29 August 2022

GUIDELINE OF TEST PROCEDURES FOR FILM PROCESSING AND INTENSIFYING SCREENS

This guideline provides details of all the procedures needed to be followed in order to perform the necessary tests for film processing and intensifying screens.

Document History

Final Version	Reason for Amendment	Effective Date
0	First issue and published for implementation	June 2010
1	– Content structured on the new SAHPRA Guideline Template – A unique document number SAHPGL-RDN-XR-14 allocated to this Guideline	August 2022

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Contents

Glossary

Abbreviation/ Term	Meaning
FFD	Focus Film Distance
Base and Fog	refers to the density measured in part of the film, which was shielded from intentional exposure when the test strip was made
Densitometer	A device that measures the degree of darkness of a photographic or exposed film
Emulsion	The radiation sensitive coating of an x-ray film consisting of silver halide
Monochromatic	X-ray film that is compose of one color
Orthochromatic	Type of film sensitive to blue and green light hence can be processed with under pure red filter
Sensitometer	Instrument used to measure the sensitivity of an x-ray image
Panchromatic	Type of film sensitive to any lights and therefore can only be processed in total darkness
Unsharpness	The loss of spatial resolution in a radiographic film or image
Thiosulphate	Is a fixer chemical used to dissolve the unexposed silver halide of an x-ray film

1. INTRODUCTION

Intensifying screens are used to shorten exposure times and, sometimes to increase the photographic contrast. While without good contact between the film and screens of the cassette, detail will be lost on the radiograph. Therefore, it is routinely necessary to perform a screen contact test on all your cassette. This guideline deals with all the procedures needed to be followed in order to perform these necessary tests.

1.1 Purpose

The purpose of this guide is to ensure that all procedures are followed when it comes to performing necessary test for film and intensifying screens. It also shows which necessary equipment are to be used for these tests even the preparation of which.

1.2 Scope

The scope of this guideline is intended to give guide to how to run the tests from darkroom safelight test, all the way to assessing point of all the tests.

2. LEGAL PROVISION

The guideline is implemented in promulgating the Hazardous Substances Act 15, 1973 (Act15 of 1973). Provisions regarding medical control and monitoring of radiation workers is stipulated in the Regulation No.R 1332 of 3 August 1973.

3. DARKROOM SAFELIGHT TEST (FOG TEST)

3.1 Purpose

3.1.1 To ensure that the condition in the darkroom complies with the minimum conditions as prescribed

3.2 Equipment Required

- Loaded cassette (18 x 24 cm)
- Densitometer
- Cardboard
- Stopwatch / Timer
- Tape measure
- X-Ray unit

3.3 Procedure

3.3.1 Expose the loaded cassette to radiation to produce an optical density of ± 0.8 – 1.0.

- ± 40 kVp and 2 mAs at 100 cm FFD for a 400-speed system to sensitize the film emulsion.

3.3.2 In the darkroom, switch off all safelights.

3.3.3 Unload the film from the cassette and place it on the work bench or area to be assessed.

3.3.4 Cover one half of the film with the piece of cardboard.

3.3.5 Switch on the safelight(s), activate the stopwatch and wait for a period of two minutes.

3.3.6 Process the film.

3.4 Image

The film will display two areas of uniform densities, divided by a straight line (line represented by the edge of the cardboard that had covered the one half of the film).

3.5 Interpretation

3.5.1 Zero and calibrate the densitometer.

3.5.2 Measure the densities on each half of the film (± 1cm from the dividing line).

3.5.3 The measured density difference may not exceed a maximum of 0.05.

3.6 Corrective Action

3.6.1 Verify the distance from the safelight(s) to the work bench or feeding tray(s).

- Distance must be at least 120 cm.

3.6.2 Check the wattage of light bulbs in the safe lights (15 – 25 Watts).

3.6.3 Verify that the correct safelight filters are used for the film types in use.

- U/V-Blue Film (Monochromatic): Amber Filter (mixture of red, orange and some yellow.
- U/V-Blue-Green (Orthochromatic): Pure Red Filter.
- Multiformat- or Laser camera Film (Red or amber sensitivity): Green Filter.
- Panchromatic Film (Cine-Film): Total darkness.

3.6.4 Inspect the safelight filters for cracks or pinholes.

- A process of elimination must be used to correct each of the above parameters and the test must be
- repeated until the requirements are met.

4. HOW TO CALCULATE SENSITOMETRIC CONTROL PARAMETERS

4.1 Procedure

4.1.1 Expose a film on both sides using a sensitometer. (Only emulsion side for single emulsion film – two exposures).

4.1.2 Process the sensitometric control strip.

4.1.3 Measure the densities using a densitometer.

4.2 Contrast Index

4.2.1 Select two steps within the useful density range (0.25 above base + fog & 2.0 above base + fog).

4.2.2 The steps should not be adjacent but should show an adequate density difference, e.g. 4 - 7 step separation.

4.2.3 Measure and record the densities of the two steps and calculate the density difference between these steps.

4.2.4 The same two steps should be monitored daily.

4.2.5 The contrast index is plotted daily on a graph

- **Acceptable variation**: Density values of 0.15 above or below the speed index.

