Kodak

J-1 $1.95

PROFESSIONAL
DATA BOOK

PROCESSING

CHEMICALS & FORMULAS

FOR
BLACK-AND-WHITE
PHOTOGRAPHY

KODAK DATA BOOKS AND TECHNICAL PAMPHLETS

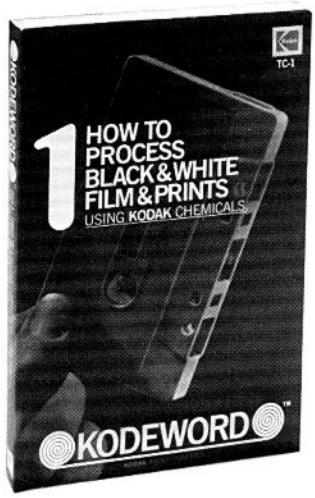
The Kodak library of publications contains a wealth of practical information useful to both professional and amateur photographers, as well as to those who use photography in a particular branch of science or industry.

You can obtain these publications through your photo dealer. If he cannot supply them, you can order them directly from Kodak, using the order form at the back of the *Index to Kodak Information,* Publication No. L-5. Ask your photo dealer for a copy of the *Index,* or write to Eastman Kodak Company, Department 412-L, 343 State Street, Rochester, New York 14650.

Publication No.	Title
G-1	KODAK B/W Photographic Papers
R-20	KODAK Darkroom DATAGUIDE
M-1	Copying
K-13	Photolab Design
F-5	KODAK Professional Black-and-White Films
TC-1	How to Process Black-and-White Film and Prints Using KODAK Chemicals

Additional technical pamphlets dealing with more specialized subject matter are listed below. You can obtain them from the same sources.

Publication No.	Title
J-28	Disposal of Photographic-Processing Effluents and Solutions
Z-126	Process Monitoring of KODAK Black-and-White Films
J-6	Small Batch Reversal Processing of KODAK B/W Films
J-10	Recovering Silver from Photographic Materials
J-19	B/W Processing for Permanence
J-52	Disposal of Photographic Processing Solutions for the Small User
Q-9	Processing Techniques, Chemicals, and Formulas for the Graphic Arts
P-229	Practical Processing in Black-and-White Photography
D-9	Small-Batch Processing of KODAK PLUS-X, TRI-X, and 4-X Reversal Motion Picture Films
H-28	How to Use KODAK Reversal Liquid Chemicals
H-34	Formulas for Processing Black-and-White Motion Picture Films
F-14	Contrast Index—A Criterion of Development



KODEWORD audio tape cassettes such as TC-1 above, can be played on a cassette player right in the darkroom, giving you step-by-step instructions for processing films and papers.

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PROCESSING SECTION—Theory and Methods

THUMB INDEX

Please Read Carefully

SAFE HANDLING OF PHOTOGRAPHIC CHEMICALS

Photographic chemicals and processing solutions should, like all other chemicals, be handled with care. The following instructions apply mainly to the chemicals used in processing black-and-white photographic materials.

Read Labels and Follow Instructions Carefully: Packages of Kodak photographic chemicals bear precautionary labels where necessary. If no hazard is present or expected in normal routine use, the package will not bear a precautionary label.

Store Chemicals and Processing Solutions Safely: Keep processing solutions and chemicals out of the reach of children. Do not store chemicals or solutions in a refrigerator used for food, because they may contaminate food or be mistaken for edible materials.

Keep the Darkroom and Mixing Room Clean: Wipe up spilled chemicals as soon as possible. Powdered chemicals or the residue from dried solutions may become airborne and be inhaled, or they may contaminate other processing solutions.

Wear Protective Clothing: Wear a waterproof apron and rubber gloves when mixing solutions. Always wear safety glasses or goggles when handling large volumes of acids or strong alkalis. To help keep chemicals off the skin, wear rubber or plastic gloves during processing operations.

Handle Chemicals Carefully: Avoid skin contact with chemicals whenever possible. In case of accidental contact, remove chemicals from the skin by washing. If chemicals are splashed into the eyes, wash the eyes at once with running water for at least 15 minutes and seek medical attention. For washing the eyes, keep a hose attached to a cold-water or tempered-water tap in the chemical mixing area.

Some constituents of photographic solutions are capable of causing allergic skin reactions. Such reactions are most commonly caused by the developers, but can be caused by other solutions as well.

Keep Chemicals and Solutions Out of the Mouth: Although most photographic processing solutions have low oral toxicity, keep them out of the mouth to prevent possible trouble. For example, never start a siphoning action by using the mouth. Do not eat food in rooms where chemicals are mixed or used.

Maintain Proper Ventilation: Vapors from black-and-white processing solutions are not usually a problem, but formaldehyde and acetic-acid vapors are given off by solutions containing these chemicals. Also, sulfur dioxide may be liberated by fixing baths. Under some circumstances, these vapors can be irritating. Consequently, all processing rooms should be adequately ventilated.

For a discussion of processing-room ventilation, refer to Kodak Publication No. K-13, *Photolab Design*.

Dispose of Used Chemicals Safely: The most common method of disposing of used photographic solutions is to pour them down the drain. When this is done, follow the disposal of the solutions with plenty of clean water. To avoid undesirable chemical reactions between solutions, discard them one at a time and run plenty of water into the drain after each solution is discarded.

Since dumping a large quantity of any chemical into the sewers is a potential source of water pollution, large users of processing chemicals should pay careful attention to their disposal practices. For information on this subject, refer to Kodak Publications No. J-28, *Disposal of Photographic Processing Effluents and Solutions* and No. J-52, *Disposal of Photographic Processing Solutions for the Small User*.

If emergency information is needed:

KODAK MAINTAINS 24-HOUR POISON INFORMATION.

The telephone numbers are:

Area Code **(716) 458-1000**

Business hours: Extension **85566**

After hours and holidays or weekends: Extension **74755**

PROCESSING

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ABOUT THIS BOOK

This Data Book is designed to familiarize the photographer with the wide range of Kodak prepared chemicals available for use in black-and-white processing, and with the properties and procedures associated with each chemical. In addition, it furnishes formulas for preparations similar to some of the prepared chemicals, so that the photographer who wishes to make up his own processing chemicals may do so.

Included in this publication are explanations of the activities of the different chemicals; the preparation, use, and storage of solutions; the processing of films and papers; and the toning of papers. Although the sections dealing with the "how to's" of processing are written primarily for photographers who do their processing by hand, the sections on prepared chemicals and formulas will be useful to users of hand and mechanical processors alike. People who wish to maintain the greatest possible consistency in film-development processes are encouraged to consult Kodak Data Book Z-126, *Process Monitoring of KODAK Black-and-White Films.* This publication covers the use of different control methods in evaluating and establishing consistency in black-and-white processing. The information given in Z-126 applies to processing done with many kinds of equipment, including spiral tanks, rectangular tanks, and mechanized processors.

If you need information on the processing of graphic arts materials, consult Kodak Publication No. Q-9, *Processing Techniques, Chemicals, and Formulas for the Graphic Arts.* A counterpart to J-1, Q-9 covers such topics as processing techniques for lith and continuous-tone films, the reversal processing of Kodalith films and plates, silver recovery, Kodak prepared chemicals for the graphic arts, and Kodak formulas for graphic arts processing solutions.

Information on various aspects of processing black-and-white motion picture films is found in Kodak Pamphlets No. D-9, No. H-28, and No. H-34.

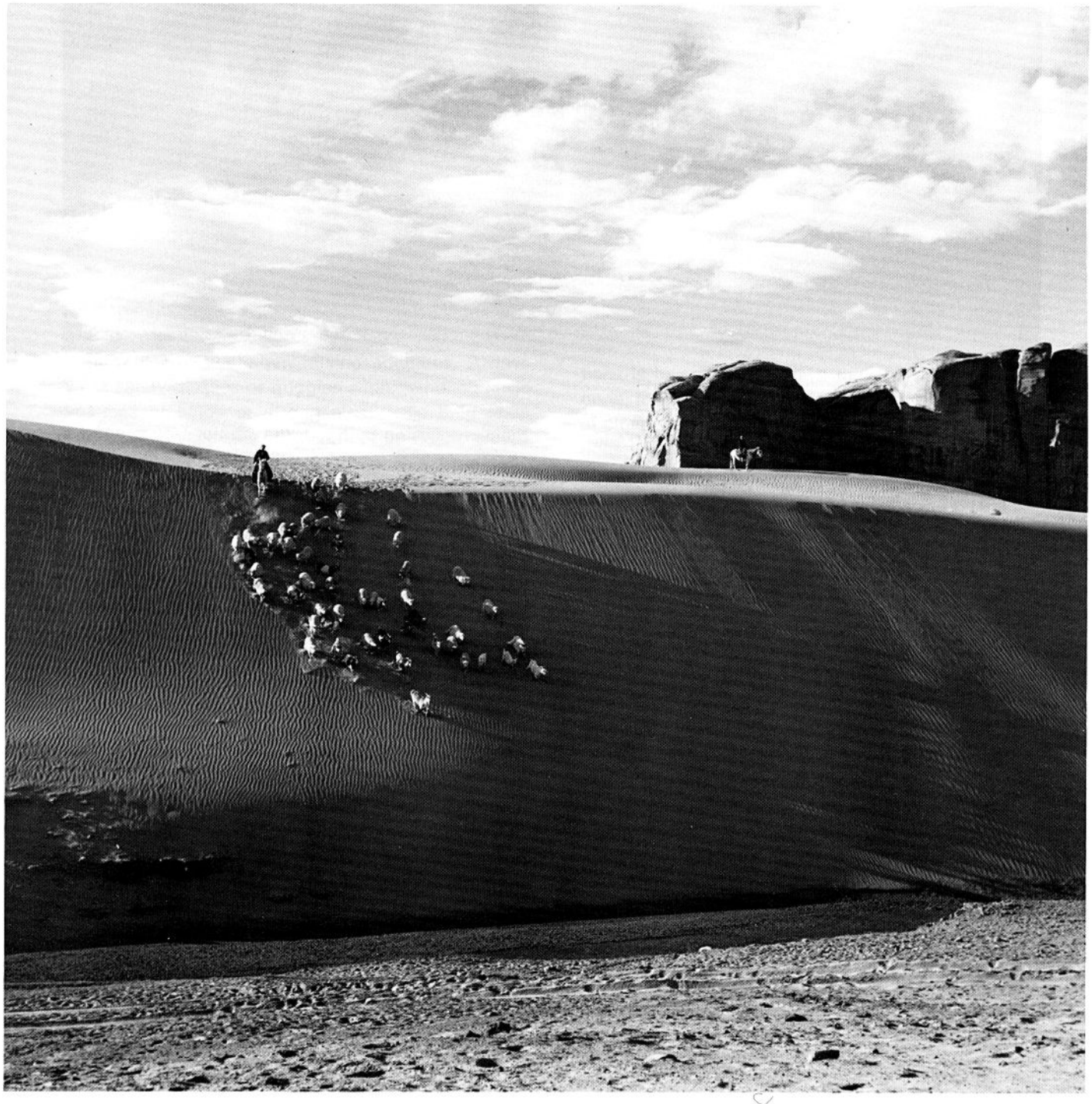
Kodak Pamphlet No. D-9, *Small-Batch Processing of KODAK PLUS-X, TRI-X, and 4-X Reversal Motion-*

Picture Films, discusses procedures for reel-and-trough, rack-and-tank, and rewind processing equipment, furnishes pertinent processing formulas, and outlines the procedures to use when processing is done with the KODAK Direct Positive Film Developing Outfit. Some suppliers of equipment suitable for small-batch processing are also listed.

Kodak Pamphlet No. H-28, *How to Use KODAK Reversal Liquid Chemicals,* covers the use of KODAK Reversal Liquid Chemicals in processing KODAK PLUS-X Reversal Film 7276, KODAK 4-X Reversal Film 7277, KODAK TRI-X Reversal Film 7278, and EASTMAN Reversal BW Print Film 7361. KODAK Reversal Liquid Chemicals are supplied as concentrated solutions, and are quickly and easily diluted to working-strength solutions.

Complimentary single copies of Kodak Pamphlets No. D-9 and H-28 can be obtained on request from Eastman Kodak Company, Department 412-L, Rochester, New York 14650.

Kodak Pamphlet No. H-34, *Formulas for Processing Black-and-White Motion Picture Films,* contains for-



mulas for preparations used in processing both negative and reversal black-and-white motion picture films. Single copies of this publication are available on request from Eastman Kodak Company, Department 412-L, Rochester, New York 14650.

Pollution Abatement

In conformity with its own continuing efforts to reduce water pollution, Kodak urges its customers to be aware of the environmental effects that some of the chemicals they use may have. Kodak Data Books J-28, *Disposal of Photographic-Processing Effluents and Solutions,* and J-52, *Disposal of Photographic Processing Solutions for the Small User,* deal with the proper disposal of photographic wastes.

In any pollution-abatement program, it is important to recognize that the volume of the waste solutions involved is a major factor. Small quantities of photographic wastes, released at intervals (as from an amateur's darkroom), are probably not of major concern. However, anyone who regularly produces large quantities of waste solutions, and releases them into the sewer system, should be aware of the possible effects these solutions may have on the environment, and should investigate other techniques for waste disposal.

If you do large volumes of processing (as with a mechanical processor), you should realize that replenishment can both reduce your waste output and conserve processing chemicals. You may also want to consider a silver-recovery system—where large volumes of processing are done, silver recovery can enable the user to regain some of the costs of processing. Kodak Data Book J-10, *Recovering Silver from Photographic Materials,* deals with silver-recovery processes.

Units of Measurement

In this book, temperatures are given first in degrees Celsius, followed by degrees Fahrenheit in parentheses; most linear, liquid, and dry measures appear first in metric units, followed by U. S. Customary Measure. Two exceptions to this practice are made: first, in those cases where products manufactured to specifications given in U. S. Customary Measure (pounds, quarts, inches, etc) are mentioned, the Customary measurements precede the metric; secondly, the formulas for making up processing chemicals from raw materials are given in the metric system only, on the assumption that those people using these formulas will be acquainted with the standard usages of chemistry.

The Photographic Process

A photographic film, plate, or paper consists of a support (film, glass, or paper) on which is coated a light-sensitive emulsion. The emulsion consists of minute crystals of a silver halide (usually silver bromide, silver chloride, or both) suspended in gelatin. When the material is exposed to light, as when an image is focused upon it by a camera or enlarger lens, chemical reactions within the emulsion produce an invisible "latent image." The image that you see in a positive or negative is made visible by developing the exposed material containing the latent image.

When the exposed film, plate, or paper enters the developer solution, the developer acts on the exposed silver halide grains, freeing the silver from the compound and depositing it in the emulsion as tiny, irregular grains of metallic silver. The density of these black grains in any particular place determines the density of the image. The more light received by any one area of the emulsion, the greater the number of silver grains present, and thus the greater the density of the image. The range from black to white in a print or negative is simply the range from a great number of developed silver grains per unit area to a very few.

The developer will also act, though very slowly, on the unexposed silver halides in the emulsion, producing a slight overall density known as "fog density." Under normal conditions of development, fog density will not adversely affect the image, since the amount of metallic silver formed is very small.

When development is complete, the undeveloped (unexposed) silver halide crystals remaining in the emulsion must be removed, or they will darken and obscure the image. The crystals are cleared from the emulsion by fixing the material in a solution of sodium or ammonium thiosulfate, commonly called "hypo." The hypo forms a soluble compound with the unexposed and undeveloped silver halide, freeing it from the gelatin and leaving the developed silver image behind.

After the undeveloped silver halides have been dissolved, the emulsion is still saturated with the chemicals of the fixing bath and with some of the dissolved silver salts. These, if allowed to remain, will slowly decompose and cause fading and staining of the image. To produce stable prints or negatives, the hypo and silver salts must be removed by washing.

Processing Principles

NOTE: The material presented in this section is covered in greater detail and breadth by Kodak Publication No. P-229, *Practical Processing in Black-and-White Photography*. One particularly useful feature of P-229 is its chart of the characteristics of Kodak developers for black-and-white materials. The chart covers the contrast, special properties, and usual employment of many developers, including those used for graphic arts and x-ray materials. The book is intended to help the photographer choose his processing techniques and chemicals according to his particular needs.

Composition of the Developer Solution

There are many different formulas for developer solutions, but almost all practical formulas contain four essential constituents: developing agent, accelerator, preservative, and restrainer.

The developing agent reduces the silver from its compound to form the image. The most important agents, which are used singly or in combination, are KODAK ELON Developing Agent and hydroquinone. An alkali, such as sodium carbonate, borax, KODALK Balanced Alkali, or sodium or potassium hydroxide, is added as the accelerator to make the developing agent become sufficiently active. The preservative, sodium sulfite, is necessary to minimize the effect of aerial oxidation of the developing agent and tends to maintain the solution colorless during mixing and storing. Many formulas also require a small quantity of potassium bromide to restrain the developer from acting on the unexposed silver halide crystals and thereby producing fog density. In addition to these main constituents, developer solutions often contain other substances, such as sodium bisulfite, sodium sulfate, alcohol, etc, added for special purposes.

Factors Affecting Degree of Development

The density obtained in a developed image depends on the nature of the emulsion, the exposure that it has received, and the degree of development. With any particular emulsion, the degree of development depends on the time of development, the temperature of the developer, the degree of agitation of the material or developer solution, and the chemical activity of the developer, which is determined by the composition and dilution of the solution and the degree of exhaustion.

Time of Development. When the exposed material is placed in the developer, the solution penetrates the emulsion and begins to reduce the exposed crystals to metallic silver. The longer the development is carried on, the more silver is formed and the denser the image becomes. The density difference between highlight and shadow areas also increases; this difference is called the density range.

In the case of negative materials, the degree of development is measured by the average slope of a portion of the characteristic curve of the material. This value is known as "contrast index." Kodak Publication No. F-14, *Contrast Index—A Criterion for Development,* contains a more detailed and informative discussion of this subject. A single complimentary copy can be obtained on request from Eastman Kodak Company, Department 412-L, Rochester, New York 14650.

If development is carried too far, the density may become too high, and the developer may begin to act on the unexposed silver bromide crystals; this causes "developer fog," which tends to veil the detail in the shadows. Development should be stopped when the desired contrast index has been reached. Since the desired degree of development may vary somewhat in different cases, contrast index curves are usually given in film specifications so that the proper development time can be selected for the particular circumstances of film use.

Temperature of Developer Solution. The rate of development is affected by the temperature of the solution. As the temperature rises, the rate of development increases. Thus, when the developer temperature is low, the reaction is slow and the development time recommended for the normal temperature would give underdevelopment; when the temperature is high, the reaction is fast and the same time would give overdevelopment. Within certain limits, these changes in the rate of development can be compensated for by increasing or decreasing the development time.

Besides these changes in development rate, there are other important effects dependent on the temperature. At high temperatures, the gelatin of the emulsion becomes so swollen and tender that it is easily damaged, and it may even loosen from the support, or wrinkle up in a fine network of lines, called reticulation. There is a particular danger of reticulation when a high-temperature solution is followed quickly by a low-temperature one. The temperatures of the developer and other solutions must be kept sufficiently low to avoid danger of damage. When it is necessary to work at high temperatures, the special precautions described under "High-Temperature Processing" should be taken to prevent injurious effects on the film.

Agitation of the Developer. If exposed photographic materials are placed in a developer solution and allowed to develop without any agitation, the action soon slows down because the developing power of the solution in the emulsion and in contact with its surface becomes exhausted. If the material is agitated, however, fresh portions of solution are continually being brought to the emulsion surface, and the rate of development remains constant. Therefore, agitation has an important effect on the degree of development obtained. An even more important effect of agitation is prevention of uneven development or mottle. If there is no agitation, the exhausted solution, loaded with by-products of development, may flow slowly across the emulsion from the dense areas and produce uneven streaks. Agitation keeps the solution uniform throughout and avoids uneven development.

Since agitation affects the rate of development, the statement of a development time would mean little if agitation were not included. The development times mentioned in various places in this book, and in other Kodak publications, usually relate to one of the general types of agitation, small tank, large tank, or tray, as described in the section on Processing Technique.

Activity of the Developer Solution. The rate of development is also affected by the chemical activity of the developing solution. This depends upon its composition and primarily upon the nature and concentration of the developing agent and the effective alkalinity of the solution. For example, KODAK Developer D-76, with its mild alkali, borax, has a slower rate of development than KODAK Developer DK-60a, which contains KODALK Balanced Alkali; this, in turn, is slower than KODAK Developer D-11, which contains sodium carbonate. Also, the developer's activity is affected by any dilution of the solution.

In addition, the exhaustion of the developer affects the activity of the solution. When a developer is used, its developing power decreases, partly because of the oxidation of the developing agent in reducing the exposed silver halide to metallic silver, but primarily because of the restraining effect of the accumulated reaction products of the development. Even when the developer is not used, its activity may decrease because of aerial oxidation of the developing agent.

Replenishers

Replenishment is an economical method of extending a developer's useful life and reducing potentially polluting wastes. Replenishers serve two important functions: (1) they replace developer used up in developing, and (2) they compensate for the decreased developer activity resulting from oxidation. Periodic use of small quantities of replenisher can, theoretically, extend the useful life of a developer almost indefinitely. In practice, however, most developers will accumulate a silver sludge, as well as particles of dirt and gelatin, which may adhere to the film surface. When a developer has been replenished several times, the developed films should be carefully examined for stain or fog, and the developer discarded immediately if any signs of these problems occur.

Replenishment Procedures. The quantity of developer solution carried out in processing varies with processing conditions. Most replenishers are balanced to suit the conditions under which they are most frequently used; for other conditions, adjustments may be necessary. If, after replenishment, the developer has lower-than-normal activity, more replenisher should be added, even though it may be necessary to discard some developer in order to maintain a constant volume. If the developer tends to gain in strength when the replenisher added is just sufficient to replace the developer carried out, dilute 3 or 4 parts of replenisher with 1 part of water, and add this solution to keep the volume constant.

Small volumes of developer are best replenished by adding the required quantity of replenisher for each sheet or roll of film processed. Consult individual replenisher instructions for specific recommendations. Ordinarily, constant developer activity will be maintained by adding 30 milliliters (1 fluidounce) of replenisher for each 516 square centimeters (80 square inches) of film processed. This is equivalent to one 8 x 10-inch (20.3 x 25.4-centimeter) or four 4 x 5-inch (10.2 x 12.7-centimeter) sheet films, one 620 roll, or one 36-exposure roll of 35mm film. After processing one 620 roll of film or its equivalent, pour 30 milliliters (1 fluidounce) of replenisher solution into the empty developer storage bottle. Then pour enough used developer into the bottle to fill it to the original volume, discarding any excess. If short of the original volume, add unused developer solution, or replenisher diluted 2:1 with water, to make up for the loss. Repeat for each 620 roll, or its equivalent, developed.

If it seems desirable to check the activity of the replenished developer before using it—and it may be important to do so before developing critical batches of film—see Kodak Data Book Z-126, *Process Monitoring of KODAK Black-and-White Films*. That publication covers the use of control strips to test developer activity.

Stop Baths

The primary reasons for using an acid rinse or stop bath between development and fixing are to check development instantaneously by neutralizing the developer carried over, and to maintain fixing bath acidity and capacity. The fixer capacity figures pub-

lished in this book apply only when a stop bath is used. An acid stop bath also minimizes the formation of dichroic fog, removes calcium scums which may have formed in the developer, and tends to prevent the formation of alum scums and sludges in the fixing bath. The use of a hardening stop bath is desirable in developing films and plates in very hot weather, because such a bath prevents excessive swelling of the gelatin and protects the softened emulsion.

The use of a stop bath is particularly recommended with paper prints, which often tend to stain when transferred directly from the developer to the fixing bath without thorough agitation in the fixing bath.

