PROCESSING CYCLES FOR *KODAK* CHEMICALS

There are many different types of minilab processors, and they are used under a variety of conditions. KODAK Chemicals are designed to offer you choices to get the best results from your minilab regardless of its operation. One of the processing cycles described in this publication should be right for your processor. Each cycle lists the best chemicals for you to use.

This section describes:

- Time and temperature
- Replenishment rates
- Agitation
- Filtration
- Drying

Special procedures for your paper process—

- Converting to KODAK EKTACOLOR PRIME Chemicals

Film Processing Cycles

There are four basic processing cycles for processing Kodak color-negative films in minilabs. Three are described here. If you are using KODAK SM Chemicals, see KODAK Publication No. Z-101, *Using KODAK SM Chemicals in SM Minilabs*. You can use each of these cycles in minilabs that operate with or without wash water. The description of the three cycles will help you decide which matches your particular processor and processing conditions. Use the cycles as guides; your processing cycle may vary slightly according to the design of your minilab.

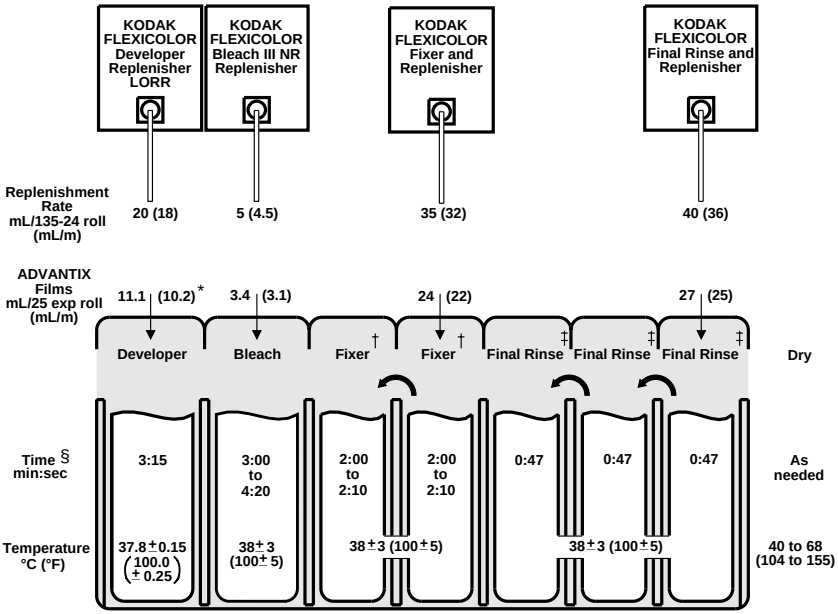
The replenishment rates given for each cycle are for a typical mix of Kodak color-negative films. Use the rates as starting points; adjust them as required according to your control-plot results

A description of each of the three cycles is included on pages 28 through 30.

Note: Do not process KODAK VERICOLOR Slide Film / SO-279/5072 or VERICOLOR Print Film / 4111 in Process C-41B or C-41RA (washless cycles). Process these films in Process C-41 only.

Process C-41B Cycle

The primary feature of this process is a shorter processing cycle. This cycle was made shorter by eliminating both washes and reducing the fixer time. Originally the process used a final wash, but the most common version in use today is the "washless" cycle.



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* These rates are averages based on an estimated film-speed mix in 25-exposure rolls of KODAK ADVANTIX Films.

