

Medical X-Ray Processor Quality Control Guidelines

Courtesy of Ewen-Parker X-Ray Corporation

Information derived from material provided by several sources including:

The City of New York
Department of Health
Bureau of Radiological Health
111 Livingston Street
Brooklyn, NY 11201

Quality Control Tools

- Optical densitometer with an internal light source.
- Calibration strip for optical densitometer from manufacturer of same.
- 11 or 21 step sensitometer.
- Thermometer with $\pm 1^\circ$ F accuracy (digital or stem dial with 1" or larger dial).¹
- Dedicated box of control film labeled as such.
- Processor graph for charting results of quality control procedures.

¹ Never use a mercury thermometer in a processor

Requirements for tools

Optical Densitometer

Monthly, each facility should read the calibration strip to verify the proper operation of the densitometer. At least three reference points should be read. Check the manufacturer's specifications for accuracy limits, which should not exceed 5%.

Sensitometer

Choose the setting on the sensitometer appropriate to the type of film in use, blue or green.

Once a year or after a battery change, check the sensitometer for consistency. Expose five (5) films and process. Read the optical density for the speed step on each of the five films. The variation among the films should not exceed the manufacturer's specifications for reproducibility or 5%, whichever is larger. If the variation exceeds these values, control values must be re-established as well as corrective action (recalibration) for the sensitometer. These films as well as the data analysis must be saved for the next inspection.

Quality Control Prerequisites

Each facility shall establish a written organizational; flow chart detailing the duties and responsibilities of each person involved in the processor quality assurance program.

Facilities doing mammography must follow the protocol entitled "Processor Quality Control Guidelines for Mammographic X-Ray Facilities" available from the Bureau of Radiologic Health.

Reserve a sufficient number of boxes of film to be designated as "control film" These are to be used only for sensitometry and not to be used for patient studies. The control box(es) may not last more than five (5) months.

The control film should be a double sided emulsion film with the same speed and contrast gradient as the film normally used by the facility.

You must know the manufacturer's recommended developer temperature for the film in use.

You are required to measure the temperature of the developer solution by immersing a thermometer (as described earlier) into the solution. The developer temperature must be measured and charted each day that any films are taken and processed.

Whenever control values are to be established, you must have the processor undergo a full preventive maintenance including cleaning of all roller assemblies, refilling of the processing chemical tanks and replenishment tanks with fresh solutions and setting the developer temperature as described above.

Flash all sensitometry films twice on opposite sides of the film and plot the average of the speed and contrast values determined from the two step wedges.

The quality control film should always be fed into the same side of the processor feed tray and the developer temperature measurement should always be taken at the same location within the developer tank to minimize any difference in temperature or agitation occurring within the processor.

Determination of Control Values:

Control values are the standard against which your daily quality control will be compared and should be established immediately after a preventive maintenance. The values established will continue to be used as long as the same control box of film is in use.

Flash and develop three (3) films from the control box in the morning on two consecutive days resulting in six (6) films. The speed, contrast and base+fog will be averaged from these films and entered in the quality control graph.

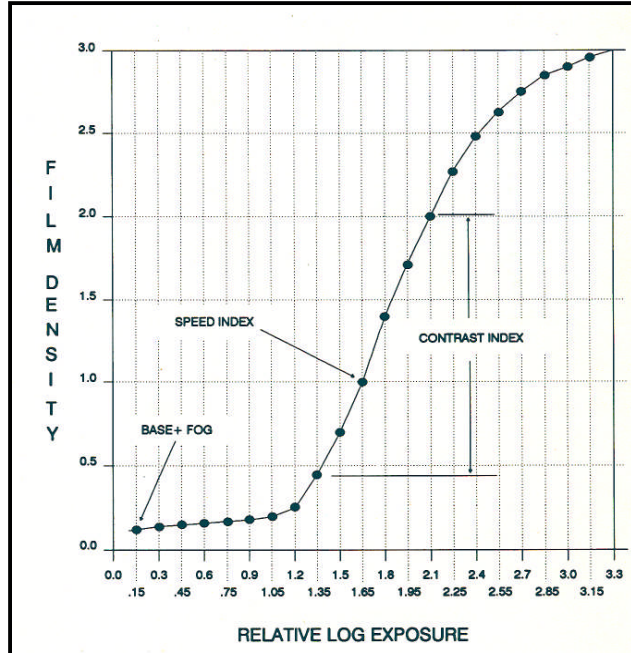
The control values for speed, contrast and base+fog will be determined using the following criteria

Speed Index

Find the step with an optical density from 1.0 to 1.30. This step becomes the speed step.

