Processing
EASTMAN EKTACHROME
Color Reversal Films,
Module 13

Process RVNP Specifications

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13 Process RVNP Specifications

INTRODUCTION

This module contains specifications describing continuous machine processing of EASTMAN EKTACHROME Cine Camera and Print Films. The following modules are also used in conjunction with Process RVNP.

Module 14	Effects of Mechanical and Chemical Variations in Process RVNP
Module 1	Process Control
Module 2	Equipment and Procedures
Module 3	Analytical Procedures (for Chemical Analyses)
Module 4	Reagent Preparation Procedures (for Chemical Analyses)
Module 5	Chemical Recovery Procedures
Module 6	Environmental Aspects

Process RVNP provides processing of the designated films through either of the two process. The Preferred RVNP Sequence wet time has been reduced to 7:52 from 14:15 in Process VNF-1, and the Alternate RVNP Sequence is reduced to 7:42.

The reduced Process RVNP wet time is accomplished through the use of:

1. Increased machine speed compared to Process VNF-1
2. Additional decreases in some solution times
3. Increased solution temperature
4. Reduced safety factor
5. Persulfate Bleach and Accelerator in place of Ferricyanide Bleach

Process RVNP can run in many existing Process VNF-1 machines with a few minor modifications. Two Process RVNP Sequences are provided to accommodate easy conversion of a greater range of existing Process VNF-1 machines.

The solution times are designed to speed up the process as much as 58 percent. The ability to increase machine speed depends on the machine drive characteristics, dryer efficiency and feed-on capacity.

Designated Films

Process RVNP is recommended for the following films:

EASTMAN EKTACHROME High Speed Film 7250 (Tungsten)

EASTMAN EKTACHROME High Speed Daylight Film 7251

EASTMAN EKTACHROME High Speed Daylight Film 2253 / ESTAR Base

EASTMAN EKTACHROME Film 7239 (Daylight)

EASTMAN EKTACHROME Film 2239 / ESTAR Base

EASTMAN EKTACHROME Film 7240 (Tungsten)

EASTMAN EKTACHROME Print Film 5399 / 7399

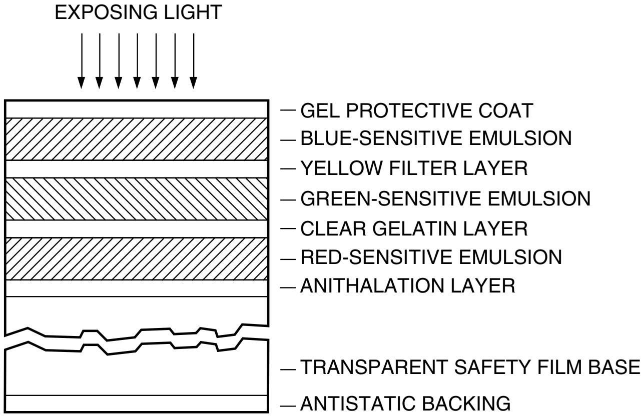
The print film requires a reduced first developer time (or temperature) and replenishment rate.

For information on exposure, lighting, color balance, required filters, image structure, sensitometric curves, printing conditions, film storage, and types of rolls available see KODAK Publication Nos. H-1-7250, H-1-7251, H-1-5239, and H-1-5240.

Film Structure

EASTMAN EKTACHROME Cine Camera and Print Films are multi-layer color films with incorporated color couplers. Figure 13-1, is a cross sectional diagram of unprocessed EKTACHROME Film.

Figure 13-1
Cross Section of Unprocessed Color Print Films



This drawing illustrates only the relative layer arrangement of the film and is not drawn to scale.

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On the bottom of the film support is an antistatic layer, that reduces friction between the film and camera pad or gate. The antihalation layer on the inner side of the support minimizes the effect of exposing light reflecting off the base.

Although the red- and green-sensitive emulsion layers are sensitive primarily to red and green light respectively, they are both slightly sensitive to blue light. The yellow filter layer absorbs blue light, preventing additional exposure of the red- and green-sensitive layers.

Process RVNP Steps

Below are the preferred and alternate process sequences. The preferred process uses persulfate bleach and the alternate process uses ferricyanide bleach.

The chart shows the steps of the two process sequences. The alternate sequence should only be used if the machine for some mechanical reason cannot be plumbed for the preferred sequence.

	Preferred Sequence	**Alternate Sequence**
Step	**Solution**	
1.	First Developer	
2.	First Stop	
3.	Wash	
4.	Color Developer	
5.	Second Stop	Bleach Accelerator
6.	Bleach Accelerator	Wash
7.	Persulfate Bleach	
8.	Fixer	
9.	Wash	
10.	Stabilizer	
11.	Dryer	
12.	Film Lubrication	

Process Step Description

Step	Function
1. First Developer	Reduces exposed silver halide grains in all three light-sensitive layers. The negative silver image is formed at the exposed silver-halide site.
2. First Stop	Stops the development of silver-halide grains and reduces emulsion swelling during the next wash.
NOTE: The film can now be handled in white light.	
3. Wash	Removes excess acid stop.
4. Color Developer	A reversal (fogging) agent makes the remaining silver halide developable without being exposed to light. The developing agent then produces a positive silver image in each layer, and the oxidized developing agent reacts with the incorporated color couplers to produce color images simultaneously at all development sites in each layer.
5. Second Stop	Stops action of the color developer.
6. Bleach Accelerator	Prepares the positive silver image for bleaching. In the Alternate Sequence it acts as a second stop following the color developer.
7. Persulfate Bleach	Converts the metallic silver from the positive image into silver-halide salts.
8. Fixer	Converts the insoluble silver halide salts into soluble complex silver thiosulfate compounds that are removed in the fixer and following wash.
9. Wash	Removes hypo and residual silver thiosulfate complex compounds that were not removed from the film in the first fixer.
10. Stabilizer	Hardens the emulsion, stabilizes the dye images and prevents water spots.
11. Dryer	Dries film for subsequent handling.
12. Lubrication	Promotes longer print projection life. It may be an in- or off-line operation. See Module 2, *Equipment and Procedures*.

Safelights for Darkroom Illumination

Total darkness is recommended when either unexposed film or exposed film is handled in a camera loading room, printer room or processing room.

During processing the designated films should be handled in total darkness until after the first stop. The remaining operations can be carried out in a lighted room. A safelight equipped with a KODAK 3 Safelight Filter / dark green, can be used to illuminate dials, meters, etc., during first development, but the light must not be allowed to shine directly on the film.

Film Storage and Handling

Processed film should be stored at 70°F (21°C) or lower and 40 to 50 percent relative humidity for normal commercial storage. For long-term storage conditions, refer to KODAK Publication No. H-23, *The Book of Film Care*.

Care must be exercised in the handling of these films to avoid scratches and/or dirt that will be noticeable on projection. Film handlers should use lint-free nylon or Dacron gloves and handle the film by the edges as much as possible. Further suggestions on how to keep camera or preprint films clean are in Module 2, *Equipment and Procedures*.

Other Film Characteristics

For information on the physical characteristics of Kodak motion picture films (including edge identification, perforations, and dimensional change characteristics), as well as cores, spools, winding, and packaging, refer to KODAK Publication No. H-1, *KODAK Motion Picture Film*.

Machine Design

The films intended for Process RVNP are processed in continuous processing machines with the film transported through the solution tanks, emulsion side up, on a series of mechanically driven spools. These spools are mounted in racks that fit into the tanks, with the film threaded over the spools so that it travels in a continuous spiral on each rack. No part of the film is allowed to contact any part of the machine that can damage either the support or the emulsion side of the film.

The required treatment or solution time for each processing solution and wash is obtained by installing an appropriate number of racks in the various solutions and washes for a specific film transport speed. The size and number of racks are predetermined by the machine manufacturer. Some machine manufacturers build racks with the upper spools fixed and the lower spools mounted on a floater or slider. With such racks, solution times can be controlled by adjusting the positions of the floaters. A buffer rack is recommended in the final wash to remove any process dirt that accumulated on the film during processing.

The layout of a typical machine for the preferred sequence and the alternate sequence are shown in Figures 13-2 and 13-3. Squeegees must be used at all the locations shown in the Figures to reduce contamination and minimize loss of solution by carry-over into subsequent solutions. The area where the machine is located should allow ample room for opening machine access covers and raising film racks.

When it is necessary to use forced processing to increase effective film speed, the machine must be equipped to allow additional first development by: (1) using adjustable racks in the first developer (or allow additional rack inserts), (2) lowering the machine speed or, (3) increasing the first developer temperature. Forced processing by increasing the first developer temperature will produce inferior results and is not recommended for more than a one-stop increase in exposure index.