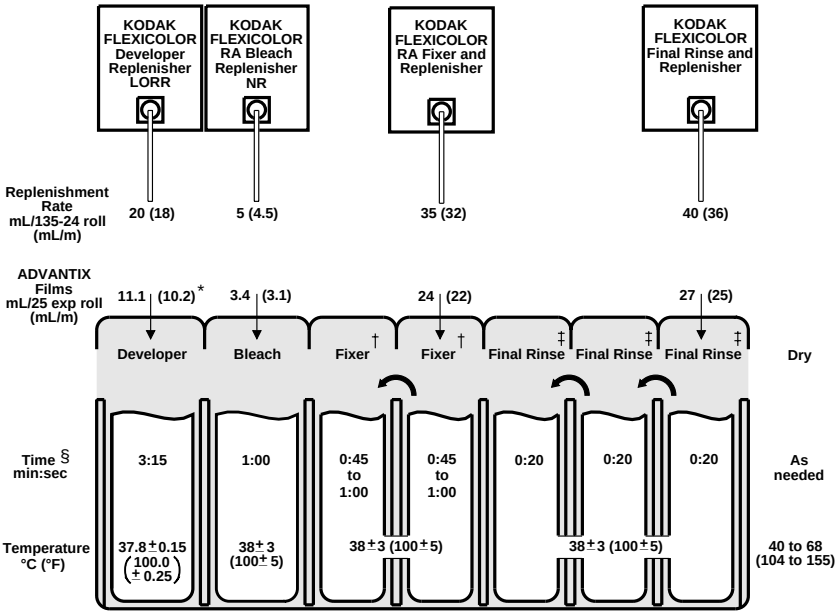
† Use two countercurrent-flow fixer tanks with equal time in each tank.

‡ If your minilab uses a final wash, also install a wash between the fixer and final rinse with a wash time of 1:40. Reduce the final rinse time to 40 seconds, and use a replenishment rate of 35 mL/135-24 roll (32 mL/m). Use a wash-flow rate of 1250 mL/135-25 roll (1080 mL/m) for a two-stage countercurrent wash or 2500 mL/135-24 roll (2160 mL/m) for a single-stage wash.

§ Immersion time plus crossover time to the next tank. Bleach, fixer, and final rinse times are minimums; longer times are acceptable.

Process C-41RA Cycle

Process C-41RA has a shorter total process time than Process C-41 or C-41B. To use this cycle, the minilab must be capable of providing the higher fixer and stabilizer agitation required (direct-impingement agitation or high turbulation) and must use KODAK FLEXICOLOR RA Bleach Replenisher NR and FLEXICOLOR RA Fixer and Replenisher. Although Process C-41RA was designed to be a "washless" cycle, you can use it with a final wash.



* These rates are averages based on an estimated film-speed mix in 25-exposure rolls of KODAK ADVANTIX Films.

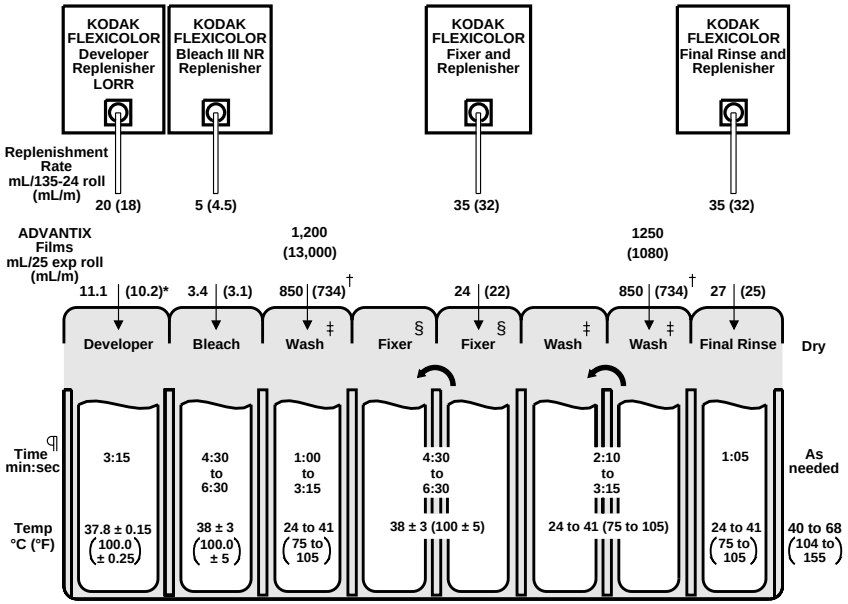
† Use two countercurrent-flow fixer tanks with equal times in both tanks (0:45 to 1:00 in each tank). Your equipment must provide the higher agitation required for this solution.