Fixing Baths

In addition to the hypo (sodium or ammonium thiosulfate), which dissolves the undeveloped silver halides, most practical fixing baths contain an acid, such as acetic acid; a preservative, such as sodium sulfite; and a hardening agent, such as potassium alum. The alum is added to harden the gelatin of the emulsion in order to prevent excessive swelling or softening in the wash water, particularly under summer conditions. The acid serves to provide the best conditions for efficient hardening action, and the sodium sulfite is necessary to prevent the hypo from being decomposed by the acid. If boric acid is added to a bath of this type, it increases the hardening power of the alum and also helps to prevent the formation of aluminum sulfite sludge, which might be formed if the stop bath should fail to neutralize the developer carried over by the emulsion.

Fixing Time. In use, the fixing bath should not only dissolve the unused silver halide, but also remove these dissolved silver salts from the emulsion. In fixing films and plates, a good rule is to let the bath act for twice the time it takes to clear the milky appearance, in order to allow the silver salts to diffuse out of the emulsion. With paper prints, the clearing point is not visible, and the fixing time recommended for the paper should be used. Excessive fixing times should be avoided, as they prolong the washing time necessary to remove the hypo. The bath must be in contact with the whole area of the emulsion, which is not possible when several films or prints are piled together. Thus, films or prints must be separated and agitated at intervals throughout the fixing time.

As the bath is used, the silver compounds accumulate in the solution; the bath becomes slower in action and has more difficulty in removing the last trace of silver salt from the emulsion. If the bath is kept in use too long, past the point when it takes twice as long to fix as it did when fresh, it may lose its ability to remove all of the unused silver salts. Although not visible, these will remain in the emulsion even after washing and, with age, will decompose and stain the negative or print.

Two-Bath Method. In order to facilitate complete fixing, especially with paper prints, it is a good plan to use two baths, treating the sensitive material in the first until the emulsion has cleared, then transferring it to a second bath for an equal time. The first bath does most of the work, and the second bath removes the last traces of silver compounds. When the first bath approaches exhaustion, it is discarded and the second bath put in its place. A fresh fixer is then prepared and used for the second bath. After five such changes, discard both fixing baths and mix fresh solutions.

Testing Stop Baths and Fixing Baths. Stop baths and fixing baths should not be used beyond exhaustion, because this leads to stains and spots on the negatives or prints. The stains may be evident immediately, or may not appear until some time later. An overworked stop bath will be neutralized by the developer solution carried over, so that it ceases to check development and thus becomes useless as a stop bath.

Except for baths that contain a special indicator dye, such as the KODAK Indicator Stop Bath, the appearance of stop baths and, to some extent, of fixing baths does not change until well beyond their useful lives. Some means of determining quickly and accurately when they are unsafe for further use should therefore be employed. The KODAK Testing Solutions for Print Stop Baths and Fixing Baths provide a positive method of testing the baths used for prints.

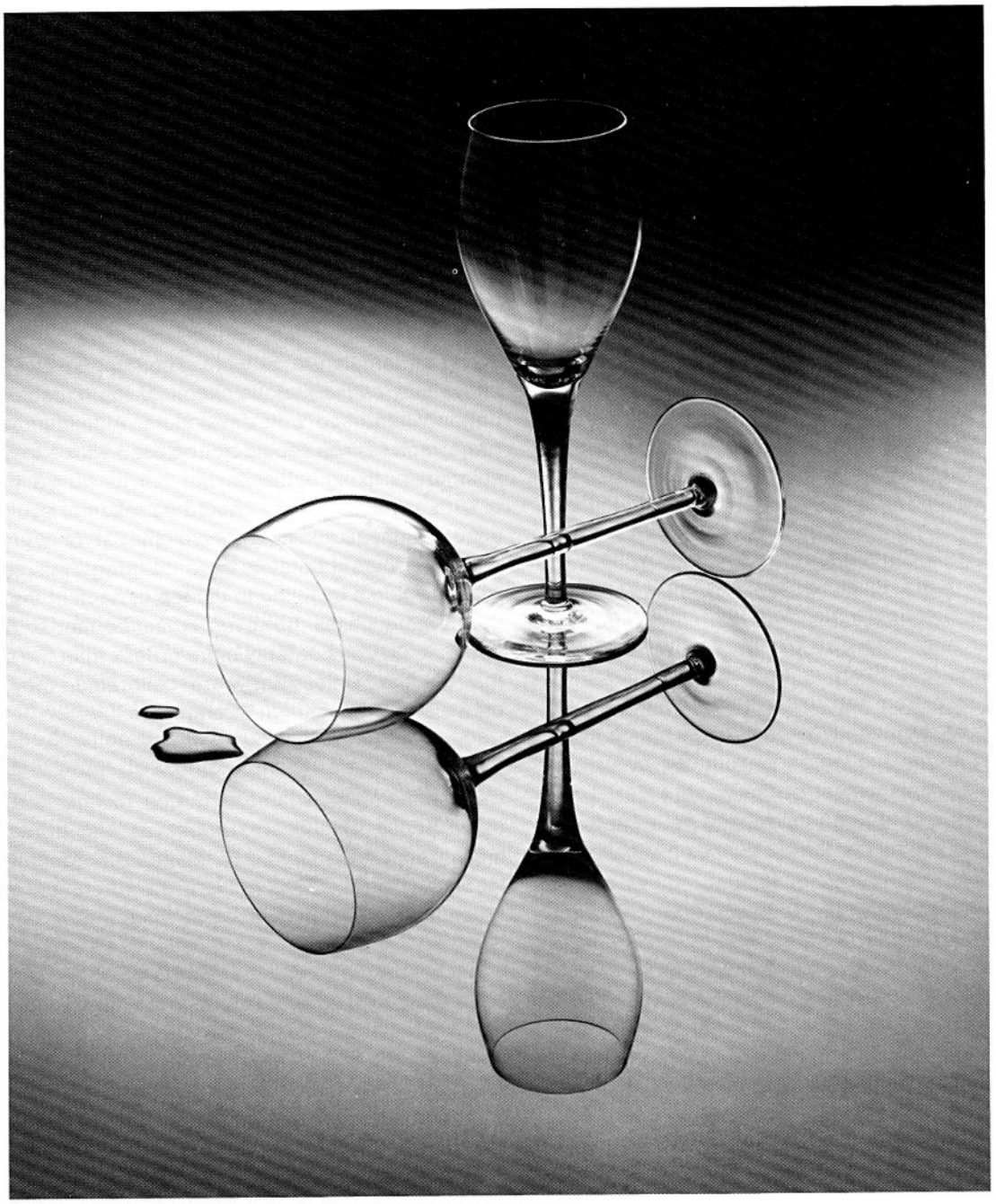
It is recommended that one fixing bath be used for films and plates and another for papers.

Washing

After all of the undeveloped silver halide has been removed, the emulsion is still saturated with the chemicals of the fixing bath and some dissolved silver compounds. If these are not removed by washing, stains may occur in the non-image areas, or the image may become discolored and faded.

Time for Complete Washing. Only exact experimental measurements will tell how quickly a particular vessel and stream of water will wash a specific kind of paper or film. Complete washing is obtained in the minimum time when the surfaces of the material are exposed to a rapid flow of fresh water. The washing time is influenced by the nature and condition of the fixing bath, design of the washing vessel, and temperature of the wash water. The washing efficiency decreases rapidly with decreased temperature, and is very low at temperatures below 16° C (60° F).

Hypo is generally eliminated from most negative materials in 20 to 30 minutes if the rate of flow of wa-



ter is rapid enough to completely replace the water in the washing vessel once every 5 minutes. Paper prints should be washed for at least 1 hour under these conditions if the hypo is to be satisfactorily removed.* The time is measured from the immersion of the last plate, film, or print in the washing vessel, since the partly washed emulsions will absorb hypo from contaminated water just as readily as they give it up to fresh water. Rinsing each film or print before placing it in the washing vessel will remove the excess hypo from the surfaces and thus materially aid the washing process.

Papers require a longer washing time than films because small quantities of hypo are held tenaciously by the paper base and are difficult to remove by washing alone. KODAK Hypo Clearing Agent is a washing aid which makes possible more rapid and complete washing of both films and prints, even with cold water, to produce greater stability than can be obtained under normal processing conditions. Treatment in KODAK Hypo Eliminator HE-1 is recommended for removing the last traces of hypo from photographic prints intended for long-term keeping.

*NOTE: Water-resistant papers, such as KODAK POLYCONTRAST Rapid RC Paper, should *not* be washed for extended periods. Wash these papers for 4 minutes only.

Preparation Of Solutions

Water Supply

Impurities in water supplies are not responsible for as many troubles as is usually supposed. Although most tap water does contain some impurities, most of these have no photographic effect.

Large quantities of suspended organic matter, particles of finely divided sulfur, hydrogen sulfide, and soluble metallic sulfides are the only impurities likely to cause serious trouble with developers. Organic matter is usually precipitated on mixing the developer, but, frequently, biological growths and bacteria thrive in a developer and form a slime or scum on the walls of the tank. Certain types of these growths act on the sulfite in the developer and change it to sodium sulfide, a chemical which fogs the emulsion. Organic matter may also give trouble in the washing process, since it is likely to be coagulated by the alum introduced from the fixing bath and settle on the surfaces of the negatives or prints. This can be avoided by filtering the water, or reduced by using a rapid rate of replacement of the wash water. The addition of boric acid to an acid fixing bath, up to a maximum of 15 grams per liter (2 ounces per gallon), is also helpful.

Sulfides can be removed from a developer by developing some waste film or by adding 0.4 gram of lead acetate per liter (25 grains per gallon) of developer. The precipitated lead sulfide and excess lead will settle, and the clear liquid can then be decanted for use.

Extremely hard water may give a finely divided precipitate when the developer is mixed. This precipitate will usually settle out on standing, but even if it remains in suspension, it will have no photographic effect. If the precipitate is considered objectionable, it can generally be avoided by the addition of KODAK Anti-Calcium.

Certain developers which are clear when mixed may form a finely divided precipitate after they have been used. This is a normal effect and is not an indication of poor mixing or impure water.

A chemical analysis of the water supply usually reveals very little concerning its photographic usefulness. The only really useful test is to prepare the required photographic solution with the suspect water sample and actually try it; then compare these results with those obtained with the same developer or fixing bath prepared with distilled water. In most cases both solutions will be alike in their photographic effect, even if not in appearance.

For more complete information about water in photographic processing, see Kodak Publication No. K-13, *Photolab Design*.

Types of Containers

Glass, hard rubber, polyethylene, enameled steel, and stainless steel are the materials most commonly used in the construction of containers for mixing, storing, and using photographic solutions. All are used safely with any ordinary solution. The choice is determined primarily by economy, convenience, or size availability.

Not all metals are suitable. Tin, copper, and their alloys may cause serious chemical fog or rapid oxidation when used with developers. Aluminum, zinc, or galvanized iron should not be used with either developers or fixing baths.

With any vessel, care should be taken to avoid inaccurate measurements of volume. It is common practice, when a bottle is used, to bring the solution to final volume by filling to the top or neck of the bottle. In many cases, however, so-called liter or quart bottles hold considerably more or less than the nominal volume. Unless they are calibrated, they will cause errors in solution strength.

Cleanliness

Contamination of solutions during mixing is a frequent cause of unusable negatives and prints. All mixing apparatus should be cleaned thoroughly immediately after use to prevent the formation of incrustations which may dissolve when a new solution is mixed.

It is desirable to use a separate mixing vessel for each solution. If several solutions are mixed consecutively in the same vessel, they should be prepared in the order in which they are used in processing. Traces of developer in a fixing bath will have little or no effect, but small quantities of hypo in a developer may cause serious fogging or image tone changes.

Chemicals, particularly those in the form of light powder, should not be mixed in the darkroom or in places where sensitized goods are handled. Chemical dust becomes airborne and settles on bench and table tops. As a result, spots and stains may appear on prints or negatives. Also, chemical dust may settle on the surfaces of other processing solutions and cause contamination. For this reason, solution storage tanks should be equipped with dust covers.

Mixing Solutions

When solutions are made up, the constituents must be dissolved in the proper sequence, in order to avoid undesirable reactions and to facilitate complete mixing.

To avoid the possibility of error in mixing, most Kodak formulas are arranged so that the ingredients

are named in the order in which they should be dissolved, unless the directions specifically state some exception to this rule.

When solutions are made from packaged preparations, the instructions supplied with the package should be followed. With preparations supplied in powder form, the entire contents of a container should be used in making up a solution, and no attempt should be made to prepare a small quantity of solution by using only a portion of the chemicals. Otherwise, because of possible segregation of the granular constituents during shipping and handling, considerable difficulty may be encountered in obtaining solutions with uniform characteristics.

Temperature. Photographic solutions are usually prepared by dissolving the constituents in water at a specified temperature. Developers are mixed at 32 to 50° C (90 to 125° F); most packaged fixing baths are mixed at a temperature not exceeding 26.5° C (80° F).

Agitation. Proper agitation during mixing is important, not only to increase the rate of solution of the chemicals, but also to avoid undesirable effects. A type of agitator that will not introduce excessive air into the solution should be used. Developers are particularly prone to oxidize readily; a few minutes of violent agitation may weaken the developer noticeably and produce staining compounds. On the other hand, insufficient agitation may permit the chemicals to settle at the bottom of the mixing vessel and form a hard cake that will not dissolve readily.

Care should be taken to stir the solution thoroughly after the addition of the final volume of water. The concentrated solution at the bottom of the vessel is heavier than water and will tend to remain at the bottom if not thoroughly mixed. Mechanical agitation is a convenient means of promoting proper mixing. Several types of electric mixers are available, including commercial models used in preparing large batches of chemicals. They should not operate at such high speeds or at such an angle as to induce frothing or aeration of the solution.

Measurement of Small Quantities

The accuracy demanded in measuring small quantities of chemicals for photographic formulas may exceed that of the equipment found in some photographic laboratories. Therefore, if you intend to mix your own photographic chemicals from the formulas given in this book, you should be sure that your scale will weigh masses of up to 100 grams, within an accuracy of 0.5 gram, and that you have a small graduate capable of fluid measurement accurate to 0.5 milliliter.

Where minute quantities of a dry chemical are called for, it is frequently more practical to mix a dilute stock solution of the chemical and use an appropriate quantity of that solution instead. For instance, to prepare a 10-percent stock solution, mix 100 grams of the dry chemical with a small amount of water, and then add water to make 1 liter. Each milliliter of this solution will contain 0.1 gram of the solid chemical.

Storing Solutions

Most photographic solutions will remain in good condition for weeks or months if properly stored. In the studio or finishing plant, the solutions are usually kept in the processing tanks. The tanks, when not in use, should be protected with a floating cover to lessen the rate of aerial oxidation and to prevent contamination from dust and other foreign bodies. KODAPAK Sheet formed into a shallow tray makes a satisfactory cover. The sides of the tray should be about 5 centimeters (2 inches) high and a trifle smaller than the tank, with a handle fastened at the center of the inside with KODAK Film Cement. Polyethylene sheeting will float on the developer solution and can also be conveniently employed.

Small quantities of solution are best kept in stoppered bottles. Screw tops are quite satisfactory provided that they are free from rust or other foreign materials, have liners or gaskets, and are screwed down tightly. However, improperly sealed screw-cap closures are probably a major cause of developer oxidation.

To avoid contamination, no one cork, stopper, or cap should be used for more than one type of solution. Glass stoppers have a tendency to stick, especially with alkaline solutions.

Air is one of the worst enemies of a photographic solution. Oxidation may take place even in a tightly sealed bottle if the solution level is low. When stock solution is used from a large bottle, the air space is increased each time a portion of the solution is used, and the chances for aerial oxidation are greatly increased. It is best, therefore, to store stock solutions in small bottles. A small air space should be left so that the solution volume, varying with temperature, will not loosen the stopper or burst the bottle. The entire contents of a small bottle can be used at one

The temperature of storage is important. Developers, in particular, oxidize rapidly at elevated temperatures, with a resultant loss in activity and an increased propensity for staining. A developer which normally keeps for 2 or 3 months at 18.5 to 21° C (65 to 70° F) may be unsatisfactory in a few days at 32 or 35° C (90 or 95° F). However, Kodak liquid concentrate developers are stable in the original sealed package.

Storage at too low a temperature can also be undesirable. Some concentrated solutions crystallize readily at low temperatures, usually below 13° C

(55° F), and redissolve with great difficulty or not at all, even when heated. Repeated changes in temperature may shorten the life of many photographic solutions.

Cleaning Processing Apparatus

Trays, tanks, and other processing equipment sometimes become discolored or coated with decomposition products of the photographic solutions. While this may do no harm if a container is always used for the same kind of solution, it is much better to clean all containers each time they are emptied. The simplest method of cleaning a tray or tank is to wash it out several times with water and then wipe the surfaces with a clean cloth. This procedure is preferable to the constant use of strong cleaning solutions, which should be used only when washing is ineffective. Most cleaning solutions are either strong alkalies or acids, and therefore should be used with caution. Observe all precautionary warnings on the package labels.

Trays and Tanks. Stains from oxidized developer are usually brown or yellow-brown in color. Fresh stains can often be removed by washing with soap and water and wiping with a cloth. Severe stains require the use of a strong oxidizing solution, such as KODAK Tray Cleaner TC-1 or TC-3, or KODAK Developer System Cleaner. These cleaners will also remove most deposits of silver or silver sulfide. Fixing and washing tanks, film hangers, and racks can be cleaned with KODAK Fixer System Cleaner. *Do not* clean developing tanks with Fixer System Cleaner.

Developer tanks often become coated with a scale consisting essentially of basic calcium sulfite, with some silver and other substances. This scale is difficult to remove by scrubbing. It is soluble in acids, but the ease of removal varies according to the conditions under which the scale was formed. Generally it will be removed by filling the tank with a solution of KODAK Developer System Cleaner and allowing it to stand for thirty minutes. If this is not available, the scale can frequently be loosened by filling the tank with KODAK Stop Bath SB-1 and allowing it to stand overnight. The tendency for the formation of such scale can be greatly reduced by the use of KODAK Anti-Calcium in the developer.

Large developer tanks of wood or stoneware often become coated with a layer of slime consisting of gelatin, organic matter, fungus and mold growths, and dust. Some of the molds or fungi can act on the sulfite of the developer and convert it to sodium sulfide, which is a strong fogging agent. Trouble from this source can be avoided by sterilizing the tank at regular intervals, especially during warm weather. The tank should be scrubbed thoroughly with a wire brush, then filled with a solution of sodium hypochlorite and allowed to stand overnight. It should then be emptied and given another thorough scrubbing and five or six washings with plain water before being used again. Bleach solutions sold for laundry use usually consist of sodium hypochlorite, or a solution can be prepared by adding sodium carbonate solution to a solution of calcium hypochlorite (bleaching powder) until no more precipitate is formed.

Film Hangers and Clips. Metal film hangers and clips tend to accumulate a plating of silver when immersed in a fixing bath which contains dissolved silver salts. Such deposits are often of a spongy nature and may be mixed with gelatin and other substances. These deposits absorb chemicals from the processing solutions and are not removed by ordinary washing; then, when the hangers are reimmersed in the developer, some of these chemicals may leach out and cause either light or dark streaks on the film. Probably the simplest method of removing these deposits is to soak the equipment in a solution of KODAK Fixer System Cleaner. The equipment should remain in the cleaner for at least 30 minutes; heavy deposits may require overnight soaking. Thoroughly rinse the cleaned equipment with warm water.

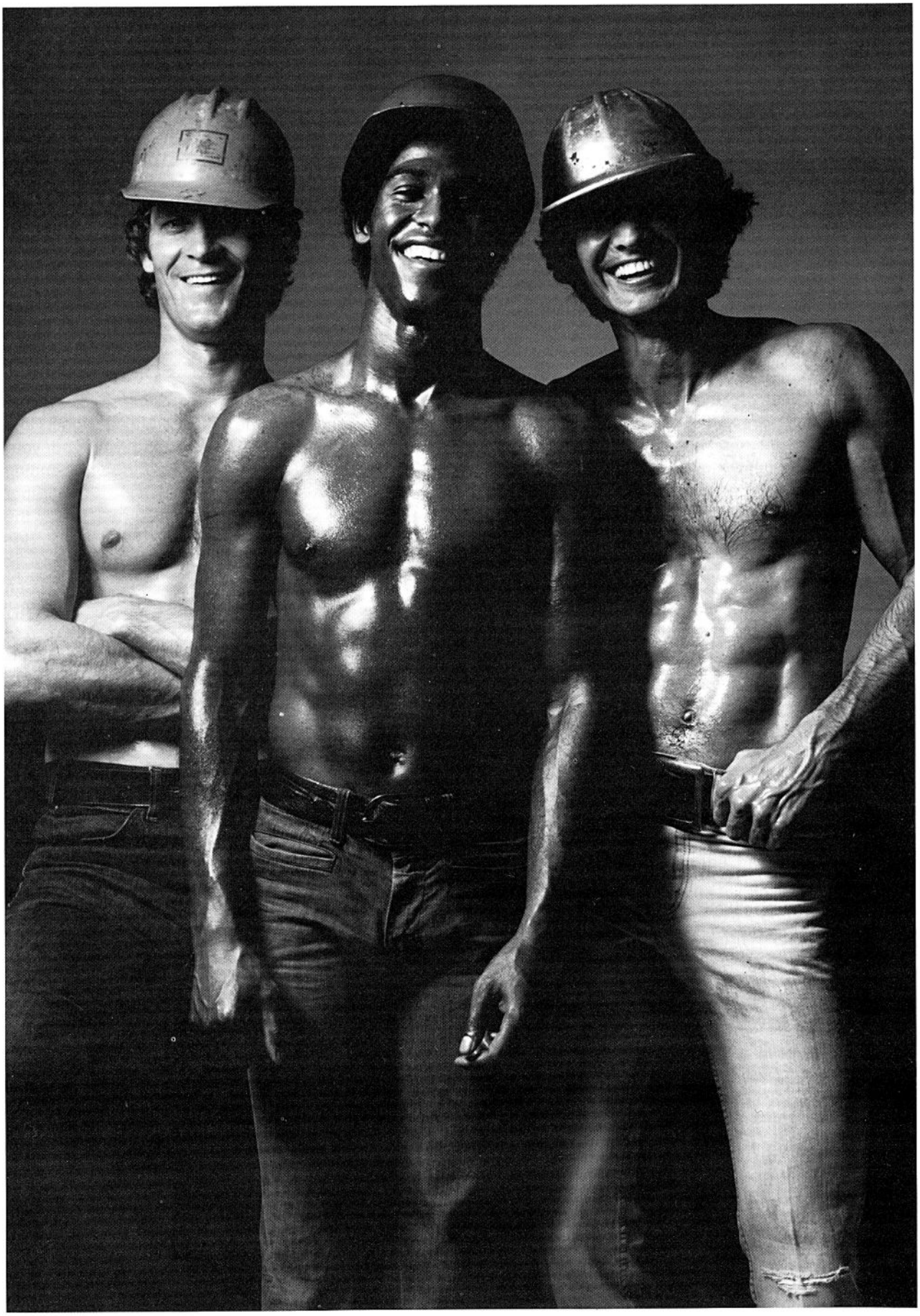
There are several other methods of removing such deposits, and the choice of method will depend on the severity of the conditions. The acetic acid treatment described below is the simplest; boiling with trisodium phosphate, however, will be more effective in most cases. Tray cleaner should be used with caution on metal equipment.

Acetic Acid Treatment: Soak the hangers or clips for an hour in a tray or tank filled with 10 percent acetic acid solution (1 part glacial acetic acid to 9 parts of water). The acid tends to loosen the deposit. Then wash with clear water and scrub off the deposit with a stiff brush.

Trisodium Phosphate Treatment: Boil the equipment for several minutes in a 10 percent solution of trisodium phosphate; then wash it with water and scrub thoroughly with a stiff brush. This method is especially useful for cleaning deposits of spongy silver mixed with gelatin. Do not use it for cleaning aluminum ware.