4.3 Speed Index

4.3.1 Measure the densities on the strip with a densitometer.

4.3.2 Select a step with a density of 1 above base + fog (towards the middle of the straight-line portion of the characteristic curve) under normal circumstances.

4.3.3 Measure and record the density of this step.

4.3.4 This selected step will be the step that is measured daily to monitor the speed index.

4.3.5 Daily density readings of this step are plotted on a graph.

- **Acceptable variation**: Density values of 0.15 above or below the speed index.

4.4 Base and Fog Level

4.4.1 The density is measured in the part of the film, which was shielded from intentional exposure when the test strip was made (e.g. centre of the film or step 1).

4.4.2 Plot this value (fog index) on a graph.

Any change taken place will be towards an increase in fog level. A fog level above 0.3 is unacceptable.

If the fog level enters the useful density range there will be deterioration in contrast

Please note that once established, these index values should not change unless a deliberate change or changes have been made to the processing standards, for example:

- the introduction of a new film type;
- the use of chemistry from a different supplier;
- willful adjustment of the developer temperature;
- willful adjustment of the developer and/or fixer replenishment rates, and
- change in the processing cycle time.

5. PROCEDURE FOR ESTABLISHMENT OF A SENSITOMETRIC PROCESSOR CONTROL PROGRAMME

5.1 Purpose

To determine the standard operating levels for all processors in the department – i.e. STANDARD PROCESSING CONDITIONS. These levels should be the same for all processors processing the same film type.

5.2 Equipment Required

- Sensitometer
- Densitometer
- Digital thermometer
- Stopwatch
- Control emulsion (film type most frequently used)
- Processor and fresh chemicals
- Control chart

5.3 Preparation

5.3.1 Darkroom

Darkroom must be checked for correct safelight conditions and white light leaks.

5.3.2 Processor

Perform all the actions of a processor service according to the manual of your processor and the recommendations of the supplier of your chemicals, which should include the following:

5.3.2.1 Clean the processor rollers and replenishment tanks thoroughly. Flush out all lines, including

the tubing from the replenishment.

5.3.2.2 Replace the developer re-circulation filter.

5.3.2.3 Use a checklist to inspect all components of the processor. Inspect alignment and wear points.

5.3.2.4 Correct any mechanical problems. Make note of and order new parts when indicated. Record this information.

5.3.2.5 Lubricate all necessary points.

5.3.2.6 Carefully mix and install fresh chemicals in the following order:

a. Fixer and developer replenishment tanks. While operating the replenisher pumps temporarily to assure that all fresh water is flushed out of the replenisher lines and to assure that the replenisher pumps are functioning properly.

b. Flush processor fixer tank with fresh water

c. Fill fixer tank and replace rack.

d. Flush developer tank with fresh water.

e. Fill developer tank and replace rack. Make note of chemical brand, type, order code or other identification and serial number. **Also note amount of starter solution added to the developer solution in the tank.** Replace remaining racks.

5.3.2.7 Replace remaining racks.

5.3.2.8 Perform start-up procedure

5.3.2.9 Allow the processor to operate for 30 minutes.

5.3.2.10 Check and record:

a. Developer temperature

b. Fixer temperature

c. Wash water temperature. The chemistry temperatures should be within 0.5 0C of those recommended

d. Replenishment rates

e. Film transport time

5.3.2.11 Process films and wait until approximately 50 (35 x 43 cm) films have been processed or the developer is seasoned.

a. To season the developer, use “starter” solution obtainable from the chemical supplier

and add the required quantity to the developer solution in the developer processing tank (amount in millilitre per developer tank volume of your processor) to season the developer.

5.4 Procedure

5.4.1 Expose at least six sensitometric films with the sensitometer under the recommended safelight conditions. Double emulsion film should be exposed on both sides of the film. Single emulsion film should be exposed only on the emulsion side.

5.4.2 Wait at least 30 minutes but not longer than 4 hours before processing of the films.

5.4.3 Process the films - crosswise, same position on feed tray (this position should be standardised).

5.4.4 Zero and calibrate the densitometer.

5.4.5 Read the densities on the six strips. Be sure to read the densities in the centre of each strip, not near the edges. Check the zero and calibration of the densitometer after reading each strip.

5.4.6 Determine the average of the densities of the six strips.

5.4.7 Select and mark the steps producing the densities nearest to 0.25; 1.0 and 2.0 above the base-plus-fog level.

5.4.8 Determine the appropriate values and record these values and indicate the control limits on the control chart.

5.4.8.1 Three values should be recorded:

- Contrast Index (± 0.15)
- Speed Index (± 0.15)
- Base and Fog (± 0.03) and less than 0.3

5.4.9 Record all operating levels on the processor maintenance standard form and the control chart (graph).

5.4.10 Adjust each processor in the department that uses the same type of chemistry and film to produce the same density for the same steps on the sensitometric control strip that have received the same exposure.

5.5 Corrective Action

If you have difficulties with any of the above procedures, contact the technical service representative from the firm that manufacturers your film and chemistry.