‡ Use three countercurrent-flow final rinse tanks with equal times in all tanks (0:20). Your equipment must provide the higher agitation required for this solution. Replenish the third final rinse tank at 40 mL/135-24 roll (36 mL/m). If your processor has two countercurrent-flow final rinse tanks followed by a single tank, replenish the second countercurrent tank at 40 mL/135-24 roll (36 mL/m) and the single tank at 20 mL/135-24 roll (18 mL/m).
For minilabs with a final wash after the fixer, use a wash time of 1:40 and reduce the final rinse time to 40 seconds. Use a wash rate of 1250 mL/135-24 roll (330 mL/ft) for a two-stage countercurrent-flow wash. Double this rate for a single wash. Use a final rinse replenishment rate of 33 mL/135-24 roll.

§ Immersion time plus crossover time to the next tank. Bleach, fixer, and final rinse times are minimums; longer times are acceptable.

Process C-41 Cycle

This process cycle is used most frequently in older minilabs. It is most commonly used with wash water. If you want to use this cycle in a "washless" mode, see the second footnote.



* These rates are averages based on an estimated film-speed mix in 25-exposure rolls of KODAK ADVANTIX Films.

† For a two-stage countercurrent-flow wash. Double this rate for a single-stage wash. If your minilab uses a final rinse *instead of washes,* use a replenishment rate of 40 mL/135-24 roll (36 mL/m) or 27 mL/25-exposure roll (25 mL/m) of ADVANTIX Film.

‡ Use a two-stage countercurrent-flow wash. For a single-stage wash, double the replenishment rate. If your minilab uses a final rinse step *instead of* a final wash, eliminate both washes. Use three countercurrent-flow final rinse tanks with a minimum final rinse time of 2:20 (0:47 in each tank). Use a final rinse temperature of 38 ± 3°C (100 ± 5°F) and a replenishment rate of 40 mL/135-24 roll (36 mL/m).

§ Use two countercurrent-flow fixer tanks with equal times in both tanks (2:10 to 3:15).

¶ Immersion time plus crossover time to the next tank. Bleach, fixer, and final rinse times are minimums; longer times are acceptable.

Processing Times—Times include immersion time plus crossover time to the next tank. Times given are the minimum times for bleach, fixer, and stabilizer solutions; longer times are acceptable in these solutions.

Replenishment Rates—The replenishment rates given are starting-point recommendations for a typical mix of Kodak color-negative films.
Developer—If needed, adjust the developer replenishment rate according to your control plots. Your developer replenishment rate depends on:

- type of processor
- amount of the various types of film processed
- film exposure
- other variables of the processing system

Bleach—To maintain chemical concentrations and pH level, the bleach replenishment rate must be high enough to compensate for developer carryover into the bleach. The replenishment rate given is for typical carryover rates. If the carryover rate is higher, leuco-cyan dye and/or retained silver halide may occur. To offset higher carryover, increase the replenishment rate. See your equipment manual for specifications and adjustments for squeegees or squeegee rollers.

Bleach Aeration—The bleach requires oxygen to return the exhausted bleaching agent to a usable form. Aeration provides oxygen by pumping air bubbles through the bleach. Insufficient aeration can cause leuco-cyan dye and retained silver problems, particularly with diluted or underreplenished bleach. Too much aeration can cause the bleach to foam or splash. This can contaminate other solutions or cause staining that can increase D-min densities.

Stabilizer—Use Kodak Final Rinse and Replenisher in all types of minilabs. This stabilizer uses a non-formaldehyde stabilizing agent for safer handling, and to protect film dye stability. It also contains a wetting agent to provide uniform drying.

Wash Rates—If your minilab uses a wash step, adjust the flow rate for the maximum film load and then operate at this rate. Do not use average rates. If your minilab has a wash between the bleach and fixer, you can save water and energy by supplying the wash with the overflow from the final wash.

Filtration—Small amounts of insoluble material in the water and solutions can stick to the film and minilab tank walls and rollers. This dirt can damage film. Install filters recommended by the manufacturer of your minilab to remove these materials. Usually, filters with a porosity of 10 to 30 microns are effective for solutions and wash water, and filters with a porosity of 15 microns are effective for incoming water supplies. You can use the following filter materials with processes that use FLEXICOLOR Chemicals:

- bleached cotton
- cellulose with phenolic resin binder
- fiber glass with phenolic resin binder
- polypropylene
- spun polypropylene
- viscose-activated carbon
- viscose rayon with phenolic-resin binder (**do not** use in the developer)
- activated carbon

Polypropylene is the most acceptable filter-core material and one of the least expensive. This material has no photographic effect, but the surfactants used to produce the polypropylene yarns may have an effect on your process. Therefore, monitor your process carefully when you first change filters. Replace filters regularly as part of routine maintenance.

