

Service Bulletin

Carestream Health, Inc., Rochester, NY 14608

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KODAK X-OMAT Processors KODAK X-OMAT Multiloaders KODAK MIN-R MAMMOGRAPHY Processors

Processing Recommendations

IMPORTANT: *When doing the procedures in this document, you must use safe work practices and wear the correct Personal Protective Equipment (for example, Safety Eyewear) according to your Company's Standard Operating Procedures.*

Instructional

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Updates from Previous Version

- New Information:
 - Added information for MIN-R 2000 Plus and MIN-R S Films.
 - Added information for MEDICAL X-RAY Processors
 - Updated product names
 - Removed discontinued products

Purpose of Service Bulletin 30

1.] To document the current processing recommendations for the following KODAK Processors:

- KODAK M35/M35A/M35-M/M35A-M X-OMAT Processors, KODAK X-OMAT M43/M43A/CLINIC 1 Processors, KODAK RP X-OMAT Processor, Model M7B/M7B-E/M6A-N/M6AW/M6B Processors, KODAK X-OMAT 270/3000 RA Processors, KODAK X-OMAT 180 LP/180 LPS Processors, KODAK X-OMAT Processor, MODEL M6RA, KODAK X-OMAT 460/480/5000 RA Processors, KODAK X-OMAT 1000/1000A/1000J and 2000/2000A Processors
- KODAK X-OMAT Multiloader 7000, and the KODAK X-OMAT Multiloader 300 and 300 Plus
- KODAK MIN-R MAMMOGRAPHY Processors

2.] To document the current processing recommendations for Carestream medical films with Carestream processing chemicals.

NOTE:

- This data supersedes all previous replenishment information given in publications for KODAK X-OMAT Processors, KODAK X-OMAT Multiloaders and KODAK MIN-R Processors.
- **These guidelines should be used as an initial starting point, and may be changed as needed to satisfy specific site conditions and sensitometric objectives.**

Recommended Replenishment Rates

General Radiography, Laser Films, and Non-Dedicated Mammography

NOTE: Carestream mammography films should not be processed in the following processors: KODAK MEDICAL X-RAY Processors, KODAK X-OMAT 1000/1000A/1000J, M43/M43A/CLINIC 1, 2000/2000A Processors, or KODAK M35/M35A X-OMAT Processors.

For Area Processors with Smart Replenishment- ENABLED

- KODAK X-OMAT 270/3000 RA Processors, KODAK X-OMAT 180 LP/LPS Processors, KODAK X-OMAT 460/480/5000 RA Processors, KODAK X-OMAT Processor, Model M6RA, KODAK X-OMAT Multiloader 7000, and the KODAK X-OMAT Multiloader 300/300 Plus.

NOTE: MIN-R EV, MIN-R 2000 Plus, and MIN-R S Films should be fed emulsion side down in the KODAK X-OMAT 270 RA and 3000 RA Processors.

- Smart Replenishment is enabled by default.
- Replenishment takes place after the equivalent area of a 35 x 43 cm (14 x 17 in.) film has been fed; therefore, replenishment rates must be set for a 35 x 43 cm (14 x 17 in.) film feed.
- Additional replenishment occurs automatically during low film usage.

Film Size Processed	Use Condition	Average Amount of 35 x 43 cm Equivalent Films per 8 hours of Processor Operation	Replenishment Rates (ml per 35 x 43 cm)	
			Developer	Fixer
All	Any	Any number *	60	85
* Flooded replenishment should not be needed due to the automatic compensation for use, but It is available if needed to maintain sensitometry for very low use conditions.				

For Area Processors with Smart Replenishment- DISABLED

- KODAK X-OMAT M43/M43A/CLINIC 1 Processors
- RA Processors with Smart Replenishment turned off (special mammo feature enabled)
- The equivalent area of a 35 x 43 cm (14 x 17 in.) film is 1505 cm sq. (238 sq. in.).
- Replenishment takes place after the equivalent area of a 35 x 43 cm (14 x 17 in.) film has been fed; therefore, replenishment rates must be set for a 35 x 43 cm (14 x 17 in.) film feed.
- Replenishment rates need to be set for different usage conditions.

