

# 2 CHEMICALS AND CHEMICAL MIXING

## INTRODUCTION

To help you understand the terms we've used to describe the chemicals and solutions in this manual, here are some definitions:

- **Chemical Concentrates**

Chemicals that must be diluted to make replenisher or tank processing solutions, or chemicals that are added to other solutions.

- **Fresh Solution**

Newly mixed, unused solutions prepared from chemical concentrates.

- **Replenisher**

Solution used to restore the chemical components of the tank solution to maintain photographic performance over time.

- **Seasoned Solution**

A tank solution that has been used and replenished for a period of time. The chemical components and seasoning by-products are at an optimum level for processing.

- **Starter**

Concentrate added to a replenisher solution to prepare a fresh tank solution so it yields results similar to those provided by a seasoned tank solution.

- **Tank Solution**

The solution used in the processor tank; often referred to as "working solution."

## KODAK PROFESSIONAL CHEMICALS, PROCESS E-6

### Sizes

These chemicals are available in sizes to meet the needs of all types of processing operations. When selecting chemicals, choose sizes that are economical for your setup and appropriate for your chemical-keeping conditions.

### Chemicals for Small-Volume Processing

The following sizes are appropriate for use with small tanks, sink lines, and rotary-tube processors. For larger volumes, use the 5- or 25-gallon sizes of these chemicals.

Prepare the solutions according to the instructions packaged with the chemicals.

Product	To Make	CAT No.*
KODAK PROFESSIONAL Single-Use Chemistry Kit, Process E-6	5 litres	107 7643
KODAK PROFESSIONAL First Developer Replenisher, Process E-6	10 litres	831 3611
KODAK PROFESSIONAL First Developer Starter, Process E-6	26 gallons	167 1577
KODAK PROFESSIONAL Reversal Bath and Replenisher, Process E-6	10 litres	112 3611
KODAK PROFESSIONAL Color Developer Replenisher, Process E-6	10 litres	182 7872
KODAK PROFESSIONAL Color Developer Starter II, Process E-6	25 gallons	185 8158
KODAK PROFESSIONAL Pre-Bleach and Replenisher, Process E-6	10 litres	128 6228
KODAK PROFESSIONAL Bleach Replenisher, Process E-6	10 litres	819 2395
KODAK PROFESSIONAL Bleach Starter, Process E-6	25 gallons	177 9792
KODAK PROFESSIONAL Fixer and Replenisher, Process E-6	10 litres	154 5466
KODAK PROFESSIONAL Final Rinse and Replenisher, Process E-6	10 litres	814 0279

\* Catalog numbers listed are for sizes available in the U.S. and Canada. Other regions may supply these chemicals in different sizes. For more information, contact Kodak in your country.

## Chemicals for Cost-Saving Replenishment: Small- and Medium-Volume Processing

If you process a large amount of film in a replenished sink-line process, these may be the best sizes for you to use. They are also appropriate for large rotary-tube processors or larger automatic processors that have low utilization. For larger volumes, use the 25-gallon or larger size of chemicals. Prepare the solutions according to the instructions packaged with the chemicals. To prepare first- and color-developer and bleach tank solutions, mix the replenisher with starter according to the instructions.

Product	To Make	CAT No.*
KODAK PROFESSIONAL First Developer Replenisher, Process E-6	5 gallons	100 7608
KODAK PROFESSIONAL First Developer Starter, Process E-6 (500 mL concentrate)	26 gallons	167 1577
KODAK PROFESSIONAL Reversal Bath and Replenisher, Process E-6	5 gallons	113 1580
KODAK PROFESSIONAL Color Developer Replenisher, Process E-6	5 gallons	837 2542
KODAK PROFESSIONAL Color Developer Starter II, Process E-6 (1-pint concentrate)	25 gallons	185 8158
KODAK PROFESSIONAL Pre-Bleach and Replenisher, Process E-6	5 gallons	802 6569
KODAK PROFESSIONAL Bleach Replenisher, Process E-6AR	5 gallons	196 5623
KODAK PROFESSIONAL Bleach Starter, Process E-6 (½-gallon concentrate)	25 gallons	177 9792
KODAK PROFESSIONAL Fixer and Replenisher, Process E-6	5 gallons	127 8019
KODAK PROFESSIONAL Final Rinse and Replenisher, Process E-6	5 gallons	890 9590
KODAK PROFESSIONAL Defoamer, Process E-6 (4-ounce bottle)	—	125 3566

\* Catalog numbers listed are for sizes available in the U.S. and Canada. Other regions may supply these chemicals in different sizes. For more information, contact Kodak in your country.

## Chemicals for Large-Volume Automatic Processors and Processors with In-Line Dilution/Blender Systems

The following sizes are appropriate for rack-and-tank, continuous, and roller-transport processors. Prepare the solutions according to the instructions packaged with the chemicals. To prepare first- and color-developer and bleach tank solutions, mix the replenisher with starter according to the instructions.

