

1 KODAK EKTACOLOR Chemicals

KODAK EKTACOLOR Chemicals are designed for processing all Kodak color papers. This section describes the chemicals, lists the available sizes, and tells you how to mix and store them. It also gives simple methods of checking chemical mixes, and tells how to dispose of used chemicals properly and safely.

EKTACOLOR Chemicals can process the following papers and materials:

- KODAK EKTACOLOR EDGE Paper
- KODAK ROYAL Digital Paper
- KODAK ROYAL Luminous Digital Paper
- KODAK Photo Book Paper
- KODAK PROFESSIONAL SUPRA ENDURA VC Digital Paper
- KODAK PROFESSIONAL ULTRA ENDURA Paper
- KODAK PROFESSIONAL ULTRA ENDURA High Definition Paper
- KODAK PROFESSIONAL ENDURA Metallic VC Paper
- KODAK PROFESSIONAL ENDURA Clear Display Material
- KODAK PROFESSIONAL ENDURA Transparency Display Material

Notes:

1. For information on KODAK EKTACOLOR SM Chemicals for Process RA-2SM, see KODAK Publication No. Z-101, *Using KODAK SM Chemicals in SM Minilabs*.
2. For Information on using the KODAK EKTACOLOR Processing Cartridge 111, for use in all models of Fuji Frontiers, and some models of Noritsu Digital Minilab equipment, using Processes CP-48S and CP-49E, see KODAK Publication No. CIS-229, *Using the KODAK EKTACOLOR Processing Cartridge 111 with Digital Minilabs using Processes CP-48S and CP-49E*.
3. For Information on KODAK EKTACOLOR Processing Cartridge 92/110, for use in KODAK PROFESSIONAL RP30 and SRP30 Laser Printers, see KODAK Publication Nos. CIS-239, *Using the KODAK EKTACOLOR Processing Cartridge 92/110, CAT No. 1440775, for Professional Color Papers in KODAK PROFESSIONAL RP30 and SRP30 Laser Printers*, and CIS-280, *Using the KODAK EKTACOLOR Processing Cartridge 92/110, CAT No. 1440775, for Processing KODAK EKTACOLOR EDGE, ROYAL Digital, and KODAK PROFESSIONAL Pro Image II and PROFOTO Color Papers*.

WHY USE KODAK CHEMICALS?

The primary considerations when you choose photographic chemicals are—

- quality of the results the chemicals produce
- availability, reliability, and expertise of the service you receive
- availability of the chemicals
- environmental impact of the chemicals
- chemical cost

In all of these factors, KODAK EKTACOLOR Chemicals are superior or competitive. Low replenishment rates not only lower your chemical costs; they mean less chemical mixing and lower labor costs. They also mean less environmental impact, because the volume of effluent is reduced.

KODAK EKTACOLOR Chemicals are readily available. And when you purchase KODAK Chemicals, you are supported by a reliable network of expertise: Kodak field representatives, the Kodak Information Center, Kodak Service and Support, Kodak Environmental Services, KODALINK Quality Management Software, and many helpful publications and other services.

Choosing the chemicals recommended in this publication ensures that you are using chemicals that provide optimum results with the smallest possible environmental impact.

KODAK EKTACOLOR Chemicals for Process RA-4 offer you these features and benefits:

| FEATURES | BENEFITS |
|---|---|
| • Fast access time | • Quick processing of prints • Fast results from printer tests |
| • Low replenishment rates | • Less chemical mixing • Less effluent discharged and less environmental impact • Lower chemical cost |
| • Lower water usage | • Low water and energy costs • Less effluent discharge |
| • Chemicals suitable for minilabs with a washless cycle | • Additional water and energy savings • Lower effluent volume |
| • Process stability | • Consistent, repeatable print quality over a broad range of processor utilizations • Less need to adjust for low utilization • Fewer printer changes due to process shifts |
| • Patented preservatives to protect developing agent from oxidation | • Stable developer activity |
| • Good mixes with a variety of water supplies | • Quality of local water supply not critical |
| • Stain-reducing agent | • Clean, crisp whites in prints |

WHAT KODAK EKTACOLOR CHEMICALS ARE AVAILABLE?

KODAK EKTACOLOR Chemicals are available in a variety of sizes to meet the needs of any type of processing operation. Choose the sizes that are the most economical for you and that best meet your storage requirements.

The sizes listed in this publication are available in the U.S. and Canada; other regions may supply these chemicals in different sizes.

Chemicals for Large- and Medium-Volume Continuous Processors

These large sizes of KODAK EKTACOLOR RA Chemicals enable high-volume labs to make fewer mixes. Mix the solutions according to the directions packaged with the chemicals.

KODAK EKTACOLOR RA Developer Replenisher 12

This developer is designed specifically for continuous processors that have a utilization of at least one tank turnover per week. The developer time is the same as that recommended for EKTACOLOR RA Developer Replenisher; however, you must increase the developer temperature to 37.8°C (100.0°F).

Available in a size to prepare 150 gallons (568 litres) of replenisher solution.

KODAK EKTACOLOR RA Developer Regenerator 12/55

This regenerator enables you to collect and reuse overflow from EKTACOLOR RA Developer 12. With this regenerator, you do not need to use ion-exchange equipment. For information on using this regenerator, see Section 5, *Processing Options with KODAK EKTACOLOR Chemicals*.
Available in a size to prepare 150 gallons (568 litres) of replenisher from developer overflow.

KODAK EKTACOLOR RA Developer Replenisher

Use this developer if your processor's utilization is too low to use EKTACOLOR RA Developer Replenisher 12.

Available in sizes to prepare 25 gallons (95 litres) and 75 gallons (284 litres) of replenisher solution.

KODAK EKTACOLOR RA Developer Starter

Use this starter to prepare developer tank solution from EKTACOLOR RA Developer Replenisher, EKTACOLOR RA Developer Replenisher 12, EKTACOLOR PRIME SP Developer Replenisher LORR, EKTACOLOR RA Developer Replenisher RT, or EKTACOLOR Digital Developer Replenisher RT. Mix the solution according to the directions on the starter label.

Available in an 80-ounce (2.366 litre) bottle to prepare 25 gallons (95 litres) of tank solution from EKTACOLOR RA Developer Replenisher or EKTACOLOR RA Developer Replenisher RT and EKTACOLOR Digital Developer Replenisher RT or 20.8 gallons (78 litres) from EKTACOLOR RA Developer Replenisher 12.

KODAK EKTACOLOR RA Bleach-Fix and Replenisher NR

This bleach-fix is designed for continuous processors with high utilization. It features a low replenishment rate.

Available in sizes to prepare 20 gallons (76 litres) and 208 gallons (787 litres) of replenisher solution.

KODAK EKTACOLOR RA Bleach-Fix and Replenisher

Use this bleach-fix if your processor's utilization is too low to use EKTACOLOR RA Bleach-Fix and Replenisher NR. Use as a replenisher or a tank solution.

Available in a size to prepare 5 or 10 litres, or 25 gallons (95 litres) of solution.

KODAK EKTACOLOR RA Bleach-Fix Regenerator II

Use this bleach-fix for continuous processors with high utilization. (It is not recommended for use in roller transport processors.) After electrolytically desilvering the bleach-fix overflow, add this chemical to prepare the overflow for use as a replenisher. Regenerating the bleach-fix significantly reduces the BOD, COD, and iron in the effluent.