Film Size Processed	Use Condition	Average Number of 35 x 43 cm Equivalent Films per 8 hours of Processor Operation	Replenishment Rates (ml per 35 x 43 cm)	
			Developer	Fixer
Equivalent to 35 x 43 cm	High	75 sheets or more	60	85
	Medium	25-75 sheets	80	100
	Low	25 sheets or less *	100	120
* If sensitometry does not stay within control limits, flooded replenishment may be needed.				

Recommended Replenishment Rates (continued)

General Radiography, Laser Films, and Non-Dedicated Mammography For Length Processors

KODAK M35/M35A/M35M/M35A-M X-OMAT Processors, KODAK RP X-OMAT Processors, Model M7B/M7B-E/M6A-N/M6AW/M6B/M6R, KODAK X-OMAT 1000/1000A/1000J, 2000/2000A Processors, and the KODAK MIN-R MAMMOGRAPHY Processors

- Replenishment takes place whenever film is in the entrance rollers.
- Replenishment rates must be set according to usage and film size(s) fed.
- Film should be fed as recommended in the processor Operator Manual/User Guide: MIN-R EV Film, MIN-R 2000 Plus Film, and MIN-R S Film should be fed **primary emulsion side down** in the M35-M, M35 A-M X-OMAT Processors and in the KODAK MIN-R MAMMOGRAPHY Processors.
- KODAK M35M, M35A-M X-OMAT Processors and the KODAK MIN-R MAMMOGRAPHY Processors are **not recommended** for roll film.

Film Size Processed	Use Condition	Average Number of Films per 8 hours of Processor Operation	Replenishment Rates (ml per 35 x 43 cm)	
			Developer	Fixer
Roll 35 cm wide (only)	High	32 meters (105 linear feet) or more	50	70
	Medium	10.7–32 meters (35–105 linear feet)	65	85
	Low	10.7 meters (35 linear feet) or less *	80	100
35 x 35 cm (only)	High	90 sheets or more	50	70
	Medium	30–90 sheets	65	85
	Low	30 sheets or less *	80	100
Average size intermix	High	115 sheets or more	50	70
	Medium	40–115 sheets	65	85
	Low	40 sheets or less *	80	100
35 x 43 cm (only)	High	75 sheets or more	60	85
	Medium	25–75 sheets	80	100
	Low	25 sheets or less *	100	120
* If sensitometry does not stay within control limits, flooded replenishment may be needed.				

Recommended Replenishment Rates (continued)

For Dedicated Mammography

- A processor is considered dedicated if only single-emulsion film (mammography, ultrasound, etc.) is processed.
- General purpose (non-dedicated) film should use the replenishment rates listed for general radiography (see previous section).

IMPORTANT: These guidelines should be used as initial starting points only.

NOTE: Carestream mammography films should not be processed in the following processors:

KODAK MEDICAL X-RAY Processors* , KODAK X-OMAT M43/M43A/CLINIC1, 2000/2000A, 1000/1000A/1000J Processors, and KODAK M35/M35A X-OMAT Processors.

*Acceptable results may be achieved in the KODAK MAMMOGRAPHY Processor, Model MXP-M with MIN-R S film processed in RP X-OMAT or X-OMAT EX II chemistries.

For Area Processors with Smart Replenishment- ENABLED

- KODAK X-OMAT 270/3000 RA Processors, KODAK X-OMAT Processor, Model M6RA,
- KODAK X-OMAT 460/480/5000 RA Processors
- KODAK X-OMAT Multiloader 7000, and the KODAK X-OMAT Multiloader 300/300 PLUS

NOTE: MIN-R EV, MIN-R 2000 Plus, and MIN-R S Films should be fed emulsion side down in the KODAK X-OMAT 270 RA and 3000 RA Processors.

- Smart Replenishment is enabled by default.
- The equivalent area of a 35 x 43 cm (14 x 17 in.) film is 1505 cm sq. (238 sq. in.).
- Replenishment takes place after the equivalent area of a 35 x 43 cm (14 x 17 in.) film has been fed; therefore, replenishment rates must be set for a 35 x 43 cm (14 x 17 in.) film feed.
- Additional replenishment occurs automatically during low film usage. This feature can be disabled by using software version 3.0 or higher. **Note:** KODAK X-OMAT 3000 RA and 5000 RA Processors have the ability to override this feature without installing new software.