Product	To Make	CAT No.*
KODAK PROFESSIONAL First Developer Replenisher, Process E-6AR†	25 gallons	800 8401
KODAK PROFESSIONAL First Developer Starter, Process E-6 (500 mL concentrate)	26 gallons	167 1577
KODAK PROFESSIONAL Reversal Bath and Replenisher, Process E-6	5 gallons	113 1580
KODAK PROFESSIONAL Reversal Bath and Replenisher, Process E-6AR†	100 gallons	158 3566
KODAK PROFESSIONAL Color Developer Replenisher, Process E-6AR† Part A Part B (Part A and Part B are needed to make a replenisher solution)	25 gallons 25 gallons	840 2224 100 7509
KODAK PROFESSIONAL Color Developer Starter II, Process E-6 (1-pint concentrate)	25 gallons	185 8158
KODAK PROFESSIONAL Pre-Bleach and Replenisher, Process E-6AR†	50 gallons	103 8660
KODAK PROFESSIONAL Bleach Replenisher, Process E-6AR†	5 gallons	196 5623
KODAK PROFESSIONAL Bleach Starter, Process E-6 (½-gallon concentrate)	25 gallons	177 9792
KODAK PROFESSIONAL Fixer and Replenisher, Process E-6	5 gallons	127 8019
KODAK PROFESSIONAL Fixer and Replenisher, Process E-6AR†	50 gallons	121 3677
KODAK PROFESSIONAL Final Rinse and Replenisher, Process E-6	10 litres	814 0279
KODAK PROFESSIONAL Final Rinse and Replenisher, Process E-6AR†	500 gallons	115 2156
KODAK PROFESSIONAL Defoamer, Process E-6 (4-ounce bottle)	—	125 3566

\* Catalog numbers listed are for sizes available in the U.S. and Canada. Other regions may supply these chemicals in different sizes. For more information, contact Kodak in your country.

† E-6AR sizes are supplied in flexible plastic containers for use with processors with in-line dilution/blender systems or to prepare larger amounts of solutions for use with other processors.

**Table 2-1**  
**Processing Capacity of Process E-6AR Chemicals**

Process E-6AR Chemical	Mix Volume (gallons)	Replenishment Rate (mL/sq ft)	Amount of Film Processed per Cube (sq ft)
First Developer	25	200	475
Reversal Bath	100	100	3,780
Color Developer	25	200	475
Pre-Bleach	50	100	1,890
Bleach	5	20	950
Fixer	50	100	1,890
Final Rinse	320	100	12,110

## CHEMICAL MIXING

### Procedures

The liquid concentrates supplied by Kodak make it easy to prepare processing solutions for Process E-6. However, to avoid errors that can affect process quality and control, mix these solutions carefully according to the instructions supplied with the chemicals. This section gives you tips to help you use proper mixing procedures.

Prepare all solutions with water between 68 and 104°F (20 and 40°C). However, it is best to use water that is close to your processing temperature to avoid unnecessary delays waiting for the solution to come to temperature, and to avoid using a replenisher with a temperature that is drastically different from the temperature of your tank solution.

**Note:** For consistent results, always use water at the same temperature when preparing solutions.

For information on diagnosing mixing errors, see section 5, “Corrective Actions for Processing Solutions.”

## Water Quality

Water can have a significant effect on photographic quality. Generally, most municipal water supplies are satisfactory for mixing solutions and for use as wash water. Note that the quality of water supplies can vary seasonally. It is a good idea to have the quality of your water supply tested. Water used for washes should have less than 1,000 ppm of total dissolved solids and be free of color, suspended material, hardness, and heavy metals. The pH should be 7.0 to 8.5, and the water should not be highly buffered.

The water supplied by most municipalities is satisfactory for preparing processing solutions. Practical limits for common water impurities for photographic processing are listed in Table 2-2. If you use well water, be sure that you test it for the impurities listed in Table 2-2.

Poor plumbing materials (old, rusty pipes, or pipes made out of the wrong materials) can be a source of dirt and contamination. Check your plumbing and replace it if necessary.