Acid Dichromate Treatment: If the silver deposit clings tenaciously to the metal hangers, it may be necessary to dissolve it with KODAK Tray Cleaner TC-1 diluted 1 part TC-1 to 2 parts of water.

The length of time the hangers or clips should remain in this solution depends on the quantity of silver to be removed. An immersion of 10 minutes is usually sufficient. When the articles are removed, rinse them thoroughly and brush off any reddish colored scale. It is advisable to use a glass or hard-rubber tray, since an enamelled tray will be etched slowly by the cleaning solution. This solution should not be used with chromium-plated metal articles, because it tends to destroy the copper undercoating.



Processing Technique

The following section is devoted to manual processing of plates, films, and papers. If large quantities of films or papers must be processed daily, or if negatives must be processed in a minimum of time, investigate the possibilities of mechanized processing. For information, write to the Professional and Finishing Markets Division, Eastman Kodak Company, 343 State Street, Rochester, N.Y. 14650.

Processing of Films and Plates

Tank development with intermittent agitation is highly recommended for roll films, film packs, sheet films, and plates. The use of a tank enables the operator to produce clean, evenly developed negatives, and at the same time permits accurate control of development factors. Tank development is the most practical method of processing 35mm films.

In the development of films and plates, certain methods of agitation must be followed to develop the film uniformly and keep it free from flow marks. Development irregularities due to improper agitation are a principal cause of many poor-quality negatives. Such effects as edge intensification, streaks, irregular densities, and mottle are caused by insufficient or excessive agitation, but can be avoided by following the various recommended procedures.

When films or plates receive little or no agitation, or are allowed to remain undisturbed for long periods without agitation, the accumulation of development by-products is not replaced adequately by fresh developer solution, and uneven development results. With excessive agitation, intensified edge development may occur because of the greater turbulence of developer around the edges of the film or plate, or through the perforations of developing hangers.

Where volume of work warrants its installation, the gaseous burst method of agitation provides the most nearly ideal method for practical photographic service. It is reasonably economical and, because it is automatic, does not require full-time attention. This method is not, however, recommended for use with films in spiral reels. More detailed information can be found in Kodak Publication No. E-57, *Gaseous-Burst Agitation in Processing.* Single copies are available on request from Eastman Kodak Company, Department 412-L, Rochester, New York 14650.

The several procedures described in the following pages will produce uniform, high-quality results. These instructions assume correct use of the recommended safelight.

Unloading Film Magazines and Cartridges. Carry out the following procedures in total darkness.

135 Magazines—Using a bottle-cap opener, lift the metal cap from either end of the magazine (the end where the spool does *not* project is generally the easier one to open). Draw the loaded spool out, taking care not to let the film unwind itself. Feed the film into any standard 35mm processing reel.

126 Cartridges—Using both hands, grasp the two cylindrical chambers of the exposed 126 cartridge. Break the cartridge in two by bending the chambers toward the label. Remove the film spool from the large chamber by separating the plastic sections surrounding the spool. Unroll the film and the paper backing.

110 Cartridges—Using both hands, grasp the two cylindrical chambers of the exposed 110 cartridge. Hold the cartridge with the label facing you and your thumbs on the label. Break the cartridge by bending the chambers back. Next, pull the film and its paper backing from the take-up chamber (pull so that the *paper* rubs against the inner surface of the cartridge back. This precaution minimizes the likelihood of scratching the emulsion). If the film trailer has been wound into the take-up chamber, you will have to pry open the chamber (after breaking the cartridge) in order to retrieve it.

Small-Tank Development: Roll Films, Film Packs, and Small Sizes of Sheet Film (in Tanks with Removable Reels or Racks). Fill the tank with developer at the recommended temperature, turn out the light, load the film on the reel, and proceed as follows.

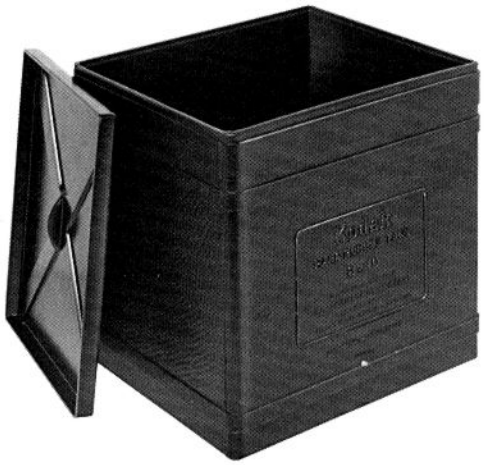
1. Start the timer. Place the loaded reel in the tank containing the developer. Keep the reel under the surface of the solution, and tap it sharply on the bottom of the tank to aid in dislodging air bells before you replace the cover on the tank. After the cover has been replaced, developing and other operations can be done in full room light.

2. For tanks that cannot be inverted: After the reel has been immersed 30 seconds, agitate the tank for 5 seconds by sliding it back and forth over a distance of about 25 centimeters (10 inches) at a rate of 2 cycles per second. At the same time, turn or rotate it back and forth through about one-half turn. Repeat the agitation at intervals of 30 seconds.

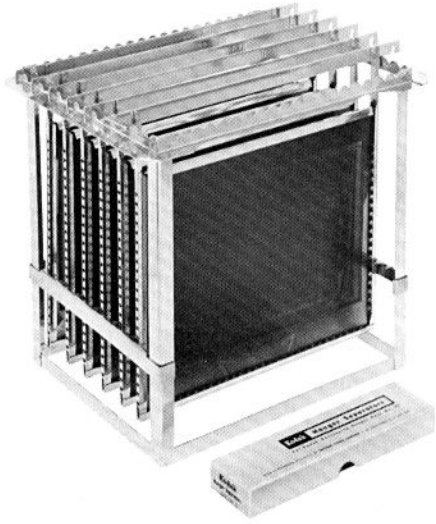
With tanks permitting an inversion type of agitation: After the reel has been immersed 30 seconds, invert the tank once per second for 5 seconds. Repeat at 30-second intervals throughout the total developing time.

3. Pour out the developer and fill the tank with KODAK Indicator Stop Bath or KODAK Stop Bath SB-5, at 18.5 to 24° C (65 to 75° F). Agitate continuous-

Small-tank development of roll films can be carried out in the KODACRAFT Miniature Roll-Film Tank, supplied with aprons to accommodate 135-size and 828-size films. The similar KODACRAFT Roll-Film Tank is supplied with aprons to accommodate 620-, 120-, and 127-size films.



The KODAK Hard Rubber Tank, 8 x 10 (3½ gallons), is used for developing sheet films and plates.



A setup used for developing films and plates in the KODAK Hard Rubber Tank: KODAK Film and Plate Developing Hangers, No. 4A, in a KODAK Developing Hanger Rack No. 40, separated with KODAK Hanger Separators.

ly for about 30 seconds. For a water rinse, empty and refill the tank several times with fresh water.

4. Pour the fixing bath into the tank and agitate the tank as above for about 30 seconds. Repeat several times during fixing.

5. When fixing is complete, wash the negatives for 30 minutes in running water. This can be done in the uncovered tank. Empty the tank at 5-minute intervals to obtain more thorough washing.

Tank Development: Sheet Films and Plates in Hangers. Do not develop more films in a tank than can be accommodated with at least a 1-centimeter (½-inch) separation between each sheet. A 3½-gallon KODAK Hard Rubber Tank accommodates twelve 8 x 10-inch KODAK Film and Plate Developing Hangers No. 4A. For ease in handling batches of hangers, use the KODAK Developing Hanger Rack No. 40. This rack takes twelve 8 x 10-inch film hangers and fits into the 3½-gallon hard rubber tanks. As a safeguard against the films touching one another during processing, and to maintain even separation between the films, use KODAK Hanger Separators (for KODAK Developing Hanger Rack No. 40), supplied in a set of two.

Arrange the tank so that the plane of the films will be parallel to the front edge of the bench or sink. With the processing solutions at the recommended temperature, turn out the light, load and assemble the developing hangers, and proceed as follows:

1. Start the timer. Lower the hangers as a unit smoothly and carefully into the developer. Immediately tap the hangers sharply two or three times on the upper edge of the tank to dislodge any air bells clinging to the emulsion. Check the spacing of the hangers to make certain that they are at least 1 centimeter (½ inch) apart.

2. Allow the hangers to remain undisturbed for the remainder of the first minute. Then, quickly but smoothly, lift them clear of the solution and, keeping the plane of the films parallel to the edge of the bench or sink, rotate them one-quarter turn either clockwise or counterclockwise, and back. Immediately reimmerse them and again lift them clear of the solution, rotating them one-quarter turn in the opposite direction. It is important that the angle of rotation should not be appreciably less than 70 degrees. Reimmerse the hangers quickly in the solution and check their spacing. The entire cycle of lifting and reimmersion should be as rapid as possible without interfering with smooth operation. It should be completed in about 5 to 7 seconds. Repeat at 1-minute intervals. *Caution:* With films larger than 5 x 7 inches (12.7 x 17.8 centimeters), take care not to lift or immerse them so quickly that the films are pulled from the hangers.

3. When development is complete, lift the hangers from the developer, drain them for 1 or 2 seconds,

and transfer them to the stop bath or rinse water. Lift and reimmerse the hangers several times before transferring them to the fixing bath.

4. Lift and reimmerse the hangers several times at the beginning of fixing and again at the end of the first minute. Allow them to remain until fixing is complete. Separation of the hangers and frequent agitation will shorten fixing time.

Tray Development: Roll Films. With the solutions at the proper temperature, follow these steps:

1. Unroll the paper backing and fasten a film clip to the end of the film. Place the clip over a hook on the wall [about 1.8 meters (6 feet) above the floor] and slowly unwind the remainder of the film, maintaining a slight tension to prevent coiling. Detach the film at its lower end from the protective paper backing and attach a second film clip.

2. Remove the clip from the hook and, with one clip held in each hand, allow the film to sag in a U loop with the emulsion side down. Pass the film through water at 18.5 to 24° C (65 to 75° F) by alternately lowering one end while raising the other at the rate of once every 5 seconds for about 1 minute. This prewetting helps to prevent the formation of air bells and greatly reduces the tendency to curl.

3. Start the timer. Turn the film so that its emulsion side is up and transfer it promptly to the developer. Proceed in the manner described above, and continue the movement throughout development.

4. Pass the film up and down through the rinse water or stop bath 2 or 3 times.

5. Transfer the film to the fixing bath contained in a deep tray and continue agitating for 2 minutes. Then place one end of the film, emulsion side up, in the fixing tray and lower the strip in folds into the solution. For shallow trays or long rolls, it may be desirable to cut the negatives into 2 or 3 lengths to avoid the necessity for looping in the tray. Move the films at intervals to allow for uniform fixing.

6. When fixing is complete, place the films in a deep washing tray and wash thoroughly in running water for 20 to 30 minutes.

Tray Development: Single Sheet Film or Plate. Tray development of a single film or plate can be accomplished best by placing about 1 centimeter (½ inch) of developer in a tray somewhat larger than the film. With the solutions at the proper temperature, proceed as follows:

1. Start the timer and immediately slide the film or plate, emulsion side up, smoothly into the developer. Agitate the tray continuously throughout development as follows:

Raise the left side of the tray about 1 to 2 centimeters (½ to ¾ inch), lower it smoothly, and then immediately raise and lower the near side similarly; next, raise and lower the right side, and then again the near side. These four operations constitute an "agitation cycle," which requires a total time of about 8 seconds.

2. When development is complete, rinse the negative in a separate tray with agitation for several seconds in fresh water or a stop bath.

3. Transfer the film or plate to the fixing bath and agitate by rocking the tray as described above for about 30 seconds. Repeat the agitation at intervals for the duration of the fixing time.

4. Wash the negative in running water for 20 to 30 minutes.

Tray Development: Several Sheet Films. The following method of developing 2 to 6 films in a tray is capable of producing good negative uniformity. However, considerable care is required to prevent scratches or finger marks. Also, the temperature of the developer should not exceed the recommended range, and the use of a highly alkaline developer should be avoided to prevent softening of the gelatin. A modification of this procedure is recommended for tray development of color-separation negatives.

Using trays slightly larger than the films and with the solutions at the proper temperature, follow these steps:

1. Immerse the exposed films one at a time and emulsion side up in a tray of water, at not above 24° C (75° F). The topmost film must be completely covered with water before the next film is placed over it. When all the films are in the tray, draw one film carefully from the bottom and place it on top. Handle the film only by the extreme edges, and take care to prevent a corner of the film from digging into the emulsion of the film on the top of the pile. Repeat this replacement from bottom to top until the films have been leafed through twice. This prewetting procedure will prevent films from sticking together and also dislodge any air bells which may have formed.

2. Start the timer and transfer the films quickly, one at a time, from the bottom of the pile into the developer tray. Briefly drain each film before transferring it. Continue the rotation of films from bottom to top throughout the period of development. At intervals, turn the films end for end, emulsion side up, as they are placed on the top of the pile.

3. When development is complete, transfer the films, one at a time, to the KODAK Stop Bath SB-5, and leaf through the pile twice. Contamination of the developer with the stop bath can be avoided by using one hand for removing the films from the developer solution and the other hand for immersing them in the stop bath.

4. Place the films, one at a time, in the fixing bath. Continue the replacement from bottom to top 2 or 3

times immediately and then at intervals until the negatives are completely fixed.

5. Wash the negatives in running water for 20 to 30 minutes by continuing the rotational method or by placing the negatives in developing hangers and using a washing tank.

Tray Development: Several Plates. If several plates are to be developed in a tray, the tray should be large enough to hold all the plates in separate positions. *Enough developer should be provided to cover the plates at all times as the tray is rocked.* Overlapping of the plates during development and fixing can be avoided by the use of rubber suction cups, which are attached to the bottom of the tray in such positions as to keep the plates separate when the tray is rocked.

With the solutions at the proper temperature, follow these steps:

1. Start the timer. Then, handling each plate individually and by the edges, slide the plate (emulsion side up) under the developer and into its proper position in such a manner that the entire emulsion surface is wetted almost instantly. Note the position of the plates so that they can be removed in the same order as they are immersed. With a large wad of cotton which has been previously soaked in the developer, swab lightly over the entire surface of each plate in order to remove any air bells which may adhere to the emulsion.

2. Agitate the tray continuously throughout development as follows: Raise the left side of the tray 1 to 2 centimeters (½ to ¾ inch), lower it smoothly, and then immediately raise and lower the near side similarly; next, raise and lower the right side, and then again the near side. These four operations constitute an agitation cycle that requires a total of about 8 seconds. Do not allow any of the plates to become partially uncovered by developer.

3. At the end of the development time, take the plates from the developer in the same order as they were immersed and rinse them quickly in the water rinse or stop bath. Then place them in the fixing bath. Contamination of the developer with the fixing bath can be avoided by using one hand for removing the plates to the rinse or stop bath and the other hand for immersing them in the fixing bath.

4. After fixing, wash in running water for 20 to 30 minutes.

Drying Films and Plates

After washing, grit and scum should be swabbed from the emulsion with a tuft of cotton applied under water. As soon as the film or plates are taken from the wash water for drying, water droplets should be removed with a damp KODAK Photo Chamois or soft viscose sponge, or the negatives can be bathed in diluted KODAK PHOTO-FLO Solution for about 30 seconds and drained before drying. The negatives preferably should be removed from the channel-type hanger before drying.

Drying should be done in a warm, dry room free from dust and excessive drafts, or in a cabinet supplied with warm, filtered air.

Development Times

Development recommendations for various Kodak films are given in the instruction sheets packaged with the materials.

The development times suggested will usually produce a degree of development suitable for the types of work for which each material is most often used. Longer or shorter times can be used if experience indicates that an increase or decrease in the degree of development would be desirable for the particular working conditions and the type of camera and printing equipment in use.

The times given in connection with each developer formula, and on the labels of packaged developers, are of necessity average times that give good results with most materials; naturally, they cannot agree exactly with the different times which are recommended specifically for each individual material.

The recommended development temperature for most films is 20° C (68° F), but many films can now be satisfactorily developed at higher and lower temperatures. Instruction sheets packaged with most Kodak films give development times for various appropriate developers at temperatures ranging from 18.5 to 24° C (65 to 75° F). For development at temperatures above 24° C (75° F), follow the method outlined under "High-Temperature Processing."

The Developing Computer in the *KODAK Darkroom DATAGUIDE* provides a convenient means for determining the development times needed to produce approximately equal degrees of development with a large number of combinations of Kodak films and developers. It also provides a very convenient means for adjusting the times if a higher or lower degree of development is desired.

Rapid Film Processing

In some situations, such as in newspaper work, it is occasionally necessary to process a negative as quickly as possible. The processing time can be shortened considerably over normal processing times by the use of a fast-working developer, such as KODAK Developer D-19 or KODAK HC-110 Developer (Dilution A), and by taking certain short cuts in fixing and washing. Keep in mind, however, that development times of less than 5 minutes in a tank may produce poor uniformity.

For rapid processing and where permanence of the image is not important, fixing can be considered adequate as soon as the milky appearance has cleared from the emulsion. The use of a fresh fixing bath and thorough agitation of the film in the fixing bath decreases the clearing time considerably and helps to produce adequate hardening of the emulsion. For most rapid fixing KODAK Rapid Fixer (with Hardener) is recommended. This is supplied as a concentrated fixer solution, with the hardener solution in a separate bottle. When mixed according to the instructions given for rapid fixing, the fixing rate is more than twice that of usual fixing baths, such as KODAK F-5, and the useful capacity is considerably greater.

The processing is completed by washing the film a few minutes in a rapid stream of water and drying with currents of warm air directed against both sides of the film.

To hasten the drying and prevent the formation of water marks on the film, all drops of surface water should be removed by wiping both sides of the film with a KODAK Photo Chamois or soft viscose sponge. Rapid drying can also be obtained by (1) treating the film in a saturated solution of potassium carbonate, which removes the water from the emulsion and leaves the film dry enough for printing, or (2) soaking the film in alcohol for a minute or so before drying it. Methyl alcohol should not be used since it attacks the film base. Ethyl or isopropyl alcohol can usually be used successfully, provided that the alcohol is diluted with 10 percent of water, the film is not bathed in the alcohol for too long a period, and the film is finally dried with air at a temperature not higher than 21 to 26.5° C (70 to 80° F). Soaking the film in undiluted alcohol and drying with air that is too hot may cause the gelatin to become opalescent. If this should occur, the opalescence can usually be removed by soaking the film in water and drying slowly.

After the rush prints have been made, the negatives should be returned to the fixing bath for 5 or 10 minutes and then washed thoroughly and dried in the usual manner to prevent fading or staining.

NOTE: Some films may be adversely affected by the alcohol used in rapid drying. Therefore, before processing valuable work, test a sample of the film being processed to determine how it will react.

High-Temperature Processing

Whenever possible, the temperature of the processing solutions should be held at 18.5 to 24° C (65 to 75° F). When this is not practical, special precautions must be taken to avoid excessive swelling and softening.

At higher temperatures, the use of KODAK Prehardener SH-5 before development will harden the emulsion sufficiently to allow use of normal solutions and processing procedure, even at temperatures as high as 43° C (110° F). Full instructions for use, including adjustment of developing time for various temperatures, are given with the prehardener formula in the "Formulas" section.

The use of the prehardener is the simplest and safest procedure for processing at high tempera-

tures. When the prehardener is not available, however, the addition of sodium sulfate to the developer solution will permit operation at temperatures up to 32 or 35° C (90 or 95° F). Addition of the quantities of sodium sulfate shown in the table below will maintain approximately normal developing times at the higher temperatures. In using any of these developers, it is necessary to observe the following precautions:

1. Developer, stop bath, fixing bath, and wash water must be at the same temperature to within approximately 2.5° C (5° F) of each other.

2. After development, the film should be treated in a freshly prepared hardening rinse bath, such as KODAK Hardening Bath SB-4. The film should be agitated for several seconds when first immersed in the stop bath, and then left for 3 minutes.

3. The film should be fixed in a fresh acid hardening fixing bath, such as KODAK Rapid Fixer (2 minutes) or KODAK Fixing Bath F-5 (5 minutes).

4. The film should be washed for 10 to 15 minutes in running water or in several changes of water. Longer washing may cause trouble.

Processing of Papers

You must process papers correctly if you want to obtain high-quality prints; follow the manufacturer's recommendations for the paper you use. You will obtain your best-quality prints when you adjust the printing exposure so that the print develops to the desired density within the recommended development time. "Muddy" prints are commonly caused by underdevelopment, as when you pull a rapidly darkening print from the developer before development is completed. Images treated in this manner are often poor in tone and mottled from uneven development. Overdeveloped prints, or prints left for long periods in an overworked solution, are likely to acquire a yellow stain from the developer oxidation products. Therefore, expose your prints correctly, and they will not be marred by the effects of under- or overdevelopment.

If you frequently process large numbers of prints, or need to produce prints for immediate use, you may be interested in activation or stabilization processing. These are methods by which special papers are mechanically processed and dried within a matter of minutes. See the sections on page 21 for more information.

When you are processing papers by hand, use trays which are somewhat larger than the largest print you will process. Such trays will give you room to handle and properly agitate the prints.

Developing Prints. Slip the exposed print edgewise and face up into the developer solution, so that the print is covered quickly and evenly. During development, agitate the solution by gently rocking the tray or by keeping the print in motion. Be sure that the print is constantly immersed in the solution. If you are developing several prints, put them into the tray one at a time, and agitate by taking the print off the bottom of the pile and then gently pushing it under the solution on the top of the pile. This is called interleafing agitation and should be done continuously until development is complete. When development is completed, briefly drain each print and transfer it, without any intermediate examination, to the stop and then the fixing bath. Prints should remain in an acid stop bath, such as KODAK Indicator Stop Bath or KODAK Stop Bath SB-1, for 5 to 10 seconds.

Fixing Prints. Fix most prints for 5 to 10 minutes in an acid hardening fixing bath, such as KODAFIX Solution, KODAK Fixer, EKTAFLO Fixer, or KODAK Fixing Bath F-5 or F-6. Fix prints made on water-resistant papers, such as KODAK POLYCONTRAST Rapid RC Paper, for no more than 2 minutes. If the fixing time exceeds 2 minutes, the fixer may penetrate the paper via the edges, and the resin coating will then make it difficult for the wash water to thoroughly remove the fixer.

By far the best practice is to use two fixing baths in succession. Keep both baths at 18.5 to 21° C (65 to 70° F). Fix the prints for 3 to 5 minutes in the first bath, drain them for approximately 5 seconds, and fix them for 3 to 5 minutes in the second bath. Agitate the

KODAK Developers	Range of Temperatures		KODAK Sodium Sulfate (Anhydrous) Per Liter
	Celsius	Fahrenheit	
D-11, D-19 D-61a, *D-76*	24 to 26.5	75 to 80	50 grams
	26.5 to 29.5	80 to 85	75 grams
	29.5 to 32*	85 to 90*	100 grams
DK-50 *DK-60a*	24 to 26.5	75 to 80	100 grams
	26.5 to 29.5	80 to 85	125 grams
	29.5 to 32*	85 to 90*	150 grams

*If necessary to develop at 32 to 35° C (90 to 95° F), decrease the time by about one-third.

prints frequently to insure that the print surfaces are constantly in contact with the solution. Do not allow the prints to stick to one another, or fixing may be incomplete.

After fifty 8 x 10-inch (20.3 x 25.4-centimeter) prints, or their equivalent in area, have been fixed per 946 milliliters (quart) of first bath, discard the first bath. Advance the second bath to replace the first, and prepare a fresh second bath. An additional fifty 8 x 10-inch (20.3 x 25.4-centimeter) prints per 946 milliliters (quart) of first bath can then be processed through these two baths. After three more such changes (for a total of two hundred and fifty 8 x 10-inch prints, or their equivalent), discard both baths and replace them with fresh solutions.