Available in a size to prepare 100 gallons (378.5 litres) of replenisher solution from desilvered bleach-fix overflow.

Chemicals for Minilabs

KODAK EKTACOLOR PRIME SP Developer Replenisher LORR

This developer replenisher is designed for minilabs with average to high utilization. Supplied as a single-part concentrate, it offers easy and convenient mixing and reduced replenishment rates.

Available in sizes to prepare 10 litres and 10-gallon sizes of replenisher solution.

KODAK EKTACOLOR RA Developer Starter

Use this starter to prepare developer tank solution. This starter will make 52.6 litres of tank solution from KODAK EKTACOLOR PRIME SP Developer Replenisher LORR or 95 litres of tank solution from EKTACOLOR RA Developer Replenisher RT, according to the direction on the starter label.

KODAK EKTACOLOR PRIME SP Bleach-Fix Replenisher LORR

This single-part bleach-fix replenisher is designed for minilabs with average to high utilization. You can use this bleach-fix if your processor has a tank turnover at least every four weeks. The replenishment rate is 75 percent lower than that of EKTACOLOR RA Bleach-Fix and Replenisher.

Available in sizes to prepare 5 and 10 litres and 10 gallons (38 litres) of replenisher solution.

KODAK EKTACOLOR PRIME SP Bleach-Fix Starter

To make bleach-fix tank solution, mix this starter with KODAK EKTACOLOR PRIME SP Bleach-Fix Replenisher LORR according to the directions on the starter label. *Makes 20 litres of tank solution.*

KODAK EKTACOLOR PRIME Stabilizer and Replenisher LORR

Use this stabilizer in place of a final wash in washless minilabs. Use as a replenisher or a tank solution.

Available in sizes to prepare 5 and 10 litres and 12.5 gallons (47 litres) of replenisher solution.

KODAK EKTACOLOR RA Developer Replenisher RT

If your minilab is operating in low utilization conditions, use this developer replenisher. See Section 3, page 3, for details on utilization requirements.

Available in sizes to prepare 10 litres and 25 gallons (95 litres) of replenisher solution.

KODAK EKTACOLOR RA Bleach-Fix and Replenisher

If your minilab is operating in low utilization conditions, use this replenisher. See Section 3, page 3, for details on utilization requirements. Use as a replenisher or a tank solution.

Available in sizes to prepare 10 litres and 25 gallons (95 litres) of solution.

Chemicals for Digital Printers / Processors Requiring Cartridges

KODAK EKTACOLOR Processing Cartridge 92/110

Use this cartridge in KODAK PROFESSIONAL RP 30 and SRP 30 Laser Printers. Each cartridge is mixed automatically and makes enough developer, bleach-fix, and stabilizer to process 92 square metres of professional paper (about 1770 8 x10-inch prints) or 110 square metres of EDGE or ROYAL Digital Paper (about 2120 8 x10-inch prints).

KODAK EKTACOLOR Processing Cartridge 111

Use this cartridge on all models of the FUJI Frontier Digital Minilab. It is a drop-in product that requires no changes or modification to the equipment or existing chemistry. Simply load the cartridge and continue processing. Each cartridge provides enough developer and bleach-fix to process 111 square metres of paper, or about 7170 4 x 6-inch prints.

KODAK EKTACOLOR PC 111 Tank Developer

Use this developer to prepare 4.2 litres of developer tank solution.

KODAK EKTACOLOR PC 111 Tank Bleach-Fix

Use this bleach-fix to prepare 4.2 litres of bleach-fix tank solution.

KODAK Rinse Tablets

Use these tablets on all models of the FUJI Frontier Digital Minilab. This is a drop-in product that requires no changes or modification to the equipment or existing chemistry. Just place the tablet in the slot on the machine and mix with water. Each tablet will make 5 litres of final rinse.

Chemicals for Roller-Transport and Low-Utilization Processors

KODAK EKTACOLOR RA Developer Replenisher RT

This developer has built-in protection from oxidation and evaporation that makes it particularly suitable for roller-transport processors and continuous or minilab processors operating in low utilization conditions.

Available in sizes to prepare 10 litres and 25 (95 litres) gallons of replenisher solution.

KODAK EKTACOLOR Digital Developer Replenisher RT

This developer is designed for commercial pro labs using Process RA-4. It produces increased color saturation and extra-high D-max (i.e., intense blacks) with KODAK PROFESSIONAL ENDURA Transparency and Clear Display Materials. It is primarily designed for digitally exposed output processed through roller-transport (RT) processors.

Available in sizes to prepare 50 gallons (189 litres) of replenisher solution.

KODAK EKTACOLOR RA Developer Starter

Add this concentrate to EKTACOLOR RA Developer Replenisher RT to prepare a developer solution for roller-transport processors.

Available in an 80-ounce (2.366 litres) bottle to prepare 25 gallons (95 litres) of tank solution from EKTACOLOR RA Developer Replenisher RT and EKTACOLOR Digital Developer Replenisher RT.

KODAK EKTACOLOR RA Developer Additive

If your processor's utilization is very low (requiring more than 8 weeks for a tank turnover), add this chemical to EKTACOLOR RA Developer Replenisher RT to provide additional protection from oxidation. Use this additive **only** with EKTACOLOR RA Developer Replenisher RT. Add this chemical *only* to the developer replenisher; *do not* add it directly to the developer working tank solution. Follow the directions on the bottle closely, because this additive requires a different dilution for the developer replenisher. Use the replenishment rates given in Section 4, *Using KODAK EKTACOLOR RA Chemicals in Professional Finishing Labs*; replenisher treated with this additive requires a different replenishment rate.

Available in a case of six 48-ounce (1.42 litre) bottles. Each bottle makes 15.6 gallons (59 litres) of developer replenisher from a 12 1/2-gallon size.

KODAK EKTACOLOR RA Bleach-Fix and Replenisher

Dilute and mix this concentrate for use as a replenisher or a tank solution.

Available in sizes to prepare 5 litres, 10 litres, and 25 gallons (95 litres) of solution.

KODAK EKTACOLOR RA Beach-Fix Additive

If your processor utilization is very low, you can add this solution to EKTACOLOR RA Bleach-Fix and Replenisher for additional oxidation protection. Add this chemical *only* to the bleach-fix replenisher; *do not* add it directly to the bleach-fix working tank solution.

Available in a case of six 48-ounce (1.42 litre) bottles.

CHEMICAL TERMS

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

Chemical Concentrates—Chemicals that are diluted to make replenishers or tank solutions.

Fresh Solution—A newly mixed, unused solution.

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

Regenerator—A solution or concentrate added to tank-solution overflow to convert it for reuse as a replenisher.

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

Starter—Concentrate added to a replenisher to prepare a fresh tank solution so that 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.”

MIXING CHEMICALS

For the most current mixing instructions, follow those on the label of the chemical container or packaged with the chemicals. Be sure to follow all safety precautions and the handling recommendations under *Safe Handling of Photographic Chemicals*.

Table 1-1 summarizes the mixing instructions for EKTACOLOR Chemicals.