Eastman Kodak Company does not market processing machines or auxiliary equipment suitable for Process RVNP. However, a list of some manufacturers of processing equipment can be obtained on request through the Entertainment Imaging Division regional offices.

Construction Materials

The construction materials recommended for the developers, stop, fixer, stabilizer, persulfate bleach and accelerator are listed in Table 13-1. Persulfate bleach is more corrosive than ferricyanide bleach. Therefore, Titanium, Hastelloy C, and engineering plastics such as PVC are recommended materials for persulfate bleach.

Some materials that are compatible with ferricyanide bleach are not acceptable with persulfate bleach. Prior to use, all construction materials should be tested to be certain they are photographically inert toward the films and processing solutions they contact.

Red brass is commonly found in ferricyanide bleach systems; it will quickly be dissolved by persulfate bleach. In addition to machine tanks, it is often found in fittings, flowmeters, heat exchangers, and valves. Small red-brass parts have been found even when the bleach tank is constructed of titanium, Hastelloy C, or PVC.

Monel is a commonly used staple material; it is dissolved by persulfate bleach in several hours. Stainless-steel staples are recommended for extended lifetime in persulfate bleach. Standard carbon-steel staples will show some corrosion, but maintain their integrity in persulfate bleach much longer than Monel-type staples. In all cases, it is a good practice to avoid extended exposure of staples to any bleach.

Some plastic and elastomeric materials will be degraded by persulfate bleach. This degradation is accelerated by the presence of chlorine in the bleach. Some materials known to be degraded by persulfate bleach are low-density polyethylene, acrylonitrile, butadiene, styrene, nylon 6/6, and neoprene. All plastics and elastomeric materials (other than PVC, RTV-60, silicone, and Vitron) should be tested before being used in persulfate bleach. Most plastics, including PVC, will discolor in persulfate bleach, but retain their mechanical properties. Tygon tubing, which turns white, is an example of this effect.

Viscose rayon has caused undesirable sensitometric effects in the past and it is not recommended as a filter material for the bleaches. Polypropylene, fiberglass, and cotton are recommended filter materials. The filter core should be made from an acceptable plastic material.

The holding tank for the first and color developer replenisher should have a tight-fitting floating cover to minimize air oxidation of the solution and the absorption of carbon dioxide gas from the air. Clearance between the cover and the tank wall should not be greater than ¼ inch (6.4 mm). Polyethylene sheeting of ½ inch (12.7 mm) thickness make adequate covers in sizes up to 3 feet (1 m) in diameter. A dust cover alone permits too much air to come in contact with the solution and is not adequate by itself for this application. Dust covers should be used with other solutions to minimize dirt in the replenisher tanks.

Additional materials of construction and information regarding their use are given in KODAK Publication No. K-12, *Construction Materials for Photographic Processing Equipment*.

Figure 13-2 Machine Schematic for Process RVNP Preferred Sequence

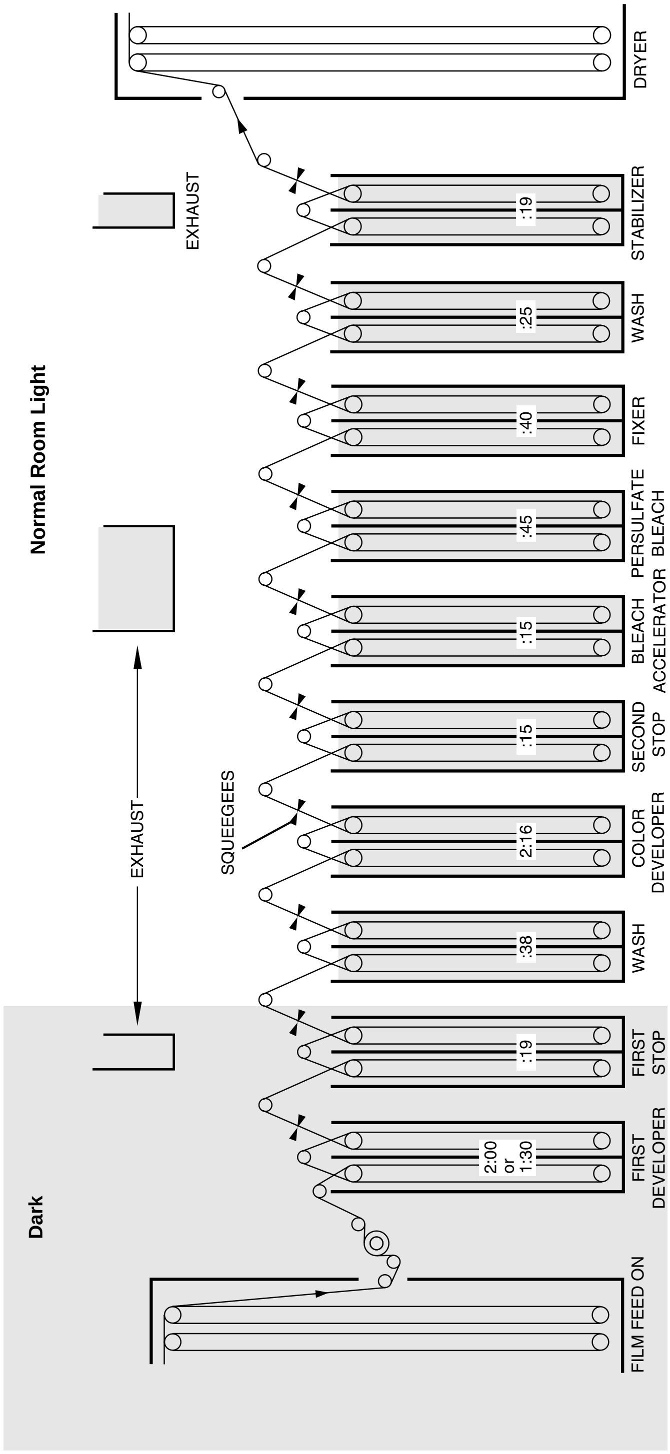

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Figure 13-3 Machine Schematic for Process RVNP Alternate Sequence

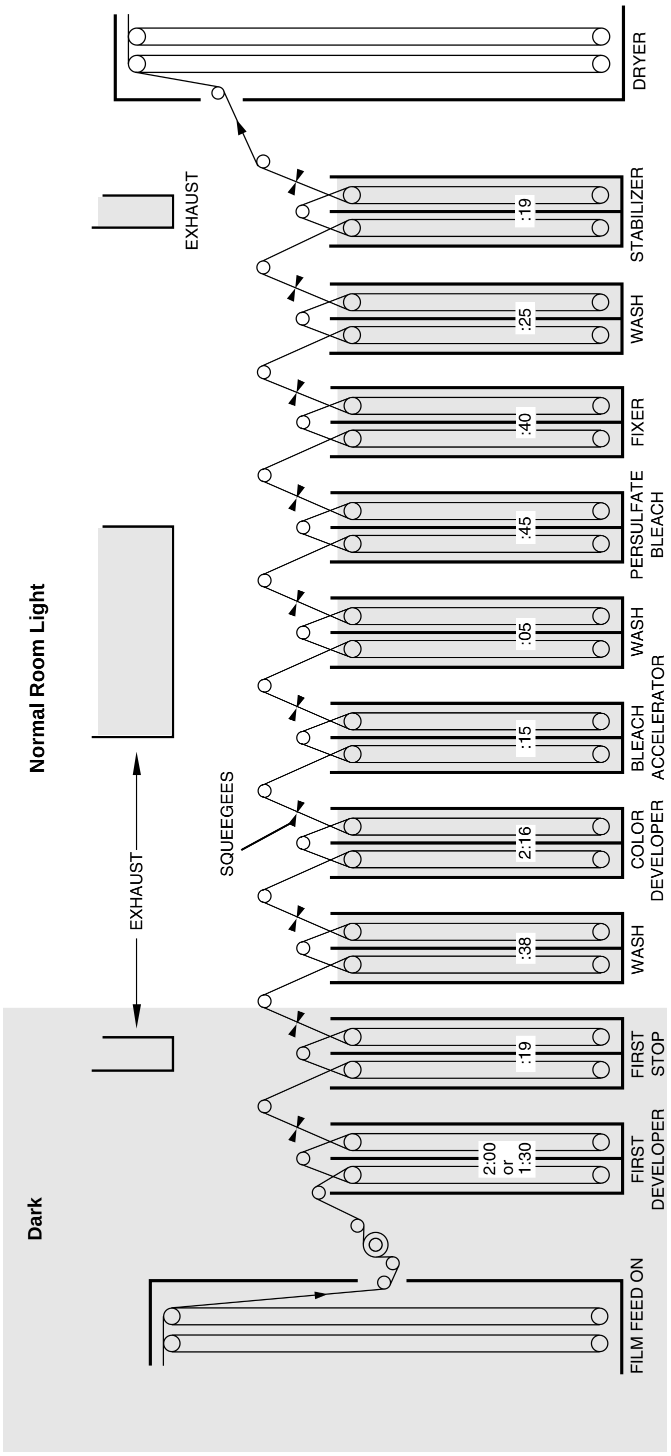

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Table 13-1 Construction Materials for Process RVNP