6. PROCEDURE FOR DAILY SENSITOMETRIC CONTROL OF SPEED, CONTRAST AND BASIC FOG FOR AUTOMATIC PROCESSOR

6.1 Purpose

Sensitometric control would indicate variations in the processing conditions before they are noticed on the processed radiographs and the cause for the variation can thus be rectified before marked changes are visible on the radiographs or before breakdown of the processing cycle occurs.

6.2 Requirements

- Sensitometer
- Densitometer
- Digital thermometer
- Control emulsion

6.3 Conditions and Data to be Recorded

6.3.1 The standardised processing conditions previously established must be adhered to.

6.3.2 The following data must be recorded on:

a. The sensitometric film

- Date and time film was processed
- Colour of sensitometric exposure
- Processor being evaluated
- Measured Speed Index, Contrast Index, Base and Fog level

b. The control chart

- Speed Index, Contrast Index, Base and Fog.
    - This information is charted in terms of deviation from established normal values.For example, if the normal Speed Index density = 1.15 and the sensitometric reading 1.20 it would be charted as +0.05 from the normal value.
- Processor Maintenance Standards
    - Developer temperature
    - Fixer temperature
    - Wash water temperature

- Developer Replenishment rate
- Fixer Replenishment rate
- Dryer temperature

6.4 Control Indexes

6.4.1 Speed Index

- Speed index refers to that density step chosen in the standardization procedure which has a density of ± 1 above base + fog.
- Acceptable variation is: 15 - 20 % i.e. 0.15 above or below the standardised speed index.

6.4.2 Contrast Index

- Contrast index refers to the density differences between two steps, in the useful density range (0.25 - 2.0 above base + fog), chosen in the standardization procedure. The steps should not be adjacent but should show an adequate density difference (4 - 7 steps).
- Acceptable variation is: 15 - 20 % i.e. 0.15 above or below the standardized contrast index.

6.4.3 Base And Fog

- Base and fog refers to the density measured in part of the film, which was shielded from intentional exposure when the test strip was made.
- An expected change will be towards an increase in the fog level.
- A fog level above 0.25 is suspect and a fog level of 0.30 is unacceptable.

6.4.4 Method

6.4.4.1 Follow the manufacturer's start-up procedure every day.

6.4.4.2 Run several clean-up sheets and check them for roller marks and scratches (Use exposed unprocessed film).

6.4.4.3 Allow sufficient time for the processor temperature to stabilize - ± ½ hour.

6.4.4.4 Check the following:

a. Solution temperatures
b. Replenishment rates
c. Water flow rates
d. Dryer temperature

6.4.4.5 Expose the control film(s) with the sensitometer under safelight conditions. Dual emulsion

film should be exposed on both emulsions.

6.4.4.6 Process the film (Feed film at the standardized position on the feed tray e.g. crosswise / lengthwise and left / centre / middle).

6.4.5 Image

The processed film will show two series of stepped exposures.

6.4.6 Interpretation

6.4.6.1 Zero and calibrate the densitometer.

6.4.6.2 Read the density of the base-fog level.

6.4.6.3 Read the density levels of the two steps representing the contrast index on each strip.

6.4.6.4 Read the density level of the step representing the speed index on each strip.

6.4.6.5 Average the values for the two strips on the film.

6.4.6.6 Plot values on the control chart.

6.4.6.7 Analyse the control charts carefully.

a. Are all three points within the control limits?

b. Are there any apparent trends?

6.4.6.8 If any single point (or points) falls outside of the control limits, run two more strips and verify that the first readings were correct. If points are still outside the limits, corrective action must be taken before any patient films are processed.

6.4.6.9 Record relevant data on the control charts.

6.4.7 Corrective Action

6.4.7.1 Make the adjustments that you believe will bring the processor back into control.

a. If control limits are exceeded check the following:

i. Developer temperature

ii. Replenishment rates

iii. Water flow rates

iv. Water temperature (if appropriate)

v. Re-circulation

vi. Filters

vii. Batch mix dates

viii. Recent maintenance

ix. Film fog

x. Transport time

xi. Control emulsion

b. If trends are noted in the control chart, check the following:

i. Developer temperature

ii. Replenishment rates

iii. Change in mix, types and number of films processed

iv. Proper mixing of replenisher

v. Control emulsion age or fog

vi. Leaks from overflow from the fixer tank getting into the developer tank

vii. Gremlins

6.4.7.2 Make only one adjustment to the processor at a time.

6.4.7.3 After each change run another sensitometric strip.

6.4.7.4 Record the types of changes made and the resultant change in the three control parameters.

6.4.7.5 Special considerations (Miscellaneous)

- A processor quality control programme can only be effective if the processors are maintained in a clean, functional condition as intended by the manufacturer.
- A sensitometric control strip should be processed after any maintenance or cleaning operation.
- All maintenance and cleaning should be recorded on a log that is maintained near the processor, since this may provide vital clues to otherwise unexplainable shifts in photographic processor quality.

7. CHANGING OF CONTROL EMULSIONS (FILM CROSSOVER PROCEDURES)

7.1 Purpose

When one nears the end of the box of film that has been used for processor monitoring, crossover testing

should begin with the new box of film.