Avoid prolonged fixing times, particularly with warm-tone prints. Prolonged fixing may bleach the image, change its tone, and make thorough washing difficult.

Washing Prints. Wash most prints for at least 1 hour, using a flow of water sufficient to change the water in the tray 10 to 12 times per hour. Wash water-resistant papers for just 4 minutes. Do not overload the tray, or the prints will mat together, impeding water circulation and making thorough washing impossible. The KODAK Automatic Tray Siphon is a convenient device for promoting efficient water circulation.

For most efficient washing, keep the water temperature between 18.5 and 21° C (65 and 70° F). If the water temperature is below 18.5° C (65° F), you will have to extend the washing time; if the water is very cold, even long washing times may not adequately remove the fixer. Avoid water temperatures greater than 24° C (75° F); warm water may soften and swell the emulsion, making it vulnerable to physical damage, and will not appreciably reduce the time needed for thorough washing.

Removing Fixer with Washing Aids. Various washing aids will speed up the rate at which the hypo is removed from the paper, and will thus reduce the washing time for the prints. KODAK Hypo Clearing Agent, a very effective washing aid, is used to facilitate faster and more thorough hypo removal than is usually possible with water. When Hypo Clearing Agent is used, a 10-minute wash for single-weight prints, or a 20-minute wash for double-weight prints, is adequate, even with water as cold as 2° C (35° F). Used at 18.5 to 21° C (65 to 70° F), for the times just given, Hypo Clearing Agent removes fixer more effectively than does a water wash used for a full hour. If prints are to be kept for many years, treat them in KODAK Hypo Eliminator HE-1 to remove the last traces of residual hypo. To protect prints from fading caused by oxidizing atmospheres, follow the Hypo Eliminator treatment with a treatment in KODAK Gold Protective Solution GP-1. Consult Kodak Publication No. J-19, *B/W Processing for Permanence,* for more detailed information on processing papers for long-term keeping.

Drying Prints. After thoroughly washing the prints, place them on a clean glass or board and remove the excess water from their surfaces. Do this with a squeegee, cotton, or a viscose sponge.

Dry matte prints, or glossy prints which do not require ferrotyping, in a KODAK Photo Blotter Roll, between sheets of KODAK Blotting Paper, on a muslin or plastic-screen drying rack, or on a twin-belt, matte drying machine.

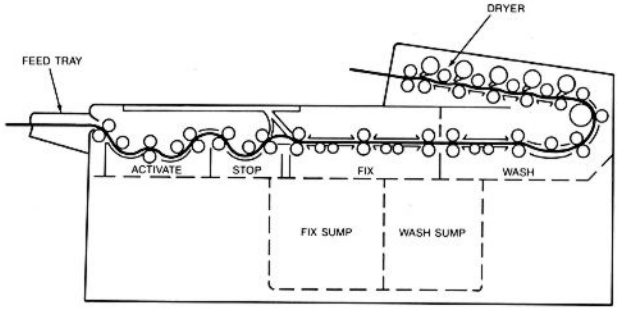
Glossy papers can be ferrotyped on chromium-plated sheets or on a ferrotyping machine. Glossy water-resistant papers, such as KODAK POLYCONTRAST Rapid RC Paper, F, should *not* be dried in contact with a heated drum; the resin coating may stick to the chromium-plated surface. Prints ferrotyped on plated sheets should be allowed to dry naturally. Those ferrotyped on heated-drum machines are best dried at a temperature of approximately 82° C (180° F).

Cleanliness is most important in all ferrotyping operations. The wash water should be filtered to remove solid particles; the glazing surface of plates and machines, as well as the conveyor belts of machines, should be protected from airborne dust. For information about ferrotyping, refer to Kodak Publication No. G-10, *Ferrotyping KODAK Glossy Papers.*

If prints tend to curl after drying, dampen their backs with water and re-dry them, between blotters and under heavy pressure, for two or three hours. You can minimize print curling by treating prints in KODAK Print Flattening Solution before drying them. Do not, however, treat resin-coated papers with Print Flattening Solution.

Activation Process

The KODAK ROYALPRINT Processor, Model 417, processes developer-incorporated, water-resistant papers such as KODAK EKTABROME SC Paper and KODABROME II Paper in less than 1 minute. This processor uses an activation-conventional process that produces fixed, washed, and dry prints that have optimum stability.



ACTIVATION PROCESS

Activate: The highly alkaline activator develops the image in about 9 seconds.

Stop: The stop bath stops the developing action and neutralizes any activator remaining in the emulsion in about 5 seconds.

Fix: The fixer completely fixes the print in about 10 seconds. This short fix time is possible because of the combination of the fixer formulation, high temperature, and high-turbulence fountain-jet agitation.

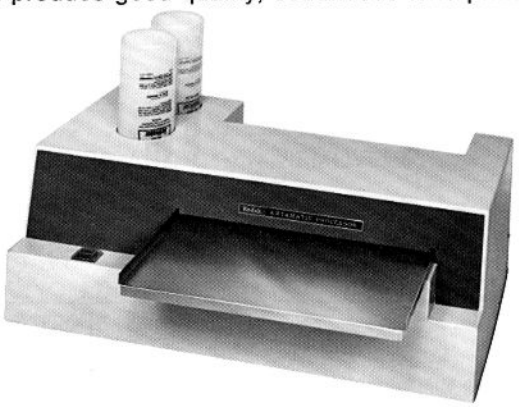
Wash: The wash consists of two stages. The first is a high-turbulence fountain-jet wash similar to the fix. The second is a quick run through standing water. The wash takes about 8½ seconds.

The dry-to-dry time for an 8 x 10-inch print is 55 seconds. Prints made on EKTABROME SC and KODABROME II Papers and processed in the ROYALPRINT Processor meet optimum stability levels as measured in accordance with American National Standard PH4.32-1974, Method for Evaluating the Processing of Black-and-White Photographic Images with Respect to the Stability of the Resultant Image. For more information, see Kodak Publication No. G-6, *Faster and Better B/W Print Processing.*

Stabilization Process

Stabilization is a mechanized method by which specially prepared black-and-white papers are processed, producing prints for immediate use and short-term keeping (up to several months). With fixing and washing, machine-stabilized prints will keep as long as will any conventionally processed prints.

Because stabilized prints are produced in about 15 seconds, and dry completely in a few minutes under normal room conditions, stabilization processing is especially valuable in situations where prints must be readied for use in a very short time. For proofing, deadline work, medical, military, and police photography, and newspaper work, stabilization processing can produce good-quality, continuous-tone prints in a few minutes, eliminating the delay associated with conventional processing and drying in black-and-white printmaking. Stabilized prints, having served their immediate purpose, can then be fixed and washed for more permanent keeping.



The KODAK EKTAMATIC Processor, Model 214-K. Using this processor, you can process exposed prints in about 15 seconds, and eliminate the need for sinks, trays, and washing arrangements.

To fix stabilized prints, immerse them for 8 to 12 minutes in KODAK Fixer, KODAK Fixing Bath F-5 or F-6, or KODAK Rapid Fixer (paper dilution) at 18.5 to 21° C (65 to 70° F). KODAFIX Solution and KODAK EKTAFLO Fixer are *not* recommended for use on stabilized prints.

The KODAK EKTAMATIC Processor, Model 214-K, is a sturdy, two-solution (activator and stabilizer) stabilization processor, recommended for use with KODAK EKTAMATIC SC Papers. More information on stabilization processing, and on KODAK EKTAMATIC Products, may be found in Kodak Pamphlet No. G-25, *Stabilization with KODAK EKTAMATIC Products.* Single copies are available, at no cost, from Eastman Kodak Company, Department 412-L, 343 State Street, Rochester, New York 14650.

KODAK EKTAMATIC SC Papers can be tray-processed in the same solutions used for normal paper processing. KODAK DEKTOL Developer, diluted 1 part developer to 2 parts water, is recommended. Develop for about 60 seconds at 20° C (68° F). The subsequent steps in processing, including drying and ferrotyping, are then the same as for conventional papers. See the Toning Classification Chart for toning recommendations. Only prints that have been fixed and washed should be toned.

Toning

The silver image produced by development is normally black or gray, but it can be modified within certain limits by changes in the developer to produce tones ranging from blue-black to brown-black or yellow-brown. The range of these tones is not very great, however, and, in order to produce more pronounced tones, the image must be changed by some chemical means. In most of the popular toning treatments, the silver image is converted to, or covered by, other metals or inorganic compounds such as silver sulfide.

Preparation for Toning. The color of a toned print is influenced by many factors, including variations in development, fixing, and washing, and the choice of paper type, grade, surface, and stock tint. The visual contrast and density are often changed, too. To attain the best possible quality, consider all of these factors and, if necessary, adjust them prior to toning.

A full scale of tone values, with sufficient detail in the highlights and shadows, is necessary in prints to be toned. Prints to be toned in KODAK Sepia Toner or in KODAK Sulfide Sepia Toner T-7a should receive an increase in exposure, the amount depending on

the kind and grade of paper. Those to be toned in KODAK Hypo Alum Sepia Toner T-1a should receive increased exposure (up to 15 percent) and increased developing time (up to 50 percent), depending on the kind and grade of paper. Prints to be toned in KODAK Brown Toner or in KODAK Polysulfide Toner T-8 should be given an increase in developing time, the amount again depending on the kind and grade of paper. A slight increase in print development is needed with KODAK POLY-TONER diluted 1 to 50. KODAK Rapid Selenium Toner intensifies the image slightly, and prints may be improved by slightly less development.

The usual control manipulations, such as dodging, flashing, and overall reduction of the print, if required, must be performed prior to toning. Prints which have been reduced must be washed well before toning, if pink stains are to be avoided. Residual silver salts and hypo retained in the paper may cause uneven toning or staining. For thorough washing, the prints should be rinsed in water after they have been fixed, and then treated in KODAK Hypo Clearing Agent before washing prior to toning. Hypo Clearing Agent need not be used if prints are to be toned with KODAK Gold Toner T-21 or KODAK Hypo Alum Sepia Toner T-1a, because complete elimination of the hypo prior to toning is not required with these toners.

It is important that no metallic surface come in contact with toning solutions. Trays and tanks should be made of nonmetallic materials such as inert plastics or hard rubber. Enameled trays must not have cracks or chipped spots.

Paper Characteristics. Not all papers tone alike. To accommodate the many negative ranges and to satisfy the personal tastes of photographers and the numerous applications to which photographic prints are put, a variety of paper emulsions must be made. These necessary variations in contrast, speed, and image tone affect the toning rate and final color. In the following chart, the Kodak toners checked as recommended for use with the various Kodak papers are ones that will produce tones acceptable to most people. Since the tones vary considerably in both color and strength, some experimentation is necessary to determine the one best suited to a particular use. The toners checked as not recommended produce either no change in tone or a very slight change toward an unpleasant tone.

TONING CLASSIFICATION CHART

KODAK Paper	Hypo Alum Sepia T-1a	Sepia or Sulfide Sepia T-7a	Brown or Poly-Sulfide T-8	Gold T-21	Rapid Selenium	POLY-TONER (1:24)	Blue
AD-Type	X	X	P	NR	X	P	NR
AZO	X	X	P	NR	X	P	NR
EKTABROME SC	NR	P	NR	NR	NR	NR	NR
EKTALURE	X	X	X	P	P	P	X
EKTAMATIC SC*	P	P	P	NR	X	X	X
KODABROME II	NR	P	NR	NR	NR	NR	NR
KODABROME RC	X	P	P	NR	X	NR	P
KODABROMIDE	X	P	NR	NR	NR	NR	NR
MEDALIST	P	P	P	NR	X	P	X
Mural	P	P	P	NR	X	P	X
PANALURE	P	P	P	X	X	X	X
PANALURE Portrait	P	†	‡	X	P	P	X
POLYCONTRAST POLYCONTRAST Rapid POLYCONTRAST Rapid RC	P	P	P	NR	X	X	X
PORTRALURE	P	P	P	P	P	P	X
Portrait Proof	X	X	X	P	P	P	X
VELOX	P	P	X	NR	NR	NR	X
VELOX PREMIER	X	X	X	NR	NR	NR	X
VELOX UNICONTRAST	P	P	X	NR	X	NR	X

P—Primary recommendation
NR—Not Recommended
X—Although not a primary recommendation, it will produce a tone which may have special-purpose applications.
*Prints must be fixed and washed before toning.
†X for KODAK Sepia Toner, P for KODAK Sulfide Sepia Toner T-7a.
‡X for KODAK Brown Toner, P for KODAK Polysulfide Toner T-8.

DATA SECTION—Chemicals and Formulas

KEEPING PROPERTIES AND USEFUL CAPACITIES OF SOLUTIONS

The figures given in this table are estimates based on experience, and are intended for use only as a guide. The values for keeping properties without use are for solutions stored at 18.5 to 21° C (65 to 70° F), and are proportionately less at higher temperatures. The useful capacity figures are based on exhaustion of the solution without replenishment. Under most conditions, longer life and greater capacity can be assumed if some change in quality is tolerable. Developer replenishers have the same keeping properties as their respective developers.

The small table at the foot of this page indicates equivalents in area between roll and sheet films. Since the useful capacities of solutions are expressed in terms of the number of 8 x 10-inch (20.3 x 25.4-centimeter) sheets that can be processed per liter [gallon], you will need these equivalent measurements when you are processing roll films.

SOLUTION	KEEPING PROPERTIES WITHOUT USE				USEFUL CAPACITIES	
	Stock Solution In Stoppered Bottle		Working Solution		8 x 10-Inch Sheets Per Liter [Gallon]	
KODAK Film and Plate Developers	Full	Half Full	Tray	Gallon Tank	Tray	Narrow and Deep Tank
D-8	2 mo	2 wk	2 hr (2:1)	48 hr (2:1)	16 [60] (2:1)	16 [60] (2:1)
D-11	6 mo	1 mo	24 hr	1 mo	8 [30]	10 [40]
D-19	6 mo	2 mo	24 hr	1 mo	12 [45]	16 [60]*
DK-20†	6 mo	2 mo	24 hr	1 mo	4 [16]	4 [16]
D-23	6 mo	2 mo	24 hr	1 mo	4 [16]	4 [16]
D-25	6 mo	2 mo	24 hr	1 mo	4 [16]	4 [16]
DK-50	6 mo	2 mo	24 hr	1 mo	5 [20]	10 [40]*
DK-50 (1:1)	6 mo	2 mo	12 hr	2 wk	2 [10]	5 [20]
DK-60a	6 mo	2 mo	24 hr	1½ mo	5 [20]	10 [40]*
D-61a†	6 mo	2 mo	24 hr (1:1)	2 wk (1:3)	4 [15] (1:1)	8 [30] (1:3)
D-76	6 mo	2 mo	24 hr	1 mo	4 [16]	4 [16]*§
MICRODOL-X‡	6 mo	2 mo	24 hr	1 mo	4 [16]	4 [16]*§
POLYDOL	6 mo	2 mo	24 hr	1 mo	10 [40]	10 [40]*
HC-110 (Concentrate)‖	—	—	—	—	—	—
HC-110 (Dilution A)	6 mo	2 mo	24 hr	1 mo	5 [20]	10 [40]*
HC-110 (Dilution B)	6 mo	2 mo	12 hr	2 wk	2½ [10]	5 [20]*
VERSATOL (Concentrate)‖	—	—	—	—	—	—
VERSATOL (1:7)	6 mo	2 mo	—	2 wk	—	4 [15]
HRP	6 mo	2 mo	8 hr	2 wk	16 [60]	16 [60]
KODAK Paper Developers						
D-52	3 mo	1 mo	¶	—	21 [80] (1:1)	—
D-72	6 mo	2 mo	¶	—	26 [100] (1:2)	—
SELECTOL	4 mo	6 wk	¶	—	21 [80] (1:1)	—
SELECTOL-SOFT	4 mo	6 wk	¶	—	21 [80] (1:1)	—
DEKTOL	6 mo	2 mo	¶	—	32 [120] (1:2)	—
EKTAFLO, Type 1 (Concentrate)‖	—	—	—	—	—	—
EKTAFLO, Type 1 (1:9)	—	—	¶	—	26 [100]	—
EKTAFLO, Type 2 (Concentrate)‖	—	—	—	—	—	—
EKTAFLO, Type 2 (1:9)	—	—	¶	—	26 [100]	—
EKTONOL	4 mo	6 wk	¶	—	26 [100]	—
VERSATOL (Concentrate)‖	—	—	—	—	—	—
VERSATOL (1:3)	6 mo	2 mo	¶	—	21 [80]	—

*Life of developer can be extended by proper replenishment.

†Formula for this developer appears in Appendix.

‡Data also apply for KODAK MICRODOL-X Liquid Developer.

§When developing time is increased by approximately 15 percent after each sheet per liter (four sheets per gallon).

‖Keeps indefinitely in the original sealed package.

¶One working day.

ROLL SIZE	NO. OF ROLLS	EQUIVALENT NO. OF 8 x 10-INCH SHEETS
127	2	1
135 (36 exp)	1	1
120 or 620	1	1
116 or 616	1	1¼
126 (12 exp)	7	2
110 (12 exp)	9	1
150 ft x 35 mm	—	30

SOLUTION	KEEPING PROPERTIES WITHOUT USE			USEFUL CAPACITIES
		Working Solution		
KODAK Stop Baths	Stock Solution In Stoppered Bottle	Tray	Gallon Tank	8 x 10-Inch Sheets Per Liter [Gallon] Tray or Tank
Indicator Stop Bath§	Indef	3 days	1 mo	Discard when
EKTAFLO Stop Bath§	Indef	3 days	1 mo	the color changes
Universal Stop Bath	Not intended to be bottled or stored	3 days	—	to purplish blue.
SB-1	Indef	3 days	1 mo	20 [75]
SB-1a	Indef	3 days	1 mo	10 [40]
SB-3	6 mo†	1 day	1 mo†	7 [25]†
SB-4	6 mo	1 day	1 mo†	7 [25]†
SB-5	Indef	3 days	1 mo	13 [50]
SB-5a	Indef	3 days	1 mo	26 [100]
KODAK Fixing Baths*‡				
KODAK Fixer	2 mo	1 wk	1 mo	26 [100]
EKTAFLO Fixer (Concentrate)§	—	—	—	—
EKTAFLO Fixer (1:7)	—	1 wk	1 mo	26 [100]
KODAFIX Solution§	2 mo	1 wk	1 mo	32 [120] negatives (1:3) 26 [100] prints (1:7)
Rapid Fixer	2 mo	1 wk	1 mo	32 [120] negatives (1:3)
(with hardener)§	2 mo	1 wk	1 mo	26 [100] prints (1:7)
Photo-Fix	2 mo	1 wk	1 mo	26 [100] prints
F-5	2 mo	1 wk	1 mo	26 [100]
F-6	2 mo	1 wk	1 mo	26 [100]
F-7	2 mo	1 wk	1 mo	32 [120]
F-24	2 mo	1 wk	1 wk	26 [100]
KODAK Hardeners				
Liquid Hardener, Used In:				
Stop Bath	Indef	3 days	1 mo	20 [80]
Fixing Bath	2 mo	1 wk	1 mo	26 [100]
KODAK Toners				
Rapid Selenium Toner§	—	—	—	26 [100]
Brown Toner§	—	—	—	39 [150]
Blue Toner	—	—	—	16 [60]
Sepia Toner	—	—	—	42 [160]
POLY-TONER (Stock)§	—	—	—	—
POLY-TONER (1:24)	—	—	—	21 [80]
POLY-TONER (1:50)	—	—	—	10 [40]
KODAK Intensifiers and Reducers				
Chromium Intensifier	2 mo	—	24 hr	10 [40]
Farmer's Reducer	2 mo (stock solutions stored separately)	—	10 min	—
KODAK Washing Aids				
Hypo Clearing Agent	3 mo	24 hr	—	Prints: 20 [80] without pre-rinse 50 [200] with pre-rinse Negatives: 12-15 [50-60] without pre-rinse 35-50 [150-200] with pre-rinse

*Capacity figures apply only if a stop bath is used.

†Hardening capacity decreases rapidly on use or standing; do not keep a used bath for more than 3 days.

‡The capacity of a fixing bath can be increased by the use of the two-bath system described on page 20 of this book.

§Keeps indefinitely in the original sealed package.

KODAK PREPARED CHEMICALS

Photographic processing involves many complex reactions of chemicals in solution. These reactions determine, to a great degree, the properties and qualities of the images. Therefore, the purity, strength, and uniformity of the chemicals and the manner in which they are combined are of utmost importance in achieving results of uniformly high quality.

Photographers rarely have the time or experience necessary to analyze and test their processing solutions. Their interest is in the finished photograph, and they rely on the uniformity and dependability of the materials they use to produce the desired result.

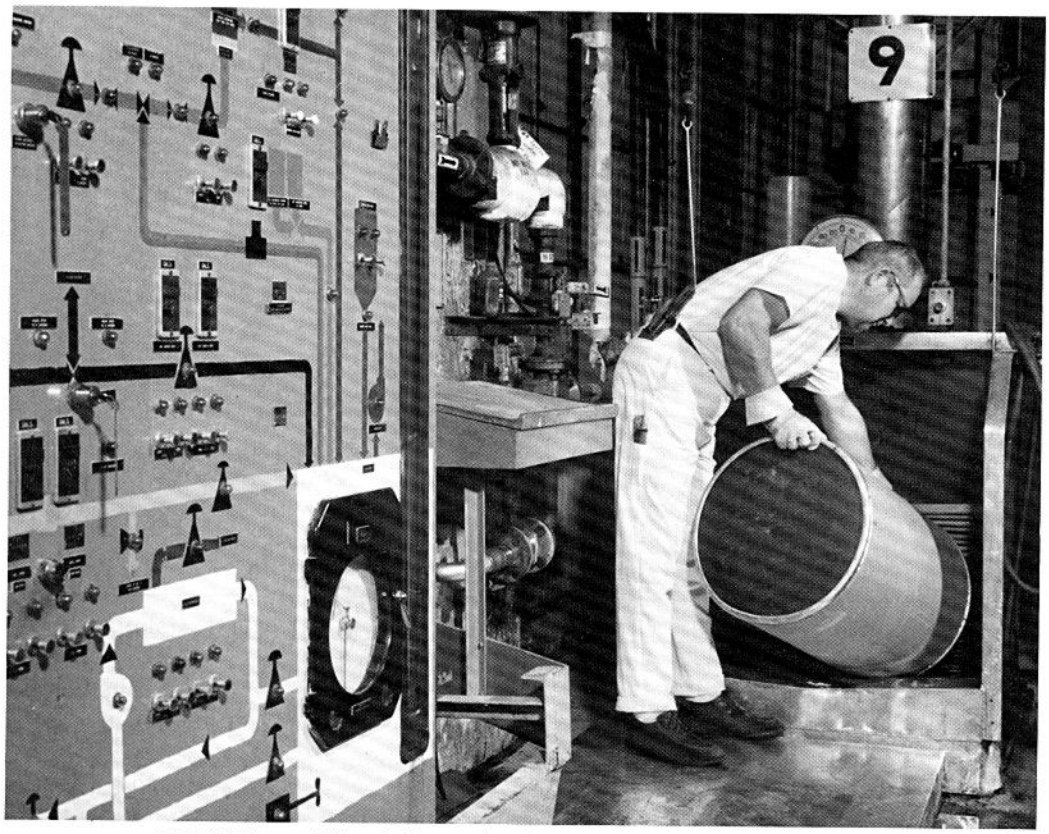
In order to provide accurately compounded solutions, and to save time for the darkroom worker, Eastman Kodak Company makes available many KODAK Prepared Chemicals which need only be dissolved or diluted according to the directions on the package. Some of these packaged preparations are essentially the same as the published formulas, and are designated by the formula numbers. Other preparations, identified by trademarked names, are not identical with any published formulas, though in many cases their photographic properties are similar to those of certain popular formulas.