Table 1-1 Mixing KODAK EKTACOLOR Chemicals

| EKTACOLOR RA or EKTACOLOR Chemical | Comments |
|---|---|
| Developer Replenisher Developer Replenisher RT Digital Developer Replenisher RT Developer Replenisher 12 | Mix at 21 to 38° C (70 to 100° F). The mixing order is important with developer replenishers because Part A contains the preservatives. Therefore, add Part B only after allowing Part A to mix for at least two minutes, and add Part C only after allowing Part B to mix for at least two minutes. Failure to do so may result in the formation of precipitates that are very difficult to redissolve. Once the final kit parts are added, agitate enough to mix the developer completely, typically not more than 5 minutes, and be sure that mixing does not draw air into the solution. NOTE: Digital Developer Replenisher RT only has two parts, Part A and Part B. |
| Developer Regenerator 12/55 | See Section 5, <i>Processing Options with KODAK EKTACOLOR Chemicals</i> , and the instructions packaged with the chemicals. |
| PRIME SP Developer Replenisher LORR | Add the single-part concentrate to warm water (at 21 to 38° C [70 to 100° F]). Rinse the concentrate bottle with a small amount of water, and add the water to the mix. |
| Bleach-Fix Bleach-Fix and Replenisher Bleach-Fix and Replenisher NR PRIME SP Bleach-Fix and Replenisher LORR | Mix at 21 to 38° C (70 to 100° F). The chemicals mix easily. The bleach-fix and replenisher should be dark red when completely mixed. |
| Bleach-Fix Regenerator II | See Section 5, <i>Processing Options with KODAK EKTACOLOR Chemicals</i> , and the instructions packaged with the chemicals. |
| PRIME Stabilizer and Replenisher LORR | Mix at 21 to 35° C (70 to 95° F). Excessive agitation can cause foaming. |

Contamination Can Ruin a Process

To minimize the possibility of contamination, keep processing and mixing equipment and storage containers clean. Dirt and contamination can affect the life and photographic quality of the processing solutions. Avoid conditions where solutions can come in contact with other chemicals. Contamination is most often caused by—

- solution splashed or dripped into another solution
- using mixing equipment that has not been thoroughly cleaned
- dry chemicals that become airborne during mixing
- pipes and tanks made of material that reacts with the photographic chemicals

To reduce the possibility of contamination, take care to avoid dripping solution into other tanks when you remove racks for cleaning, avoid splashing by not agitating too vigorously, and check that processing and mixing equipment and plumbing are made of suitable material. If possible, use a separate set of mixing equipment to mix each type of solution, and wash all equipment *thoroughly* before you reuse it.

Using separate mixing tanks may not always be practical or possible. Table 1-2 gives mixing arrangements for one to four mixing tanks. Use it as a guide for using your mixing tanks in the best manner to reduce the possibility of contamination.

- If you mix only chemicals for NEGATIVE processes, use two mix tanks: one for developer and one for all other solutions.
- If you mix chemicals for NEGATIVE and REVERSAL processes, use four mix tanks: one for the negative developer and the reversal first developer; one for color developer; one for bleach and bleach-fix; and one for all other solutions.

Remember also that good housekeeping (e.g., keeping the mixing area clean, neat, and well ventilated; proper storage of chemicals, etc.) will reduce the possibility of contamination and provide safer working conditions.

Table 1-2 Configurations for Chemical Mixing Tanks

| |
|---|
| If you have ONE tank: |
| <p>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:</p> <ul style="list-style-type: none"> • Thoroughly rinse the tank and mixing equipment with room-temperature water • Flush tubing and lines • Thoroughly clean transfer pumps |
| If you have TWO tanks: |
| <p>Use the FIRST tank for:</p> <ul style="list-style-type: none"> • Black-and-white developers • First developer for Process E-6 • Color developer for Process RA-4 and C-41, and for Process E-6 Color Developer |
| <p>Use the SECOND tank for:</p> <ul style="list-style-type: none"> • 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: |
| <p>Use the FIRST tank for:</p> <ul style="list-style-type: none"> • Black-and-white developers • First developer for Process E-6 • Color developer for Process RA-4 and C-41, and for Process E-6 Color Developer |
| <p>Use the SECOND tank for:</p> <ul style="list-style-type: none"> • All stop baths and stabilizers • Reversal bath, pre-bleach, and final rinse for Process E-6 • Final rinse for Process C-41 |
| <p>Use the THIRD tank for:</p> <ul style="list-style-type: none"> • All bleaches, fixers, and bleach-fixers |
| If you have FOUR tanks: |
| <p>Use the FIRST tank for:</p> <ul style="list-style-type: none"> • Black-and-white developers • First developer for Process E-6 |
| <p>Use the SECOND tank for:</p> <ul style="list-style-type: none"> • Color developer for Process RA-4 and C-41, and for Process E-6 Color Developer |
| <p>Use the THIRD tank for:</p> <ul style="list-style-type: none"> • Stop baths and stabilizers • Reversal bath, pre-bleach, and final rinse for Process E-6 • Final rinse for Process C-41 |
| <p>Use the FOURTH tank for:</p> <ul style="list-style-type: none"> • All bleaches, fixers, and bleach-fixers |

Water Quality

Water can have a significant effect on photographic quality. Generally, most municipal or public water supplies are sufficiently pure for photographic use. Note that the quality of water supplies can vary seasonally, and it is a good idea to have your water supply tested periodically.

Water for photographic processing should be free of color, suspended material, and heavy metals, and should not be excessively hard. For mixing processing solutions, the water should have less than 250 ppm of total dissolved solids (less than 1000 ppm for wash water). The pH of water should be 6.5 to 8.5 and should not be highly buffered. Practical limits for common water impurities for photographic processing are listed in Table 1-3. If you use well water, be sure to have the water tested for the impurities listed in Table 1-3.

Also, poor plumbing materials (e.g., old, rusty pipes or pipes made of the wrong material) can be a source of dirt and contamination. Check your plumbing and replace it if necessary.

Table 1-3 Practical Limits of Impurities for Water Used in Photographic Processing

| Impurity | Acceptable Limit or Range (ppm) |
|-------------------------------------|---------------------------------|
| Color, suspended material | None |
| Dissolved solids | 250 |
| pH | 6.5 to 8.5 |
| Hardness, as CaCO ₃ | 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 |
| Silica | 20.0 |

Note: If analysis of water shows a marked deviation from the amounts in Table 1-3, consult a water-conditioning company to determine the most suitable method of treatment or filtration of the water.

Construction Materials for Processing Equipment

It is important to use the proper construction materials for processing equipment.

Developers—Use Type 316 stainless-steel tanks for developers. Some plastic materials, such as PVC and polyethylene, are also acceptable.

Bleach-Fix—Bleach-fix rapidly corrodes brass and copper. Avoid all contact of these materials with the bleach-fix. The best material to use for the bleach-fix and the wash tanks following the bleach-fix is Type 316 stainless steel. Several plastic materials, such as PVC and polyethylene, are also acceptable. When you discharge bleach-fix to the drain, flush it with a large volume of running water to avoid corroding metal pipes.

Clean Your Processor Tanks and Racks Regularly

Always wear splash-proof goggles and protective gloves and apron when you clean racks and tanks.