7.2 Change Over from One Box to The Next (Same Batch/ Emulsion Number)

With the processor within the predetermined limits, one piece of film from the old box and one piece of film from the new box should be exposed sensitometrically and processed with the same orientation. Gross fog, speed and contrast should be read on both films, and the correction factor for the new film should be calculated to adjust the limits.

7.3 Change Over from One Box to The Next (Different Batch/ Emulsion Number)

When changing from one batch of film to the other, six control strips of the old and six strips of the new emulsion should be processed.

The average values for the three basic parameters to be controlled should be determined and the standardised values be changed accordingly on the control chart.

8. TEST FOR RESIDUAL THIOSULPHATE

8.1 Purpose

To assess the efficiency of the washing process thus determining how effective residual soluble fixing salts are removed from the film. Salts remaining on the film will deteriorate the image in time.

8.2 Requirements

Chemical Reagent Test-pack with comparator card Processed radiography

8.3 Method

8.3.1 Select a clear area on the film not carrying a developed density (clear film base).

8.3.2 Spot the reagent on the selected area by means of a dropper (one or two drops).

8.3.3 Leave for two minutes.

8.3.4 Blot the reagent off - a brownish stain will be left on the tested area.

8.3.5 Immediately compare the colour of the stain with the set of tints on the comparator chart in good, ordinary room lighting.

NB The stain will darken when exposed to light, which is bright, especially if it is direct sunlight. A long delay in assessing the depth of the colour will alter the result of the test.

8.4 Interpretation

8.4.1 The card bears a set of tints, which begins with a pale straw colour (corresponding to a low level of residual thiosulphate) and ends with a light tan (corresponding to a higher level of residual

thiosulphate).

8.4.2 Information on the comparator chart relates the tones shown on it to amounts of thiosulphate and the levels of acceptability for keeping radiographs for normal use and for archival storage.

8.4.3 A thiosulphate level of < 3 micro-g/ sq. cm. is recommended for archival permanence.

8.4.4 If the result of the test shows the washing to be inefficient, the fault may lie with one of the following:

a. water flow rate inadequate

b. water circulation pump malfunctioning

c. wash water too cold.

8.4.5 The level must be lower when the keeping-time is longer.

8.4.6 Radiographs kept as medical records in hospital fit into the group classified for ordinary use.

9. VISUAL INSPECTION, IDENTIFICATION AND CLEANING OF CASSETTES

9.1 Purpose of Test

To ensure the cassettes are in good order, are clearly marked with the correct type & speed of intensifying screens, and are identified by number to enable any cassette causing a film fault to be easily traced.

9.2 Equipment Required

- Cassettes to be checked.
- Intensifying screen identification labels (provided by manufacturer).
- Inedible marker.

9.3 Method

9.3.1 Clean external surfaces of cassettes with damp swabs and soap or spirit-based swabs, taking particular care to avoid spirit contact with intensifying screens.

9.3.2 Inspect cassette for damage, particularly the edges, hinge and catches.

9.3.3 Check that the type of intensifying screen is clearly marked.

9.3.4 Check that the cassette is marked with a number, which corresponds to the number on the intensifying screen.

9.4 Assessment and Evaluation

If the cassette is damaged in a way that may allow light to enter the cassette it should be tested for light tightness. Cassettes with damage to the hinge or catches should be sent for repair or discarded. Intensifying

screen identification labels should be replaced if not clear. All cassettes should be marked with indelible marker with a number to correspond to the number on the intensifying screen.

10. ASSESSMENT OF THE LIGHT TIGHTNESS OF CASSETTES

10.1 Purpose of Test

To test for light leakage into cassettes causing film fogging.

10.2 Equipment Required

- Cassette to be tested.
- Light source, e.g. x-ray film illuminator.

10.3 Method

10.3.1 Load the cassette with a film

10.3.2 Place the cassette with suspect area of cassette uppermost, next to light source.

10.3.3 Leave for 15 - 30 minutes.

10.3.4 Process the film.

10.4 Assessment and Evaluation

Any light leakage will cause and area of density on the film. If this light fogging is likely to interfere with an image when the cassette is in use, the cassette must be sent for repair or discarded

11. VISUAL INSPECTION, IDENTIFICATION AND CLEANING OF INTENSIFYING SCREENS

11.1 Purpose of Test

To ensure that the intensifying screens are undamaged, are clearly identified, so that any artefact found on a radiograph can be traced to the offending cassette, and marks are removed.

11.2 Equipment Required

- Cassette to be checked.
- Method of marking screens, e.g. Letraset, biro.
- Cleaning fluid recommend by intensifying screen manufacturer.

11.3 Method

11.3.1 Open cassette and inspect intensifying screen in bring light, looking for marks on the screen surface and any damage to the screen super coat. If the surface of the intensifying screen appears to be damaged a test radiograph must be taken to assess the extent of any artefact.

11.3.2 Check that the intensifying screens are marked with a number which corresponds to the number on the outside of the cassette.