Drying—Keep the film-drying area clean and free of dirt. If the dryer has a filter, check it regularly. Ideally, the drying temperature should not exceed 68°C (155°F). If the film has excessive curl, the ambient conditions are too dry; increase the relative humidity.

Processing Cycles for KODAK EKTACOLOR Chemicals

Chemical Options for Your Paper Processor

KODAK EKTACOLOR PRIME Chemicals for Process RA-4 are designed for short process times, stable performance, and low replenishment rates.

Kodak recently introduced three new chemicals that will be the best choice for most minilabs:

KODAK EKTACOLOR PRIME SP Developer Replenisher LORR

KODAK EKTACOLOR PRIME Bleach-Fix Replenisher LORR

KODAK EKTACOLOR PRIME Stabilizer Replenisher LORR

The new EKTACOLOR PRIME LORR Chemicals are recommended for all minilabs with medium to high production volumes. The lower replenishment rates mean that waste-solution volume, packaging waste, and the need for solution mixing are all minimized. EKTACOLOR PRIME SP Developer Replenisher LORR is supplied as a single-part concentrate for easy mixing

Note: The new EKTACOLOR PRIME LORR Chemicals will not be available in all regions at the same time. Contact your local supplier of KODAK Chemicals for information on availability.

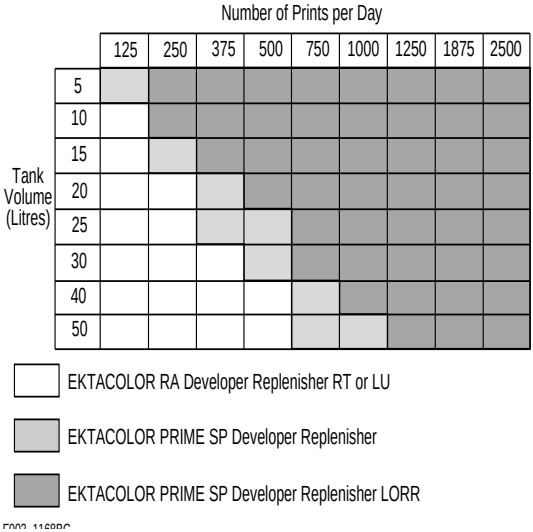
Processors designed for the short process times required for Process RA-4 use a stabilizer step (“washless” cycle) or a final wash. These process options are similar except that in the washless version, you use KODAK EKTACOLOR PRIME Stabilizer and Replenisher instead of wash water.

Choosing which chemicals to use in your minilab is a simple exercise. You will need only two pieces of information:

1. Volume of the developer tank
2. Number of prints processed in an average day

If the developer tank volume is relatively large and the number of prints per average day is relatively low, your processor is operating for a significant amount of time without sufficient replenishment of fresh chemicals. This can lead to oxidation of the solutions and considerable evaporation from the tank. Both conditions can adversely affect print quality. See a later section on recommendations for low-production volume periods.

In the table, find the point that matches your developer tank volume and the number of prints per day. You can them determine by the color coding which developer choice is best for your processor.



After you've chosen the developer, it's easy to determine the right bleach-fix and stabilizer replenishers.