Routine Cleaning—Follow the recommendations described below. **Be sure to follow your equipment manufacturer's recommendations for regular maintenance procedures.**

1. Remove crossovers, squeegee rollers, or squeegees daily at shutdown, and rinse them with hot water.
2. Once a week, remove each rack from the processor, clean it with hot water and a soft, non-abrasive brush, and rinse thoroughly. Inspect the racks for non-moving rollers, deformities in rollers, worn or broken springs, loose screws, deteriorated retaining clips, etc., to ensure smooth transport of paper.
3. On a periodic basis (every 6 to 12 months), clean racks and tanks with a non-abrasive brush, and remove stains from racks and tank walls with a cleaner such as KODAK Developer System Cleaner and Neutralizer for developer tanks and KODAK Fixer/Wash Systems Cleaner for bleach-fix, fixer and wash tanks (follow the instructions provided with these products). Rinse racks and tanks thoroughly before you refill the tanks.

Removing Biological Growth—Biological growth can occur in stabilizer and wash tanks. This is a potential source of dirt. Clean wash tanks weekly and stabilizer tanks as needed. To remove biological growth:

1. Empty the processing solution or wash water from the tank. Dispose of waste solutions according to disposal regulations.
2. Rinse the tanks and racks with hot water; drain the rinse water and repeat.

DANGER! The addition of cleaning agents that contain strong acids or oxidizing agents (e.g., chlorine-containing bleaches) to thiocyanate-containing photoprocessing solutions (i.e., some fixer solutions) may release poisonous and flammable hydrogen cyanide gas, as well as other irritating and toxic gases, such as cyanogen chloride and sulfur dioxide. **Do not** add cleaning agents to processing tanks unless the tanks, racks, and recirculation system have been completely drained and thoroughly flushed and rinsed with water. Read the Material Safety Data Sheet for information on the potential hazards of the working tank solution.

3. Fill the tanks with sodium hypochlorite (NaOCl) solution, such as 2 mL Clorox (5.25 percent NaOCl) or 1 mL Sunny Sol (12.5 percent NaOCl) per litre of water. (Note the caution above.)
4. Allow the hypochlorite solution to remain in the tanks for up to 30 minutes. Longer dwell times can damage plastic or rubber materials. After treatment, dispose of the hypochlorite solution according to local or state disposal regulations.
5. Brush foreign matter from the tanks and racks.
6. Before refilling the tanks, flush them *thoroughly* with water. Small amounts of remaining hypochlorite can have an adverse effect on processing solution activity. *Be sure to recirculate rinse water through the recirculation system to remove traces of hypochlorite.*

Note: For more information on the recommended methods for cleaning processing tanks, in the U.S., contact the Kodak Information Center at 866-352-4367. In Canada, call 800-465-6325. In other regions, contact Kodak in your country. For information on controlling biological growth, go to www.kodak.com/go/photochemicals for KODAK Publications CIS-3, *Biocides for Photographic Solution Tanks and Wash Water* and CIS-167, *Removal of Silver Sulfide from Fixer, Bleach-Fix, Wash or Stabilizer Racks/Rollers in Photographic Processes*.

CHECKING CHEMICALS AND CHEMICAL MIXES

Fresh EKTACOLOR Chemical concentrates and solutions have a characteristic appearance and odor. By checking the appearance and odor, you may be able to determine if a concentrate was stored properly or if a solution was mixed correctly. Table 1-4 summarizes the characteristics of EKTACOLOR Chemicals and solutions. You can check your mixes for possible mixing errors by using specific-gravity measurements. For information on making specific-gravity measurements, see *Check Your Mixes with Specific-Gravity Measurements*.

Table 1-4 Characteristics of KODAK EKTACOLOR Chemicals

| EKTACOLOR Chemical | Appearance of Concentrates | Normal Appearance of Mixed Replenisher | Comments |
|---|---|--|--|
| Developer Developer Replenisher RT Developer Replenisher 12 | Part A — clear, yellow to reddish amber; amine odor Part B — Clear amber to tan; sulfite odor Part C — Clear, colorless; odorless | Pale yellow to amber | Darkens slightly with age/storage, this will not affect activity. If appearance of Part B concentrate is dark, opaque, solution is oxidized, do not use. If appearance of mixed replenisher is dark, opaque, it is oxidized, do not use. |
| Digital Developer Replenisher RT | Part A — clear, amber to reddish amber; amine odor Part B — Clear to yellow | Pale yellow to amber | Darkens slightly with age/storage, this will not affect activity. If appearance of Part A concentrate is dark, opaque, solution is oxidized, do not use. If mixed replenisher is dark, opaque, it is oxidized, or if precipitate is present, do not use. |
| PRIME SP Developer Replenisher LORR | Clear, yellow-amber to orange; fresh odor | Pale amber to amber | Appearance of concentrate can darken slightly with age/storage, this will not affect activity. If the appearance of the concentrate or mixed replenisher is dark, opaque, solution is oxidized, do not use. |
| Developer Starter | Clear, colorless; odorless | — | — |
| Bleach-Fix Replenisher | Part A — Clear, colorless, slight ammonia odor Part B — Dark red-brown | Dark red-brown | Do not allow concentrate to freeze, as precipitate may form. Age, exposure to high temperature, or oxidation can cause sulfurization of Part A or of mixed replenisher. Severely degraded bleach-fixes can produce a large amount of white to yellow precipitate (sulphur) and may have a hydrogen sulfide odor. (i.e., rotten egg odor). |
| PRIME SP Bleach-Fix and Replenisher LORR | Dark red-brown, slight acetic acid odor | Dark red-brown | |
| PRIME SP Bleach-Fix Starter | Dark red-brown | — | — |
| PRIME Stabilizer and Replenisher LORR | Clear, colorless to pale green | Clear, colorless | — |

Check Your Mixes with Specific-Gravity Measurements

Specific gravity is the ratio of the mass of a liquid to the mass of an equal volume of water at a specific temperature. Specific gravity provides a convenient way to measure the total dissolved material in a solution. Its primary use with EKTACOLOR Chemicals is to check for mixing errors in freshly mixed solutions. The specific-gravity range for a seasoned tank solution makes readings more variable.

How to Measure Specific Gravity—To make specific-gravity measurements of EKTACOLOR Chemicals, use a hydrometer that meets the standard ASTM E100-05. The hydrometer should be marked in increments of 0.001 for an accuracy of ± 0.0005 . Although most hydrometers are calibrated at 15.5°C (60°F), you can use them at other temperatures. Table 1-5 gives typical specific-gravity ranges for fresh mixes and seasoned tank solutions of KODAK EKTACOLOR Chemicals at a temperature of 25°C (77°F). To measure specific gravity:

1. Choose a hydrometer with a range suitable for the solution you are measuring.
2. Fill a clean, dry 250 mL graduated cylinder to within 2.5 cm (1 inch) of the top with the solution you are measuring. Place the cylinder in a sink or tray to catch overflow.
3. Adjust the solution to $25.0 \pm 1^\circ\text{C}$ ($77 \pm 2^\circ\text{F}$). Proper solution temperature is very important.
4. Be sure that the hydrometer is clean and dry. Carefully lower it into the solution. Be sure that the hydrometer floats freely.
5. Read the number on the hydrometer stem at the top of the meniscus of the solution.
6. Compare your reading with the approximate number in Table 1-5. Specific-gravity values that are lower than normal indicate that your solution is too dilute. If the values are higher than normal, your solution is too concentrated.
7. After making the measurement, discard the sample. To avoid contaminating solutions, **do not** return the sample to the tank.
8. Rinse the hydrometer and graduated cylinder thoroughly with water.