11.3.3 Clean the intensifying screens using fluid recommended by manufacturer and following the instructions carefully.

11.3.4 Leave cassette open to dry for 30 minutes

11.4 Assessment and Evaluation

All the intensifying screens in use should be free from any artefacts and clearly marked for identification purposes. Discard any intensifying screens which cause artefacts. Any intensifying screens that are not identified should be marked using either “Letraset” or a biro. Note that this mark will be permanent, therefore great care must be taken in the marking process. This number should be positioned so as not to impede on the image but be visible within an exposed area. A suggested place is close to the identification window in the cassette.

12. SATISFACTORY CONTACT BETWEEN X-RAY FILM AND INTENSIFYING SCREENS

12.1 Purpose of Test

To assess any unsharpness in the image as a result of poor contact between the x-ray film and intensifying screens.

12.2 Equipment Required

- Cassette to be tests.
- Test object - wire mesh, size 36x44 cm, i.e. large enough to cover all cassettes. Wire diameter about 0.5 mm and mesh spacing about 6 times wire diameter x-ray generator and tube.

12.3 Method

12.3.1 Load the cassette to be tested with an x-ray film.

12.3.2 Place the test object on top of the cassette.

12.3.3 Position the x-ray tube so that the x-ray beam covers the cassette, with the FFD at least 1 m. A distance of 1.5 m is preferable as this minimizes geometrical unsharpeness.

12.3.4 Expose the film. The exposure factors should be such that the kilovolt age does not penetrate the wire mesh (approximately 50 kVp) and the density of the image should be between 1.0 and 2.0. The correct density depends upon the closeness (gauge) of the mesh (see assessment).

12.3.5 Process the radiograph.

12.4 Assessment and Evaluation

Place the film on an x-ray film illuminator and view at normal viewing distance. The outline of the mesh should be clearly seen with a sharp contrast between the densities of the wire and the unfiltered beam. When a close mesh is used the background density needs to be darker (approximately 2.0) and any area of unsharpness will be clearly seen as an area of increased density. Many of the test objects available have a more open mesh and when these are used the density should be about 1.0. The area of unsharpness is then more easily seen as poorly defined edges to the image of the mesh. Any cassettes in which poor film-intensifying screen contact is demonstrated in an area likely to affect the image should be replaced.

13. ASSESSMENT OF THE RELATIVE SPEED OF INTENSIFYING SCREENS FOR REPLACEMENT

13.1 Purpose of Test

To assess any significant variation in intensifying screen speeds when new screens are being introduced into the department.

13.2 Equipment Required

- Cassettes with intensifying screens in present use
- Step wedge or phantom of uniform thickness
- Cassette with intensifying screens to be evaluated
- Densitometer (optional)

13.3 Method

13.3.1 Load both cassettes with film from the same box.

13.3.2 Place cassettes side by side on the tabletop.

13.3.3 Place the step wedge or phantom so that it covers part of each cassette.

13.3.4 Centralize the x-ray beam over the cassettes and collimate to cover the step wedge/phantom.

13.3.5 Set exposure factors.

13.3.6 Make an exposure.

13.3.7 Process both films in the same processor simultaneously if possible.

13.4 Assessment and Evaluation

The radiographs should be viewed side by side on an illuminator (viewing box). The image densities should

not vary significantly when viewed with the naked eye. Densitometer readings should be within 10% of each other Note that the attenuation of cassettes can vary from type to type. To obtain consistent results all the cassettes in the department containing intensifying screens of the same speed should be of the same type. Any variation in speed may be caused by a change of response in the intensifying screens in use. Repeat the test against a different cassette to assess the consistency of speed loss. Discuss the results with the manufacturer of the intensifying screens.

14. ASSESSMENT OF THE RELATIVE SPEED OF INTENSIFYING SCREENS IN CURRENT USE

14.1 Purpose of Test

To identify a difference in speed in intensifying screens of the same type in current use in the department.

14.2 Equipment Required

- Cassettes with intensifying screens to be tested
- Phantom of uniform thickness (at least 30 x 30 cm in area)
- Densitometer (optional)

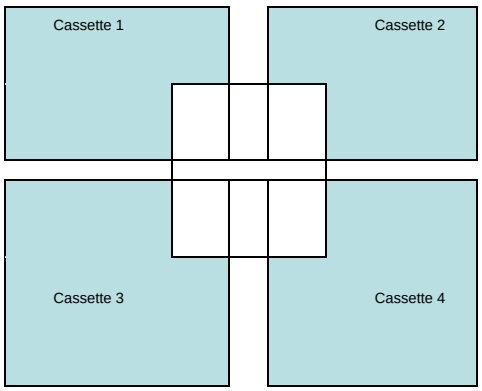
14.3 Method

14.3.1 Load all the cassettes with film from the same box.

14.3.2 Place four cassettes corner to corner on the tabletop.

14.3.3 Place the phantom in the centre of the four cassettes so that it covers one corner of each cassette.

Figure 1 cassettes



14.3.4 Centralize the x-ray beam over the cassettes and collimate to cover the phantom.

14.3.5 Set exposure factors.

14.3.6 Make an exposure.

14.3.7 Repeat for all cassettes to be tested, keeping one of the cassettes unchanged throughout.

14.3.8 Process the films as soon as possible using the same processor.

14.4 Assessment and Evaluation

Providing the cassettes are all of the same type, the density produced on the radiograph should not vary significantly. Densitometer readings should be within 10% of each other. Any significant variation should be discussed with the manufacturer of the intensifying screens

15. ASSESSMENT OF THE RELATIVE SPEED OF INTENSIFYING SCREENS WHEN NEW SCREENS ARE INTRODUCED

15.1 Purpose of Test

To assess any significant variation in intensifying screen speeds when new screens are being introduced into the department.