Solution	Plastics such as Polyvinyl Chloride or Polyolefins	Titanium	Hastelloy C	Austenitic Stainless Steel AISI Type 316
Persulfate Bleach:				
Tanks and Racks	●[a]	●	●	
Mixing Tanks	●[a]	●	●	●[b]
Replenisher Holding Tanks	●[a]	●	●	
Piping, Pumps, Valves, and Filter Cores	●[a]	●	●	
Bleach Overflow Holding Tank	●[a]	●	●	
Stop and Accelerator:				
Tanks and Racks	●[a]	●	●	
Mixing Tanks	●[a]	●	●	●
Replenisher Holding Tanks	●[a]	●	●	●
Piping, Pumps, Valves, and Filter Cores	●[a]	●	●	●
Accelerator Overflow Collection Tanks	●[a]	●	●	●
Others:				
Tanks and Racks	●	●	●	●
Mixing Tanks	●	●	●	●
Replenisher Holding Tanks	●	●	●	●
Piping, Pumps, Valves, and Filter Cores[c]	●	●	●	●

[a] Plastics compatible with low pH solutions should be used. Except for polyvinyl chloride, polypropylene, and high-density polyethylene, the compatibility of other plastics should be evaluated under actual use.

[b] Short-term storage of persulfate bleach in stainless steel tanks is acceptable.

[c] If the solution temperature at the filter pot might exceed 120°F (49°C), do not use a polypropylene filter core.

Leader Requirements

Machine leaders (16 mm) recommended for maintaining thread-up are EASTMAN Processing Machine Leader 3988 (ESTAR Base), 0.007 in., and EASTMAN Processing Machine Leader 3989 (ESTAR Base), 0.004 in.

EASTMAN Green Leader 7982 is satisfactory if ONLY camera films are processed. When Green Leader is reused, KODAK Reversal Agent, RA-1 is absorbed from the color developer and leaches out into the first developer. The RA-1 will cause adverse sensitometric effects first noticeable on the print film.

EASTMAN Black-and-White Opaque Leader 7981 produces the same effect when reused, but since it adsorbs more reversal agent, the effect is greater. The the top (blue-sensitive) film layer is fogged, giving the appearance of a bluish looking film (no yellow dye).

Filters

Filters are required in replenisher lines, recirculation systems, and wash-water lines, because these solutions usually contain some insoluble material in the form of solids and tars. If this material is not removed, it can adhere to the film being processed, machine tank walls, rollers, lines, etc.

The porosity rating of the filters should be 10 microns, but the back pressure of a 10-micron filter is sometimes too great to permit adequate flow unless oversize pumps are used. Increasing the filter area (parallel filters) will decrease the back pressure. Filters with porosity ratings larger than 30 microns will produce low-back pressure, but these filters are of little value in removing insoluble material. In some cases it may be necessary to use two or more filters in series, with filters of high porosity preceeding filters of low porosity. The high-porosity filters keep the low-porosity filters from clogging rapidly.

A definite replacement schedule for filters should be established and followed. It is suggested that the filters be changed once every week or whenever the pressure differential across the filter pot exceeds 10 psig (69 kPa).

For Process RVNP, polypropylene, fiber glass, or bleached cotton can be used as the filter media for all solutions. Viscose rayon should not be used with the developer since it can cause adverse photographic effects. See Table 13-1 for construction materials for filter cores. All filters should be tested before use to determine whether they produce any adverse photographic effects.

Crossover Squeegees

Use crossover squeegees to minimize the loss and dilution of processing solutions resulting from the carry-out of solution or carry-in of wash water or solution by the film from the preceding tank. Squeegees wipe solution off both sides of the film strand and back into the appropriate tank using wiper blades[*], air streams, vacuum, buffer plush[†], sponge, felt, or some other material. Locate a crossover squeegee on the exit strand of each solution for Process RVNP, except between stages of counter-current washes

Employ wiper-blade squeegees of 30- to 40-durometer hardness, but make sure they do not scratch the film. When air squeegees are employed, operate them so the misting and splattering of processing solutions do not occur. At some combinations of temperature and humidity, a deposit of salt crystals will form on the air squeegee following solutions of high salt content such as bleach and fixer. Minimize the buildup by heating the air supplied to the squeegee, so that upon exit, the air is about 100°F (38°C). Use a very efficient squeegee after the final rinse to achieve uniform drying.

For a general discussion on the use of squeegees, see “A Review of the Effects of Squeegees in Continuous Processing Machines,” *Journal of the SMPTE*, 79:121-123, February 1970. More details on squeegee design details are covered in Module 2, *Equipment and Procedures*.

Dryer Cabinet

Carefully control film drying. If not dried thoroughly, the film emulsion remains soft and sticky. This leads to a physical defect called *ferrotyping*. If dried too much, the emulsion becomes brittle and tends to blister. Satisfactory drying leaves the film dry without tackiness about one half to two thirds of the way through the drying cabinet. Cool the film to room temperature before windup. After cooling, the film should have a moisture content in equilibrium with air at 50 percent relative humidity.

Use either impingement or convection (nonimpingement) drying. The impingement dryer dries film in a shorter time and occupies less space than a nonimpingement dryer. Regardless of the type, the drying equipment must produce adequate and uniform drying to prevent deformation of the film support or emulsion. Filter the input air to the dryer to remove dust particles that can stick to the film. A high-efficiency particulate air (HEPA) filter, such as the Micretain Equi Flo[‡] filter (95 percent efficient at 0.3-micron particle size) is recommended.

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[*] The wiper-blade squeegee is described in “Spring-Loaded Wiper-Blade Squeegees,” *Journal of the SMPTE* 81:742-796, October 1972.

[†] The rotary buffer squeegee is described in “Jet Antihalation Backing and Its Removal From Films During Processing,” *Journal of the SMPTE*, 80:564-569, July 1971.

[‡] A product of Cambridge Filter Corporation, 7645 Henry Clay Blvd., Liverpool, NY 13088.

Machine Exhaust and Room Ventilation Systems

Install local exhausts at specific locations on the processing machine and at specific work areas to provide for the safety and comfort of the laboratory personnel. Supplement local exhausts with a room ventilation system having a capacity of 10 air changes per hour. Vent the discharge air from these systems outside the building so that discharged air does not contaminate incoming air.

Locate local exhausts over chemical mixing tanks to remove irritating chemical dust and vapor produced when processing solutions are mixed.

Some machine tank solutions require local exhausts because of objectionable gasses produced there.

A slot-type exhaust on the far side of the first stop tank will carry away any sulfur dioxide or hydrogen sulfide generated by developer carried over into the stop. An efficient squeegee after the first developer can minimize the carry-in.

Processing machines running the persulfate bleach, need local exhausts at the accelerator and bleach tanks. A slot-type exhaust on the far side of both the accelerator and persulfate bleach will eliminate the accelerator's distinctive odor and the small amount of chlorine released from the persulfate bleach. This low chlorine lever presents no safety or operational problems but can cause some corrosion of stainless steel and other materials surrounding the bleach tank if not vented properly.

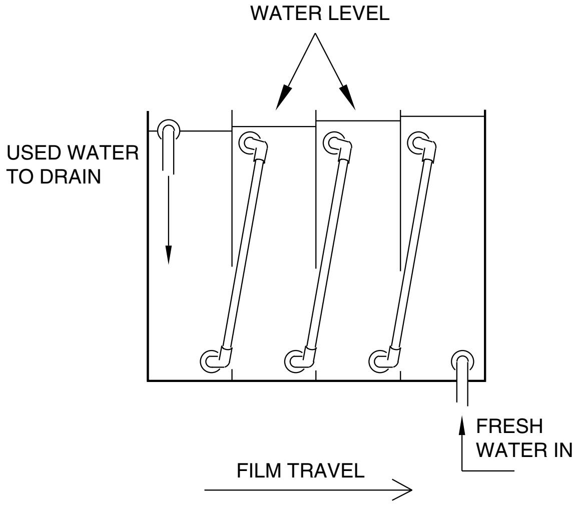
An exhaust over the machine's stabilizer tank will remove formaldehyde fumes.