Note: Never take specific-gravity readings of solutions in the tanks. If you use the wrong hydrometer, it can sink to the bottom of the tank and break, or bob on the surface, where the stem may hit the edge of the tank and break. Label hydrometer boxes to avoid confusion. **Do not** tape labels on hydrometers.

Table 1-5
Acceptable Specific-Gravity Ranges for KODAK EKTACOLOR
Chemical Solutions at 25°C (77°F)

| KODAK EKTACOLOR Chemical | Specific Gravity at 25° C (77° F) | | |
|---|-----------------------------------|----------------|----------------|
| | Fresh Tank | Seasoned Tank | Replenisher |
| Developer | 1.017 to 1.023 | 1.027 to 1.035 | 1.024 to 1.030 |
| RA 12 Developer Replenisher | 1.019 to 1.025 | 1.028 to 1.036 | 1.022 to 1.028 |
| RA 12/55 Regenerator | NA | 1.032 to 1.040 | 1.029 to 1.037 |
| RA Developer Replenisher RT | 1.017 to 1.023 | 1.026 to 1.034 | 1.020 to 1.026 |
| Digital Developer Replenisher RT | 1.022 to 1.028 | 1.027 to 1.035 | 1.027 to 1.033 |
| RA Developer Replenisher RT (with Additive) | NA | NA | 1.018 to 1.024 |
| PRIME SP Developer LORR | 1.018 to 1.028 | 1.027 to 1.035 | 1.023 to 1.031 |
| Processing Cartridge PC 92/110 Developer | 1.030 to 1.036 | 1.032 to 1.042 | 1.034 to 1.042 |
| Processing Cartridge PC111 Developer | NA | 1.039 to 1.047 | 1.041 to 1.049 |
| RA Bleach-Fix NR | 1.060 to 1.070 | 1.080 to 1.110 | 1.125 to 1.135 |
| RA Bleach-Fix | 1.070 to 1.080 | 1.066 to 1.096 | 1.070 to 1.080 |
| Processing Cartridge PC 92/110 Bleach-Fix | — | 1.090 to 1.120 | 1.113 to 1.123 |
| Processing Cartridge PC111 Bleach-Fix | NA | 1.090 to 1.120 | NA |

STORING CHEMICAL CONCENTRATES AND SOLUTIONS

How well you store chemical concentrates and solutions may affect the activity of processing solutions. For the most up-to-date source of information on mixing and storing chemicals, see the instructions packaged with the chemicals.

Storage Temperature—Store *unmixed chemical concentrates* in a dry location at a temperature of 7 to 30°C (45 to 86°F). Lower temperatures may cause components to come out of solution or crystallize. Higher temperatures can accelerate chemical reactions and cause deterioration.

Store *mixed solutions* in polyethylene storage tanks at approximately 21°C (70°F). If a replenisher is stored at a temperature that is too low, it can affect the temperature of the tank solution. Too high a storage temperature accelerates oxidation and evaporation.

Storage Tanks and Containers—Equip storage tanks with floating lids and dust covers to minimize evaporation and protect solutions from dust and dirt.

Once you open the original container, the chemical concentrates are exposed to oxygen that will react with the chemicals and gradually cause them to deteriorate. This is especially true of developers. Oxidation occurs to some extent even if you immediately reseal the container.

Store drums upright to expose as little surface area to the air as possible.

Length of Storage Time—For best results, **do not** use solutions stored longer than the times given in Table 1-6.

Table 1-6 Solution Storage Times

| Mixed Solutions | Solution in Processor—No Operation | Replenisher in Covered Tank with Floating Lid |
|---|------------------------------------|---|
| EKTACOLOR RA Developer EKTACOLOR RA Developer RT | 1 week | 6 weeks |
| EKTACOLOR Developer 12 EKTACOLOR RA Developer Regenerator 12/55 | 1 week | 3 weeks |
| EKTACOLOR PRIME SP Developer LORR | 1 week | 3 weeks |
| All other solutions | 2 weeks | 8 weeks |

SAFE HANDLING OF PHOTOGRAPHIC CHEMICALS

Every substance we come into contact with is composed of chemicals—the food we eat, the air we breathe, the clothing we wear, the medicine we take. Although most of these chemicals are not hazardous, you may need to take precautions to limit the exposure to some chemicals that could be harmful. For example, direct skin or eye contact with or inhalation of vapors or mists from some household cleaning products can be irritating.

When handled properly, photographic processing chemicals are safe to use. Follow the guidelines below to minimize the potential hazardous effects of these chemicals.

Be Informed

Safe handling of chemicals requires that you recognize and avoid the potential hazards. Learning more about photographic processing chemicals reduces the possibility of illness or injury.

Occupational Health and Safety Regulations

The Occupational Safety and Health Administration (OSHA) Hazard Communication Standard requires chemical manufacturers to label their products properly and to provide Material Safety Data Sheets (MSDSs) for hazardous chemicals. OSHA also requires employers to make MSDSs available in the workplace for the purpose of proper chemical container labeling, and to train employees on the safe use of chemicals. Local emergency responders may also require MSDS's to be on hand.

Product Labels

Kodak provides warning and precautionary statements on product labels, instruction sheets, and packaged products. Kodak also provides labels for processor and replenisher tanks. Kodak evaluates photographic processing chemicals for potential health and physical hazards. When a photographic processing chemical has little, if any, potential hazard, the statement "LOW HAZARD FOR RECOMMENDED HANDLING" is included on the label. Photographic processing chemicals that are potentially hazardous have appropriate precautionary statements, such as the following:

Signal Word

-For example, "CAUTION," "WARNING," or "DANGER!"

Statement of Hazard

-For example, "CAUSES SKIN AND EYE BURNS," "HARMFUL IF ABSORBED THROUGH THE SKIN," or "FLAMMABLE."

Precautionary Wording

-For example, "Do not get in eyes, on skin, or on clothing" or "Keep away from heat, sparks, and flame."

First-Aid Statements

-Included on labels and signs to describe immediate measures you must take in case of contact with or overexposure to a photographic processing chemical.

Material Safety Data Sheets

Photographic processing facilities are required by OSHA to have MSDSs for all hazardous chemicals. MSDSs provide detailed information about each product. Information included in MSDSs is outlined in the following categories: chemical and manufacturer identification; composition/ingredients; hazard identification; first-aid measures; fire-fighting measures; accidental release measures; handling and storage; exposure controls and personal protection; physical and chemical properties; stability and reactivity; toxicological information; ecological issues; disposal issues; transport issues; regulatory issues; and other information.

Kodak provides customers with MSDSs for all photographic processing chemicals. If you need replacement(s) or extra MSDSs for any Kodak chemical, visit the Kodak website at www.kodak.com/go/MSDS or call 1 800 242 2424. You will need to supply the catalog (CAT) number of the products for which you need MSDSs.

Training

OSHA requires that all employees be trained on the safe handling of photographic processing chemicals and general lab safety prior to their initial assignment and whenever new hazards are introduced into the workplace. Employees should be familiar with the OSHA Hazard Communication Standard, operations where hazardous chemicals are present, the location and content of Material Safety Data Sheets, physical and health hazards of chemicals in their work area, and additional topics. For more information on OSHA's Hazard Communication Standard, see KODAK Publication No. J-311, *Hazard Communication for Photographic Processing Facilities*. You may also want to review KODAK Publication No. J-98R, *Health, Safety, and Environmental Program*.