These named preparations are free from many of the limitations of published formulas. A single product may contain many component parts, including chemicals that are not ordinarily stocked by dealers. When research points the way toward product improvement, changes in quantities or in the constituents themselves can be made without delay or inconvenience.

Before KODAK Prepared Chemicals reach the market, they are already darkroom veterans. Where pertinent, they are tested for reaction to humidity, heat, and cold; for resistance to aeration; for capacity; for ease of mixing; for clarity of solution; and for useful life. Practical tests are made in several independent departments, as well as in the Kodak Research Laboratories. As a final check, trade tests are made in selected areas, and customer reaction is studied carefully.

KODAK Tested Chemicals

KODAK Tested Chemicals are tested for purity and uniformity; when used according to the instructions given in the formulas, they produce solutions of consistent and reliable quality. If you prefer to mix your own solutions from the formulas in this book, we recommend using KODAK Tested Chemicals or equivalent.



KODAK Prepared Chemicals are mixed in bulk, under rigid controls, to achieve the uniformity and high quality required by modern photographic processes.

Developers

The instruction sheets packaged individually with Kodak materials recommend the most appropriate developers. The sheets include detailed recommendations for developing at different temperatures.

Always consult the instruction sheet accompanying the material you plan to develop before you proceed with processing. Because changes and improvements are made in products, it is not possible to publish specific recommendations in this book and be sure they will retain their applicability.

KODAK MICRODOL-X Developer

KODAK MICRODOL-X Developer is an excellent fine-grain developer which produces low graininess coupled with high sharpness of image detail. The stock solution can be diluted 1:3, in which case greater sharpness can be attained, with a slight sacrifice of quality in grain characteristics and a loss in film speed. MICRODOL-X Developer has very little tendency to sludge with use, is free from sludge when dissolved in hard water, and has no tendency to form scum on exhaustion, aeration, or replenishment.

Development Recommendations: The average development time, using the developer full strength, is about 10 minutes in a tank at 20° C (68° F).

Capacity: Without replenishment, 4 rolls of 620-size film or 36-exposure 35mm film or equivalent 2,060 square centimeters (320 square inches) per 946 milliliters (1 quart) of full-strength developer. After the first roll has been developed, the development time must be increased by about 15 percent for each succeeding roll developed per liter (quart). With replenishment, capacity is increased to 15 rolls per quart, and development time remains constant.

For MICRODOL-X Developer, diluted 1:3, capacity is two rolls (1,030 square centimeters or 160 square inches) per 946 milliliters (1 quart). When developing a roll of 36-exposure 35mm film in an 8-fluidounce (236-milliliter) tank of MICRODOL-X Developer diluted 1:3, increase the recommended developing time by about 10 percent. MICRODOL-X Developer (1:3) cannot be replenished. Discard after use.

Replenishment: *Small-tank*—Add 30 milliliters (1 fluidounce) of MICRODOL-X Replenisher per 516 square centimeters (80 square inches) processed.

Package Sizes: KODAK MICRODOL-X Developer is supplied in packets, to make 4 fluidounces (118 milliliters); also, packages to make 1 quart (946 milliliters) and 1 and 5 gallons (3.8 liters and 19 liters). KODAK MICRODOL-X Liquid Developer is supplied in 1-quart (946-milliliter) bottles of ready-to-use solution. KODAK MICRODOL-X Replenisher is supplied in packages to make 1 quart (946 milliliters) and 1 gallon (3.8 liters).

KODAK POLYDOL Developer

KODAK POLYDOL Developer is designed for commercial, portrait, and school photography. It has excellent capacity and tank life, good speed-grain ratio, superior tonal reproduction characteristics, and stable replenishment properties for consistent negative quality throughout its use.

Development Recommendations: Development times for most sheet films range from 8 to 11 minutes at 20° C (68° F), and from 6 to 8 minutes at 24° C (75° F).

Replenishment: Add KODAK POLYDOL Replenisher as required to maintain solution level, or at a rate of 18 to 22 milliliters (⅝ to ¾ fluidounce) per 516 square centimeters (80 square inches) of film. If the carry-out rate varies, or if the negatives are unusually dense or thin, more or less replenisher will be needed.

Package Sizes: POLYDOL Developer is supplied in packages to make 1 and 3½ gallons (3.8 and 13.2 liters) of stock solution; the Replenisher, in packages to make 1 and 5 gallons (3.8 and 19 liters).

KODAK DEKTOL Developer

KODAK DEKTOL Developer is a single-powder, easily prepared developer for producing neutral and cold-tone images on cold-tone papers. It remains unusually free from muddiness, sludge, precipitation, and discoloration throughout the normal solution life. It has a high capacity and uniform development rate.

Development Recommendations: Dilute 1 part of stock solution with 2 parts of water. Average development times for recommended papers range from 1 to 1½ minutes at 20° C (68° F).

Package Sizes: Carton of 6 packets, each to make 8 fluidounces (236 milliliters) of working solution; also packages to make 1 quart (946 milliliters) and ½, 1, 5, 25, and 50 gallons (1.9, 3.8, 19, 95, and 189 liters) of stock solution.

KODAK EKTAFLO Developer, Type 1

KODAK EKTAFLO Developer, Type 1, is a concentrated liquid developer that is diluted 1:9 for print processing. Its characteristics are similar to those of KODAK DEKTOL Developer, in that it yields neutral or cold tones on cold-tone papers.

Development Recommendations: Average development times for recommended papers range from 1 to 1½ minutes at 20° C (68° F).

Package Size: 1 gallon (3.8 liters) of the concentrate in a plastic container.

KODAK EKTAFLO Developer, Type 2

KODAK EKTAFLO Developer, Type 2, is a concentrated liquid developer for warm-tone papers. It is similar to KODAK EKTONOL Developer and yields warm, rich tones on papers for which its use is recommended. The concentrate is diluted 1:9 for use.

Development Recommendations: Develop warm-tone papers for 2 minutes at 20° C (68° F). Increased developing time results in colder tones.

Package Size: 1 gallon (3.8 liters) of the concentrate in a plastic container.

KODAK SELECTOL Developer

KODAK SELECTOL Developer is a long-life developer specially designed for the development of warm-tone papers. It produces the same pleasing image tone and contrast as KODAK Developer D-52, remains clear during use, and has high development capacity and good keeping properties. Since the development activity decreases only very slowly with use, constant image tone is easy to maintain.

Development Recommendations: Dilute 1 part of stock solution with 1 part of water. For average results, develop 2 minutes at 20° C (68° F). For slightly warmer image tone, develop 90 seconds. Contrast can be increased slightly with some papers by developing up to 4 minutes. Increased development times will produce colder image tones.

Package Sizes: To make ½, 1 and 5 gallons (1.9, 3.8 and 19 liters) of stock solution.

KODAK SELECTOL-SOFT Developer

KODAK SELECTOL-SOFT Developer, except for what the name implies, is similar in all respects to KODAK SELECTOL Developer. It is recommended whenever results with SELECTOL Developer tend to be too contrasty for adequate shadow detail. Much softer results can be obtained than with regular SELECTOL Developer, and there is no sacrifice in tonal scale.

Package Size: To make 1 gallon (3.8 liters) of stock solution. The stock solution is diluted 1:1 for use.

KODAK EKTONOL Developer

A non-carbonate developer designed for use with warm-tone papers. It minimizes stain on prints that are to be toned. The development rate remains practically uniform throughout the useful life and thus holds the image tone constant from print to print.

Development Recommendations: Dilute 1 part of stock solution with 1 part of water. Develop prints on recommended papers 2 minutes at 20° C (68° F).

Package Sizes: To make 1 and 5 gallons (3.8 and 19 liters) of stock solution.

KODAK VERSATOL Developer

KODAK VERSATOL Developer is an all-purpose developer for use with films, plates, and papers. It is packaged in convenient, concentrated liquid form and stays unusually clear during use. Simply dilute with water for use.

Development Recommendations: *Papers*—dilute 1:3 and develop prints for 1 to 1½ minutes at 20° C (68° F). *Films and Plates*—dilute 1:19 and develop for about 4½ minutes at 20° C (68° F) in a tank.

Package Sizes: 8-fluidounce (236-milliliter), 1-quart (946-milliliter), and 1-gallon (3.8-liter) containers.

KODAK Developer D-8

KODAK Developer D-8 is a fast-acting film-and-plate developer for continuous-tone or linework requiring *very high* contrast and density (D-11 is recommended for general high-contrast work).

Development Recommendations: For use, mix 2 parts of stock solution with 1 part of water. Develop about 2 minutes in a tray at 20° C (68° F). This developer has a short tray life, and must be used immediately after mixing.

Package Size: To make 1 gallon (3.8 liters).

KODAK Developer D-11

KODAK Developer D-11 is a vigorous film-and-plate developer with good keeping properties, for general use where high contrast is desired. When very high contrast is desirable, use KODAK Developer D-8. D-11 is recommended for use with high-contrast films for reproducing written or printed matter, line drawings, and similar material.

Development Recommendations: For line subjects, use without dilution. For development of copies of continuous-tone subjects, dilute with an equal volume of water. Develop about 5 minutes in a tank or 4 minutes in a tray at 20° C (68° F).

Package Sizes: To make 1 and 5 gallons (3.8 and 19 liters).

KODAK Developer D-19

A high-contrast, clean-working developer, KODAK Developer D-19 produces brilliant negatives with short development times. It has good keeping properties and high capacity. D-19 is recommended especially for continuous-tone work that requires higher-than-normal contrast.

Development Recommendations: Develop about 6 minutes in a tank or 5 minutes in a tray at 20° C (68° F).

Package Sizes: To make 1 and 5 gallons (3.8 and 19 liters).

KODAK Developer DK-50

Clean-working and moderately fast, KODAK Developer DK-50 is extremely popular with commercial and portrait photographers. It can be used with or without dilution, in a tank or tray, to produce crisp-looking negatives from all types of subjects. DK-50 Developer is highly recommended for portraiture.

Development Recommendations: For tank development of portrait negatives, dilute with an equal volume of water; develop about 10 minutes at 20° C (68° F). For tray development, use without dilution; develop about 6 minutes at 20° C (68° F).

For commercial work, use without dilution. Develop about 6 minutes in a tank or 4½ minutes in a tray at 20° C (68° F).

Replenishment: Add 30 milliliters (1 fluidounce) of KODAK Replenisher DK-50R per 8 x 10-inch (20.3 x 25.4-centimeter) sheet or equivalent (516 square centimeters or 80 square inches) processed.

If the developer is diluted 1:1 for use, the replenisher should be diluted in the same proportion.

Package Sizes: To make 1, 3½, and 10 gallons (3.8, 13.2, and 38 liters). KODAK Replenisher DK-50R is available in a 1-gallon (3.8-liter) size.

KODAK Developer D-76

KODAK Developer D-76 is unsurpassed by any other Kodak developer in ordinary use for its ability to give full emulsion speed and maximum shadow detail with normal contrast. Films developed in D-76 Developer have excellent grain characteristics. For greater sharpness, but with a slight sacrifice in grain characteristics, dilute the developer 1:1. D-76 has excellent development latitude, and produces relatively low fog on forced development. This developer has long been a favorite of pictorial photographers.

Development Recommendations: For sheet films, the average development time is about 9 minutes in a tray or 11 minutes in a tank at 20° C (68° F).

Replenishment: Add 30 milliliters (1 fluidounce) of KODAK Replenisher D-76R per 8 x 10-inch (20.3 x 25.4-centimeter) sheet or equivalent (516 square centimeters or 80 square inches) processed.

Package Sizes: To make 1 quart (946 milliliters) and ½, 1, and 10 gallons (1.9, 3.8, and 38 liters). KODAK Replenisher D-76R is available in a size to make 1 gallon (3.8 liters).

KODAK HC-110 Developer

KODAK HC-110 Developer is a highly active solution designed for rapid development of most black-and-white films. Available in concentrated liquid form, it yields six different working solutions when diluted according to instructions. It is an extremely versatile developer and, because of its concentrated liquid form, is easy to mix and use.

HC-110 produces sharp images with good grain characteristics, maximum shadow detail, and long density scale, but causes no loss in film speed. It is particularly suitable for commercial, industrial, and press photography. For more detailed information, consult Kodak Pamphlet No. J-13, *KODAK HC-110 Developer.* A single copy can be obtained on request from Eastman Kodak Company, Department 412-L, 343 State Street, Rochester, New York 14650.

Development Recommendations: Prepare stock and working solutions as indicated on the bottle. The average development time in a tank, at 20° C (68° F), with Dilution A (1:15 dilution of the concentrate), is 3½ minutes for film packs and rolls, 3¾ minutes for sheet films; with Dilution B (1:31 dilution of the concentrate), 5¾ minutes for film packs and rolls, 6¼ minutes for sheet films.

Replenishment: Add KODAK HC-110 Developer Replenisher solution to Dilution A at the rate of 22 milliliters (¾ fluidounce) per 516 square centimeters (80 square inches) of film. To replenish Dilution B, dilute the stock replenisher solution with 1 part of water per 2 parts of replenisher, and replenish as directed for Dilution A.

Package Sizes: KODAK HC-110 Developer is supplied in highly concentrated liquid form in bottles to make 2 and 3½ gallons (7.6 and 13.2 liters) of Dilution A; KODAK HC-110 Developer Replenisher is supplied in a bottle to make 1 gallon (3.8 liters).

KODAK HRP Developer

This liquid developer is used for KODAK High Resolution Plates and KODAK Electron Image Plates. It can be diluted 1:4 for a developing time of 5 minutes at 20° C (68° F), or diluted 1:2 for a developing time of 3¾ minutes at 20° C (68° F).

Package Sizes: To make 1, 5 and 25 gallons (3.8, 19 and 95 liters) of solution at the 1:4 dilution.

Stop Baths, Fixing Baths, & Hardeners

KODAK Indicator Stop Bath

Supplied in convenient concentrated liquid form, KODAK Indicator Stop Bath makes up quickly into a nonhardening stop bath for use with films, plates, or papers. Light yellow when freshly mixed, the bath turns purplish blue when exhausted; it then appears dark under a safelight, and must be discarded.

Package Sizes: Available in 16-fluidounce (473-milliliter) and 1-gallon (3.8-liter) bottles of concentrated solution.

KODAK Universal Stop Bath

KODAK Universal Stop Bath (with Indicator) is a convenient "one-time-use" nonhardening bath used for processing small quantities of film or paper. When mixed, it has a light yellow color by room light, but appears colorless by safelight illumination. When it becomes exhausted, it turns purplish blue, and appears dark under a safelight. KODAK Universal Stop Bath is supplied with the KODAK Tri-Chem Pack for prints and is also available as a separate packet.

Package Size: Packets to make 8 fluidounces (236 milliliters) of working solution.

KODAK EKTAFLO Stop Bath

KODAK EKTAFLO Stop Bath is a liquid concentrate used in black-and-white print processing. The fresh solution is yellow, but changes to purplish blue when the bath is exhausted. The concentrate is diluted 1:31 for use.

Package Size: Packets to make 8 fluidounces (236 milliliters) of working solution.

KODAK Fixer

KODAK Fixer is a hardening fixing bath recommended for general use with films, plates, and papers. It gives good hardening without having a tendency to sludge. Its use is particularly recommended if prints tend to stick to belt or drum dryers, or become softened in toning operations.

Package Sizes: To make 1 quart (946 milliliters), ½, 1, 5, and 25 gallons (1.9, 3.8, 19, and 95 liters) of solution.

KODAFIX Solution

KODAFIX Solution is a concentrated single-solution hardening fixing bath requiring only the addition of water to prepare it for immediate use with films, plates, or papers. Its long life, high capacity, and convenience of preparation make it popular for general-purpose use.

Package Size: To make 1 gallon (3.8 liters) of working-strength film and plate fixer or 2 gallons (7.6 liters) of working-strength fixer for papers.

KODAK Rapid Fixer

KODAK Rapid Fixer is a concentrated, easy-to-prepare hardening fixing bath with long life and high capacity. It is intended primarily for very rapid fixing of films and plates, but with proper dilution can be used for papers. The proportion of hardener constituent can be varied in special cases, such as when the temperature is unusually high or low. When it is mixed in the recommended proportions, the hardening action is sufficiently rapid to allow taking full advantage of the very rapid fixing rate.

Preparation: *Films and Plates*—Dilute 946 milliliters (1 quart) of Solution A with 1.9 liters (½ gallon) of water; then add slowly, while stirring, 89 milliliters (3 fluidounces) of Hardener Solution B. Add water to make 3.8 liters (1 gallon). *Papers*—Dilute 473 milliliters (16 fluidounces) of Solution A with 1.9 liters (½ gallon) of water; then add slowly, while stirring, 45 milliliters (1½ fluidounces) of Hardener Solution B. Add water to make 3.8 liters (1 gallon).

Replenishment, Film and Plate Fixer: Replenish a 1-liter or 1-quart tank as follows (for larger volumes, multiply the figures given by the number of liters or quarts in the fixing bath to be replenished): after fixing the equivalent of ten 8 x 10-inch (20.3 x 25.4-centimeter) films (5160 square centimeters or 800 square inches), remove 45 milliliters (1½ fluidounces) of the fixing bath and replace it with 37 milliliters (1¼ fluidounces) of undiluted Rapid Fixer and about 4 milliliters (⅛ fluidounce) of Hardener (do *not* add Hardener to undiluted Fixer, or an insoluble precipitate may form). Repeat after each 5160 square centimeters (800 square inches) of film for a total of 13 times, then discard the bath and make up a new one.

NOTE: The above instructions *do not apply* for X-ray films. See the instruction sheet for information on using KODAK Rapid Fixer with X-ray films.

Package Sizes: To make 1 and 5 gallons (3.8 and 19 liters) of film and plate fixer. Also, 5- and 52-gallon (19- and 198-liter) Cubitainer® packages of Solution A (fixer) to make 20 and 208 gallons (76 and 792 liters) of film fixer, and a 1-gallon (3.8-liter) bottle and 5-gallon (19-liter) Cubitainer package of Solution B (hardener).

KODAK EKTAFLO Fixer

KODAK EKTAFLO Fixer is a companion to KODAK EKTAFLO Developers and Stop Bath. It is available as a single-solution concentrate, and is diluted 1:7 for print processing.

Package Size: 1 gallon (3.8 liters) of concentrate in a plastic container.

KODAK Photo-Fix

KODAK Photo-Fix is an economical hardening fixer specially prepared for fixing photographic prints for portrait, commercial, and photofinishing purposes. Photo-Fix can also be used with films and plates, provided that an acid stop bath is used.

Package Sizes: Available in cases of 10 packets, each sufficient to prepare 7 quarts (6.6 liters).

KODAK Liquid Hardener

The concentrated solution of KODAK Liquid Hardener provides a rapid and convenient means of preparing an acid stop bath or acid hardening fixing bath for films, plates, and papers. The solutions keep well, and a fixing bath prepared with Liquid Hardener has excellent hardening properties.

Preparation: *Stop Bath*—Dilute 1 part of KODAK Liquid Hardener with 13 parts of water. *Fixing Bath*—Completely dissolve 240 grams of KODAK Sodium Thiosulfate (Pentahydrated) in one liter of water (or dissolve 8 ounces in 1 quart of water); then add 78 milliliters per liter or 2½ fluidounces per quart of KODAK Liquid Hardener. *Hardening Bath After Toning*—Dilute 1 part of KODAK Liquid Hardener with 13 parts of water.

Package Size: Concentrated solution available in a 1-gallon (3.8-liter) jug.

Toners

Best results in toning will generally be obtained by choosing a toner suited to the particular kind of photographic paper on which the print is made. Refer to the table on page 22 for standard recommendations.

KODAK Rapid Selenium Toner

KODAK Rapid Selenium Toner is a concentrated single-solution toner that can be used at various dilutions with Kodak warm-tone papers to produce several hues of reddish brown tones. The working solutions have no marked odor and are used at room temperature. The toned image is quite permanent.

Package Sizes: Available in 8-fluidounce (236-milliliter), 1-quart (946-milliliter), and 1-gallon (3.8-liter) bottles.

Tone Control: When the full effect of toning is desired in minimum time, use a dilution of 1 part of toner to 3 parts of water. Complete toning occurs in 2 to 8 minutes at 20° C (68° F), depending on the type of paper used. When intermediate tones are desired, use a more dilute solution, such as 1 part of toner to 9 parts of water. The toning action is then much slower, and the print can be removed when the desired intermediate tone is obtained. Toning continues for a short time in the wash water, and allowances should be made for this action.

KODAK Brown Toner

KODAK Brown Toner is a very concentrated single-solution, polysulfide-type toner that will produce pleasing warm brown tones on Kodak cold-tone papers. Toning to completion is possible either at room or elevated temperatures. Brown Toner keeps well, even in a partially filled bottle, and produces clear, permanently toned images.

Package Sizes: Available in 8-fluidounce (236-milliliter) and 1-gallon (3.8-liter) jugs of stock solution.

KODAK POLY-TONER

By varying the dilution and toning times of this single-solution direct toner, a series of hues can be produced. They range from a reddish brown, similar to that produced by KODAK Rapid Selenium Toner, to a very warm brown approaching that produced by KODAK Brown Toner. KODAK POLY-TONER is recommended for use with KODAK PORTRALURE and EKTALURE Papers.

Tone Control: KODAK POLY-TONER can be thought of as two toners in one solution—the "selenium type" being most active at high concentrations (such as 1:4) and the "brown type" being most active at low, or dilute (1:50), concentrations.

Dilutions of KODAK POLY-TONER

Dilution (Toner:Water)	Temperature	Time (Approximate)
1:4	21° C (70° F)	1 minute
1:24	21° C (70° F)	3 minutes
1:50	21° C (70° F)	7 minutes

In most cases, the 1:24 dilution with a toning time of only 3 minutes will produce the most pleasing tone. Tones intermediate to those produced by the recommended dilutions can be obtained by varying the dilution.

Package Sizes: Available in 1-quart (946-milliliter) and 1-gallon (3.8-liter) containers of stock solution.

KODAK Sepia Toner

KODAK Sepia Toner is a two-solution toner of the bleach and redevelop type. It is one of the few toners that will produce a pleasing warm-brown tone on cold-tone papers. With the inherently warm-tone papers, it tends to produce rather pronounced yellowish brown tones. Appreciable tone control with Sepia Toner is not practical; to avoid irregular tones, prints should be fully bleached before sulfiding.

Package Size: Available in a 2-part packet to make 1 quart (946 milliliters) each of bleach and toner.

KODAK Blue Toner

KODAK Blue Toner is supplied in combined liquid and powder form to prepare a single-solution toner to produce cold blue tones on most Kodak papers. The solution is odorless and the toned image quite permanent.

Package Size: Available in a 2-part package to make 1 quart (946 milliliters) of toner.

Chemical Processing Aids

KODAK Anti-Calcium

KODAK Anti-Calcium is a dry chemical recommended for addition to most photographic developers to prevent or reduce the formation of calcium scum on films, sludges in the solution, and scale on tank walls or other equipment. These insoluble accumulations are due chiefly to the calcium salts in hard water, and their formation is inhibited by use of a calcium binding agent.

Package Size: Available in 1-pound (454-gram) bottles of dry chemical.

KODAK Anti-Fog, No. 1 (Benzotriazole)

KODAK Anti-Fog, No. 1, tends to suppress fog when added to a film or paper developer, and thus effectively increases contrast by producing relatively fog-free negatives and clean highlights in the prints. Anti-Fog, No. 1, is useful when films or papers tend to show fog from excessive age or unfavorable storage conditions, when long storage of films or papers has occurred between exposure and processing, and when forced development seems necessary. It is also useful in retarding fog during warm-weather processing, when it may not be possible to maintain the developer at 20° C (68° F).

Package Sizes: Available in 50-tablet bottles, and 4-ounce (113-gram) and 1-pound (454-gram) bottles of dry powder.