Exhausts need not fit tightly over tanks, and slots should be placed to draw air away from the operator. The exhaust system should provide an air flow of 175 ft^3/min (5 m^3/min) for every one foot^2 (0.09 m^2) of solution surface, and provide 50 to 75 ft/min (15 to 23 m/min) control velocity over the surface of the tank.

Countercurrent Washes

Multitank countercurrent wash methods provide a great savings in water. In this technique, fresh water enters the last tank, flows to the previous tank, and so on to the first tank, in a direction counter to that of film travel. As the film advances through the wash, it enters cleaner and cleaner water. A four-stage countercurrent final wash is illustrated in Figure 13-4.

Figure 13-4 Four-Stage Countercurrent Wash



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Pneumatic Agitation

In the bleach and fixer, air is used to provide agitation. Oil-free compressed air is forced into the tank solution through perforated tubes in pneumatic agitation. The tube perforations are located near the bottom of the tank. The bubbles rising up through the solution keep it constantly mixing, maintaining a uniform concentration in the tank. The degree of agitation is controlled by adjusting the air flow.

Recirculation System

Recirculation also keeps the solution mixing in the tank, and in addition, replenishes it and maintains the solution temperature.

A basic recirculation system includes piping, replenisher solution, flow meters, pumps, filters, heat exchanger, temperature controller, temperature sensors, electric solenoid valves, solution distributors or turbulators and tank. Figure 2-7 in Module 2, *Equipment and Procedures* shows a basic system.

Recirculation and filtration are required for the first developer, color developer and bleach accelerator in Process RVNP. The bleach and fixer are either recirculated or air agitated in both alternate sequences.

OPERATING SPECIFICATIONS

Mechanical Specifications

Process RVNP can be run in many existing Process VNF-1 machines with a few minor modifications. Two Process RVNP Sequences are provided to accommodate easy conversion of a greater range of existing Process VNF-1 machines. The alternate sequence should only be used if the machine for some reason cannot be modified for the preferred sequence.

The mechanical specifications for the preferred sequence of Process RVNP is presented in Table 13-2. Table 13-3 presents the alternate sequence. Included are temperatures with tolerances, processing solution times, replenishment rates, and other pertinent information.

Use the processing times and drying conditions shown in the tables as a guide for preliminary machine design. The processing times actually used may differ slightly from the ones shown in the tables because of machine design variables, such as film-transport speed, degree of solution agitation, and amount of solution carry-over. You must determine those specifications necessary to produce satisfactory quality for your installation. Optimum drying conditions (air volume, temperature, and relative humidity) also vary with each dryer design.

Use the replenishment data listed as a starting point for determining exact requirements to maintain the tank chemical analytical specifications.

Handle the exposed film stock designated for Process RVNP in total darkness during machine loading and processing until after the first stop. The processing steps that follow can be performed in normal room light.

Table 13-2 Mechanical Specifications for Process RVNP Preferred Sequence

Process Steps	Temperature[a]		Time	Rack Type[b]	Replenishment per 100 ft of 16 mm Film[c]		Recirculation (R); Filtration (F); Agitation (A)
	°F	°C			Film	Leader	
First Developer [d, e]	111.2 ± 0.5	44.0 ± 0.3	2:00	R	850 mL	0 mL[f]	R & F @ 40 L/min
First Stop [g, h]	104 ± 5	40 ± 3	:19	R	1100 mL	300 mL	None
Wash[i]	104 ± 2	40 ± 1	:38	R	8000 mL	8000 mL	None
Color Developer	114.8 ± 1.0	46.0 ± 0.6	2:16	R	800 mL	150 mL	R & F @ 40 L/min
Second Stop[h]	104 ± 5	40 ± 3	:15	R	650 mL	200 mL	None
Bleach Accelerator	104 ± 5	40 ± 3	:15	R	200 mL	150 mL	R & F @ 15 L/min[j]
Persulfate Bleach[g]	104 ± 5	40 ± 3	:45	Ti[k]	200 mL	150 mL	Air A or R @ 15 L/min[l]
Fixer	104 ± 5	40 ± 3	:40	R	625 mL[m]	150 mL	Air A or R @ 15 L/min[l]
Wash[i]	104 ± 2	40 ± 1	:25	1B/1R	8000 mL	8000 mL	None
Stabilizer[g]	104 ± 5	40 ± 3	:19	R	300 mL	150 mL	None
Impingement Dryer[n] Input Air, Dry Bulb 130-140°F (54-60°C), 17-20% RH, 2:15 ± 15							

[a] Fahrenheit temperatures are primary. Celsius temperatures are rounded consistent with process-control requirements.

[b] Rack Type: R = Regular, B = Buffer, Ti = Titanium or Hastelloy C.

[c] Use 2x the replenishment rates for 35 mm film. All rates assume efficient squeegees on the exit strand of each solution except the stops and washes.

[d] Forced processing of the camera films may be accomplished by increasing the time of the first developer. Forced processing by increasing the first developer temperature will produce inferior results and is not recommended for more than a one-stop increase in exposure index. Table 13-4 shows suggested starting points for 1- and 2-stop force processing that varies just time or just temperature.

[e] When processing print film, either the first developer time is reduced to 1:30 by shortening the thread up in the developer solution or the first developer temperature is reduced to 101.8 ± 0.5°F (38.8 ± 0.3°C). Reduce the replenishment rate to 488 mL/100 ft of 7399 film, or 975 mL/100 ft of 5399 film.

[f] If a large quantity of leader is being run, the level of the first developer tank should be checked periodically and First Developer Replenisher added to make up for excessive carry-out.

[g] Install a slot-type exhaust at the first stop tank if objectionable amounts of sulfur dioxide are detected. A similar exhaust at the accelerator and bleach tanks will remove thiol odor and trace amounts of benzaldehyde and chlorine.

[h] The overflow from the first stop can be used as the replenisher for the second stop, resulting in equal replenishment rates.

[i] Single-tank washes can be used. However, countercurrent flow washes are more efficient.

[j] Recirculation and filtration are required. Air agitation is not recommended. An efficient squeegee after the Color Developer will keep the Bleach Accelerator cleaner and minimize the filter cartridge changes.

[k] The bleach tank and racks can also be constructed of Hastelloy C or suitable plastics.

[l] Approximately 25 ft^3/min (0.7 m^3/min) of oil-free compressed air is required to supply the rack squeegees, final squeegees, and solution agitation system.

[m] Recirculation of the fixer through an electrolytic silver-recovery unit is possible, but a reduction of the replenishment rate is not recommended.

[n] Film should be dry (no tackiness) about one half to two thirds of the way through the dryer cabinet. With a faster machine speed an increase in temperature and/or air flow may be required.

Table 13-3 Mechanical Specifications for Process RVNP Alternate Sequence

Process Steps	Temperature[a]		Time	Rack Type[b]	Replenishment per 100 ft of 16 mm Film[c]		Recirculation (R); Filtration (F); Agitation (A)
	°F	°C			Film	Leader	
First Developer [d, e]	111.2 ± 0.5	44.0 ± 0.3	2:00	R	850 mL	0 mL[f]	R & F @ 40 L/min
First Stop [g]	104 ± 5	40 ± 3	:19	R	1100 mL	300 mL	None
Wash[h]	104 ± 2	40 ± 1	:38	R	8000 mL	8000 mL	None
Color Developer	114.8 ± 1.0	46.0 ± 0.6	2:16	R	800 mL	150 mL	R & F @ 40 L/min
Bleach Accelerator [g, i]	104 ± 5	40 ± 3	:15	R	200 mL	150 mL	R & F @ 15 L/min[j]
Wash[h]	104 ± 2	40 ± 1	:05	R	800 mL	8000 mL	None
Persulfate Bleach [g]	104 ± 5	40 ± 3	:45	Ti[k]	200 mL	150 mL	Air A or R @ 15 L/min[l]
Fixer	104 ± 5	40 ± 3	:40	R	625 mL[m]	150 mL	Air A or R @ 15 L/min[l]
Wash[h]	104 ± 2	40 ± 1	:25	1B/1R	8000 mL	8000 mL	None
Stabilizer	104 ± 5	40 ± 3	:19	R	300 mL	150 mL	None
Impingement Dryer[n] Input Air, Dry Bulb 130-140°F (54-60°C), 17-20% RH, 2:15 ± 15							