Minilabs with Medium to High Production Volume

KODAK EKTACOLOR PRIME SP Developer Replenisher LORR

KODAK EKTACOLOR PRIME Bleach-Fix Replenisher LORR

KODAK EKTACOLOR PRIME Stabilizer Replenisher LORR

Minilabs with Low Volume Production

KODAK EKTACOLOR PRIME SP Developer Replenisher

KODAK EKTACOLOR PRIME Bleach-Fix Replenisher

KODAK EKTACOLOR PRIME Stabilizer Replenisher

Minilabs with Very Low Production Volume (or equipment with a roller-transport design)

KODAK EKTACOLOR RA Developer Replenisher RT (or EKTACOLOR PRIME Developer Replenisher LU in certain regions)

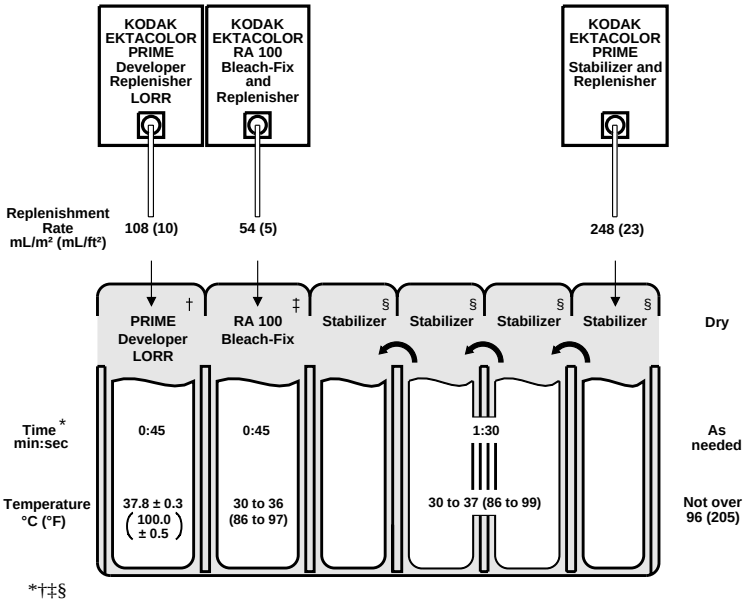
KODAK EKTACOLOR RA Bleach-Fix Replenisher

KODAK EKTACOLOR PRIME Stabilizer Replenisher

Process RA-4 Cycles

The Process RA-4 cycles are standard cycles for processing KODAK EKTACOLOR Edge Paper and EKTACOLOR ROYAL Paper. Use the chemical choice determined from the chart on page 34.

Medium to High Production Volume



Note: The starting recommendation replenishment rates are for KODAK EKTACOLOR Edge and ROYAL Papers. For KODAK PROFESSIONAL SUPRA ENDURA Paper, increase the developer and bleach-fix replenishment rates by 20 percent to 96 mL/m² (9.0 mL/ft²) for EKTACOLOR PRIME SP Developer Replenisher LORR and 65 mL/m² (6 mL/ft²) for EKTACOLOR PRIME Bleach-Fix Replenisher LORR.

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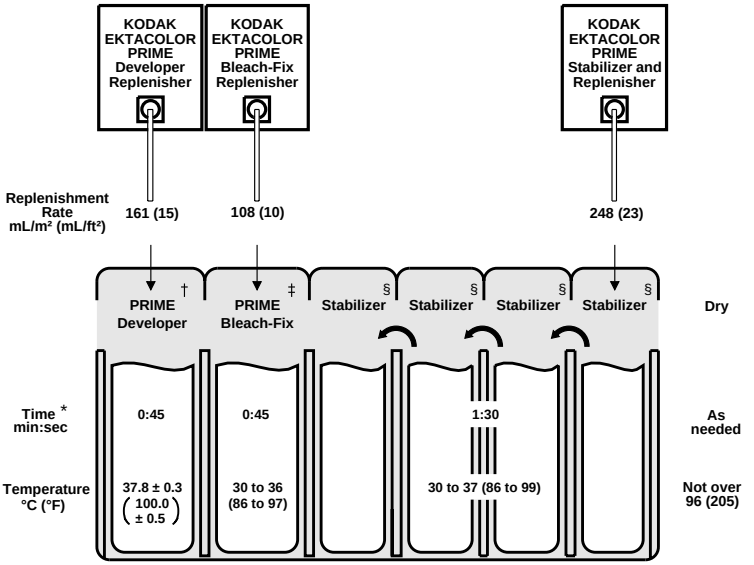
* Immersion time plus crossover time to the next tank. For best results, use the recommended times with crossover times of 6 seconds or less.

† Check the developer temperature frequently with an accurate thermometer. Recirculate and filter. Use squeegees at tank exit.