KODAK Anti-Fog, No. 2 (6-Nitrobenzimidazole Nitrate)

KODAK Anti-Fog, No. 2, tends to suppress certain types of fog when added to a film prehardener or film developer. Anti-Fog, No. 2, is useful against fog caused by aldehydes in prehardeners and developers, and is also effective against fog caused by aeration of developers. It is not interchangeable with KODAK Anti-Fog, No. 1.

Package Sizes: Available in 1-pound and 5-pound (454-gram and 2.27-kilogram) bottles of dry powder.

KODAK Anti-Foam

KODAK Anti-Foam is an inhibitor particularly recommended for the prevention of air bells, spots, streaks, or stains caused by foam or froth on photographic processing solutions. It can be used in any photographic solution.

KODAK Anti-Foam is effective in very small quantities and should be used sparingly. Just a few drops added to a solution will reduce foaming; too much may cause spots on the film.

Package Size: Available in 1-fluidounce (30-milliliter) bottles.

KODAK Desensitizer (Pre-Bath Type)

KODAK Desensitizer is used before the developer to reduce the sensitivity of the emulsion to light, and to make possible visual inspection of the image during development. With the desensitizer, you can judge the degree of development of orthochromatic or panchromatic films, including high-speed materials, using a safelight with the recommended filter. You may find this desensitizer helpful when developing underexposed or overexposed films.

To Use: Make up the stock solution as indicated in the directions accompanying the product. Dilute this stock solution in the ratio of 1 part of stock solution to 50 parts of water. In total darkness, immerse films or plates in the diluted solution for 2 minutes at 20° C (68° F). Rinse the films or plates for at least 10 seconds, and then place them in the developer.

You can now use a safelight, as recommended in the directions accompanying KODAK Desensitizer, to inspect the progress of development.

Store the unused or partially used solution in an amber bottle, away from bright light.

Capacity: 1 liter (1 quart) of the diluted solution will treat approximately 15 4 x 5-inch (10.2 x 12.7-centimeter) films or plates, or their equivalent in area. The capacity can be increased somewhat by prolonging the immersion time in the used solution.

NOTE: The desensitizer will be rendered inactive if added to a developer. Use it only as a pre-bath.

Package Size: Available in 1-gram bottles of dry powder.

KODAK PHOTO-FLO Solution

KODAK PHOTO-FLO Solution is a powerful wetting agent that has been carefully selected as safe and dependable for photographic use. PHOTO-FLO Solution decreases the surface tension of water so that it flows evenly from film surfaces without collecting in drops. Thus the solution prevents the water marks and streaks that might otherwise be produced during drying. It also helps water solutions to flow evenly onto the emulsion surface, and so facilitates the application of watercolors, opaques, and retouching dyes.

No sludge or precipitate forms when KODAK PHOTO-FLO Solution is mixed with hard water, or when it is contaminated by traces of fixing bath introduced by incompletely washed films.

KODAK PHOTO-FLO Solution is available in three different concentrations; when diluted according to instructions, each concentrate yields the same working solution. Working solutions are made by mixing the concentrate with water in the following proportions: for KODAK PHOTO-FLO 200 Solution, 1:200; for KODAK PHOTO-FLO 600 Solution, 1:600; and KODAK PHOTO-FLO 2100 Solution, 1:2100.

Directions for Use: *Drying*—Wash the films thoroughly, bathe them for about 30 seconds in a working solution of PHOTO-FLO, drain them briefly, and hang them to dry. Wiping is unnecessary. *Intensification and reduction*—Before intensifying or reducing negatives, bathe them for about 1 minute in the working solution. This promotes uniform action of the intensifier or reducer. *Coloring and retouching films and prints*—Add double-strength dilute PHOTO-FLO Solution (i.e., 1:100 instead of 1:200) to the watercolor solution or the opaque, or treat the surface of the material with the normal working solution.

Package Sizes: KODAK PHOTO-FLO 200 Solution is available in 4-fluidounce (118-milliliter) and 16-fluidounce (473-milliliter) bottles. KODAK PHOTO-FLO 600 Solution (concentrated) and KODAK PHOTO-FLO 2100 Solution (superconcentrated) are both available in a 1-gallon (3.8-liter) jug.

KODAK Print Flattening Solution

KODAK Print Flattening Solution contains a hygroscopic material which helps to retain enough moisture in photographic prints to prevent them from curling excessively or becoming brittle and cracking when handled. Particularly in the winter, in the atmosphere of heated buildings, the emulsion layer of the paper may become overly dry. Soaking the prints in diluted KODAK Print Flattening Solution before drying will help protect them from the effects of a dry atmosphere, and will help keep them flat and flexible. Do not treat water-resistant papers in this solution.

Prepare a working solution by diluting 1 part of Print Flattening Solution with 10 parts of water.

Directions for Use: Immerse the *well-fixed* and *well-washed* print, before drying, in the diluted solution, keeping it there for 5 minutes at 20° C (68° F). Dry prints in the usual way.

The strength of the working solution can be varied according to atmospheric conditions. Use a 1:20 dilution if the air is very moist, or a 1:5 dilution if the air is very dry.

Package Sizes: KODAK Print Flattening Solution is available in 8-fluidounce (236-milliliter) and 1-gallon (3.8-liter) containers.

KODAK Chromium Intensifier

KODAK Chromium Intensifier is designed for building up density in weak, flat negatives, lantern slides, and black-and-white transparencies. It is reliable in

its action, and produces an image with little color change but a high degree of permanence. All operations can be carried out under artificial light or subdued daylight. For greater intensification, the entire process can be repeated.

Package Size: Packets to make 16 fluidounces (473 milliliters) each of bleach and clearing solution.

KODAK Farmer's Reducer

KODAK Farmer's Reducer is a high-capacity, subtractive reducer which removes equal quantities of silver from high, intermediate, and low densities. It is recommended for all general reduction of overexposed or overdeveloped negatives or slides. The extent of the reduction can be easily controlled by visual examination during the treatment. All operations can be carried out under normal room lighting.

Package Size: Packets to make 1 quart (946 milliliters).

KODAK Hypo Clearing Agent

KODAK Hypo Clearing Agent can be used to save time and water when removing hypo from films and from non-resin-coated photographic papers. A 30-second wash for films or a 1-minute wash for papers, between fixing and treatment in Hypo Clearing Agent, is optional, but significantly increases the capacity of the solution.

Directions for Use: After fixing and washing (if desired), treat films for 1-2 minutes, single-weight prints for 2 minutes, or double-weight prints for 3 minutes in the clearing agent solution. Wash according to the times and instructions given with the Hypo Clearing Agent. If longer washing times are used than are suggested, increased stability will result. Nevertheless, the recommended wash times provide a higher degree of stability than would be obtained with normal processing conditions. Even with wash water at temperatures as low as 2° C (35° F), the stability obtained equals that produced by normal washing conditions.

NOTE: To help obtain maximum possible permanence, follow the treatment in KODAK Hypo Clearing Agent with a treatment in KODAK Hypo Eliminator HE-1 (formula on page 40). This solution helps remove the last traces of processing chemicals from photographic papers. Hypo Eliminator can be used with all well-washed, conventionally processed papers, both single-weight and double-weight, whether or not Hypo Clearing Agent has been previously used.

To protect the silver image from atmospheric attack (which can occur even when the print has been treated in both KODAK Hypo Clearing Agent and KODAK Hypo Eliminator HE-1), treat prints in KODAK Gold Protective Solution GP-1 (see page 40).

Package Sizes: KODAK Hypo Clearing Agent is available in cartons of 5 packets each, each packet to make 5 quarts (4.7 liters), and in packages to make 5 gallons (19 liters) of working solution.

KODAK Developer System Cleaner

KODAK Developer System Cleaner provides a convenient means of removing the deposits which accumulate in darkroom tanks, trays, and continuous-processing equipment. These deposits are rather difficult to remove by conventional cleaning procedures.

To clean darkroom tanks or trays, use the working solution at about 32° C (90° F) for best results. Fill the tank or tray to be cleaned with the working solution and allow it to remain for at least 30 minutes with occasional agitation. Then drain the solution from the tank or tray and flush thoroughly with warm water.

Package Size: To make 12 gallons (45.4 liters) of working solution.

KODAK Fixer System Cleaner

KODAK Fixer System Cleaner can be used to remove the deposits which tend to accumulate on metal film hangers and clips used in fixing baths, and in the fixer systems of continuous-processing equipment.

To clean darkroom equipment, mix the working solution as directed on the package. Immerse the equipment being cleaned and allow it to remain in the solution for at least 30 minutes. Heavy deposits may require overnight soaking. Flush the cleaned equipment thoroughly with warm water.

Package Size: Available in a package to make 2½ gallons (9.5 liters) of working solution.

KODAK Chemical Preparations must pass chemical and, in many cases, photographic tests before they are released for packaging.

FORMULAS

IMPORTANT: The chemicals in these formulas are listed in the order in which they should be added to the solution.

Always stir the solutions thoroughly before using them.

Developers & Replenishers

KODAK Developer D-8

Water, about 32° C (90° F)	750 milliliters
KODAK Sodium Sulfite (Anhydrous)	90.0 grams
KODAK Hydroquinone	45.0 grams
KODAK Sodium Hydroxide (Granular)	37.5 grams
KODAK Potassium Bromide (Anhydrous)	30.0 grams
Water to make	1.0 liter

See page 28 for instructions on how to use this developer.

KODAK Developer D-11

Water, about 50° C (125° F)	500 milliliters
KODAK ELON Developing Agent	1.0 gram
KODAK Sodium Sulfite (Anhydrous)	75.0 grams
KODAK Hydroquinone	9.0 grams
KODAK Sodium Carbonate (Monohydrated)	30.0 grams
KODAK Potassium Bromide (Anhydrous)	5.0 grams
Cold water to make	1.0 liter

See page 28 for instructions on how to use this developer.

KODAK Developer D-19

Water, about 50° C (125° F)	500 milliliters
KODAK ELON Developing Agent	2.0 grams
KODAK Sodium Sulfite (Anhydrous)	90.0 grams
KODAK Hydroquinone	8.0 grams
KODAK Sodium Carbonate (Monohydrated)	52.5 grams
KODAK Potassium Bromide (Anhydrous)	5.0 grams
Cold water to make	1.0 liter

See page 28 for instructions on how to use this developer.

KODAK Replenisher D-19R

Water, about 50° C (125° F)	500 milliliters
KODAK ELON Developing Agent	4.5 grams
KODAK Sodium Sulfite (Anhydrous)	90.0 grams
KODAK Hydroquinone	17.5 grams
KODAK Sodium Carbonate (Monohydrated)	52.5 grams
KODAK Sodium Hydroxide (Granular)	7.5 grams
Water to make	1.0 liter

Use this replenisher undiluted. After each 8 x 10-inch (20.3 x 25.4-centimeter) film or its equivalent developed, add to the developer 25 milliliters of replenisher solution (1 fluidounce for each 100 square inches of film). The total volume of replenisher added should not exceed the original volume of the developer.

KODAK Developer D-23

This is a slow-working developer that will not produce high contrast even with extended developing times. Use it when a low density range is desired.

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	7.5 grams
KODAK Sodium Sulfite (Anhydrous)	100.0 grams
Cold water to make	1.0 liter

Average development time is about 12 minutes in a tank or 10 minutes in a tray at 20° C (68° F).

The life of the developer can be extended by using KODAK Replenisher DK-25R. Add the replenisher at the rate of 23 milliliters per roll developed (¾ fluidounce per roll). Discard the developer after about 26 rolls (13,420 square centimeters or 2,080 square inches) of film per 946 milliliters (1 quart).

KODAK Developer D-25

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	7.5 grams
KODAK Sodium Sulfite (Anhydrous)	100.0 grams
KODAK Sodium Bisulfite (Anhydrous)	15.0 grams
Cold water to make	1.0 liter

Most Kodak roll films should be developed in a tank for approximately 20 minutes at 20° C (68° F), or for approximately 11 minutes at 25° C (77° F). If the developer is used at 25° C (77° F), the results will be similar to those obtained by using KODAK Developer DK-20 (in the Appendix, page 51) at 20° C (68° F). The grain resembles that obtained with the popular paraphenylenediamine type of developer, but KODAK Developer D-25 is nontoxic and nonstaining.

If it is not essential to obtain minimum graininess, or if it is not convenient to work at the higher temperature, use half the specified quantity of sodium bisulfite. The development time will then be approximately 14 minutes at 20° C (68° F). The graininess will usually be intermediate between that for KODAK Developer D-23 and that for KODAK Developer D-25.

Replenishment: Add KODAK Replenisher DK-25R at the rate of 38 milliliters per 946 milliliters of solution (1¼ fluidounces per quart) for each roll developed, for the first 13 rolls, and at the rate of 23 milliliters per 946 milliliters of solution (¾ fluidounce per quart) for each of the following 13 rolls. Then replace the developer with a fresh solution.

KODAK Replenisher DK-25R

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	10.0 grams
KODAK Sodium Sulfite (Anhydrous)	100.0 grams
KODALK Balanced Alkali	20.0 grams
Cold water to make	1.0 liter

KODAK Developer DK-50

Stock Solution

Water, about 50° C (125° F)	500 milliliters
KODAK ELON Developing Agent	2.5 grams
KODAK Sodium Sulfite (Anhydrous)	30.0 grams
KODAK Hydroquinone	2.5 grams
KODALK Balanced Alkali	10.0 grams
KODAK Potassium Bromide (Anhydrous)	0.5 gram
Water to make	1.0 liter

See page 29 for instructions on how to use this developer.

KODAK Replenisher DK-50R

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	5.0 grams
KODAK Sodium Sulfite (Anhydrous)	30.0 grams
KODAK Hydroquinone	10.0 grams
KODALK Balanced Alkali	40.0 grams
Water to make	1.0 liter

See page 29 for instructions on how to use this replenisher.

KODAK Developer D-52

For information about a packaged preparation with similar photographic properties, embodying all the latest improvements and offering ease of preparation, see KODAK SELECTOL Developer, page 28.

Stock Solution

Water, about 50° C (125° F)	500 milliliters
KODAK ELON Developing Agent	1.5 grams
KODAK Sodium Sulfite (Anhydrous)	22.5 grams
KODAK Hydroquinone	6.0 grams
KODAK Sodium Carbonate (Monohydrated)	17.0 grams
KODAK Potassium Bromide (Anhydrous)	1.5 grams
Cold water to make	1.0 liter

Follow the instructions given for the use of KODAK SELECTOL Developer, page 28.

KODAK Developer DK-60a

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	2.5 grams
KODAK Sodium Sulfite (Anhydrous)	50.0 grams
KODAK Hydroquinone	2.5 grams
KODALK Balanced Alkali	20.0 grams
KODAK Potassium Bromide (Anhydrous)	0.5 gram
Water to make	1.0 liter

This is a fast-working, general-purpose developer. The average development times for most films are 4 minutes in a tray and 5 minutes in a tank.

KODAK Replenisher DK-60aTR

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	5.0 grams
KODAK Sodium Sulfite (Anhydrous)	50.0 grams
KODAK Hydroquinone	10.0 grams
KODALK Balanced Alkali	40.0 grams
Cold water to make	1.0 liter

KODAK Developer D-72

For information about a packaged preparation with similar photographic properties, embodying all the latest improvements and offering ease of preparation, see KODAK DEKTOL Developer, page 27.

Water, about 50° C (125° F)	500 milliliters
KODAK ELON Developing Agent	3.0 grams
KODAK Sodium Sulfite (Anhydrous)	45.0 grams
KODAK Hydroquinone	12.0 grams
KODAK Sodium Carbonate (Monohydrated)	80.0 grams
KODAK Potassium Bromide (Anhydrous)	2.0 grams
Water to make	1 liter

To use, follow the instructions given on page 27 for KODAK DEKTOL Developer.

KODAK Developer D-76

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	2.0 grams
KODAK Sodium Sulfite (Anhydrous)	100.0 grams
KODAK Hydroquinone	5.0 grams
KODAK Borax (Granular)	2.0 grams
Water to make	1.0 liter

See page 29 for instructions on how to use this developer.

KODAK Replenisher D-76R

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	3.0 grams
KODAK Sodium Sulfite (Anhydrous)	100.0 grams
KODAK Hydroquinone	7.5 grams
KODAK Borax (Granular)	20.0 grams
Water to make	1.0 liter

Stop Baths, Fixing Baths, & Hardeners

KODAK Stop Bath SB-1

Water	1.0 liter
*KODAK 28% Acetic Acid	48.0 milliliters

*To make approximately 28% acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with 8 parts of water.

Rinse prints for 5 to 10 seconds with agitation.

KODAK Stop Bath SB-1a

Water	1.0 liter
*KODAK 28% Acetic Acid	125.0 milliliters

*To make approximately 28% acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with 8 parts of water.

This bath is recommended for use after highly alkaline developers, such as those used with line materials.

KODAK Hardening Bath SB-4

This solution is recommended for use in conjunction with developers containing sodium sulfate (see "High-Temperature Processing," page 19). It is used at temperatures above 24° C (75° F).

Water	1.0 liter
KODAK Potassium Chrome Alum, Crystals (Dodecahydrated)	30.0 grams
*KODAK Sodium Sulfate (Anhydrous)	60.0 grams

*If crystalline sodium sulfate is preferred to the anhydrous form, use 2¼ times the quantity listed.

Agitate the negatives for 30 to 45 seconds when they are first immersed in the hardener, or streakiness will result. Leave them in the bath for at least 3 minutes between development and fixing. If the temperature is below 29.5° C (85° F), rinse the negatives for 1 to 2 seconds in water before immersing them in the hardener bath.

The hardening bath is a violet-blue color by tungsten light when freshly mixed, but it ultimately turns a yellow-green with use; it then ceases to harden and should be replaced with a fresh bath. The hardening bath should never be overworked. An unused bath will keep indefinitely, but the hardening power of a partially used bath decreases rapidly on standing for a few days.

This is a non-hardening stop bath for use up to 26.5° C (80° F).

Treat the films or plates in this bath for about 30 seconds with agitation at 18.5 to 21° C (65 to 70° F) between developing and fixing.

This bath should be replaced after approximately 13 rolls have been processed per liter (quart).

KODAK Stop Bath SB-5a: For photofinishing, use double above quantities of KODAK 28% Acetic Acid.

KODAK Fixing Bath F-5

KODAK Fixing Bath F-5 is recommended for general use. This bath has the advantage (over the older type of fixing baths, which did not contain boric acid) of giving much better hardening and having less tendency to precipitate a sludge of aluminum sulfite.

Water, about 50° C (125° F)	600 milliliters
KODAK Sodium Thiosulfate (Pentahydrated)	240.0 grams
KODAK Sodium Sulfite (Anhydrous)	15.0 grams
*KODAK 28% Acetic Acid	48.0 milliliters
**KODAK Boric Acid, Crystals	7.5 grams
KODAK Potassium Alum, Fine Granular (Dodecahydrated)	15.0 grams
Cold water to make	1.0 liter

*To make approximately 28% acetic acid from glacial acetic acid, add 3 parts of glacial acetic acid to 8 parts of water.

**Crystalline boric acid should be used as specified. Powdered boric acid dissolves only with great difficulty, and its use should be avoided.

Films or plates should be fixed properly in 5 to 10 minutes in a freshly prepared bath. The bath need not be discarded until the fixing time becomes excessive; that is, over 10 minutes. Fix prints 5 to 10 minutes.

The hardener can also be mixed separately as a stock solution as follows:

KODAK Hardener F-5a

Water, about 50° C (125° F)	600 milliliters
KODAK Sodium Sulfite (Anhydrous)	75.0 grams
*KODAK 28% Acetic Acid	235.0 milliliters
**KODAK Boric Acid, Crystals	37.5 grams
KODAK Potassium Alum, Fine Granular (Dodecahydrated)	75.0 grams
Cold water to make	1.0 liter

*To make approximately 28% acetic acid from glacial acetic acid, add 3 parts of glacial acetic acid to 8 parts of water.

**Crystalline boric acid should be used as specified. Powdered boric acid dissolves only with great difficulty, and its use should be avoided.

Slowly add 1 part of the cool stock hardener solution to 4 parts of cool 30% hypo solution (300 grams of sodium thiosulfate per liter of water), while stirring the hypo rapidly.

KODAK Fixing Bath F-6

In warm weather and in inadequately ventilated darkrooms, the odor of sulfur dioxide given off by the KODAK Fixing Bath F-5 may be objectionable. This can be eliminated almost entirely by omitting the boric acid and substituting twice its weight in KODALK Balanced Alkali. This modification, which is known as KODAK Fixing Bath F-6, can also be used to advantage for fixing prints, since it washes out of photographic papers more rapidly than the baths which have a greater hardening action. It should be used in conjunction with a stop bath such as KODAK Indicator Stop Bath or KODAK Stop Bath SB-1 to obtain the full useful life.

KODAK Rapid Fixing Bath F-7

This bath fixes much more rapidly than KODAK Fixing Bath F-5 or F-6, and its useful fixing capacity is considerably greater.

Water, about 50° C (125° F)	600 milliliters
KODAK Sodium Thiosulfate (Pentahydrated)	360.0 grams
Ammonium Chloride	50.0 grams
KODAK Sodium Sulfite (Anhydrous)	15.0 grams
*KODAK 28% Acetic Acid	48.0 milliliters
**KODAK Boric Acid, Crystals	7.5 grams
KODAK Potassium Alum, Fine Granular (Dodecahydrated)	15.0 grams
Cold water to make	1.0 liter

*To make approximately 28% acetic acid from glacial acetic acid, add 3 parts of glacial acetic acid to 8 parts of water.

**Use crystalline boric acid as specified. Powdered boric acid dissolves only with great difficulty and its use should be avoided.

Caution: With rapid fixing baths, do not prolong the fixing time for fine-grain film or plate emulsions or for *any* paper prints; with prolonged fixing, the image may have a tendency to bleach, especially at temperatures higher than 20° C (68° F). This caution applies particularly to warm-tone papers.

KODAK Rapid Fixing Bath F-9

If corrosion is encountered when KODAK Rapid Fixing Bath F-7 is used in stainless steel containers, it can be minimized by substituting 60 grams of ammonium sulfate for the 50 grams of ammonium chloride in each liter of solution. When this change is made, the resultant formula is known as KODAK Rapid Fixing Bath F-9.

KODAK Fixing Bath F-24

This bath can be used for films, plates, or papers when no hardening is desired. For satisfactory use, the temperature of the developer, rinse bath, and wash water should not be higher than 20° C (68° F).

Water, about 50° C (125° F)	500 milliliters
KODAK Sodium Thiosulfate (Pentahydrated)	240.0 grams
KODAK Sodium Sulfite (Anhydrous)	10.0 grams
KODAK Sodium Bisulfite (Anhydrous)	25.0 grams
Cold water to make	1.0 liter

KODAK Special Hardener SH-1

Water	500 milliliters
Formaldehyde, about 37% solution by weight	10.0 milliliters
KODAK Sodium Carbonate (Monohydrated)	6.0 grams
Water to make	1.0 liter

This formula is recommended for the treatment of negatives that normally would be softened by the chemical treatment given for the removal of stains or for intensification or reduction.

After hardening for 3 minutes, negatives should be rinsed and immersed for 5 minutes in a fresh acid fixing bath and then washed thoroughly before they are given any further chemical treatment.

KODAK Prehardener SH-5

Solution A	
Formaldehyde, about 37% solution by weight	5 milliliters
Solution B	
Water	900 milliliters
*0.5% solution of KODAK Anti-Fog, No. 2 (6-Nitrobenzimidazole Nitrate)	40.0 milliliters
KODAK Sodium Sulfate (Anhydrous)	50.0 grams
KODAK Sodium Carbonate (Monohydrated)	12.0 grams
Water to make	1.0 liter

*To prepare a 0.5% solution, dissolve 1 gram of KODAK Anti-Fog, No. 2, in 200 milliliters of water.