a Fahrenheit temperatures are primary. Celsius temperatures are rounded consistent with process-control requirements.
b Rack Type: R = Regular, B = Buffer, Ti = Titanium or Hastelloy C.
c Use 2x the replenishment rates for 35 mm film. All rates assume efficient squeegees on the exit strand of each solution except the stops and washes.
d Forced processing of the camera films may be accomplished by increasing the time of the first developer. Forced processing by increasing the first developer temperature will produce inferior results and is not recommended for more than a one-stop increase in exposure index. Table 13-4 shows suggested starting points for 1- and 2-stop force processing that varies just time or just temperature.
e When processing print film, either the first developer time is reduced to 1:30 by shortening the thread up in the developer solution or the first developer temperature is reduced to 101.8 ± 0.5°F (38.8 ± 0.3°C). Reduce the replenishment rate to 488 mL/100 ft of 7399 film, or 975 mL/100 ft of 5399 film.
f If a large quantity of leader is being run, the level of the first developer tank should be checked periodically and First Developer Replenisher added to make up for excessive carry-out.
g Install a slot-type exhaust at the first stop tank if objectionable amounts of sulfur dioxide are detected. A similar exhaust at the accelerator and bleach tanks will remove thiol odor and trace amounts of benzaldehyde and chlorine.
h Single-tank washes can be used. However, countercurrent flow washes are more efficient.
i this solution replaces the Stop Bath after the Color Developer in the preferred sequence of Process RVNP. The overflow from the First Stop Bath cannot be used to replenish this solution, nor can this solution be used in place of the First Stop Bath.
j Recirculation and filtration are required. Air agitation is not recommended. An efficient squeegee after the Color Developer will keep the Bleach Accelerator cleaner and minimize the filter cartridge changes.
k The bleach tank and racks can also be constructed of Hastelloy C or suitable plastics.
l Approximately 25 ft^3/min (0.7 m^3/min) of oil-free compressed air is required to supply the rack squeegees, final squeegees, and solution agitation system.
m Recirculation of the fixer through an electrolytic silver-recovery unit is possible, but a reduction of the replenishment rate is not recommended.
n Film should be dry (no tackiness) about one half to two thirds of the way through the dryer cabinet. With a faster machine speed an increase in temperature and/or air flow may be required.

Forced Processing (To increase effective film speed)

If you are required to alter the process to yield higher effective camera film speeds, you must recognize that some loss of photographic quality will result. The degree of quality loss that will still yield acceptable results must be determined by you or your customer.

To increase the effective film speed, extend the first development time only. Forced processing by increasing the first developer temperature will produce inferior results and is not recommended for more than a one-stop increase in exposure index. Table 13-4 suggests starting points for one- and two-stops forced processing. Forced processing to three stops is possible but not recommended because of the degree of image quality loss.

A Status A green density of 1.0 has been chosen as the criterion to determine the extent of forced processing. A subject whose image records at 1.0 green density for normal exposure and normal process, will also record at 1.0 green density when underexposed and forced processed.

Figure 13-5 graphically represents the forced processing relationship in a Time vs Temperature Function.

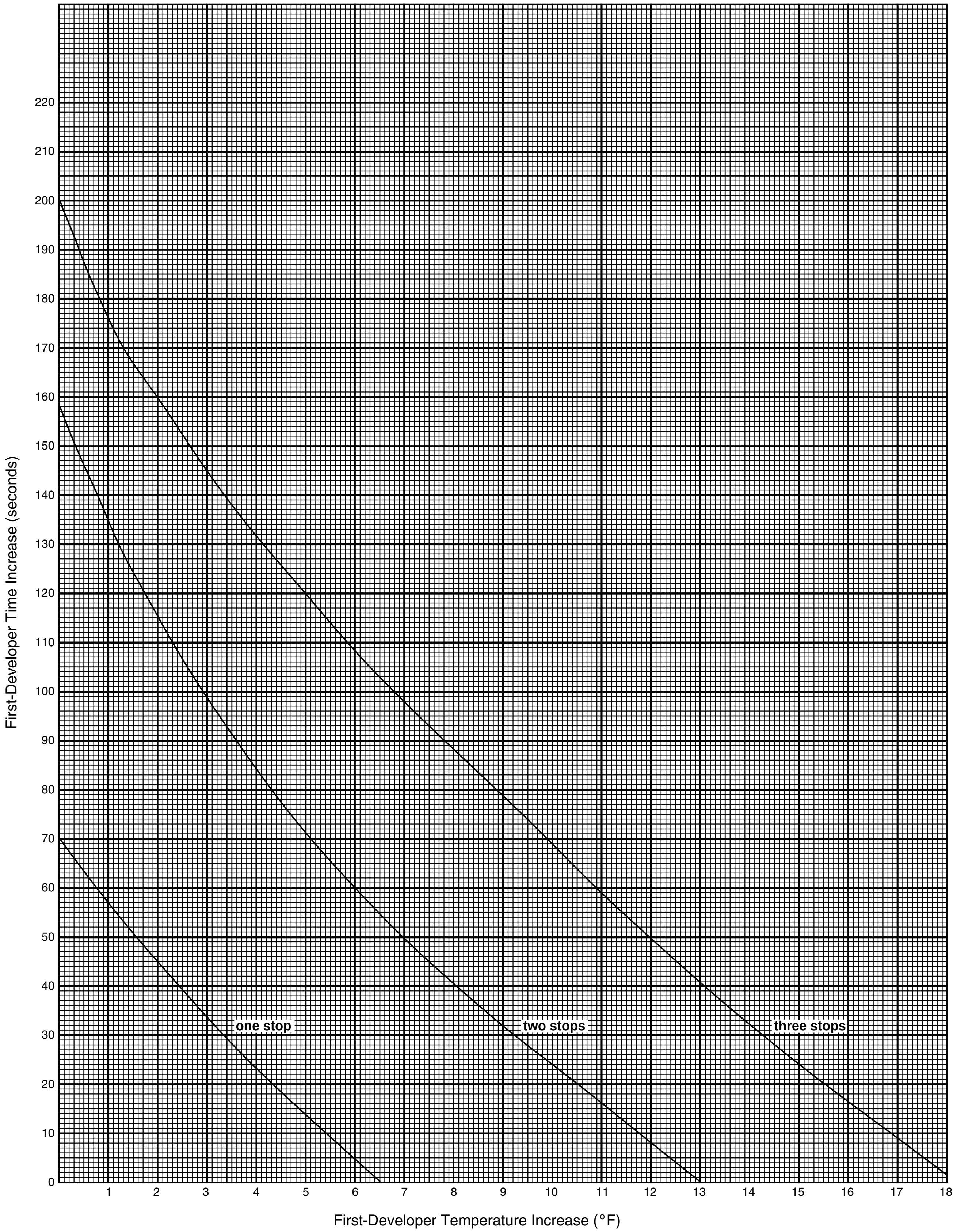
Table 13-4 Effective Film Speeds of Forced Processed EASTMAN EKTACHROME Films

Film	Exposure Source and (Filter)	Effective Exposure Index	Either Suggested First Developer Temperature	Or Suggested First Developer Time
One-Camera Stop Increase				
7239	Daylight (None)	320	118.4°F (48°C)	2:50
7240	3200K (None)	250		
	Daylight (85B)	160		
7250	3200K (None)	800		
	Daylight (85B)	500		
7251	Daylight (None)	800		
Two-Camera Stop Increase				
7239	Daylight (None)	640[a]	Not Recommended	3:50
7240	3200K (None)	500[a]		
7250	3200K (None)	1600		
	Daylight (85B)	1000		
7251	Daylight (None)	1600		

[a] Emergency use only. Use 7250 and 7251 film at normal exposure indices for best image quality.

Note: Forced Processing to increase exposure index eight times (three stops) is possible in an emergency but is not recommended because of image quality degradation.

Figure 13-5 Forced Processing: Time vs Temperature Function



NOTE: These are approximate time and temperature increases from normal conditions. Exact times and temperatures will vary depending on machine agitation level and the film emulsion.

F002_1137EC

Packaged Chemicals

As a convenience, packaged chemicals for Process RVNP are available from Eastman Kodak Company through its marketing and distribution centers. These packaged chemicals are listed in Table 13-5. The packages are sized to prepare 100 litres of solution, except as noted below.