Handle Chemicals Properly

Once you know the hazards, learn how to handle chemicals safely. Safe handling practices include wearing personal protective equipment, following procedures that minimize chemical contact, and following the instructions on chemical labels. If contact occurs, know how to treat or obtain medical/first-aid assistance.

Protective Equipment and Clothing

OSHA requires that personal protective equipment (PPE) be used in the workplace whenever the possibility of chemical contact exists. OSHA also requires that you perform a hazard assessment in your facility to determine what type of personal protective equipment is required to protect against the hazards present. In general, the personal protective equipment required for handling photographic processing chemicals includes:

- Neoprene or nitrile gloves
- Safety goggles
- Vinyl or rubber apron or lab coat

Check personal protective equipment often to make sure it is in good working condition, is clean, and works and fits properly. Training must be provided on the use, limitations, and maintenance of personal protective equipment. For more information, see KODAK Publication No. J-312, *Personal Protective Equipment Requirements for Photographic Processing Facilities*.

Corrosive Materials

Certain photographic processing chemicals contain materials that can burn or irritate the skin and eyes, sometimes with only brief contact. To reduce the possibility of injury, always wear personal protective equipment when handling photographic processing chemicals. Also make sure an emergency eyewash station is readily available.

Contact Dermatitis

Dermatitis is the medical term used to describe a skin inflammation. Contact with some materials, such as acids and bases, can cause irritative contact dermatitis, while other chemicals, such as photographic developers, may cause allergic contact dermatitis.

Early symptoms of **irritative contact dermatitis** may include dry, red, cracked, or scaly skin at the site of contact. Symptoms may worsen with continued chemical exposure. In most cases of **allergic contact dermatitis**, the symptoms are itchy blisters similar to those seen from exposure to poison ivy or poison oak. Although the rash is usually confined to the site of contact, most often fingers, hands, and forearms, it may spread to other areas.

Sometimes people can work with a chemical for years without any noticeable effect, only to develop contact dermatitis at a later date. The time between contact and when a response develops varies widely among individuals. People with a history of skin allergies, eczema, or other skin disorders may be more susceptible to the effects of contact with chemicals.

If you think you have developed contact dermatitis, contact your manager. A medical examination may be required to determine the cause of the problem. **Do not** attempt to self-medicate with lotions or creams; they may make the problem worse.

To **prevent contact dermatitis** when handling photographic processing chemicals, follow these guidelines:

- **Read the labels** on chemical containers so that you know what precautions to take when handling the contents.
- **Avoid contact with chemicals whenever possible.** Handle chemical solutions carefully to avoid splashing. Keep all personal protective equipment (gloves, goggles, apron, etc.) free of chemical residues.
- **Wear the proper gloves.** Do not use gloves sold for household use; they may not be durable enough for handling photographic processing chemicals. Neoprene or nitrile gloves protect you from photographic processing chemicals. To minimize the possibility of chemicals coming in contact with your bare hands, rinse gloves thoroughly with water before taking them off. On a regular basis or if chemicals get inside the gloves, wash them inside and out, and hang them by the fingertips to dry.
 - Check gloves regularly for pinholes, leaks, or tears.
 - Dispose of gloves when they are damaged or begin to degrade.
 - Barrier creams ARE NOT an acceptable substitute for gloves.
- **In case of contact with chemicals, wash your hands or other affected skin areas immediately** with plenty of water. Wash with a mild soap or pH-balanced cleanser (like pHhisoderm or pHotoDerm). Avoid using harsh or abrasive soaps or hand cleaners.
- **Protect skin abrasions or cuts.** The risk of contact dermatitis is increased if chemicals penetrate the skin. Skin damaged by cuts or abrasions is especially susceptible to irritants.
- **Change and launder clothing worn while handling chemicals.** If photographic processing chemicals are splashed or spilled on your clothes, immediately rinse the clothes to remove the chemical residue. Wash contaminated clothing before wearing it again.
- **Clean up chemical spills or splashes immediately.** Always wear personal protective equipment when cleaning up spilled photographic processing chemicals. Follow the directions under "Accidental Release Measures" in the MSDS. To prevent a potentially dangerous chemical reaction, never use soaps, bleaches, or other cleaners directly on a spill.
- **Immediately report any unusual skin condition** that you think might be related to photographic processing chemicals to your manager and to your physician. Conditions such as contact dermatitis can be caused by materials other than photographic processing chemicals; dermatitis usually will not improve until the cause is found and the condition is properly treated.

Absorption of Chemicals Through the Skin

Some chemicals are able to enter the body by absorption through the skin. A variety of factors determines the effects of these chemicals, including the toxicity of the chemical, its concentration, and the duration of skin contact. Chemicals can have a toxic effect even without skin irritation. If tests indicate that a photographic processing chemical may be absorbed through the skin in amounts that could cause an adverse effect, the product label will include a precautionary statement, such as "HARMFUL IF ABSORBED THROUGH THE SKIN." Always wear personal protective equipment when handling these chemicals.

Ventilation

Proper ventilation is important to ensure a safe and comfortable indoor air environment for photographic processing areas. Several common potential indoor air contaminants can be associated with photographic processing. These include acetic acid, sulfur dioxide, and ammonia. These chemicals may be eye and respiratory tract irritants depending on their airborne concentrations. OSHA and other agencies have established exposure guidelines and standards that represent concentrations under which it is believed that nearly all employees may be repeatedly exposed to these chemicals without adverse health effects. If significant eye or respiratory tract irritation occurs during normal photographic processing or maintenance operations, this may indicate elevated levels of these materials and the need for better control.

For more information, see KODAK Publication No. J 314, *Indoor Air Quality and Ventilation in Photographic Processing Facilities*.

Photographic Chemicals in a Home Darkroom

Photographic chemicals used in home darkrooms are essentially the same as those used in commercial photoprocessing labs, but they are used in smaller volumes and less frequently. The safety precautions are the same as those required for commercial labs. However, it is important to take extra precautions for storage and use to protect young children and pets.

Know First Aid in Case of an Emergency

Appropriate first-aid treatment is included in the MSDS and on the product and processor labels. First aid should be used for immediate treatment in the event of an emergency and is not intended to replace medical attention. Do not administer first aid to others unless you have been specifically trained to do so.

Chemical Splashes

If a chemical gets into a person's eye(s), use an eyewash station to thoroughly flush the eye(s). Get medical attention, if necessary.

If you get chemicals on your clothing, thoroughly rinse the affected clothes to remove all of the chemical residue. Use water to rinse the skin area where the chemical contact took place. If the chemical is a developer, wash with a pH-balanced cleanser. Wash contaminated clothing before wearing it again. Thoroughly clean contaminated shoes; if they cannot be cleaned, discard them.

Swallowed Chemicals

Immediately identify which chemical was swallowed and follow the first-aid recommendations on the container/processor label and in the MSDS. Call a physician or poison-control center as quickly as possible; make sure you have the MSDS with you when you call.

Inhaled Vapors and Gases

Immediately get fresh air. If symptoms persists, get medical attention.