Film Processed	Use Condition	Average Number of Films per 8 hours of Processor Operation	Replenishment Rates* (ml per 35 x 43 cm)	
			Developer	Fixer
MIN-R EV, MIN-R 2000 Plus, MIN-R S	Smart Replenishment enabled (Not recommended)	260 sheets or more	90	105
		200 sheets	80	
		150 sheets	70	
		100 sheets	65	
		70 sheets	60	
		Less than 60 sheets	Flooded	Flooded

* Flooded replenishment is available if needed to maintain sensitometry for very low use conditions.

Recommended Replenishment Rates (continued)
For Dedicated Mammography

For Area Processors with Smart Replenishment- DISABLED

- KODAK X-OMAT 270/3000 RA Processors, KODAK X-OMAT Processor, Model M6RA, and the KODAK X-OMAT 460/480/5000 RA Processors
- KODAK X-OMAT Multiloader 7000, and the KODAK X-OMAT Multiloader 300/300 PLUS

NOTE: MIN-R EV, MIN-R 2000 Plus, and MIN-R S Films should be fed emulsion side down in the KODAK X-OMAT 270 RA and 3000 RA Processors.

Film Processed	Use Condition	Average Number of 18 x 24 cm Films per 8 hours of Processor Operation	Replenishment Rates* (ml per 35 x 43 cm)	
			Developer	Fixer
MIN-R EV, MIN-R 2000 Plus	Medium, High	60 sheets or more	105 – 120	105
MIN-R S	Low	60 sheets or less*	Flooded	Flooded

* If sensitometry does not stay within control limits, flooded replenishment may be needed.

For Length Processors

- KODAK M35-M/M35A-M X-OMAT Processors, KODAK RP X-OMAT Processor, Model M7B/M7B-E, M6A-N/M6AW/M6B/M6R
- KODAK MIN-R MAMMOGRAPHY Processors

- Replenishment takes place whenever film is in the entrance rollers.
- Replenishment rates must be set according to usage and film size(s) fed.
- MIN-R S, MIN-R 2000 Plus and MIN-R EV films are fed **emulsion side down** in the KODAK M35-M, M35A-M X-OMAT Processors and the KODAK MIN-R MAMMOGRAPHY Processors.
- For the KODAK Miniloader 2000P and the KODAK X-OMAT Multiloader 700 docked to length-replenished Processors, mammography rates are set using 18 cm film travel.

Film Processed	Film Feeding	Use Condition	Average Number of Films per 8 hours of Processor Operation	Replenishment Rates (ml per 18 x 24 cm)**	
				Developer	Fixer
MIN-R EV MIN-R 2000 Plus	Single	Medium - High	60 sheets or more	30 – 40	30
		Low	60 sheets or less*	Flooded	Flooded
MIN-R S	Double	Medium - High	60 sheets or more	60 – 80	60
		Low	60 sheets or less*	Flooded	Flooded

* If sensitometry does not stay within control limits, flooded replenishment may be needed.
 ** Use a single 18 x 24 cm film to set the replenishment rates listed. If processing a single 24 x 30 multiply the rate by 1.67

NOTE: For additional mammography film systems information, refer to Film Conversion Guides, User Guides, And Optimization Guides available on the Carestream website: www.carestream.com

Recommended Replenisher Mixing

For best results, mix processing solutions between 21.1 °C–26.7 °C (70 °F–80 °F).

If using Replenisher Tank:

- Replenisher tank should be sized such that volume is approximately equal to or less than, the volume used in 2 weeks.
- Mix only in quantities large enough to be used in **2 weeks or less**.
- A floating lid **must** be installed in the developer/replenisher tank to reduce oxidation of the developer solution.

If using an Automixer without a floating lid:

- Mix only in quantities large enough to be used in **1 week**.
- Mix only when replenisher volume is near or at the low level alarm.

NOTE: Do not feed films into the processor during chemical mixing

For information on specific processors, refer to the “General Processor Information” at the end of this document.