‡ Recirculate and filter. Use squeegees at tank exit.

§ Recirculate and filter. Four countercurrent-flow tanks. For three countercurrent-flow tanks, use a rate of 390 mL/m² (36 m/ft²); for two countercurrent-flow tanks, use a rate of 970 mL/m² (90 mL/ft²).
If your minilab uses a countercurrent-flow wash instead of a stabilizer, use a wash-water temperature of 30 to 40°C (86 to 104°F). For wash times of 1:30 or longer, the wash-flow rate should be between 2,160 to 10,800 mL/m² (200 and 1,000 mL/ft²). The actual rate depends on the number of tanks; see *Wash Rates* on page 39. Plumb wash tanks for countercurrent flow.

Low Production Volume



Note: The starting recommendation replenishment rates are for KODAK EKTACOLOR Edge and ROYAL Papers. For KODAK PROFESSIONAL SUPRA ENDURA Paper, increase the developer and bleach-fix replenishment rates by 20 percent to 130 mL/m² (12 mL/ft²) for EKTACOLOR PRIME SP Developer Replenisher and 65 mL/m² (6 mL/ft²) for EKTACOLOR PRIME Bleach-Fix Replenisher.

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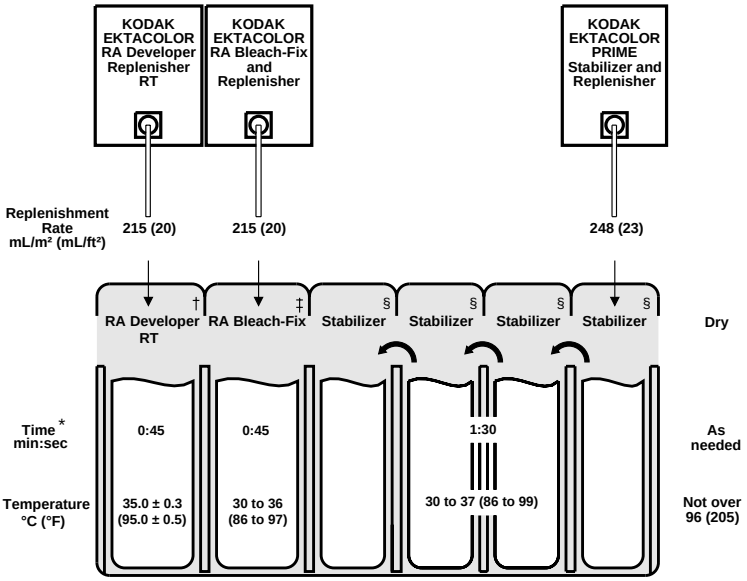
* Immersion time plus crossover time to the next tank. For best results, use the recommended times with crossover times of 6 seconds or less.

† Check the developer temperature frequently with an accurate thermometer. Recirculate and filter. Use squeegees at tank exit.

‡ Recirculate and filter. Use squeegees at tank exit.

§ Recirculate and filter. Four countercurrent-flow tanks. For three countercurrent-flow tanks, use a rate of 495 mL/m² (46 m/ft²); for two countercurrent-flow tanks, use a rate of 970 mL/m² (90 mL/ft²).
If your minilab uses a countercurrent-flow wash instead of a stabilizer, use a wash-water temperature of 30 to 40°C (86 to 104°F). For wash times of 1:30 or longer, the wash-flow rate should be between 2,160 to 10,800 mL/m² (200 and 1,000 mL/ft²). The actual rate depends on the number of tanks; see *Wash Rates* on page 39. Plumb wash tanks for countercurrent flow.

Very Low Production Volume



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* Immersion time plus crossover time to the next tank. For best results, use the recommended times with crossover times of 6 seconds or less.

† Check the developer temperature frequently with an accurate thermometer. Recirculate and filter. Use squeegees at tank exit.

‡ Recirculate and filter. Use squeegees at tank exit.