15.2 Equipment Required

- Cassettes with intensifying screens in present use
- Step wedge or phantom of uniform thickness
- Cassette with intensifying screens to be evaluated
- Densitometer (optional)

15.3 Method

a. Load both cassettes with film from the same box.

b. Place cassettes side by side on the tabletop.

c. Place the step wedge or phantom so that it covers part of each cassette.

d. Centralize the x-ray beam over the cassettes and collimate to cover the step wedge/phantom.

e. Set exposure factors.

f. Make an exposure.

g. Process both films in the same processor simultaneously if possible.

15.4 Assessment and Evaluation

The radiographs should be viewed side by side on an illuminator (viewing box). The image densities should

not vary significantly when viewed with the naked eye. Densitometer readings should be within 10% of each other. Note that the attenuation of cassettes can vary from type to type. To obtain consistent results all the cassettes in the department containing intensifying screens of the same speed should be of the same type. Any variation in speed may be caused by a change of response in the intensifying screens in use. Repeat the test against a different cassette to assess the consistency of speed loss. Discuss the results with the manufacturer of the intensifying screens.

16. REFERENCES

The following related documents are referenced:

16.1 South Africa, 1973. Hazardous Substances Act, 1973 (Act of 15 of 1973). https://www.sahpra.org.za/radiation-control-acts-and-regulations/

16.2 South Africa, 1973. Regulations Concerning the Control of Electronic Products. Regulation Gazette No 3991. https://www.sahpra.org.za/radiation-control-acts-and-regulations/

16.3 Guideline for QC in medical diagnostic X-Ray imaging systems, 2022. https://www.sahpra.org.za/radiation-control-guidelines-and-codes-of-practice/

16.4 SAHPGL-RDN-XR-02_v1 Guideline for Code of Practice for Users of Medical X-Rays Equipment, 2022. https://www.sahpra.org.za/radiation-control-guidelines-and-codes-of-practice/

17. VALIDITY

This guideline is valid for a period of 5 years from the effective date of revision and replaces the old guideline for Test Procedures for Film Processing and Intensifying Screens, revised June 2010. It will be reviewed on this timeframe or as and when required.

18. ANNEXURES (FORMS TO ADOPT)

The following Forms are to be adopted:

- Processing Maintenance Standards (see Annexure A, below)
- Maintenance Standards Density Readings (see Annexure B, below)
- Crossover Worksheet (see Annexure C, below)
- Crossover Worksheet – Example (see Annexure D, below)
- Daily Processor Control Chart (see Annexure E, below)
- X-Ray Processing Control Chart Action Form (see Annexure F, below)
- Individual Cassette and Screen Record (see Annexure G, below)
- Records of QC tests: Cassettes and Screens (see Annexure H, below)
- Record of QC Tests for Cassettes and Screens (see Annexure I, below)
- Repeat and Reject Analysis (see Annexure J, below) and
- Screen Speed Evaluation Test Results (see Annexure K, below)

18.1 ANNEXURE A: Processing Maintenance Standards

PROCESSOR / DARKROOM:	PERIOD:

CHEMICALS

	Type	Supplier	
Developer			
Starter			
Fixer			

PROCESSOR

	Vol. (L/ml)	Cycle Time (sec.)	Temp. (°C)	Repl. rate (ml/area or vol.)	Total Cycle Time (sec.)	Verification Date	Verification Date	Verification Date	Verification Date
Developer									
Starter									
Fixer									
Water									
Dryer									

SENSITOMETRIC CONTROL STANDARDS

QA CONTROL FILMS

Cross-over Date			

Type									
Batch no.									
Expiry date									
SENSITOMETRIC VALUES									
Parameters	Base +fog	Speed Index	Contrast Index	Base +fog	Speed Index	Contrast Index	Base +fog	Speed Index	Contrast Index
Date									
Step no.									
Density Value									

18.2 ANNEXURE B: Maintenance Standards Density Readings

Hospital/institution:		**Date:**
Processor:	***Cycle time(s):***	**Temp.:**
Chemicals:		
Sensitometric Conditions:		***e.g. Red Safelight; Green; X-Rite Dual Colour Model 334***
Film Feeding Orientation:		***e.g. Emulsion up; lengthwise (notches first); Left side of feedtray***
Film Type(s):	**Batch no.:**	**Expiry date:**
Sensitometer s/n:		**Densitometer s/n:**

Film no. 1 — **Density Values:**

B + F =	Step no.	Left	Right	Top	Bottom	Average
Nearest to 1 + (B+F)						
Nearest to 0.5						
Nearest to 2.0 + B+F						
Contrast Index						