Directions for Mixing: The working solution should be prepared just before use by adding 5 milliliters of Solution A to 1 liter of Solution B and mixing thoroughly.

Directions for Use: Bathe the exposed film in KODAK Prehardener SH-5 for 10 minutes with moderate agitation. Then remove the film from the solution, drain for a few seconds, immerse in water for 30 seconds, drain thoroughly, and immerse in the developer. In general, up to 32° C (90° F), conventional developers such as KODAK Developer D-76, DK-60a, D-19, etc, can be used without modification.

Times of development will be about as follows:

Temperature	% of Normal Development Time*
24° C (75° F)	100%
26.5° C (80° F)	85%
29.5° C (85° F)	70%
32° C (90° F)	60%
35° C (95° F)	50%

*Normal development time recommended when the developer is used at 20 C (68 F) without a prehardener.

Following development, rinse, fix in an acid hardening fixing bath, wash, and dry in the usual way.

At Temperatures Above 35° C (95° F): Increase the concentration of KODAK Anti-Fog, No. 2, in the prehardener, using as much as double the normal formula concentration, if necessary, to control fog. Process as before, using a low-activity developer, such as KODAK Developer D-76, to avoid excessively short development times. The average development time at 43° C (110° F) after prehardening is about one-quarter of the normal time at 20° C (68° F).

In case the development time at elevated temperatures is too short for practical use, sodium sulfate can be added to the developer to extend the time of development.

Keeping Properties and Useful Capacity: The keeping properties are adequate for ordinary tray and tank practice. Gradual deterioration does occur on standing, but the bath will keep satisfactorily, if unused, in a closed bottle for 3 or 4 weeks at 35° C (95° F). For most applications, the useful capacity without replenishment is more than ten 8 x 10-inch (20.3 x 25.4-centimeter) films per 946 milliliters (1 quart) without serious change in properties.

KODAK Testing Solutions for Print Stop Baths and Fixing Baths

The KODAK Testing Solutions for Print Stop Baths and Fixing Baths provide a quick and accurate method for determining when such baths should be revived or discarded. An acid stop bath or fixing bath should not be overworked, since the use of an exhausted bath frequently leads to stains and markings in the prints. When produced by a fixing bath, such stains show up only after a period of time.

Since the appearance of a fixing bath, or of an acid stop bath without an indicator, changes very little during its useful life, some means of determining when it is unfit for further use should be employed. These solutions permit a quick check on the acidity of the stop bath and the silver content of the fixing bath.

KODAK Stop Bath Test Solution, SBT-1

Water (distilled or demineralized) at 26.5° C (80° F)	750 milliliters
Sodium Hydroxide	6.0 grams
With stirring add:	
Bromocresol Purple (EASTMAN Organic Chemical No. 745*)	4.0 grams
Mix for 15 to 20 minutes, then add phosphoric acid (86%)	3.0 milliliters
Water to make	1.0 liter

Caution: The Stop Bath Test Solution contains chemicals that can be hazardous.

Sodium hydroxide is caustic and is capable of causing severe burns in all tissues. Special care should be taken to prevent contact with skin or eyes. A face shield or goggles should be used when handling the solid compound.

Phosphoric acid is a strong, nonvolatile inorganic acid. It is corrosive to tissue and can cause severe skin or eye burns. Impervious gloves and goggles should be worn when handling the concentrated solution.

In case of contact with either of these chemicals, immediately flush the involved areas with plenty of water; for eyes, get prompt medical attention.

KODAK Fixer Test Solution, FT-1

Water at 26.5° C (80° F)	750 milliliters
Potassium Iodide	190.0 grams
Water to make	1.0 liter

How to Test a Print Stop Bath

Fill a clean, empty 30-ml vial about three-quarters full with the acid stop bath. To this add 2 drops of the KODAK Stop Bath Test Solution, SBT-1. An acid stop bath that is still useful will remain yellow. When the acid has been neutralized, the bath will turn purple.

Under a KODAK Safelight Filter OC (light amber), or equivalent, the yellow color is not noticeable but the purple color appears dark.

The KODAK Stop Bath Test Solution, SBT-1, can also be added directly to the tray containing the stop bath. Add the test solution directly to the stop bath, while stirring, as recommended in the table below:

Solution	Metric			U.S. Liquid		
Acid Stop Bath	1 l	2 l	4 l	1 qt	2 qt	1 gal
SBT-1	1 ml	2 ml	4 ml	20 drops	40 drops	80 drops

Again, if the liquid darkens under safelight illumination or turns a light purple in room light, the bath is exhausted and should be discarded. Prints should not remain in the stop bath containing the test solution much longer than 2 minutes; otherwise, slight yellow stains may result.

How to Test a Print Fixing Solution

Single-Bath Fixer: To 5 drops of KODAK Fixer Test Solution, FT-1, add 5 drops of the fixing bath to be tested and 5 drops of water. Discard the fixer if a yellow-white precipitate forms instantly. Any slight milkiness should be disregarded.

Two-Bath Fixer: First Bath: Test as described above for a single-bath fixer.

Second Bath: To 5 drops of KODAK Fixer Test Solution, FT-1, add 5 drops of the fixing bath to be tested to 15 drops of water.

If both tests result in a yellow-white precipitate, replace both with fresh fixing baths. If only the first bath forms a precipitate, replace the first bath with the second, and replace the second bath with a fresh bath.

Storage: Mixed solutions can be stored in brown, stoppered glass bottles for one year.

Processing For Long-Term Keeping

For long-term keeping of photographic prints, treatment in Hypo Eliminator HE-1 is recommended for complete removal of the residual hypo. Even with this treatment, the silver image can still be affected by atmospheric conditions. Therefore, the print should be treated in KODAK Gold Protective Solution GP-1 to protect the image with a gold coating that renders the image far less susceptible to attack by external forces.

KODAK Hypo Eliminator HE-1

Water	500 milliliters
Hydrogen Peroxide (3% solution)	125.0 milliliters
*Ammonia Solution	100.0 milliliters
Water to make	1.0 liter

Caution: Prepare the solution immediately before use and keep in an open container during use. Do not store the mixed solution in a stoppered bottle, or the gas evolved may break the bottle.

*Prepared by adding 1 part of concentrated ammonia (28%) to 9 parts of water.

Directions for Use: Treat the prints with KODAK Hypo Clearing Agent, as described on page 34, or wash them for about 30 minutes at 18.5 to 21° C (65 to 70° F) in running water flowing rapidly enough to replace the water in the tray or tank once every 5 minutes. Then immerse each print for approximately 6 minutes at 20° C (68° F) in the Hypo Eliminator HE-1 solution, and finally wash about 10 minutes before drying. At lower temperatures, increase the washing time.

Useful Capacity: Approximately thirteen 8 x 10-inch (20.3 x 25.4-centimeter) prints, or their equivalent, per 946 milliliters (1 quart).

KODAK Gold Protective Solution GP-1

Water	750 milliliters
*Gold Chloride (1% stock solution)	10.0 milliliters
KODAK Sodium Thiocyanate (Liquid)	15.2 milliliters
Water to make	1.0 liter

*A 1% stock solution of gold chloride can be prepared by dissolving 1 gram in 100 milliliters of water.

Add the gold chloride stock solution to the volume of water indicated. Dissolve the sodium thiocyanate *separately* in 125 milliliters of water. Then add the thiocyanate solution slowly to the gold chloride solution, stirring rapidly.

To Use: Immerse the well-washed print (preferably treated with Hypo Eliminator) in the Gold Protective Solution for 10 minutes at 20° C (68° F), or until a just-perceptible change in image tone (very slightly bluish black) takes place. Then wash for 10 minutes in running water and dry as usual.

Useful Capacity: Eight 8 x 10-inch (20.3 x 25.4-centimeter) prints per 946 milliliters (1 quart). For best results, mix the KODAK Gold Protective Solution GP-1 just before using it.

TESTS FOR SILVER

An overworked fixing bath contains complex silver thiosulfate compounds that are retained by the films or prints and cannot be removed completely by washing. These salts lead to stains which may not become evident for a period of time. The KODAK Testing Solutions for Print Stop Baths and Fixing Baths provide a quick and accurate method for determining when a print fixing bath should be discarded.

KODAK Residual Silver Test Solution ST-1

Water	125 milliliters
Sodium Sulfide (Anhydrous)	2 grams

Store in a small stoppered bottle for not more than 3 months.

To Use: Dilute 1 part of stock solution with 9 parts of water. The diluted solution keeps for a limited time, and should be replaced weekly.

Testing Films and Prints: To determine whether films and prints are thoroughly fixed, place a drop of the Residual Silver Test Solution ST-1 on the margin of a squeegeed film or print (or on an unexposed piece of photographic paper, of the same type as the prints being processed and treated in the same chemicals). Remove the solution with a clean white blotter after 2 or 3 minutes.

Any yellowing of the test spot, other than a barely visible cream tint, indicates the presence of silver. If the test is positive, residual silver can be removed by refixing the print or negative in fresh hypo and rewashing for the recommended time. Prints toned in a sulfide toner or selenium toner will not yield to this treatment, however, because the residual silver has been toned together with the image. The yellow stain so formed is permanent.

Testing with KODAK Rapid Selenium Toner

If you wish to use a more stable reagent than KODAK Residual Silver Test Solution ST-1, you can use a dilute solution of KODAK Rapid Selenium Toner to test whether prints are thoroughly fixed.

To use, dilute 1 part of KODAK Rapid Selenium Toner with 9 parts of water. These proportions are not critical. Using this solution, follow the directions given above for the use of KODAK Residual Silver Test Solution ST-1.

NOTE: The test fails where a very large excess of hypo is present, as in stabilized prints.

TEST FOR HYPO

The residual hypo content of films and prints can be accurately determined only by actually testing the processed photographic material. This is particularly true in the case of prints, because the paper support retains hypo in its fiber structure.

KODAK Hypo Test Solution HT-2

Water	750 milliliters
*KODAK 28% Acetic Acid	125.0 milliliters
KODAK Silver Nitrate, Crystals	7.5 grams
Water to make	1.0 liter

*To make approximately 28% acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with 8 parts of water.

Store in a screw-cap or glass-stoppered brown bottle, away from strong light. Do not allow the test solution to come in contact with hands, clothing, negatives, prints, or undeveloped photographic material; it will stain them black.

Testing Prints: To determine whether prints are thoroughly washed, wipe the excess water from the face (emulsion side) of an unexposed piece of the same paper being used in the batch of prints being processed, or from the extra margin area of one of the prints. Place 1 drop of the test solution on the face of the processed paper sample. Allow the solution to stand on the sample for 2 minutes, rinse to remove the excess reagent, and compare the stain with the tints shown in the KODAK Hypo Estimator, available from photo dealers.

If you want your prints to have good long-term keeping properties, use washing aids such as KODAK Hypo Clearing Agent and KODAK Hypo Eliminator HE-1. If the above spot test is used after washing aids other than KODAK Hypo Clearing Agent, it may give misleading results. The face may show less stain than a print washed only in water, and yet the hypo content of the two prints may be equal. In cases where, for this reason, results obtained with KODAK Hypo Test Solution HT-2 may be unreliable, you may prefer to measure the transmission density of the material after total immersion in the silver nitrate test solution

Testing the Degree of Washing of Films: After washing, cut off a small strip from the clear margin of the film and immerse a portion of it in a small volume of the test solution for about 3 minutes. Well-washed films, including those for record purposes, should show very little or no discoloration.

The spot technique should not be used on wet films because of the danger of spreading the reagent.

A quantitative test for residual chemicals in films and papers can be found in American National Standard PH4.8-1971, Methylene Blue Method for Measuring Thiosulfate and Silver Densitometric Method for Measuring Residual Chemicals in Films, Plates, and Papers. ANSI Standards are available from the American National Standard Institute, Inc., 1430 Broadway, New York, New York 10018.

Intensifiers & Reducers

With modern negative materials and printing papers, and modern control techniques for exposure and development, reduction or intensification operations are seldom needed, but they may occasionally be used to salvage a mistake when it is not possible to remake the negative.

In general, some increase in graininess may occur with intensifiers, especially in the treatment of coarse-grained emulsions. On the other hand, a decrease in graininess does not usually occur with reducers, although it has been observed in some instances.

Precautions: Intensification or reduction always involves some danger of ruining the image. Therefore, the best possible print should be made before attempting such treatments. In addition, to reduce the likelihood of staining or other damage, the following precautions should be observed: (1) The negative should be fixed and washed thoroughly before treatment and be free of scum or stain; (2) It should be hardened in the formalin hardener, KODAK Prehardener SH-1, before the intensification or reduction treatment; (3) Only one negative should be handled at a time, and it should be agitated thoroughly during the treatment. Following the treatment, the negative should be washed thoroughly and wiped off carefully before drying.

INTENSIFIERS

The mercury intensifier and the quinone-thiosulfate intensifier, In-6, are recommended where extreme intensification is desired but where permanence of the resulting image is not essential. If permanence is essential, either the chromium or the silver intensifier should be used.

KODAK Mercury Intensifier In-1

Bleach the negative in the following solution until it is white; *then wash it thoroughly.*

KODAK Potassium Bromide (Anhydrous)	22.5 grams
*Mercuric Chloride	22.5 grams
Water to make	1.0 liter

Following the bleach and wash, the negatives can be intensified in any of the following solutions. Each solution, as listed, gives greater density than the one preceding it.

(1) a 10% sulfite solution

(2) a developing solution, such as KODAK Developer D-72 diluted 1:2

(3) dilute ammonia [1 part of concentrated ammonia (28%) to 9 parts of water]

(4) for greatly increased contrast, the following solutions, used as directed:

Solution A

Water	500 milliliters
*Sodium Cyanide	15.0 grams

Solution B

Water	500 milliliters
KODAK Silver Nitrate, Crystals	22.5 grams

***Danger!** Mercuric chloride and sodium cyanide are poisonous materials and may be fatal if swallowed. Sodium cyanide reacts with acids to form the poisonous gas, hydrogen cyanide. Cyanide salts and solutions must never be used except in adequately ventilated areas. Mercuric chloride and sodium cyanide must not be allowed to contact the skin. Use impervious rubber gloves while handling these chemicals or their solutions. The outer surface of the gloves and the hands should be washed thoroughly after each use. Containers of mercury intensifier solutions should be adequately labeled as poisonous. If they are used in the home, they should be stored in a locked cabinet out of the reach of children. Read carefully any directions on the manufacturer's label for these substances. Follow regulations of local health authorities regarding disposal of waste solutions.

To prepare the intensifier, add the silver nitrate, Solution B, to the cyanide, Solution A, until a permanent precipitate is just produced; allow the mixture to stand a short time; then filter. The resultant solution is called Monckhoven's intensifier.

Redevelopment cannot be controlled as with the chromium intensifier, KODAK Chromium Intensifier In-4, but must go to completion.

KODAK Chromium Intensifier In-4

Stock Solution

Water to make	1.0 liter
KODAK Potassium Dichromate (Anhydrous)	90.0 grams
Hydrochloric Acid (concentrated)	64.0 milliliters

NOTE: See precautions on handling negatives given at left.

To Use: Take 1 part of stock solution to 10 parts of water.

Harden the negative first in the KODAK Special Hardener SH-1. Bleach thoroughly at 18.5 to 21° C (65 to 70° F), then wash 5 minutes, and redevelop fully in artificial light or daylight (not sunlight) in any quick-acting, nonstaining developer which does not contain an excess of sulfite. Then rinse, fix for 5 minutes, and wash thoroughly. Greater intensification can be secured by repeating the process.

Warning: Slow-working developers, such as KODAK Developer D-76, KODAK MICRODOL-X Developer, and KODAK Developer DK-20, should not be used, since they tend to dissolve the bleached image before the developing agents are able to act on it.

Negatives intensified with chromium are more permanent than those intensified with mercury.

KODAK Silver Intensifier In-5

The following formula is the only intensifier known that will not change the color of the image on positive film on projection. It gives proportional intensification and is easily controlled by varying the time of treatment. In-5 acts more rapidly on fine-grain materials and produces greater intensification than on coarse-grain materials. The formula is equally suitable for positive and negative film.

Stock Solution No. 1
(Store in a brown bottle)

KODAK Silver Nitrate, Crystals	60.0 grams
Distilled water to make	1.0 liter

Stock Solution No. 2

KODAK Sodium Sulfite (Anhydrous)	60.0 grams
Water to make	1.0 liter

Stock Solution No. 3

KODAK Sodium Thiosulfate (Pentahydrated)	105.0 grams
Water to make	1.0 liter

Stock Solution No. 4

KODAK Sodium Sulfite (Anhydrous)	15.0 grams
KODAK ELON Developing Agent	25.0 grams
Water to make	3.0 liters

NOTE: See precautions on handling negatives given on page 42.

To Use: Prepare the intensifier solution as follows: slowly add 1 part of Solution No. 2 to 1 part of Solution No. 1, shaking or stirring to mix the solutions thoroughly. A white precipitate will appear. This is then dissolved by adding 1 part of Solution No. 3. Allow the resulting solution to stand for a few minutes, until it clears. Then add, stirring constantly, 3 parts of Solution No. 4.

When the mixing procedure is completed, treat the film immediately. The intensifier solution is stable for approximately 30 minutes at 20° C (68° F).

The degree of intensification can be regulated by varying the time of treatment according to the density desired, but the time used should not exceed 25 minutes. When intensification is sufficient, immerse the film for 2 minutes, with agitation, in a 30% sodium thiosulfate solution. Wash it thoroughly.

The stability of the mixed intensifier, and the rate of intensification, are easily changed by varying the thiosulfate concentration. To obtain a more active, but less stable, working solution than the one above, use 90 grams of sodium thiosulfate (instead of 105 grams) in Stock Solution No. 3. Mix the working solution according to the procedure given above. This intensifier will keep for only 20 minutes at 20° C (68° F).

Whenever possible, use the intensifier in artificial light. The solution tends to form a precipitate of silver quite rapidly when it is exposed directly to sunlight.

KODAK Intensifier In-6

This type of intensifier produces the greatest degree of intensification of any known single-solution formula when used with high-speed negative materials. The intensified image is of a brownish hue, and is not completely permanent; it will, however, under normal storage conditions, remain in satisfactory condition for several years. The intensified image is destroyed by acid hypo; under no circumstance should the intensified negatives be placed either in fixing baths or in wash water contaminated with fixing bath.

KODAK Intensifier In-6 is not suitable for fine-grain materials or for use when only moderate intensification is desired.

Solution A

*Water, about 21° C (70° F)	750 milliliters
†Sulfuric Acid (concentrated)	30.0 milliliters
KODAK Potassium Dichromate (Anhydrous)	22.5 grams
Water to make	1.0 liter

Solution B

*Water, about 21° C (70° F)	750 milliliters
KODAK Sodium Bisulfite (Anhydrous)	3.8 grams
KODAK Hydroquinone	15.0 grams
KODAK PHOTO-FLO 200 Solution (undiluted)	3.8 milliliters
Water to make	1.0 liter

Solution C

*Water, about 21° C (70° F)	750 milliliters
KODAK Sodium Thiosulfate (Pentahydrated)	22.5 grams
Water to make	1.0 liter

*The water used for mixing the solutions for the intensifier should not have a chloride content greater than about 15 parts per million (equivalent to about 25 parts of sodium chloride per million); otherwise the intensification will be impaired. If in doubt as to chloride content, use distilled water.

†**Caution:** Always add the sulfuric acid to the water slowly, stirring constantly, and never the water to the acid; otherwise the solution may boil and spatter the acid on the hands or face, causing serious burns.

To Use: To 1 part of Solution A, add, stirring constantly, 2 parts of Solution B. Still stirring, add 2 parts of Solution C, and finally 1 part of Solution A. The prescribed order of mixing is important and should be followed.

The stock solutions will keep in stoppered bottles for several months; the mixed intensifier is stable for 2 or 3 hours without use. After using it once, discard the working solution, or it may leave a silvery scum on subsequent negatives.

To Intensify Negatives: First, wash the negatives to be treated for 5 or 10 minutes. Harden them for 5 minutes in KODAK Special Hardener SH-1, and wash them again for 5 minutes.

The greatest possible degree of intensification is achieved by treating the negatives for approximately

10 minutes at 20° C (68° F). If a lesser degree of intensification is desired, treat the negatives for shorter times. Agitate them frequently during treatment to prevent streaking. Treat only one negative at a time when processing in a tray.

When a satisfactory degree of intensification is reached, wash the negative for 10 to 20 minutes and dry as usual.

REDUCERS

Reducers are classified in one of three categories, depending on the way in which they affect the material being reduced:

(1) *Subtractive or cutting reducers.* These remove nearly equal quantities of silver from the high, intermediate, and low densities, respectively. They are useful for treating fogged or overexposed images. KODAK Reducer R-2 and KODAK Farmer's Reducer R-4a are in this category.

(2) *Proportional reducers.* These cut density proportionally, removing an equal percentage of silver from each image area. Thus, a very dense area will lose quantitatively more density than will a less dense area, although it will not lose a greater percentage of its density. Proportional reducers thus lower both gamma and visual contrast, and correct for overdevelopment. KODAK Farmer's Reducer R-4b, KODAK Reducer R-5, and KODAK Reducer R-8a are in this category.

(3) *Super-proportional reducers.* These remove proportionally *more* silver from a dense area than from a thin one. The denser an area of the image, the more vigorously the reducer acts on it. Super-proportional reducers are therefore useful for reducing highlight density without destroying shadow detail, and for treating overdeveloped negatives of contrasty subjects. KODAK Persulfate Reducer R-15 is in this category.

Ammonium Thiosulfate Reducer

This very useful reducer is easily prepared by adding citric acid to an ammonium thiosulfate rapid fixing bath, such as KODAFIX Solution.

The reducer gives off a strong odor of sulfur dioxide, and should be used in a well-ventilated room. Do not use it near sensitized photographic products. Before reducing the negative or print, clean it thoroughly; use KODAK Film Cleaner, if necessary, to remove any surface grease left from handling. Thoroughly prewet the material in diluted KODAK PHOTO-FLO Solution, in order to promote uniform reducing action.

Since the reducer is colorless, the course of the reducing action can be observed easily. When the desired degree of reduction is obtained, wash the material thoroughly, and dry.

Normal Ammonium Thiosulfate Reducer: for use in the removal of silver stains and dichroic fog, and for the reduction of prints and fine-grain negative materials.

To Make: Dilute 1 part of KODAFIX Solution with 2 parts of water, or dilute KODAK Rapid Fixer and add hardener, as recommended for the rapid fixing of negatives. To each liter of the diluted fixer add 15 grams of KODAK Citric Acid (Anhydrous).*

Removal of silver stains and dichroic fog. Immerse the negative or print in the solution and swab the surface with absorbent cotton to hasten removal of surface scum. The action is usually complete in 2 to 5 minutes. Remove the negative or print from the solution immediately if any reduction of low-density image detail is noted.

Reduction of prints and fine-grain negative materials. This solution is particularly useful for correcting slight overexposure or overdevelopment; strong reduction may cause loss of image quality.

Strong Ammonium Thiosulfate Reducer: for the reduction of negative materials.

To Make: Dilute the KODAFIX Solution or the Rapid Fixer as directed above, but add 30 grams of KODAK Citric Acid (Anhydrous)* per liter, instead of the 15 grams recommended.

The time of treatment will depend on the type of material and the degree of reduction desired. The reaction is very slow with high-speed materials.

More complete details on the characteristics of this type of reducer are given in the paper "An Ammonium Hypo Reducer," by Henn, Crabtree, and Russell, *PSA Journal* (Phot. Sci. Tech.) 17B, November, 1951.

*Possible sulfurization of the thiosulfate in the fixer can be avoided by dissolving the citric acid in a portion of the water used for dilution.

KODAK Reducer R-2

Stock Solution A

Water	1.0 liter
Potassium Permanganate	52.5 grams

Completely dissolve the permanganate crystals in a small volume of hot water (about 80° C or 180° F); then dilute to volume with cold water.