Store Chemicals Safely

Keep containers easily accessible-

Always store photographic processing chemical containers in a designated area, away from heavy traffic, where they can be identified and inventoried. Position containers in an area where you can easily reach them without having to stretch.

Do not remove chemical labels-

Container labels include the chemical name, appropriate hazard warnings, and precautionary measures where applicable.

Processor tanks and other storage tanks also need to be properly labeled. Kodak provides hazard warning labels for this purpose.

Use the proper containers-

Store photographic processing concentrates in the containers in which they were originally delivered. Do not transfer chemicals into any other containers.

Keep corrosive materials separated-

Store corrosive materials away from any materials with which they may react, and away from other incompatible materials. See the stability and reactivity section on the MSDS for more information.

Dispose of Photographic Chemicals Properly

Always follow the procedures designated for your photographic processing facility when disposing of photographic processing chemicals. These disposal procedures are based on local, state, and federal requirements that regulate the disposal of photographic processing chemicals.

If your facility discharges waste solutions, make sure you have reviewed the local sewer discharge requirements for your area. Use silver-recovery methods for silver-bearing effluents (e.g., used fixers, bleach-fixes, and stabilizers). Also, know what other materials may be discharged to a common drain. Never pour any photographic processing chemicals into a drain where cleaning agents containing chlorine are present unless the drain has been thoroughly rinsed. Run plenty of water down the drain prior to disposing of photographic processing chemical effluents. Then thoroughly rinse the drain again after disposal of effluents.

For more information on silver recovery, see KODAK Publication No. J 212, The Technology of Silver Recovery for Photographic Processing Facilities.

If off-site treatment (hauling) is used for the disposal of waste photographic processing solutions, make sure the only solutions poured into the waste drum(s) are photographic processing solutions.

Regardless of the type of recovery or disposal procedure you use in your facility, maintain the system so that overflows and spills do not occur.

Summary

Safe handling of photographic chemicals is easy when you use common sense and follow these guidelines:

- Know the chemicals you are handling.
- Read the MSDSs and container labels.
- Protect your eyes and skin by wearing personal protective equipment.
- Use caution when mixing and pouring photographic processing chemical solutions into processor tanks.
- Use care when moving containers from one location to another.
- Store photographic processing chemicals safely.
- Do not eat, drink, or smoke in chemical-handling areas.

EFFLUENT DISPOSAL

Effluent from processing labs that use KODAK EKTACOLOR Chemicals consists of developer, desilvered bleach-fix, and wastewater or stabilizer. This effluent is compatible with and can be effectively treated by a municipal secondary wash-water treatment plant.

Photographic effluent is considered an industrial waste discharge. Most municipalities require a permit to discharge industrial waste to a municipal sewer system. After efficient silver recovery, the effluent from a lab using Process RA-4 has the characteristics listed in Table 1-7.

Table 1-7 Effluent Characteristics

| | |
|--|-----------------------|
| pH | 6.5 to 9 |
| Temperature | Less than 30°C (90°F) |
| Silver | Less than 5 mg/L |
| Suspended solids | Less than 50 mg/L |
| Oils, greases, detergents | None |
| Flammable, explosive, or toxic materials | None |

Effluent from processes that use EKTACOLOR Chemicals will also contain concentrations of ammonia, iron, sulfates, developing agents, and chemicals that have an oxygen demand (BOD, COD). The concentrations of these chemicals will depend on factors such as replenishment and wash rates, type of processor, efficiency of squeegees, chemical regeneration, treatment methods, and dilution by effluent from other processes and non-processing wastewater. To characterize waste from your processing operation, it is best to have the effluent sampled by an analytical laboratory according to the method required by local discharge codes.

Keep the discharge of photographic chemicals as low as possible by using efficient squeegees and the correct replenishment rates. Avoid making batch discharges, such as tank dumps. If your permit allows, discharge large amounts of working-strength solutions by adjusting the pH and then releasing them slowly into the sewer along with your normal non-processing effluent.

Consider silver recovery as part of your normal processing operation. For more information on choosing a silver-recovery method, see KODAK Publication No. J-212, *The Technology of Silver Recovery for Photographic Processing Facilities*. For more information on how much silver can be recovered, see KODAK Publication No. J-210, *Sources of Silver in Photographic Processing Facilities*. For more information on techniques for measuring silver in a photographic processing lab, see KODAK Publication No. J-211, *Measuring Silver in Photographic Processing Facilities*.

If you have other questions about discharging EKTACOLOR Chemicals or other environmental concerns, in the U.S., call the Kodak Information Center at 800-242-2424. In Canada, call 800-465-6325. In other regions, contact Kodak in your country.

MORE INFORMATION

For general questions regarding health, safety, disposal of chemicals, or other environmental issues, in the U.S., call the Kodak Information Center at 800-242-2424. In Canada, call 800-465-6325. In other regions, contact Kodak in your country.

For emergency health or safety information, call 585-722-5151. For non-emergency information, go to www.kodak.com/go/kes for the MSDS.

For questions concerning the safe transportation of Kodak products, call Kodak Transportation Services at 585-722-2400, between 8 a.m. and 5 p.m. (Eastern time).

The products and services described in this publication may not be available in all countries. In countries outside the U.S., contact your local Kodak representative, or your usual supplier of Kodak products. For more information, visit the Kodak website at www.kodak.com/go/photochemicals.

Simplified Metric Conversion Charts

Volume, Length, and Weight

Because most laboratory measuring devices are calibrated in metric units, this summary includes tables for converting U.S. units of volume, length, and weight to metric units. **Do not** use Table 1-8 to convert from metric to U.S. values. Accuracy of the table is within one percent. This degree of accuracy is adequate for most measurements in a photoprocessing laboratory (e.g., replenishment rates, safelight distances, equipment location, etc.). To use Table 1-8, find the number you are converting at the top of the table for numbers from 1 to 9. For numbers greater than nine, find the number you are converting by using a combination of the number at the left side of the table and the number at the top.

Table 1-8 Volume, Length, and Weight Conversion

| U.S. Gallons to Litres | | | | | | | | | | |
|---------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| gal | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | — | 3.8 | 7.6 | 11.4 | 15.1 | 18.9 | 22.7 | 26.5 | 30.3 | 34.1 |
| 10 | 37.8 | 41.6 | 45.4 | 49.2 | 53 | 56.8 | 60.6 | 64.4 | 68.1 | 71.9 |
| 20 | 75.7 | 79.5 | 83.3 | 87.1 | 90.8 | 94.6 | 98.4 | 102.2 | 106 | 107.8 |
| 30 | 113.6 | 117.3 | 121.1 | 124.9 | 128.7 | 132.5 | 136.3 | 140.1 | 143.8 | 147.6 |
| 40 | 151.4 | 155.2 | 159 | 162.8 | 166.6 | 170.3 | 174.1 | 177.9 | 81.7 | 185.5 |
| U.S. Fluidounces to Millilitres | | | | | | | | | | |
| fl oz | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | — | 29.5 | 59 | 89 | 118 | 148 | 177 | 207 | 237 | 265 |
| 10 | 295 | 325 | 355 | 385 | 415 | 445 | 475 | 500 | 530 | 560 |
| 20 | 590 | 620 | 650 | 680 | 710 | 740 | 770 | 800 | 830 | 860 |
| 30 | 890 | 920 | 950 | 980 | 1006 | 1035 | 1065 | 1094 | 1124 | 1153 |
| Inches to Centimetres | | | | | | | | | | |
| in. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | — | 2.5 | 5.1 | 7.6 | 10.2 | 12.7 | 15.2 | 17.8 | 20.3 | 22.9 |
| 10 | 25.5 | 28.0 | 30.5 | 33.0 | 35.5 | 38.0 | 40.5 | 43.0 | 45.5 | 48.5 |
| 20 | 51 | 53 | 56 | 58 | 61 | 64 | 66 | 69 | 71 | 74 |
| 30 | 76 | 79 | 81 | 84 | 86 | 89 | 91 | 94 | 97 | 99 |
| Ounces to Grams | | | | | | | | | | |
| oz | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | — | 28.5 | 57 | 85 | 113 | 142 | 170 | 198 | 227 | 255 |
| 10 | 285 | 310 | 340 | 370 | 395 | 425 | 455 | 480 | 510 | 540 |
| 20 | 570 | 600 | 620 | 650 | 680 | 710 | 740 | 770 | 790 | 820 |
| 30 | 850 | 880 | 910 | 940 | 960 | 990 | 1021 | 1049 | 1077 | 1106 |