Film no. 2 — **Density Values:**

B + F =	Step no.	Left	Right	Top	Bottom	Average
19 Nearest to 1 + (B+F)						
20 Nearest to 0.5						
21 Nearest to 2.0 + B+F						
22 Contrast Index						

Film no. 3 — **Density Values:** 23 24

B + F =	Step no.	Left	Right	Top	Bottom	Average
Nearest to 1 + (B+F)						
Nearest to 0.5						
25 Nearest to 2.0 + B+F	26	27	28	29	30	31
Contrast Index						

Film no. 4 — **Density Values:**

B + F =	Step no.	Left	Right	Top	Bottom	Average
Nearest to 1 + (B+F)						
Nearest to 0.5						
Nearest to 2.0 + B+F						
Contrast Index						

Film no. 5 — **Density Values:**

B + F =	Step no.	Left	Right	Top	Bottom	Average
Nearest to 1 + (B+F)						
Nearest to 0.5						
Nearest to 2.0 + B+F						
Contrast Index						

Film no. 6 — **Density Values:**

B + F =	Step no.	Left	Right	Top	Bottom	Average
Nearest to 1 + (B+F)						
Nearest to 0.5						
Nearest to 2.0 + B+F						
Contrast Index						

32								33							

Density Values:	**Average of 6 Films**							
Film no.	**Step no.**	**1**	**2**	**3**	**4**	**5**	**6**	Average
B+ F =								
Nearest to 1 + (B+F)								
Nearest to 0.5								
Nearest to 2.0 + B+F								
Contrast Index								

Index Value for Base Fog

Index Value for Speed

Index Value for Contrast

18.3 ANNEXURE C: Crossover Worksheet

Processor / Darkroom: …… **Date:……..**

Film type:…… Batch / Emulsion No. …… Date of Expiry: …….

New Emulsion #					Old Emulsion #				
Film #	Contrast Ind. Low density (LD) Step # …….	Speed Ind. Mid Density (MD) Step # …….	Contrast Ind. High density (HD) Step # ……..	Base + Fog (B+F) # ……	Film #	Contrast Ind. Low density (LD) Step # …….	Speed Ind. Mid Density (MD) Step # …….	Contrast Ind. High density (HD) Step # ……..	Base + Fog (B+F) # ……
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
Average					1				
Ave. Density Difference: DD = HD – LD =					Ave. Density Difference: DD = HD – LD =				

MD difference between new and old film (New MD – Old MD)	
DD difference between new and old film (New DD – Old DD)	
B + F difference between new and old film (New – Old)	

	MD (Speed Index)	DD (Contrast Index)	B + F
Old operating levels			
Difference between new & old film			
New operating levels			