Table 13-5 KODAK Packaged Chemicals for Process RVNP

KODAK VNF-1/RVNP First Developer Starter
KODAK VNF-1/RVNP First Developer Replenisher
KODAK VNF-1/RVNP Stop Bath and Replenisher
KODAK VNF-1/RVNP Color Developer
KODAK VNF-1/RVNP Color Developer Replenisher
KODAK VNF-1/RVNP Liquid Fixer and Replenisher[a]
KODAK VNF-1/RVNP Stabilizer and Replenisher
KODAK VNF-1/RVNP Persulfate Accelerator and Replenisher
KODAK VNF-1/RVNP Persulfate Bleach and Replenisher, Part A
KODAK VNF-1/RVNP Persulfate Bleach and Replenisher, Part B

[a] Make this package to 85 litres only for Process RVNP.

Mixing Packaged Chemicals

Use the following mixing practices when preparing processing solutions with common mixing equipment. Mix solutions in the same order they occur in the process sequence. This order will minimize the effect of contamination of a solution by the previously mixed solution. The solutions are also less likely to be placed in the wrong holding or machine tanks.

The mixing area should be well ventilated and have a local exhaust over the mixing tank to carry off fumes and chemical dust. See Module 2, *Equipment and Procedures*, for exhaust specifications.

Information on the known hazards and safe handling of the following chemicals is available from Eastman Kodak Company. The information is in the form of Material Safety Data Sheets (MSDS), as required by the OSHA Hazard Communication Standard Act and many state laws.

The instructions for preparing each solution accompany the individual package. The general mixing instructions below apply to all solutions and are given in the order of operation.

1. Observe all precautionary information on container and package labels of each chemical, on the mixing instructions, and on the Material Safety Data Sheets for the individual chemical.
2. Rinse the mix tank with a number of small volumes of water, and run fresh water through the pump. Drain the tank and pump.
3. Fill the tank to mixing level with water at the appropriate temperature. Start the mixer; allow 30 seconds for agitation of the water before the first chemical addition. This agitation helps to remove the air from the water and to disperse the first chemical addition. Make sure the impeller position will not draw air into the water.
4. While the tank is filling, open the chemical package.
5. Follow the dissolving instructions for each package, and then pump the completed mix into the holding tank. Be sure to follow all the HAZARD and SAFETY precautions listed on the package and in the mixing instructions.

NOTE 1: Always use the entire package, and dilute to its 100-litre volume. Do not use portions of these packages to prepare volumes of solution smaller than the 100 litres except as noted for the fixer above.

NOTE 2: It may be convenient to dissolve two or more 100-litre packages at a time if the total volume of solution can be used within its storage life. The starting volume must be increased in proportion with the number of packages being dissolved. The mixing order for the solution must also be maintained. For example, if 300 litres of first developer replenisher is to be prepared, all Parts A from the three packages are added to 270 litres of water. Stir until the solution is clear. then add all Parts B from the three packages, and stir until the solution is uniform. Continue to prepare the solution in this manner, following the appropriate mixing instructions.

NOTE 3: Trapped air is often confused with undissolved solids when processing solutions are being prepared. When large amounts of powders and crystals are added to a mix, they carry a considerable amount of air into the water. The air leaving the solution gives the appearance of solid material not having gone into solution, especially when viewed from the top of the mix tank.

To determine if a chemical has dissolved, turn off the mixer, and fill a clean, clear container (such as a Pyrex beaker) with the solution. If the solution contains undissolved solids, they will remain suspended or will tend to settle on the bottom of the container. If any liquids such as benzyl alcohol are undissolved, they may be suspended, settled, or floating on the surface. Trapped sir will be readily recognized as air bubbles, which will rise to the surface of the solution.

6. Carefully rinse the tank and the pump in order to prevent contamination of one solution with another. It is best to clean the mixing equipment immediately after the tank is emptied. In this way, salts and tars will not form. The tank is more efficiently rinsed if numerous small-volume rinses are used rather than a few large-volume rinses.

Bulk Chemicals

The following list of suppliers is not intended to be all-inclusive, nor are the suppliers listed in any order of preference. The mention of a supplier is not intended as a recommendation by Eastman Kodak Company. Most of the chemicals listed are available from local chemical supply houses. For additional suppliers, consult “Chemical Week,” “Chemical Buyers,” or “Thomas’ Register” in public libraries.

Table 13-6 Bulk Chemical Suppliers

Chemical or Trade Name	Formula or Chemical Name	Some Suppliers
Acetic Acid, Glacial	CH_3COOH	Fisher Scientific
		Brown Chemical Company
Ammonium Thiosulfate	$(NH_4)_2S_2O_3$	Fisher Scientific
		General Chemical Company
		E.I. du Pont de Nemours & Company, Inc.
KODAK Anti-Calcium, No. 4	—	Eastman Kodak Company
Benzyl Alcohol[a] (Inhibited)	$C_6H_5CH_2OH$	Ashland Chemical Company
		Aldrich Chemical Company, Inc.
Beta-Aminopropionic Acid (Beta-Alanine)	—	Allan Chemical Company
		Chemical Dynamics Corporation
KODAK Bleaching Agent BL-1		Eastman Kodak Company
Borax, Decahydrate*	$Na_2B_4O_7 \bullet 10H_2O$	Ashland Chemical Company
		US Borax and Chemical Corporation
Borax, Pentahydrate*	$Na_2B_4O_7 \bullet 5H_2O$	Ashland Chemical Company
		US Borax and Chemical Corporation
KODAK Color Developing Agent, CD-2	—	Eastman Kodak Company
Citrazinic Acid*	$C_6H_5NO_4$	Aceto Corporation
		Great Lakes Chemical Corporation
		Nachem, Inc.
Ethylene-diamine*[b] (98% Assay)	$NH_2CH_2CH_2NH_2$	Fisher Scientific
		Ashland Chemical Company
		Union Carbide Corporation
		Dow Chemical USA
(Ethylenedinitrilo) Tetraacetic Acid, Disodium Salt	—	BASF Corporation
		Fisher Scientific
(Ethylenedinitrilo) Tetraacetic Acid, Tetrasodium Salt	—	Dow Chemical USA
		BASF Corporation
		Fisher Scientific
Formalin, (Formaldehyde, 37.5% Solution)	CH_2O	Fisher Scientific
		Ashland Chemical Company
Hydroquinone*	Paradihydroxybenzene	Fisher Scientific
		Aldrich Chemical Company, Inc.
		Aceto Corporation
KODAK Persulfate Bleach Accelerator PBA-1	—	Eastman Kodak Company

Chemical or Trade Name	Formula or Chemical Name	Some Suppliers
Phenidone*[c]	—	Biddle Sawyer Corporation Charkit Chemical Corporation Mallinckrodt, Inc. Ilford (Ciba-Geiga Company)
Phosphoric Acid*	H_3PO_4	Fisher Scientific Ashland Chemical Company Brown Chemical Company, Inc.
Potassium Iodide*	KI	Anachemia Chemicals, Inc. Mallinckrodt, Inc.
Potassium Persulfate*	$K_2S_2O_8$	Fisher Scientific FMC Corporation Brown Chemical Company, Inc.
Quadrafos (Sodium Tetraphosphate*)	—	Essex Chemical Company FMC Corporation, IND Chemical Group
KODAK Reversal Agent RA-1	—	Eastman Kodak Company
Sodium Acetate, Anhydrous*	CH_3COONa	Ashland Chemical Company Brown Chemical Company, Inc. Mallinckrodt, Inc.
Sodium Bromide, Anhydrous*	NaBr	Brown Chemical Company
Sodium Carbonate, Anhydrous*	Na_2CO_3	Brown Chemical Company, Inc. Ashland Chemical Company
Sodium Chloride*	NaCl	Ashland Chemical Company Mallinckrodt, Inc. American International Chemical Company
Sodium Hydroxide*	NaOH	Ashland Chemical Company Brown Chemical Company Dow Chemical USA Fisher Scientific
Sodium Metabisulfite Anhydrous*	$Na_2S_2O_5$	Fisher Scientific BASF Corporation American International Chemical Company
Sodium Persulfate*	$Na_2S_2O_8$	Fisher Scientific FMC Corporation Brown Chemical Company, Inc.
Sodium Phosphate, Monobasic, Anhydrous*	NaH_2PO_4	Pechiney World Trade USA Degussa-Huls Corporation
Sodium Phosphate (TSP)	$Na_3PO_4 \cdot 12H_2O$	Ashland Chemical Company Brown Chemical Company FMC Corporation
Sodium Sulfite, Anhydrous*	Na_2SO_3	Ashland Chemical Company Fisher Scientific
Sodium Thiocyanate*	Na_2SCN	Aldrich Chemical Company, Inc. American International Chemical Company
KODAK Stabilizer Additive	—	Eastman Kodak Company

a These chemicals must meet ANSI/ACS specifications. An index of ANSI specifications for “Photography—Chemicals is available from American National Standards Institute, Inc. 550 Mamaroneck Ave., Harrison, NY 10528.

b Solutions of several concentrations of ethylenediamine are available from various manufacturers. The purity of the solution should be determined by Method 612C in Module 3, *Analytical Procedures*.

c Phenidone is a trademark of Ilford Limited (Ciba-Geiga Company)

Mixing Bulk Chemicals

Use the following mixing practices when preparing processing solutions with common mixing equipment. Mix solutions in the order in which the solutions occur in the process sequence. This order will minimize the effect of contamination of a solution by the previously mixed solution. The solutions are also less likely to be placed in the wrong holding or machine tanks. See Module 14, *Effects of Mechanical & Chemical Variations in Process RVNP*, for sensitometric effects of contamination and solution concentration errors.