You can use Table 1-9 to convert from metric to U.S. values, or from U.S. to metric values. To do this, multiply the metric or U.S. units in column 1 by the number in column 2 (e.g., to convert 450 millilitres to fluidounces, multiply 450 by .03382 = 15.22 fluidounces).

Table 1-9 Conversion Factors

| To Convert | Multiply By |
|----------------------------|-------------|
| Millilitres to Fluidounces | 0.03382 |
| Fluidounces to Millilitres | 29.573 |
| Pints to Litres | 0.4732 |
| Litres to Pints | 2.113 |
| Quarts to Litres | 0.9463 |
| Litres to Quarts | 1.057 |
| Gallons to Litres | 3.785 |
| Litres to Gallons | 0.2642 |

Temperature

To convert a temperature from one unit of measure to another, use the following table. Find the temperature you are converting in the “°F or °C” column; if you are converting to degrees Celsius, read the number from the “to °C” column. If you are converting to degrees Fahrenheit, read the number from the “to °F” column.

Table 1-10 Temperature Conversion Chart

| to °C | °F or °C | to °F | to °C | °F or °C | to °F | to °C | °F or °C | to °F | to °C | °F or °C | to °F |
|-------|----------|-------|-------|----------|-------|-------|----------|-------|--------|----------|-------|
| 37.78 | 100 | 212.0 | 22.22 | 72 | 161.6 | 7.22 | 45 | 113.0 | -7.78 | 18 | 64.4 |
| 37.22 | 99 | 210.2 | 21.67 | 71 | 159.8 | 6.67 | 44 | 111.2 | -8.33 | 17 | 62.6 |
| 36.67 | 98 | 208.4 | 21.11 | 70 | 158.0 | 6.11 | 43 | 109.4 | -8.89 | 16 | 60.8 |
| 36.11 | 97 | 206.6 | 20.56 | 69 | 156.2 | 5.56 | 42 | 107.6 | -9.44 | 15 | 59.0 |
| 35.56 | 96 | 204.8 | 20.00 | 68 | 154.4 | 5.00 | 41 | 105.8 | -10.00 | 14 | 57.2 |
| 35.00 | 95 | 203.0 | 19.44 | 67 | 152.6 | 4.44 | 40 | 104.0 | -10.56 | 13 | 55.4 |
| 34.44 | 94 | 201.2 | 18.89 | 66 | 150.8 | 3.89 | 39 | 102.2 | -11.11 | 12 | 53.6 |
| 33.89 | 93 | 199.4 | 18.33 | 65 | 149.0 | 3.33 | 38 | 100.4 | -11.67 | 11 | 51.8 |
| 33.33 | 92 | 197.6 | 17.78 | 64 | 147.2 | 2.78 | 37 | 98.6 | -12.22 | 10 | 50.0 |
| 32.78 | 91 | 195.8 | 17.22 | 63 | 145.4 | 2.22 | 36 | 96.8 | -12.78 | 9 | 48.2 |
| 32.22 | 90 | 194.0 | 16.67 | 62 | 143.6 | 1.67 | 35 | 95.0 | -13.33 | 8 | 46.4 |
| 31.67 | 89 | 192.2 | 16.11 | 61 | 141.8 | 1.11 | 34 | 93.2 | -13.89 | 7 | 44.6 |
| 31.11 | 88 | 190.4 | 15.56 | 60 | 140.0 | 0.56 | 33 | 91.4 | -14.44 | 6 | 42.8 |
| 30.56 | 87 | 188.6 | 15.00 | 59 | 138.2 | 0.00 | 32 | 89.6 | -15.00 | 5 | 41.0 |
| 30.00 | 86 | 186.8 | 14.44 | 58 | 136.4 | -0.56 | 31 | 87.8 | -15.56 | 4 | 39.2 |
| 29.44 | 85 | 185.0 | 13.89 | 57 | 134.6 | -1.11 | 30 | 86.0 | -16.11 | 3 | 37.4 |
| 28.89 | 84 | 183.2 | 13.33 | 56 | 132.8 | -1.67 | 29 | 84.2 | -16.67 | 2 | 35.6 |
| 28.33 | 83 | 181.4 | 12.78 | 55 | 131.0 | -2.22 | 28 | 82.4 | -17.22 | 1 | 33.8 |
| 27.78 | 82 | 179.6 | 12.22 | 54 | 129.2 | -2.78 | 27 | 80.6 | -17.78 | 0 | 32.0 |
| 27.22 | 81 | 177.8 | 11.67 | 53 | 127.4 | -3.33 | 26 | 84.2 | -18.33 | -1 | 30.2 |
| 26.67 | 80 | 176.0 | 11.11 | 52 | 125.6 | -3.89 | 25 | 77.0 | -18.99 | -2 | 28.4 |
| 26.11 | 79 | 174.2 | 15.56 | 51 | 123.8 | -4.44 | 24 | 75.2 | -19.44 | -3 | 26.6 |
| 25.56 | 78 | 172.4 | 10.00 | 50 | 122.0 | -5.00 | 23 | 73.4 | -20.00 | -4 | 24.8 |
| 25.00 | 77 | 170.6 | 9.44 | 49 | 120.2 | -5.56 | 22 | 71.6 | -20.56 | -5 | 23.0 |
| 24.44 | 76 | 168.8 | 8.89 | 48 | 118.4 | -6.11 | 21 | 69.8 | -21.11 | -6 | 21.2 |
| 23.89 | 75 | 167.0 | 8.33 | 47 | 116.6 | -6.67 | 20 | 68.0 | -21.67 | -7 | 19.4 |
| 23.33 | 74 | 165.2 | 7.78 | 46 | 114.8 | -7.22 | 19 | 66.2 | -22.22 | -8 | 17.6 |
| 22.78 | 73 | 163.4 | | | | | | | -22.78 | -9 | 15.8 |

For temperatures not shown in Table 1-10, use the following calculations:

- To convert to degrees Celsius, add 40 to the Fahrenheit temperature. Then divide by 1.8; subtract 40 from the result.
- To convert to degrees Fahrenheit, add 40 to the Celsius temperature. Then multiply by 1.8; subtract 40 from the result.