Contrast Index

The contrast index is determined by measuring the difference in optical density between any two steps on the strip that are on the linear portion of the H-D curve. Select the step with a density closest to but not greater than 2.20. Then select the step closest to but not less than .45 then subtract the second from the first



Base+Fog

Measure the density on an area of the film that has received no exposure, that is, a clear area

Acceptable Tolerance Values for Charted Quality Control

Speed Index:	Control Value ± 0.15 Optical Density Units
Contrast Index:	Control Value ± 0.15 Optical Density Units
Base+Fog:	Shall not exceed 0.25 Optical Density Units and (Should not exceed 0.20 Optical Density Units)
Developer Temperature:	Recommended Value $\pm 1.0^\circ$ F ($\pm 0.5^\circ$ C)

What to do When the Control Box is Running Out (“Crossover”)

Designate another control box when there are five (5) films left in the control box currently in use.

You may crossover either by:

- 1) Running one film from the old box and one film from the new box for five consecutive days **OR**
- 2) Running one film from the old box and two (2) films from the new box for three (3) consecutive days.

Plot the data from the old box normally to ascertain that the processor is operating properly.

The control values* for the new control box are determined by taking the averages for speed, contrast and base+fog from the five or six films from the new box and entering them on the graph as the new control values.

*Control values are specific to a given box of film and will change when the film box is changed.

Daily Processor Sensitometry Procedure

Sensitometry data must be acquired and plotted on each day that patient films are to taken.

At the start of the day, warm-up the processor according to the manufacturer's recommendations.

Measure and record processor developer temperature as described earlier.

Remove one film from the control box, flash it in the sensitometer as described earlier and process the film.

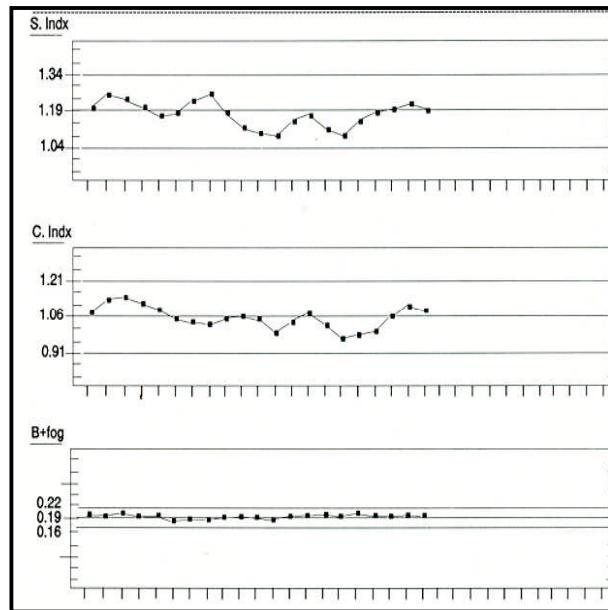
Date the sensitometry film, measure the speed step (S Index) and note the value on the film.

Compute the contrast value (C Index) and note the value on the film.

Measure the base+fog and note the value on the film.

Plot the data obtained and determine if values are within tolerance limits.

If not within limits take necessary corrective action (e.g. processor maintenance or film manufacturer tech support)



Sample of QC Data Plotted on Chart

Quality Assurance Over Time

A PM (Preventive Maintenance) of the processor must be done every four (4) weeks and more often if necessary to maintain the processor within tolerances.

Document and maintain a record of all major repairs, preventive maintenance, setting of replenishment rates, chemistry changes, etc. and retain such records.

It is strongly recommended that two (2) to four (4) clean-up films be run through the processor daily. These are new films that have been exposed to light and not only act to clean the rollers but also show up any artifacts that may be present such as scratches, roller marks, etc.

Maintenance of Records

Retain the daily sensitometry strips with all noted data for at least three (3) months.

Processor quality control graphs, control films (including crossover films) and sensitometer reproducibility films must be retained from one inspection cycle to the next.