§ Recirculate and filter. Four countercurrent-flow tanks. For three countercurrent-flow tanks, use a rate of 495 mL/m² (46 m/ft²); for two countercurrent-flow tanks, use a rate of 970 mL/m² (90 mL/ft²).
If your minilab uses a countercurrent-flow wash instead of a stabilizer, use a wash-water temperature of 30 to 40°C (86 to 104°F). For wash times of 1:30 or longer, the wash-flow rate should be between 2,160 to 10,800 mL/m² (200 and 1,000 mL/ft²). The actual rate depends on the number of tanks; see *Wash Rates* on page 39. Plumb wash tanks for countercurrent flow.

Processing Times—Times include immersion time plus crossover time to the next tank. For best results, use the recommended times with crossover times of 6 seconds or less.

Replenishment Rates—The specified replenishment rates are starting-point recommendations. Actual rates depend on the type of processor, amount of paper processed, and other variables of the processing system. The rates are given in millilitres per square metre and millilitres per square foot. To convert the rate to millilitres per minute, multiply the rate in mL/m^2 by the processor speed in m^2/min (or mL/ft^2 by the processor speed in ft^2/min).
Developer—If necessary, adjust the replenishment rate according to your control plots.
Bleach-Fix—The bleach-fix replenishment rates assume minimum developer carryover. If carryover is greater than normal, increase the bleach-fix replenishment rate to maintain the bleach-fix chemical balance and pH level. Otherwise problems, such as retained silver, may occur. See your equipment manual for specifications and adjustments for squeegees or squeegee rollers.
Stabilizer—For four countercurrent-flow tanks. For three countercurrent-flow tanks, use a rate of twice the starting point recommendation; for two countercurrent-flow tanks, use a rate of four times the starting point recommendation, e.g. for EKTACOLOR PRIME Stabilizer and Replenisher LORR the rate for two tanks would be 780 mL/m^2 (72 mL/ft^2).

Wash Rates—If your minilab processor uses a conventional water wash rather than a stabilizer solution, the flow rate of the final wash depends on the number of wash tanks and the amount of paper processed. Some processors automatically adjust the wash rate for the size and amount of paper processed. If the minilab does not automatically adjust the wash rate, set the rate for the maximum paper width.

Wash Rates for Processes RA-4

Number of Final Wash Tanks	Final Wash Rate mL/m² (mL/ft²)
1	See the note below
2	6,460 to 10,800 (600 to 1,000)
3	4,300 to 10,800 (400 to 1,000)
4	2,150 to 10,800 (200 to 1,000)

Note: If your minilab has a single wash tank, use a wash rate of at least 10,800 mL/m² (1,000 mL/ft²). You may need to make other equipment modifications to minimize the effect of bleach-fix carryover because this rate may provide only a marginal safety factor.

Agitation—The recirculation rates for the developer and bleach-fix should be 0.50 to 0.75 tank volumes/minute. The recirculation rate for the stabilizer should be 0.67 to 1.0 tank volumes/minute. With multiple tanks, the recirculation rate should be the same in each tank. Low-volume and slow-transport speed processors may require higher agitation to maintain process activity.

Good agitation is important during the first few seconds of the developer and bleach-fix steps. If initial agitation is poor in the developer, development may be uneven. Poor initial agitation in the bleach-fix may not stop development uniformly, which can cause magenta streaks and non-uniformity. This problem can be aggravated by excessive developer carryover into the bleach-fix.

Filtration—Processing solutions and wash water may contain some insoluble materials. If you don't filter out these materials, they can stick to the paper, tank walls, and rollers, and possibly damage the paper. Use the filters designed for your processor or those recommended by the manufacturer. Usually, filters with a porosity of 10 to 30 microns are effective for solutions and wash water. For incoming water supplies, use a filter with a porosity of 15 microns.

You can use the following filter materials with processes that use EKTACOLOR Chemicals:

- bleached cotton
- cellulose with phenolic-resin binder
- fiberglass with phenolic-resin binder
- polypropylene
- spun polypropylene
- viscose rayon with phenolic-resin binder (**do not** use in the developer)
- activated carbon

Polypropylene is the most acceptable filter-core material and one of the least expensive. This material has no photographic effect, but the surfactants used to produce the polypropylene yarns may have an effect on your process. Therefore, monitor your process carefully when you first change filters. Replace filters weekly for developers and every two weeks for other solutions.