**Table 2-2**  
**Practical Limits of Impurities for Water Used in Photographic Processing**

Impurity	Acceptable Limit of Range (ppm)
Color, suspended material	None
Dissolved solids	1,000 (for washes) 250 (for preparing solutions)
pH	7.0 to 8.5
Hardness, as CaCO <sub>3</sub>	40 (preferable) to 150
Copper, iron, manganese	0.10 each
Chlorine, as free hypochlorous acid	2
Chloride	100
Bicarbonate	150
Sulfate	200
Sulfide	0.10

**Note:** The values in Table 2-2 are from *Water Quality Criteria* by West (PSE V.9, pp. 398—413 [1965]).

**Table 2-3**  
**Characteristics of Process E-6 Chemical Concentrates**

Concentrate	Part	Normal Appearance	Comments
First Developer First Developer Replenisher		Clear, light yellow to light brown; mild odor	Chemicals darken with age. <b>Do not</b> use solution that is dark brown or opaque or that contains precipitates.
Reversal Bath Reversal Bath and Replenisher		Clear to slightly hazy, colorless to light yellow	Haze in concentrate is not unusual. Age has little effect on concentrate.
Color Developer Color Developer Replenisher	A A	Clear, pale yellow; mild sulfite odor; viscous	No change in appearance with age. Good keeping properties.
Color Developer Color Developer Replenisher	B B	Clear, pale yellow to light pink; odor of strong sulfuric acid gas (strong pungent odor) <b>Caution: Smell carefully; smell the cap of the container of any photographic concentrate or solution—never smell concentrates or solutions directly.</b>	Chemical darkens with age. Do not use solution that is dark brown/purple or that contains precipitates.
Pre-Bleach Pre-Bleach and Replenisher		Clear, colorless; odor of organic sulfur	Solution does not change appearance with age. Organic sulfur odor will be absent if product is badly oxidized.
Bleach Bleach Replenisher	A A	Clear, dark red	
Bleach Bleach Starter	B	Clear, colorless	Extremely stable
Fixer Fixer and Replenisher		Clear, colorless; very mild ammonia odor	Age or exposure to air may cause sulfurization (white or yellow sediment).
Final Rinse Final Rinse and Replenisher		White, cloudy appearance	
First Developer Starter		Colorless to yellow	Color darkens with age; usefulness is not affected by solution color.
Color Developer Starter		Light red to dark red	

**Table 2-4**  
**Mixing KODAK Chemicals, Process E-6**

Solution	Comments
First Developer First Developer Replenisher Color Developer Color Developer Replenisher	Start with water at 68 to 104°F (20 to 40°C); preferably near 100°F (37.8°C). Add the concentrate while stirring. Mix until the solution is uniform. Do not overmix. Excessive mixing oxidizes the developer and reduces storage life. For the first developer, it is very important that your mixing equipment is clean. Immediately after mixing, the color developer will appear deep blue or purple. The color will change to pale yellow after a short time. Mixing order is important for developers. Do not agitate so vigorously that air is mixed into the solution. When you prepare a tank solution from replenisher solution, be sure to add starter.
Reversal Bath Reversal Bath Replenisher Pre-Bleach Pre-Bleach and Replenisher	Start with water at 68 to 104°F (20 to 40°C); preferably near 100°F (37.8°C). The mixing order is not critical. The chemicals mix easily. Do not agitate so vigorously that air is mixed into the solution.
Bleach	Start with water at 68 to 104°F (20 to 40°C); preferably near 100°F (37.8°C). The mixing order is not critical. The chemicals mix easily. Agitation provides beneficial aeration; vigorous or lengthy agitation does not harm the bleach. The bleach and replenisher should appear dark red after mixing. When you prepare a tank solution from replenisher solution, be sure to add starter.
Fixer Fixer and Replenisher	Start with water at 68 to 104°F (20 to 40°C); preferably near 100°F (37.8°C). Use moderate agitation so that mixing is complete in approximately 5 minutes. Although fixers are not as sensitive to oxidation as developers, too much aeration will cause sulfurization. The solution will appear clear and colorless.
Final Rinse Final Rinse and Replenisher	Start with water at 68 to 104°F (20 to 40°C); preferably near 100°F (37.8°C). The mixing order is not critical. The chemicals mix easily. Although agitation is not critical, the final rinse will foam if the agitation is too vigorous. The solution should appear clear and colorless.

**Note:** For consistent results, always use water at the same temperature when preparing solutions.

### Contamination of Solutions

Keep your mixing, storage, and processing equipment clean; their cleanliness can affect the quality and performance of processing solutions. Be careful not to contaminate one solution with another. If possible, mix and use only one type of solution with one set of mixing equipment, and wash all equipment *thoroughly* before reusing it. The illustration which follows shows how to use your tanks to minimize contamination.