18.4 ANNEXURE D: Crossover Worksheet – Example

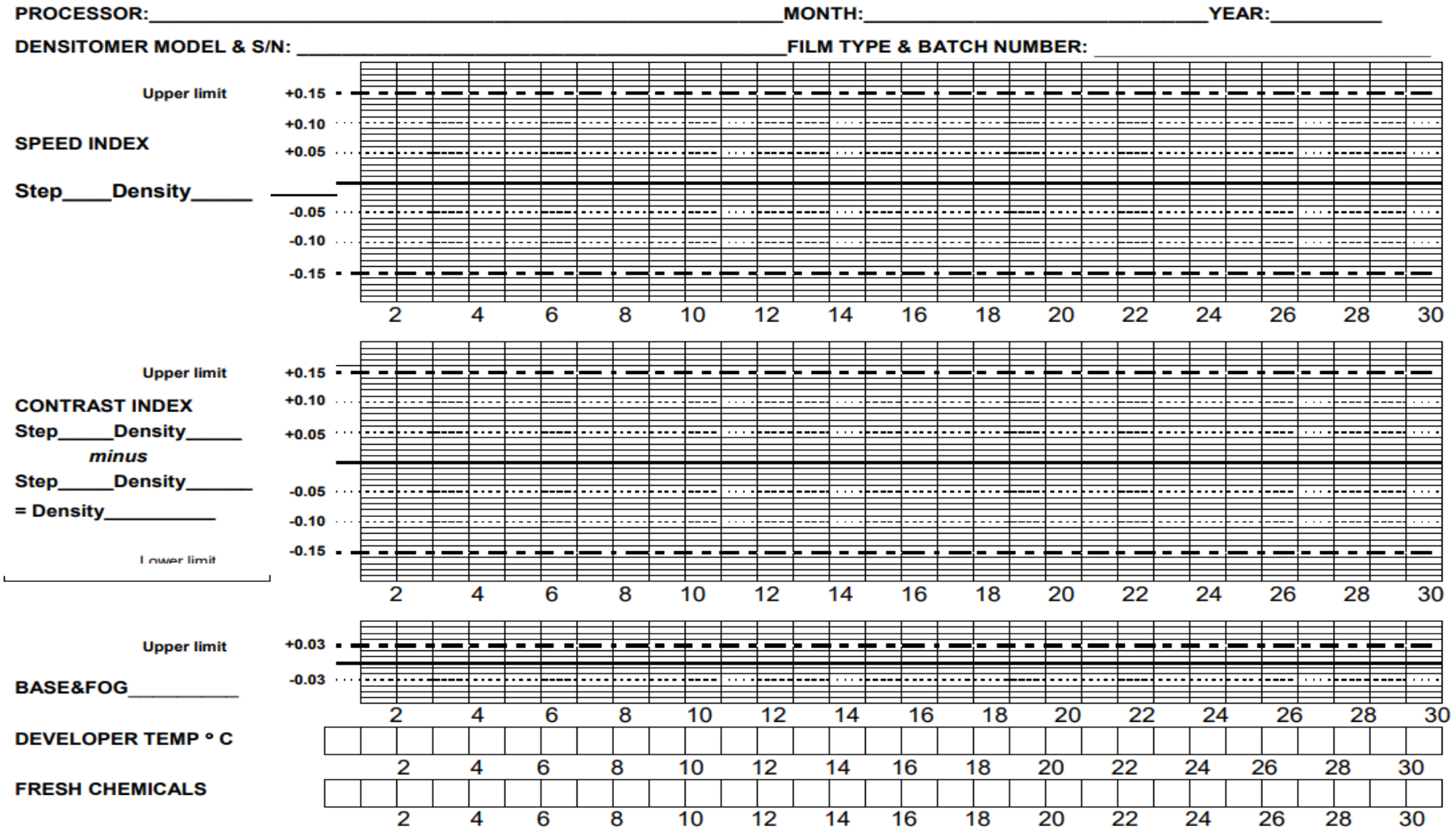
New Emulsion #					Old Emulsion #				
Film #	Contrast Ind.Low density (LD) Step # 10	Speed Ind. Mid Density(MD) Step # 11	Contrast Ind.High density(HD) Step # 13	Base + Fog (B+F) #	Film #	Contrast Ind.Low density (LD) Step # 10	Speed Ind. Mid Density(MD) Step # 11	Contrast Ind.High density(HD) Step # 13	Base + Fog (B+F) # .....
1	0.49	1.25	2.39	0.18	1	.46	1.27	2.33	7
2	0.5	1.23	2.43	0.18	2	0.48	1.30	2.30	0.17
3	0.49	1.26	2.40	0.17	3	0.46	1.27	2.28	0.18
4	0.53	1.28	2.41	0.18	4	0.48	1.28	2.32	0.17
5	0.49	1.28	2.43	0.18	5	0.47	1.31	2.31	0.18
6					6				
Average	0.53	1.26	2.41	0.18	1		1.29	2.31	0.17
Ave. Density Difference: DD = HD – LD = 1.91					Ave. Density Difference: DD = HD – LD = 1.84				

MD difference between new and old film (New MD – Old MD)	- 0.03

DD difference between new and old film (New DD – Old DD)	+ 0.07
B + F difference between new and old film (New – Old)	+0.01

	MD (Speed Index)	DD (Contrast Index)	B + F
Old operating levels	1.29	1.84	0.17
Difference between new & old film	- 0.03	+ 0.07	- 0.01
New operating levels	1.26	1.91	0.18

18.5 ANNEXURE E: Daily Processor Control Chart



18.6 ANNEXURE F: X-Ray Processing Control Chart Action Form

DATE	ACTION

18.7 ANNEXURE G: Individual Cassette and Screen Record

Cassette Size	Cas. No.	Make	Date Purchased	Screen Type e.g. AGFA Ortho Regular	Colour of emission	Screen speed	Date Installed	Comments

18.8 ANNEXURE H: Records of QC tests: Cassettes and Screens

MONTHLY CLEANING AND VISUAL INSPECTION

Cassette size													**Comment**
Cassette no. **Date**													
Pass/Fail **Date**													
Pass/Fail **Date**													
Pass/Fail **Date**													
Pass/Fail **Date**													
Pass/Fail **Date**													
Pass/Fail **Date**													
Pass/Fail **Date**													

18.9 ANNEXURE I: Record of QC Tests for Cassettes and Screens

TEST	Cassette & Screen Identification		Film-screen contact		Cassette light leaks		Screen speed evaluation	
Cassette size	Cassette no.	Date	*Pass/Fail*	Date	*Pass/Fail*	Date	*Pass/Fail*	Date	*Pass/Fail*

18.10 ANNEXURE J: Repeat and Reject Analysis

SUMMARY OF REJECTED FILMS						MONTH:					
Date	Exam. type	Radiogr. and/or UnitID	Over-exposure	Under-exposure	Motion	Positio-ning	Operatorerror	Darkroo merror	Qualiy Contrl	Machie mal - functio n	Total no. Rejects
Total number of Reject Films											
Total no. of films used:						% of rejects:					

18.11 ANNEXURE K: Screen Speed Evaluation Test Results

Licence Holder:	**Date:**
X-Ray unit used	**Exposure factors:** ……..kV ……..…mAs…….. FFD
Intensifying Screen type(s) & speed(s) in use:	
Reference Cassette Screen[1] type, speed & no.:	

Cassette ID/no	Density: Test Cassette	Density: Ref. Cassette	Density Difference	% Difference from Ref. cassette	Pass / Fail

1 A new screen/cassette must be obtained from supplier for *replacement* tests to use as a reference