Recommended Starter Volumes

Film	DEVELOPER	Starter (added to Processor Developer Tank)
All	RP X-OMAT X-OMAT EX II	25 ml per litre (3 fl oz per gallon)
	X-OMAT LE+ *	No Starter Added
* X-OMAT LE+ chemistry is not available in all regions.		

Recommended Processor Maintenance and Changing of Processing Solutions

Carestream recommends changing the developer and fixer solutions every 4–6 weeks during regular processor maintenance:

- Drain, clean, and refill the developer and fixer processing tanks with freshly mixed chemistry. Do not save and re-use the developer and fixer solutions.
- Specific site conditions may dictate more or less cleaning.
- Follow the maintenance instructions and safety procedures specified in the Processor Operator Manual, User Guide, and Service Manual.
- Be sure to follow all environmental regulations when disposing of processing solutions.

Reduced Replenishment Rate Recommendations

It may be possible to reduce the developer replenishment rate by up to 40% by using the X-OMAT EX II Developer and Replenisher or RP X-OMAT Developer and Replenisher with T-Mat films, X-Sight films, or Insight films.

Flooded Replenishment Rate Recommendations

- For low use rates, if sensitometry does not stay within control limits, flooded replenishment may be needed to maintain the developer solution at a continuously fresh chemical activity. This is accomplished by replenishing not only when film is fed or area accumulated, but also on the basis of additional replenishment added during the processor on-time with an automatic replenishment timing system.
- When in the flooded mode, developer starter is added to the replenishment tanks at a rate of 89 ml per gallon or 25 ml per litre (3 fl. oz./ gallon) for all films **including** MIN-R 2000 Plus Film.
- For detailed information on how to set up each processor for flooded replenishment, see the appropriate service publication for that processor.
- Qualified service personnel should do the processor setup.
- When filling the developer replenishment or processor tank, add starter per the table below.

Developer	Flooded Mode	Add Starter?	
		Replenishment Tank	Processor Tank
X-OMAT EX II	No	No	Yes
	Yes	Yes	No*
RP X-OMAT	No	No	Yes
	Yes	Yes	No*
X-OMAT MX	No	No	Yes
	Yes	Yes	No*
X-OMAT LE +	No	No	No
	Yes	No	No
* Fill the processor tank with chemistry that was mixed in the replenishment tank.			

- **For All KODAK Processors except the KODAK X-OMAT 1000/1000A/1000J, M43/M43A/CLINIC 1 Processors and the KODAK RP X-OMAT Processor, Model M6B**
 - Initially set the developer and fixer replenishment rates at 65 ml per 35 x 43 cm film. This amount will be fed into the processor every 5 minutes.
 - Once set, the rate may be changed depending on the individual circumstances.
 - Monitoring the processor sensitometry is required to change replenishment rates.
 - Use the following recommendations as replenishment rates are reduced:
 1. Monitor sensitometry (speed and contrast).
 2. Reduce developer and fixer replenishment rates by 5 ml.
 3. Monitor sensitometry for 2 weeks.
 4. If no change is seen, rates may be reduced by another 5 ml.
 5. Once a change is seen, increase the developer and fixer rates by 5 to 10 ml.
- **For KODAK X-OMAT 1000/1000A/1000J Processors**
 - Initially set the regular developer and fixer replenishment rates at 100 ml per 35 x 43 cm film.
 - Set the flooded replenishment rate at one-half of the above amount. The processor will feed the one-half amount (in this case, 50 ml) into the processor every 20 minutes.
 - Monitoring the processor sensitometry is required to reduce replenishment rates.

Flooded Replenishment Rate Recommendations (continued)

- Use the following recommendations as replenishment rates are reduced:
 1. Monitor sensitometry (speed and contrast).
 2. Reduce developer and fixer replenishment rates by 5 ml.
 3. Monitor sensitometry for 2 weeks.
 4. If no change is seen, rates may be reduced by another 5 ml.
 5. Once a change is seen, increase the developer and fixer rates by 5 to 10 ml.

➤ For the KODAK X-OMAT M43/M43A/CLINIC 1 Processors

- Set the flooded replenishment rate at 100 ml for developer and 120 ml for fixer.
- The processor delivers these volumes every 24 minutes to maintain sensitometry.
- **Do not reduce these rates.**
- Monitoring the processor sensitometry is required.