If you have one tank:

- 1 Reduce the chance of chemical contamination by using four separate mixing tanks. If you cannot use four separate tanks, do the following before mixing different batches of chemicals —
  - ▶ Thoroughly rinse the tank and mixing equipment with room-temperature water
  - ▶ Flush tubing and lines
  - ▶ Thoroughly clean transfer pumps

If you have two tanks:

- 1 Use this tank for —
  - ▶ black-and-white developers
  - ▶ first developer for Process E-6
  - ▶ color developer for Process E-6 and developers for Processes RA-4 and C-41

- 2 Use the second tank for —
  - ▶ all stop baths and stabilizers
  - ▶ reversal bath, pre-bleach, and final rinse for Process E-6
  - ▶ all bleaches, fixers, and bleach-fixes
  - ▶ final rinse for Process C-41

If you have three tanks:

- 1 Use this tank for —
  - ▶ black-and-white developers
  - ▶ first developer for Process E-6
  - ▶ color developer for Process E-6 and developers for Processes RA-4 and C-41

- 2 Use the second tank for —
  - ▶ all stop baths and stabilizers
  - ▶ reversal bath, pre-bleach, and final rinse for Process E-6
  - ▶ final rinse for Process C-41

- 3 Use the third tank for —
  - ▶ all bleaches, fixers, and bleach-fixes

If you have four tanks:

- 1 Use this tank for —
  - ▶ black-and-white developers
  - ▶ first developer for Process E-6

- 2 Use the second tank for —
  - ▶ color developer for Process E-6 and developers for Processes RA-4 and C-41

- 3 Use the third tank for —
  - ▶ stop baths and stabilizers
  - ▶ reversal bath, pre-bleach, and final rinse for Process E-6
  - ▶ final rinse for Process C-41

- 4 Use the fourth tank for —
  - ▶ all bleaches, fixers, and bleach-fixes

**Using Your Mixing Tanks to Reduce Solution**

**Contamination:** Minute amounts of contaminants can seriously affect a processing solution. To reduce the possibility of contamination during mixing, keep different solutions from coming in contact with each other; use separate mixing tanks for each solution whenever possible, and clean all mixing equipment thoroughly after each use.

If you don't have separate mix tanks, use the previous illustration as a guide for using your mixing tanks to reduce the possibility of contamination.

- If mixing only chemicals for **reversal processes**, you can use two mixing tanks: one for the first and color developers and one for all other solutions. However, we recommend using three mixing tanks: one for the developers, one for the bleach and fixer solutions, and one for all other solutions.
- If you mix chemicals for both **negative** and **reversal processes**, use four mixing tanks: one for the first developer and black-and-white developers, one for the color developers, one for the bleach and bleach-fix solutions, and one for all other solutions.

## Checking Your Mixes with Specific-Gravity Measurements

You can easily check your mixes for mixing errors by measuring the specific gravity of the solution. For information on measuring specific gravity or for specific-gravity aims for Process E-6 solutions, see section 3, "Monitoring and Controlling Processing Solutions."

## Storage of Solutions

For best results, **do not** use solutions that have been stored longer than the following times:

Mixed Solution (Tank or Replenisher)	Solutions in Tanks with Floating Covers*		Partially Filled Bottles of Used or Unused Solutions
	Unused	Used	
First Developer, Reversal Bath, Pre-Bleach	8 weeks	4 weeks	1 week
Color Developer	8 weeks	4 weeks	1 week
Bleach, Fixer, Final Rinse	24 weeks	24 weeks	24 week

\* Or full, tightly stoppered glass bottles.

Don't store chemicals at high temperatures. Use floating lids and dust covers on the replenisher storage tanks to reduce oxidation and dirt.

## SAFE HANDLING OF PHOTOGRAPHIC CHEMICALS

- Handle photographic chemicals and processing solutions with care. See *Safe Handling of Photographic Processing Chemicals*, KODAK Publication No. J-98A.
- Packages of Kodak photographic chemicals have precautionary labels. Always read the labels and follow the instructions carefully. Also read the Material Safety Data Sheets (MSDSs) for the chemicals for precautionary information.<sup>1</sup>
- Keep the darkroom, precessing area, and mixing room clean. Clean up spilled chemicals promptly.
- Use personal protective equipment, such as a waterproof apron and impervious gloves made of a material such as Neoprene or nitrile, when you handle solutions. Always wear goggles or safety glasses when you mix solutions from concentrates.
- Avoid skin contact with chemicals. Some photographic solutions, especially developers, can cause allergic skin reactions.
- Keep chemical solutions out of your mouth. Never start a siphoning action with your mouth. Do not eat or drink in a room where chemicals are mixed or used.
- Maintain proper ventilation in the mixing room and processing area.
- Store chemicals and processing solutions safely. Keep them out of the reach of children.
- Dispose of solutions safely. See *Dealing with Hazardous Waste and Processing Effluents at Photographic Processing Facilities*. KODAK Publication No. J-411.

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<sup>1</sup>In the USA, you can obtain MSDSs for Kodak chemicals via the internet. You can download them from the Kodak web site: [www.kodak.com/go/MSDS](http://www.kodak.com/go/MSDS). Outside of the USA, contact Kodak in your country. Please supply the catalog (CAT) numbers for the chemicals when you request MSDSs.