Drying—The maximum drying temperature for EKTACOLOR Papers is 96°C (205°F).

Converting to KODAK EKTACOLOR PRIME LORR Chemicals

A more detailed description of the conversion is available from your Kodak Marketing Support Representative. It describes the methods for changing rates on several of the more common minilab processors. Be sure to consult your printer/paper processor manual and with your minilab manufacturers for specific details on your minilab.

Before converting to EKTACOLOR PRIME LORR Chemicals, use all of your current stock of chemicals. You do not need to dump your current working tank solution. You *do not* need to change the developer, bleach-fix, and stabilizer at the same time.

When you begin to use EKTACOLOR PRIME LORR Chemicals, adjust your replenishment rate to the appropriate setting from the following table. If you currently use EKTACOLOR PRIME Bleach-Fix Replenisher LORR, you *do not* need to adjust your bleach-fix replenishment rate.

Replenishment Rates for EKTACOLOR PRIME LORR Chemicals

Solution	mL/m* x 127 mm	mL/ft* x 127 mm	mL/M²	mL/ft²
PRIME SP Developer LORR	10.3	3.2	81	7.5
PRIME Bleach-Fix LORR	6.9	2.1	54	5
PRIME Stabilizer LORR (4 tanks)	28.6	8.72	194	18
PRIME Stabilizer LORR (3 tanks)	57	17.4	388	36

* mL per linear meter or foot

If your process is in control with EKTACOLOR PRIME SP Developer Replenisher, you can also calculate the replenishment rate for EKTCOLOR PRIME SP Developer Replenisher LORR by multiplying your current rate by 0.75. Then reset the rate (or pump setting) to the new rate. If you need help adjusting the replenishment rate, contact your minilab manufacturer. The process control aims and recommendations are the same as with previous products.

Note: If your equipment allows you to backup printer/paper processor data on a floppy disc or memory card, make sure you update your backup software after adjusting the replenishment rates. Otherwise, any future data transfer from your backup memory will revert to the previous higher replenishment rates and cause overreplenishment.

Periodic Low-Volume Situations

From time to time, a minilab will experience low-volume periods. EKTACOLOR PRIME LORR Chemicals are tolerant of low-volume periods that last for four to eight weeks.

However, low-volume operation for longer periods may lead to unacceptable performance. We recommend using EKTACOLOR PRIME SP Developer Replenisher or EKTACOLOR RA Developer Replenisher RT and EKTACOLOR Bleach-Fix Replenisher, which have higher replenishment rates, until production returns to normal.

To control the effects of low-volume processing, you can also take the steps described below.

When the number of prints processed is very low, you can observe two changes in process quality:

1. D-min, especially the yellow D-min, increases by as much as 6 density points.
2. The LD (speed) process-control parameter will fall below aim by as much as 10 density points.

Note: These conditions can also result from a processor malfunction—for example, if an air leak develops in the recirculation line or the replenishment rate is too low.

You can take a number of steps to minimize these conditions. Be sure to return to normal operation when production volume returns to normal.

- The yellow D-min increase described above is most commonly caused by the stabilizer solution. Replacing the stabilizer tank solution will reduce the yellow D-min. In many cases, changing only the first tank or the first two tanks will be sufficient. Routine dumping of the stabilizer every two to four weeks will minimize yellow D-min problems.
- If high yellow D-min persists, increase the replenishment rate for the EKTACOLOR PRIME Stabilizer LORR to reduce the problem. Increase the rate from 18 mL/ft^2 (190 mL/m^2) to 23 mL/ft^2 (250 mL/m^2) until production increases.
- When production volume is low, the LD speed parameter typically moves below aim. Small printer adjustments to maintain print density can accommodate minor shifts. However, if the low LD speed falls outside the lower action limit, you should increase the developer replenishment. Typically an increase from the nominal 7.5 mL/ft^2 (80 mL/m^2) to 8.5 mL/ft2 (91 mL/m^2) will bring the process back into control. Also increase the bleach-fix rate to 6 mL/ft^2 (64 mL/m^2).

Note: Before increasing the rates, verify that the processor meets specifications for replenisher delivery, solution time and solution temperature. Also check to be sure that the developer recirculation is working properly.