➤ For the KODAK RP X-OMAT Processor, Model M6B

- Set the flooded replenishment rate at 105 ml for 35 x 43 cm.
- The processor will deliver these volumes every time the processor comes out of standby, to maintain sensitometry.
- Monitoring the processor sensitometry is required.

Recommended Ventilation Requirements

- The processing area should have 10 air changes per hour, 24 hours per day, 7 days per week.

For example: a 10 x 10 x 10-foot room has a volume of 1000 cubic feet, so the ventilation system should supply the room with 10,000 cubic feet of fresh air per hour, 24 hours per day, 7 days per week.
- For through-the-wall installations, the air pressure in the darkroom area where the processor is located must be of slightly higher pressure than the surrounding rooms to assure that the airflow through the processor is in the correct direction.
- For processor exhaust ventilation requirements, refer to Service Bulletin 101 and the appropriate service publication for the processor.

Adjusting the Dryer Temperature

- Use the lowest possible dryer temperature that will maintain proper film drying.
- Drying requirements vary depending on the processing cycle, the room temperature, ventilation and relative humidity, film type, and throughput. Adjust dryer temperature to meet individual site conditions.
- Different processing cycles require different dryer temperatures to compensate for the varying times the film is in the dryer section.
- Refer to the Processor Operator Manual/User Guide for instructions.

Recommended Film Types vs. Processing Cycle

The following chart summarizes which FILMS can be processed in which processor and at which processing cycle.

S = Standard Cycle, using RP X-OMAT or X-OMAT EX II, X-OMAT MX

Chemicals

R = Rapid Cycle, using RP X-OMAT or X-OMAT EX II, X-OMAT MX

Chemicals

NA = Not Applicable

NR = Not Recommended

NOTE: X-OMAT MX Developer is **not recommended** for use with MIN-R films.

FILM	PROCESSOR							
	M7B M7B-E M6A-N M6AW M6B M6R	M35-M, M35A-M	M35 M35A M43 M43A Clinic 1	270 RA 3000 RA XML 300 XML 300Plus M6RA 460 RA 480 RA 5000 RA XML 7000	180 LP 180 LPS	1000 1000A 1000J	2000 2000A	MIN-R MAMMOGRAPHY and MIN-R Integrated
Available Cycles →	S	S	S	S R	R	S	S R	S R
T-MAT RA	S	S	S	S R	NA	S	S R	S R
INSIGHT	S	S	S	S	NA	S	S	S
X-SIGHT G/RA				S R			S R	S R
MXB				S			S	S
MIN-R EV MIN-R 2000 Plus MIN-R S	S	S	NR	S	NA	NR	NR	S
RA Duplicating	S	S	S	S R	NA	S	S R	S R
EB/RA	S	S	S	S R	NA	NR	S	S R
EHG	S	S	S	S R	R	NR	S	NR
EIR, HQB	S	S	S	NA	NA	NR	S	NR
All Other Films	S	S	S	S	NA	S	S	NR

General Processor Information

NC = Not Controlled (temperature)