Information on the known hazards and safe handling of the following chemicals is available from the supplier of the chemical in the form of Material Safety Data Sheets, as required by the OSHA Hazard Communication Standard Act and many state laws.

The mixing area should be well ventilated and have a local exhaust over the mixing tank to carry off fumes and chemical dust. See Module 2, *Equipment and Procedures*, for exhaust specifications.

1. Observe all precautionary information on containers and packages of each chemical, and on the Material Safety Data Sheets available from the seller of the individual chemical. Footnotes with some formulas provide further precautionary information.
2. Rinse the mix tank with water, and run fresh water through the pump. Drain the tank and pump.
3. Fill the tank to mixing level with water at the appropriate temperature, and start the mixer. Be sure the mixer is large enough to provide adequate agitation for the volume of solution desired. The starting mixing level should be 80% of the final volume (if a water hopper is used, take care not to over dilute the solution). Allow one minute for agitating the water between the time the mixer is started and the first chemical addition is made. This action helps remove air from the water and disperse the first chemical addition.
4. Premeasure all chemicals*, but do not combine the dry chemicals together before adding them to the mixing tank. This practice can result in unwanted chemical reactions producing toxic and noxious fumes. The formula for each processing solution lists chemicals in the proper mixing order. Add and dissolve the chemicals in the order given, and dilute the solution to volume with water. When mixing first developer, color developer and accelerator for persulfate bleach, observe the following special mixing instructions.

   FIRST DEVELOPER: After the Phenidone is added, agitate for 10 minutes to dissolve the developing agent.

   COLOR DEVELOPER: After the benzyl alcohol is added, agitate for 10 minutes to dissolve the chemical. Wear eye protection, impervious gloves, and protective clothing when handling Reversal Agent, RA-1. Weigh out the dry RA-1 in an area with adequate exhaust ventilation. If ventilation is inadequate wear a face mask incorporating a MSA† Ultra filter (or equivalent). To minimize contact with the chemical dust, prepare a slurry immediately after weighing, by adding the RA-1 to 300 mL of 100°F water.

   ACCELERATOR for persulfate bleach: Mixing with high agitation for extended periods of time can result in the loss of some PBA-1 due to aerial oxidation. Mix only until all solid chemicals have dissolved.
5. After a solution has been diluted to volume, agitate it for a few minutes to promote complete and uniform dissolution of all the constituents. The stop, accelerator, and stabilizer should be agitated for at least 5 minutes after dilution to volume; the fixer for 10 minutes; the bleach for 15 minutes; and the developers for 20 minutes.
6. After mixing, analyze the solution for its critical constituents. Then place the certified solution into the appropriate storage tank.
7. Carefully rinse the mixing tank and any pump used to transport solution. It is best to clean the mixing equipment immediately after the tank is emptied. The equipment is easier to clean before salts and tars have time to form. The tank is more efficiently rinsed with numerous small-volume rinses than with fewer large-volume rinses.

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* When preparing processing solutions, use photographic grade chemicals (passing the ANSI or ANSI/ACS specifications). Kodak, as well as some other suppliers, provide such chemicals.

† Mine Safety Appliances Company, 121 Gamma Drive., Pittsburgh, PA 15238.

Formulas and Analytical Specifications

Maintain the fresh tank formula specifications exactly as given on the following pages. Any large deviations from tank specifications, noted by chemical analysis, should be corrected immediately by appropriate additions or cuts to the tank solution. The procedure for making additions or cuts, “Diagnosing and Correcting Nonstandard Chemical Composition of Processing Solutions,” Method XVII, is in Module 3, *Analytical Procedures*.

Any long-term tendency to deviate from the tank analytical specifications (e.g., slowly increasing pH) should be corrected by adjustment of the replenisher. The replenisher formula specifications are to be used as starting points for typical operations.

Important

Observe precautionary information on product labels and on the Material Safety Data Sheets.

Constituent	Fresh Tank	Fresh and Seasoned Tank Analytical Specifications	Fresh Replenisher	Replenisher Analytical Specifications
First Developer	**(DR-105)**		**(DR-105R)**	
Water 70-100°F (21-38°C)	800 mL		800 mL	
Quadrafos	2.0 g		2.0 g	
Sodium Metabisulfite (Anhydrous)	8.0 g		2.9 g	
Phenidone[a]	0.35 g	0.35 ± 0.05 g/L	0.37 g	0.37 ± 0.05 g/L
Sodium Sulfite (Anhydrous)	37.0 g	47.0 ± 2.0 g/L[b]	44.0 g	47.6 ± 2.0 g/L[b]
Hydroquinone	5.50 g	5.50 ± 0.30 g/L	7.00 g	7.00 ± 0.30 g/L
Sodium Carbonate (Anhydrous)	28.2 g		28.9 g	
Sodium Thiocyanate[c]	1.38 g	1.38 ± 0.10 g/L	1.42 g	1.42 ± 0.10 g/L
Sodium Bromide (Anhydrous)	2.40 g	2.40 ± 0.20 g/L	0.20 g	0.20 ± 0.10 g/L
Potassium Iodide	0.020 g	0.020 ± 0.001 g/L	0.007 g	0.007 ± 0.001 g/L
Water to make	1 L		1 L	
pH at 77.0°F (25.0°C)		9.93 ± 0.10		10.04 ± 0.05
Specific Gravity at 77.0°F (25.0°C)		1.075 ± 0.003		1.074 ± 0.003
Total Alkalinity (4 mL sample)		33.0 ± 2.0 mL		36.0 ± 2.0 mL
WARNING! May cause eye and skin irritation and allergic skin reaction. Avoid contact with eyes, skin, and clothing.				

a After the Phenidone is added, agitate for 10 minutes to dissolve the developing agent.
b These are specifications for total sulfite.
c Photographic-grade chemical is essential. KODAK Sodium Thiocyanate (liquid) may be used (1.5 mL of liquid equal to 1.0 g).

Constituent	Fresh Tank	Fresh and Seasoned Tank Analytical Specifications	Fresh Replenisher	Replenisher Analytical Specifications
First and Second Stop	**(SB-20)**		Same as Fresh Tank	
Water 70-100°F (21-38°C)	800 mL			
Glacial Acetic Acid	30.0 mL			
Sodium Hydroxide (Solid)	1.65 g			
Water to make	1 L			
pH at 77.0°F (25.0°C)		3.50 ± 0.20		

Constituent	Fresh Tank	Fresh and Seasoned Tank Analytical Specifications	Fresh Replenisher	Replenisher Analytical Specifications
Color Developer	**(DR-150)**		**(DR-150R)**	
Water 70-100°F (21-38°C)	800 mL		800 mL	
KODAK Anti-Calcium No. 4	3.0 mL		3.0 mL	
Benzyl Alcohol[a]	4.50 mL	4.50 ± 0.20 mL/L	5.10 mL	5.10 ± 0.20 mL/L
Sodium Sulfite (Anhydrous)	7.50 g	7.50 ± 0.20 g/L	7.75 g	7.75 ± 0.20 g/L
Trisodium Phosphate•$12H_2O$	36.0 g		37.5 g	
Sodium Bromide (Anhydrous)	0.90 g	0.90 ± 0.20 g/L	0.10 g	
Potassium Iodide	0.09 g	0.09 ± 0.02 g/L	0.04 g	0.04 ± 0.01 g/L
Sodium Hydroxide (Solid)	3.25 g		4.60 g	
Citrazinic Acid	1.50 g	1.50 ± 0.20 g/L	1.60 g	1.60 ± 0.20 g/L
KODAK Color Developing Agent, CD-3[b]	11.0 g	11.0 ± 1.0 g/L	12.0 g	12.0 ± 1.0 g/L
Ethylendiamine (98% by Weight)	3.00 g	3.00 ± 0.30 g/L	3.05 g	3.05 ± 0.30 g/L
KODAK Reversal Agent RA-1[c]	0.07 g		0.10 g	
Water to make	1 L		1 L	
pH at 77.0°F (25.0°C)		11.70 ± 0.10		12.04 ± 0.10
Specific Gravity at 77.0°F (25.0°C)		1.037 ± 0.003		1.038 ± 0.003
Total Alkalinity (10 mL sample)		42.0 ± 2.0 mL		44.5 ± 2.0 mL
WARNING! May cause eye and skin irritation and allergic skin reaction. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated skin contact with solution.				