NR = Process Not Recommended for this film type

Processor Model	Cycle	Approx Devl Tank Volume	Starter Volume**	Temperature			Transport Speed	Capacity 35 x 43 cm (18 x 24 cm)	Approx Devl Time	Approx Drop Time** (24cm length)
			All Other Film	Devl	Fixer*	Water				
		L (gal)	ml (fl oz)	°C (°F)	°C (°F)	°C (°F)	cm/min (in./min)	films/hour	seconds	seconds
M35	S	8.3	190	33.3 °C (92 °F)	NC	4 –29.4 °C (40 –85 °F)	76.2 (30)	94	33	150
M35A		2.25	(6.5)					94 (145)	33	150 (135)
M35-M	S	8.3 (2.25)	190 (6.5)	33.3 °C (92 °F)	NC	4 –29.4 °C (40 –85 °F)	76.2 (30)	94	33	150
M35A-M				34.4 °C (94 °F)			101.6 (40.1)	126	25	112 (101)
2000	R	8.3 (2.25)	190 (6.5)	33.3 °C (92 °F)	NC	4 –29.4 °C (40 –85 °F)	76.2 (30)	94	33	150
2000A				34.4 °C (94 °F)			101.6 (40.1)	126	25	112 (101)
MIN-R/ MIN-R Int.	S	8.3 (2.25)	190 (6.5)	33.3 °C (92 °F)	NC	4 –29.4 °C (40 –85 °F)	76.2 (30)	94	33	150
				34.4 °C (94 °F)			101.6 (40.1)	126	25	112 (101)
M43, M43A Clinic 1	S	8.7 (2.3)	190 (6.5)	33.9 °C (93 °F)	NC	4 –29.4 °C (40 –85 °F)	61.0 (24)	90	27	127
M7B	S	8.3 (2.25)	190 (6.5)	34.4 °C (94 °F)	NC	4 –29.4 °C (40 –85 °F)	106.7 (42)	146 (250)	27	120 (116)
M7B-E				34.4 °C (94 °F)				148 (250)	26	111 (104)
3000 RA	R	8.3 (2.25)	190 (6.5)	34.4 °C (94 °F)	32 °C (90 °F)	4 –29.4 °C (40 –85 °F)	106.7 (42)	148 (250)	26	111 (104)
270 RA				37.2 °C (99 °F)				201	19	82
XML300+ XML7000										
M6A-N	S	10.7 (2.8)	Molded: 250 (8.5)	35 °C (95 °F)	NC	M6A-N: 30–32.2 °C (85–90 °F) M6AW, M6B: 4–32.2 °C 40–90 °F	167.6 (66)	229 (393)	25	90 (86)
M6AW			Stainless: 237 (8)							
M6B	R	2.8 (10.7)	250 (8.5)	35 °C (95 °F)	35 °C (95 °F)	4 –29.4 °C (40 –85 °F)	167.6 (66)	233 (393)	24	95 (89)
M6RA			250 (8.5)							
460 RA	R	2.8 (10.7)	250 (8.5)	35 °C (95 °F)	35 °C (95 °F)	4 –29.4 °C (40 –85 °F)	251.5 (99)	351	16	60
480 RA										
5000 RA										
180 LP	R	8.3 (2.25)	190 (6.5)	100 °F (37.8 °C)	37.8 °C (100 °F)	4–32.2 °C 40–90 °F	160.0 (63)	180	18	79
180 LPS										
1000	S	3.8 (1.0)	90 (3.0)	35 °C (95 °F)	NC	4–29.4 °C 40 –85 °F	43.2 (17)	50 (84)	43	173
1000A										
1000J										

* Fixer temperature may exceed value listed due to internal ambient temperatures in the processor.

** Drop Time is defined as the time from the Lead Edge In (LEI) to the Trail Edge Out (TEO) for a 35 x 43 cm film. () represents 18 x 24 cm LEI/TEO.

*** No starter is required for LE+ developer.

MEDICAL X-RAY Processor Information

MEDICAL X-RAY Processor Model	Power Requirements	Tank Capacity	Starter Volume	Temperature		Capacity 35 x 43 cm (18 x 24 cm)
				Devl	Water	
			ml (fl oz)	°C (°F)	°C (°F)	films/hour
MXP-101	110V, 50/60 Hz	5 L (1.3 gal)	125 (3.9)	28–37 °C (82.4–98.6 °F)	5–30 °C (41–86 °F)	55 (89)
MXP-102	220 - 240 V, 50/60 Hz					
MXP-103	220 - 240 V, 50/60 Hz					
MXP-104	120 V, 60 Hz					
MXP-2000 Model 212	220-240V, 50 Hz	12.5 L (3.3 gal)	312.5 (9.9)	28–40 °C (82.4–104 °F)	5–25 °C (41–77 °F)	245 (232)
MXP-2000 Model 213	220-240V, 60 Hz					
MXP-M Model 112	220 - 240 V, 50 Hz	5 L (1.3 gal)	125 (3.9)	34 °C (93.2 °F).	5 – 25 °C (41–77 °F)	55 (89)
MXP-M Model 113	220 - 240 V, 60 Hz					

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