a After the benzyl alcohol is added, agitate for 10 minutes to dissolve the chemical.

b Slowly add the Developing Agent, CD-3 with a broadcasting motion.

c Wear eye protection, impervious gloves and protective clothing when handling Reversal Agent RA-1. Weigh out the dry RA-1 in an area with adequate exhaust ventilation. If ventilation is inadequate wear a face mask incorporating a filter (such as the “MSA Ultra filter,” Mine Safety Appliances Company, 121 Gamma Drive, Pittsburgh, PA 15238, or equivalent). To minimize contact with the chemical dust, prepare a slurry immediately after weighing, by adding the RA-1 to 300 mL of 100°F water.

Constituent	Fresh Tank	Fresh and Seasoned Tank Analytical Specifications	Fresh Replenisher	Replenisher Analytical Specifications
Accelerator	**(AB-3)**		**(AB-3R)**	
Water 70-100°F (21-38°C)	800 mL		800 mL	
Sodium Metabisulfite (Anhydrous)[a]	9.0 g	7.2 ± 0.5 g/L	10.0 g	8.2 ± 0.5 g/L
KODAK Persulfate Bleach Accelerator PBA-1[b]	2.5 g	2.5 ± 0.3 g/L	3.5 g	3.5 ± 0.3 g/L
Sodium Acetate	8.0 g		8.0 g	
Glacial Acetic Acid	2.3 mL	9.0 ± 2.0 mL/L[c]	0.3 mL	7.0 ± 2.0 m/L[c]
(Ethylenedinitrilo) Tetraacetic Acid Tetrasodium Salt	1.0 g		1.0 g	
Water to make	1 L		1 L	
pH at 77.0°F (25.0°C)[d]		4.5 ± 0.5		5.0 ± 0.2
Specific Gravity at 77.0°F (25.0°C)		1.012 ± 0.003		1.012 ± 0.003

a The difference between mix level and the analytical specification occurs because some sulfite is consumed in a reaction with the KODAK Persulfate Bleach Accelerator PBA-1 to form the active accelerator species “in-situ”.

b Mixing with high agitation for extended periods of time can result in the loss of some PBA-1 due to aerial oxidation. Mix only until all solid chemicals have dissolved. For convienience PBA-1 may be added from a 250 g/L stock solution made by dissolving 5 Kg of PBA-1 in 20 L of water. Four mL of stock solution equals one g of PBA-1.

c The analytical method measures buffer capacity and the results are reported in terms of glacial acetic acid. Adjustments should be made with glacial acetic acid. The buffer capacity will increase depending on the amount of carry-in of stop.

d The pH of the seasoned tank solution is lowered by the carry-in of stop bath. Adjust replenisher made by reconstitution to pH 4.7 ± 0.3.

Constituent	Fresh Tank	Fresh and Seasoned Tank Analytical Specifications	Fresh Replenisher	Replenisher Analytical Specifications
Persulfate Bleach	**(SR-45)**		**(SR-45R)**	
Water 90-100°F (32-38°C)	800 mL		800 mL	
Sodium Persulfate	60 g	60 ± 5 g/L	85 g	85 ± 3.0 g/L
Sodium Chloride	20 g	20 ± 2 g/L	25 g	25 ± 1 g/L
Sodium Dihydrogen Phosphate (Anhydrous)	15 g		15 g	
Beta-Aminopropionic Acid	2 g		2 g	
Phosphoric Acid (86%)	2.2 mL	10.0 ± 2.0 mL/L[a]	2.2 mL	10.0 ± 2.0 mL/L[a]
Water to make	1 L		1 L	
pH at 77.0°F (25.0°C)		2.2 ± 0.3[b]		3.0 ± 0.2
Specific Gravity at 77.0°F (25.0°C)		1.089 ± 0.003		1.100 ± 0.003

[a] The analytical method measures the buffer capacity of the bleach and reports the results as mL/L of phosphoric acid (85%). The analytical specification (10.0) is larger than the amount of phosphoric acid added (2.2) because the dihydrogen phosphate contributes to this measurement. If a tank addition must be made, phosphoric acid can be added on a mL for mL basis.

[b] Seasoned tank pH specification. A fresh tank pH will be the same as a fresh replenisher. The bleach pH will drop with seasoning and must be maintained within specification.

Constituent	Fresh Tank	Fresh and Seasoned Tank Analytical Specifications	Fresh Replenisher	Replenisher Analytical Specifications
Ammonium Fixer	**(F-38)**		**(F-38-R)**	
Water 70-100°F (21-38°C)	600 mL		600 mL	
(Ethylenedinitrilo) Tetraacetic Acid, Disodium Salt	1.6 g		1.6 g	
Ammonium Thiosulfate[a] Solution (58%)	194 mL	194 ± 5 mL/L	194 mL	194 ± 5 mL/L
Sodium Metabisulfite (Anhydrous)	9.4 g		9.4 g[b]	
Water to make	1 L		1 L	
pH at 77.0°F (25.0°C)		6.3 ± 0.3		6.5 ± 0.2
Specific Gravity at 77.0°F (25.0°C)		1.093 ± 0.003		1.093 ± 0.003
Hypo Index (3 mL sample)		38.5 ± 3.0 mL		38.5 ± 3.0 mL

[a] One mL of 58% ammonium thiosulfate solution equals 0.78 g of ammonium thiosulfate (anhydrous).

[b] If in-line electrolytic silver recovery is used and the replenishment rate is reduced, an increase in the sulfite level in the replenisher may be necessary to maintain the proper level in the tank.

Constituent	Fresh Tank	Fresh and Seasoned Tank Analytical Specifications	Fresh Replenisher	Replenisher Analytical Specifications
Stabilizer	**(S-16)**		Same as Fresh Tank	
Water 70-80°F (21-27°C)	800 mL			
KODAK Stabilizer Additive	0.14 mL			
Formalin (Formaldehyde Solution, 37%)	3.5 mL	3.5 + 2.0, – 0.0 mL/L		
Water to make	1 L			
DANGER! Causes eye irritation. Causes skin irritation and may cause allergic skin or respiratory reaction. Do not get in eyes, on skin, on clothing. Use only with adequate ventilation. Do not breath vapor.				

Storage of Solutions

Do not use replenishers that have been stored at normal room temperatures 70 to 75°F (21 to 24°C), longer than the times given in Table 13-7. Storage temperatures higher than 75°F (24°C) will decrease the storage life of the solutions. Storage temperatures below 60°F (16°C) can cause some solution constituents to precipitate.

Do not attempt to bring aged replenisher solutions to the formula level. Decomposition products that are formed as the solution stands cannot be eliminated from the solution. These compounds build up to a concentration that can cause adverse photographic effects.

Table 13-7 Storage Life of Replenisher Solutions at 70 to 75°F (21 to 24°C)

Replenisher	Floating Cover	Open Tank
First Developer DR-105R	2 weeks	9 days
Color Developer DR-150R	2 weeks	5 days
Accelerator AB-3R	8 weeks	4 weeks
Persulfate Bleach SR-45R	4 weeks	4 weeks
All Other Solutions	8 weeks	8 weeks

Discard the remaining few litres of replenisher before fresh replenisher is pumped into the holding tank. Replenisher remaining in the holding tank, even if kept under a close fitting floating cover, usually has deteriorated to such an extent that it is unsatisfactory for further use.

MORE INFORMATION

For more information on motion picture products, call or write to the Entertainment Imaging office nearest you.

Or access Kodak's home page on the Internet, web site address—

http://www.kodak.com/go/motion

You may want to bookmark our location so you can find us more easily.

Processing EASTMAN EKTACHROME Color Reversal Films, Module 13 Process RVNP Specifications

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