Stock Solution B

Water	1.0 liter
*Sulfuric Acid (concentrated)	32.0 milliliters

***Caution:** Always add the sulfuric acid to the water slowly, stirring constantly, and never the water to the acid; otherwise the solution may boil and spatter the acid on the hands or face, causing serious burns.

NOTE: See precautions on handling negatives given on page 42.

To Use: Mix 1 part of Solution A, 2 parts of Solution B, and 64 parts of water. Once mixed, the reducer must be used immediately. Place the negative in the solution, allowing it to remain there until the desired degree of reduction is attained. Next, immerse the negative for a few minutes in a fresh acid fixing bath (KODAK Fixing Bath F-5) to remove yellow stains. Wash the negative thoroughly, and dry it.

If the reduction proceeds too rapidly, increase the volume of water in the reducer.

Do not use this reducer as a stain remover; it tends to attack the image before it removes the stain. Use KODAK Stain Remover S-6 for removing stains.

NOTE: Negatives *must* be thoroughly washed before they are reduced; any hypo present will adversely affect the reducer. Hypo contamination in the permanganate solution will cause the formation of a surface scum; hypo in the reducer, left by poorly washed negatives, causes the formation of a reddish curd.

If proper precautions are observed, the separate stock solutions will keep and work perfectly for a considerable length of time. Do not attempt to store the combined solutions; they will not keep for long.

Follow the preceding instructions carefully. Otherwise, an iridescent scum may appear on the reduced negatives after they dry; this scum will be difficult, if not impossible, to remove.

KODAK Farmer's Reducer R-4a

Stock Solution A

KODAK Potassium Ferricyanide (Anhydrous)	37.5 grams
Water to make	500 milliliters

Stock Solution B

KODAK Sodium Thiosulfate (Pentahydrated)	480.0 grams
Water to make	2.0 liters

NOTE: See precautions on handling negatives given on page 42.

To Use: Take 30 milliliters of Stock Solution A, 120 milliliters of Stock Solution B, and water to make 1 liter. Add A to B, add the water, and *immediately* pour the mixed solution over the negative to be reduced, which should preferably be contained in a white tray. Watch the reducing action closely. When the negative has been reduced sufficiently, wash thoroughly and dry.

For less rapid reducing action, use one-half the above quantity of Stock Solution A, with the same quantities of Stock Solution B and water.

Solutions A and B should not be combined until they are to be used. They will not keep long in combination.

KODAK Farmer's Reducer R-4b

Farmer's Reducer can also be used as a two-bath formula (R-4b) to give almost proportional reduction and correct for overdevelopment. The single-solution Farmer's Reducer (R-4a) gives only cutting reduction and corrects for overexposure.

Solution A

KODAK Potassium Ferricyanide (Anhydrous)	7.5 grams
Water to make	1.0 liter

Solution B

KODAK Sodium Thiosulfate (Pentahydrated)	200.0 grams
Water to make	1.0 liter

NOTE: See precautions on handling negatives given on page 42.

Treat the negatives in Solution A with uniform agitation for 1 to 4 minutes at 18.5 to 21° C (65 to 70° F), depending on the degree of reduction desired. Then immerse them in Solution B for 5 minutes and wash thoroughly. The process can be repeated if further reduction is desired.

KODAK Reducer R-5

Stock Solution A

Water	1.0 liter
Potassium Permanganate	0.3 gram
*Sulfuric Acid (dilute solution)	16.0 milliliters

Stock Solution B

Water	3.0 liters
KODAK Potassium Persulfate	90.0 grams

*To make, take 1 part of concentrated sulfuric acid and, with caution to avoid contact with the skin, add it slowly to 9 parts of water with stirring. *Never add the water to the acid* because the solution may boil and spatter the acid on the hands or face, causing serious burns.

NOTE: See precautions on handling negatives given on page 42.

To Use: Add 1 part of Solution A to 3 parts of Solution B. When sufficient reduction is secured, clear the negative in a 1% solution of sodium bisulfite. Wash the negative thoroughly before drying.

KODAK Reducer R-8a

Water, about 32° C (90° F)	600 milliliters
KODAK Citric Acid (Anhydrous)	20.0 grams
Ferric Ammonium Sulfate	45.0 grams
*Potassium Citrate	75.0 grams
KODAK Sodium Sulfite (Anhydrous)	30.0 grams
KODAK Sodium Thiosulfate (Pentahydrated)	200.0 grams
Water to make	1.0 liter

*Sodium citrate should not be used in place of potassium citrate, because it will slow the rate of reduction considerably.

NOTE: See precautions on handling negatives given on page 42.

Dissolve chemicals in the order given.

Use full strength for maximum rate of reduction. Treat negatives 1 to 10 minutes at 18.5 to 21° C (65 to 70° F); then wash thoroughly. If slower action is desired, dilute 1 part of solution with 1 part of water. The reducer is especially recommended for the treatment of dense, contrasty negatives made on sheet films.

This is the only single-solution reducer that keeps well in a tank.

KODAK Persulfate Reducer R-15

Stock Solution A

Water	1.0 liter
KODAK Potassium Persulfate	30.0 grams

Stock Solution B

Water	250 milliliters
*Sulfuric Acid (dilute solution)	15 milliliters
Water to make	500 milliliters

*To make, take 1 part of concentrated sulfuric acid and, with caution to avoid contact with the skin, add it slowly to 9 parts of water with stirring. *Never add the water to the acid,* because the solution may boil and spatter acid on the hands or face, causing serious burns.

To Use: Take 2 parts of Solution A and add 1 part of Solution B. Only glass, hard rubber, or impervious and unchipped enamelware should be used to contain the reducer solution during mixing and use.

Treat the negative in the KODAK Special Hardener SH-1 for 3 minutes and wash thoroughly before reduction. Immerse in the reducer with frequent agitation and inspection (accurate control by time is not possible), and treat until the required reduction is almost attained; then remove from the solution, immerse in an acid fixing bath for a few minutes, and wash thoroughly before drying. Used solutions do not keep well and should be discarded promptly.

For best keeping in storage, the persulfate Stock Solution A should be kept away from excessive heat and light. Keeping life of Stock Solution A: about 2 months at 24° C (75° F).

Toners

KODAK Hypo Alum Sepia Toner T-1a

Cold Water	2.8 liters
KODAK Sodium Thiosulfate (Pentahydrated)	480.0 grams

Dissolve thoroughly, and add the following solution:

Hot water, about 70° C (160° F)	640 milliliters
KODAK Potassium Alum (Dodecahydrated)	120.0 grams

Then add the following solution (including precipitate) slowly to the hypo-alum solution while stirring the latter rapidly:

Cold water	64.0 milliliters
KODAK Silver Nitrate, Crystals	4.0 grams
Sodium Chloride	4.0 grams

After combining the above solutions, add water to make	4.0 liters

NOTE: Dissolve the silver nitrate completely before adding the sodium chloride, and immediately afterward add the solution containing the milky white precipitate to the hypo-alum solution as directed above. The formation of a black precipitate in no way impairs the toning action of the bath if the proper manipulation technique is used.

To Use: Pour the toner solution into a tray supported in a water bath and heat it to 49° C (120° F). At this temperature, prints will tone in 12 to 15 minutes, depending on the type of paper. Never use the solution at a temperature above 49° C (120° F), or blisters and stains in the prints may result. Do not continue toning longer than 20 minutes at this temperature.

This toner causes losses of density and contrast which can be corrected by increases in exposures (up to 15%) and developing time (up to 50%). The actual increases depend on the kind of paper.

Thoroughly fix the prints to be toned and wash them for 5 to 15 minutes before placing them in the toning bath. Soak dry prints thoroughly in water. Immerse the prints completely and separate them occasionally, especially during the first few minutes.

After prints have been toned, wipe them with a soft sponge and warm water to remove any sediment, and wash them for 1 hour in running water or treat them with KODAK Hypo Clearing Agent as recommended.

KODAK Sulfide Sepia Toner T-7a

Stock Bleaching Solution A

Water	2.0 liters
KODAK Potassium Ferricyanide (Anhydrous)	75.0 grams
KODAK Potassium Bromide (Anhydrous)	75.0 grams
Potassium Oxalate	195.0 grams
*KODAK 28% Acetic Acid	40.0 milliliters

*To make approximately 28% acetic acid from glacial acetic acid, add 3 parts of glacial acetic acid to 8 parts of water.

Stock Toning Solution B

Sodium Sulfide (Anhydrous)	45.0 grams
Water	500 milliliters

Prepare Bleaching Bath as follows:

Stock Solution A	500 milliliters
Water	500 milliliters

Prepare Toner as follows:

Stock Solution B	125 milliliters
Water to make	1.0 liter

First, wash thoroughly the print to be toned. Place it in the bleaching bath (Solution A) and allow it to remain until only a faint yellowish brown image remains. This operation will take about 1 minute.

NOTE: Do *not* use trays with any iron exposed; otherwise, blue spots may be formed on the prints.

Rinse the print *thoroughly* in clean, cold running water (at least 2 minutes).

Treat the print in the toning bath (prepared from Solution B) until the original detail returns. This will require about 30 seconds. Give the print an immediate and thorough water rinse; then treat it for 2 to 5 minutes in a hardening bath composed of 1 part KODAK Liquid Hardener and 13 parts water, or 2 parts KODAK Hardener F-5a stock solution and 16 parts water. The color and gradation of the finished print will not be affected by the use of this hardening bath. Remove the print from the hardener bath and wash it for at least 30 minutes in running water at 18.5 to 21° C (65 to 70° F).

For a packaged toner with similar characteristics, obtain KODAK Sepia Toner.

KODAK Polysulfide Toner T-8

Water	750 milliliters
Sulfurated Potassium (liver of sulfur)	7.5 grams
KODAK Sodium Carbonate (Monohydrated)	2.5 grams
Water to make	1.0 liter

This single-solution toning bath produces slightly darker sepia tones than the redevelopment-sulfide toner, KODAK Toner T-7a. It has the advantage, compared with hypo-alum toners, that it does not require heating, although raising the temperature to 38° C (100° F) reduces the time of toning to about one-fifth that necessary at 20° C (68° F).

To Use: Treat the well-washed black-and-white print for 15 to 20 minutes, with agitation, in the KODAK T-8 Toner bath at 20° C (68° F) or for 3 or 4 minutes at 38° C (100° F).

After toning, rinse the print for a few seconds in running water and place it for about 1 minute in a KODAK Hypo Clearing Agent bath, freshly mixed and kept for this purpose only, or in a solution containing 30 grams of sodium bisulfite per liter (1 ounce per quart) of water. Then treat the print for about 2 to 5 minutes in a hardening bath prepared by adding 1 part of KODAK Liquid Hardener to 13 parts of water, or 2 parts of KODAK Hardener F-5a stock solution to 16 parts of water. If any sediment appears on the print, wipe the surface with a soft sponge. Wash the print for at least 30 minutes at 18.5 to 21° C (65 to 70° F) before drying.

For a packaged toner with similar characteristics, obtain KODAK Brown Toner.

KODAK Gold Toner T-21

Stock Solution A

Warm water, about 50° C (125° F)	4.0 liters
KODAK Sodium Thiosulfate (Pentahydrated)	960.0 grams
KODAK Potassium Persulfate	120.0 grams

Dissolve the hypo completely before adding the potassium persulfate. Stir the solution vigorously while adding the potassium persulfate. If the solution does not turn milky, increase the temperature until it does.

Cool the above solution to about 27° C (80° F) and then add the solution below, including the precipitate, slowly and with constant stirring. *The bath must be cool when these solutions are added together.*

Cold water	64.0 milliliters
KODAK Silver Nitrate, Crystals	5.0 grams
Sodium Chloride	5.0 grams

NOTE: The silver nitrate should be dissolved completely before the sodium chloride is added.

Stock Solution B

Water	250.0 milliliters
Gold Chloride	1.0 gram

NOTE: Gold chloride is a deliquescent chemical; it will liquefy rapidly in a normal room atmosphere. Store the chemical in a tightly stoppered bottle in a dry atmosphere.

KODAK Gold Toner T-21 yields a pleasing range of tones from warm black to neutral brown with most warm-tone papers. It has little effect on cold tone papers. Gold toner is one of the few chemical formulas

that tones both highlights and shadows of the print at a uniform rate, thereby allowing the toning action to be stopped when the desired color has been attained.

To prepare a working solution, add 125 milliliters (4 fluidounces) of Stock Solution B slowly to the entire quantity of Solution A while stirring the latter rapidly.

Before using the bath, allow it to stand for about 8 hours. By this time, a yellow precipitate will have formed at the bottom of the container. Pour the clear solution off into another container and discard the precipitate.

To Use: Pour the toner into a tray supported in a water bath and heat the water to 43° C (110° F). During toning, maintain the water bath at this temperature.

Wash prints to be toned for a few minutes after fixing and before placing them in the toning solution. Soak dry prints thoroughly in water before toning.

Keep an untoned black-and-white print on hand for comparison during toning. Keep prints separated throughout the toning operation.

Some sediment will form in the toning tray, especially if many prints are toned. The sediment is harmless, but it may form a scum on the print surface. If so, wipe the print with a wet sponge or a wad of cotton immediately after toning.

When the desired tone is obtained (5 to 20 minutes), remove the prints and rinse them in cold water. After all prints have been toned, wash them for 1 hour in running water or use KODAK Hypo Clearing Agent as recommended. To prevent the formation of spots, be sure to sponge all the water off the prints before placing them in a dryer or between blotters.

Revive the bath at intervals by adding Stock Solution B. The quantity to be added will depend upon the number of prints toned and the time of toning. For example, when toning to a warm brown, add 4 milliliters (1 dram) of Stock Solution B after each fifty 8 x 10-inch prints or equivalent have been toned.

Tray Cleaners & Stain Removers

KODAK Tray Cleaner TC-1

Water	1.0 liter
KODAK Potassium Dichromate (Anhydrous)	90.0 grams
*Sulfuric Acid (concentrated)	96.0 milliliters

*__Caution:__ Always add the sulfuric acid to the solution slowly, stirring constantly, and never the solution to the acid; otherwise, the solution may boil and spatter the acid on the hands or face, causing serious burns.

To Use: Pour a small volume of the tray cleaner solution into the vessel to be cleaned. Rinse around so that the solution has access to all parts of the tray; then pour the solution out and wash the tray 6 or 8 times with water until all traces of the cleaning solution disappear. This solution will remove stains caused by oxidation products of developers and some silver and dye stains. It should *not* be used to clean the hands.

KODAK Tray Cleaner TC-3

Solution A*

Water	1.0 liter
Potassium Permanganate	2.0 grams
†Sulfuric Acid (concentrated)	4.0 milliliters

*Store the solution in a stoppered glass bottle away from the light.

†__Caution:__ Always add the sulfuric acid to the solution slowly, stirring constantly, and never the solution to the acid; otherwise, the solution may boil and spatter the acid on the hands or face, causing serious burns.

Solution B

Water	1.0 liter
KODAK Sodium Bisulfite (Anhydrous)	30.0 grams
KODAK Sodium Sulfite (Anhydrous)	30.0 grams

Cleaning Trays: To remove stains due to silver, silver sulfide, and many dyes, proceed as follows: pour a small quantity of Solution A into the vessel being cleaned and leave it there for a few minutes; rinse the vessel well, and pour in a quantity of Solution B approximately equal to the amount of Solution A used. Agitate until the brown stain is completely cleared, and wash the cleaned vessel thoroughly.

Several vessels can be cleaned consecutively without making up new solutions; the solutions should not, however, be stored for repeated use.

Prevention of Stains

Certain photographic chemicals, particularly developing agents, may cause brownish stains on the fingers or hands. Such stains usually result only after prolonged or repeated contact with the chemical, and are best prevented by avoiding contact with the chemicals and washing promptly when such contact

does occur. Should the skin come in contact with solutions or solid chemicals (especially developers or developing agents), wash at once with an acid skin cleaner. Rinse hands thoroughly after cleaning.

The use of clean rubber gloves, especially for mixing or pouring solutions and cleaning the darkroom, will protect the skin from contact with chemicals and subsequent staining. After use, and before removing the gloves, rinse the outer surfaces of the gloves with acid skin cleaner and water. Keep all working surfaces, such as bench tops, trays, tanks, and containers, clean and free from spilled solutions or chemicals.

KODAK Stain Remover S-6

KODAK Stain Remover S-6 is used to remove developer or oxidation stain from film.

Stock Solution A

Potassium Permanganate	5.0 grams
Water to make	1.0 liter

Stock Solution B

Cold water	500 milliliters
Sodium Chloride	75.0 grams
*Sulfuric Acid (concentrated)	16.0 milliliters
Water to make	1.0 liter

***Caution:** Always add the sulfuric acid to the solution slowly, stirring constantly, and never the solution to the acid; otherwise the solution may boil and spatter the acid on the hands or face, causing serious burns.

NOTE: See precautions on handling negatives given on page 42.

Mix the chemicals in the order given. When mixing Solution A, be sure that all the particles of permanganate are completely dissolved; undissolved particles may produce spots on the negatives.

When you are ready to begin the stain removal procedure, mix equal parts of Solution A and Solution B. This *must* be done immediately prior to use; the solutions do not keep long in combination.

To Use: Harden the film to be treated for 2 or 3 minutes in the formalin hardener (KODAK Special Hardener SH-1), and wash for 5 minutes. Mix Solution A and Solution B as directed above, keeping the solutions at 20° C (68° F). Immerse the film in this bleaching solution for 3 or 4 minutes. Next, to remove the brown stain of manganese dioxide formed on the negative in the bleach bath, immerse the negative in a 1% sodium bisulfite solution (make a 1% solution by adding 10 grams of sodium bisulfite to 1 liter of water). Remove, rinse well, and develop in strong light (preferably sunlight) with any nonstaining developer (such as KODAK DEKTOL Developer or KODAK Developer D-72) diluted 1:2 with water. Then wash thoroughly.

Warning: Slow-working developers, such as KODAK Developer D-76, KODAK MICRODOL-X Developer, and KODAK Developer DK-20, should not be used, since they tend to dissolve the bleached image before the developing agents are able to act on it.

KODAK Silver Stain Remover S-10

The following formula will remove brownish stains caused by splashing or spilling fixing bath on clothing. The stains are usually caused by silver compounds accumulated in a used fixing bath.

Water	750 milliliters
Thiourea	75.0 grams
KODAK Citric Acid (Anhydrous)	75.0 grams
Water to make	1.0 liter

To Use: Thoroughly wet the stained part of the fabric with this solution and wait for the stain to disappear. If the stain is old, you may have to repeat the application. Disappearance of an old stain may take longer than disappearance of a new one, so wait several minutes before repeating the application. When the stain has been satisfactorily removed, wash the garment thoroughly. This solution should not be allowed to come in contact with the skin.

NOTE: Some fabrics may be bleached or damaged by this solution. Before attempting to remove stains, test the chemical on a hidden portion of the garment (such as the shirttail, or a small scrap cut from a seam allowance) and determine whether the material is adversely affected.

Caution: Thiourea, which most preparations for removing fixer stains contain, is a powerful foggant of photographic emulsions. Therefore, KODAK Silver Stain Remover S-10, or any formula containing thiourea, must not be prepared or used in close proximity to areas where light-sensitive materials or processing chemicals are handled or used.

Warning: Thiourea may, with prolonged contact, irritate the skin. Be sure to acquaint yourself with any necessary handling precautions outlined on the product label.

Do not allow thiourea, or any solution containing thiourea, to come in contact with the eyes or skin. Avoid inhaling the dust. Use rubber gloves when preparing and using the solution. Afterwards, decontaminate the gloves by rinsing the outer surfaces with a dilute solution of sodium hypochlorite. The solution can be prepared by adding 30 milliliters of Clorox, 101, or similar liquid household bleach, to 1 liter of water (about 1 fluidounce to 1 quart). Finally, wash the gloves thoroughly with warm water.

Reversal Processing

The KODAK Direct Positive Film Developing Outfit or solutions made from the formulas listed below can be used to process small quantities of certain films to black-and-white reversal or positive images.

The KODAK Direct Positive Film Developing Outfit contains chemicals for the convenient preparation of the following solutions: 1 quart each of first developer, bleaching bath, and clearing bath, and 5 pints of redeveloper. The fixing solution can be prepared conveniently from KODAK Fixer. When using this outfit, follow the mixing instructions in the package.

If you prefer, you can make up suitable processing solutions according to the formulas given below. While the solutions made to the formulas are not identical chemically with those prepared from the packaged outfit, they produce the same photographic results. For processing instructions see KODAK Publications, J-6, *Small-Batch Reversal Processing of KODAK B/W Films* and D-9, *Small-Batch Processing of KODAK PLUS-X, TRI-X, and 4-X Reversal Motion Picture Films.*

KODAK Developer D-67

Water, about 50° C (125° F)	500 milliliters
KODAK ELON Developing Agent	2.0 grams
KODAK Sodium Sulfite (Anhydrous)	90.0 grams
KODAK Hydroquinone	8.0 grams
KODAK Sodium Carbonate (Monohydrated)	52.5 grams
KODAK Potassium Bromide (Anhydrous)	5.0 grams
KODAK Sodium Thiocyanate (Liquid) (51% Solution)	3 milliliters
Water to make	1.0 liter

This developer can also be made from a solution of KODAK Developer **D-19** (available in prepared form) as follows:

KODAK Developer **D-19** solution	1.0 liter
KODAK Sodium Thiocyanate (Liquid) (51% Solution)	3 milliliters

KODAK Replenisher D-67R For Use With KODAK Developer D-67

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	2.0 grams
KODAK Sodium Sulfite (Anhydrous)	90.0 grams
KODAK Hydroquinone	8.0 grams
KODAK Sodium Carbonate (Monohydrated)	52.5 grams
KODAK Sodium Thiocyanate (Liquid) (51% Solution)	7.5 milliliters
Water to make	1.0 liter

KODAK Bleach Bath R-9

Water	1.0 liter
KODAK Potassium Dichromate (Anhydrous)	9.5 grams
*Sulfuric Acid (Concentrated)	12.0 milliliters

***Caution:** Always add the sulfuric acid to the solution slowly, stirring constantly, and never the solution to the acid; otherwise, the solution may boil and splatter the acid on the hands or face, causing serious burns.

NOTE: KODAK Bleach for KODAK Direct Positive Paper (supplied in packages to make 1 gallon) can be used instead of this formula.

KODAK Clearing Bath CB-1

Water	1.0 liter
KODAK Sodium Sulfite (Anhydrous)	90.0 grams

NOTE: KODAK Clearing Bath for KODAK Direct Positive Paper (supplied in packages to make 1 gallon) can be used instead of this formula.

KODAK Fogging Developer FD-70a

Part A

EASTMAN Sodium Dithionite (90% minimum sodium hydrosulfite)* (Cat. No. P533)	6.0 grams

Part B

Water	900 milliliters
KODALK Balanced Alkali	15.0 grams
EASTMAN 2—Thiobarbituric Acid (Cat. No. 660)*	0.5 gram
Water to make	1.0 liter

Dissolve 6 grams of Part A in 1 liter of Part B not more than 2 hours before use. Discard after one use. If using smaller quantities, proportion accordingly: 3 grams/half liter.

Caution: KODAK Fogging Developer FD-70a contains compounds that are extremely active photographically. If the dry powder comes into contact with photographic materials, serious spotting may occur. Therefore, take care to prevent the powder suspended in the air from reaching photographic materials or areas where they are handled. Also, wash thoroughly not only your hands, but also the containers used for mixing and using this solution. Sodium Dithionite is a flammable solid. Use caution.

*EASTMAN Organic Chemicals can be obtained from many laboratory supply dealers.

KODAK Stop Bath SB-1

See page 37.

KODAK Fixing Bath F-5

See page 38.

KODAK Fixing Bath F-6

See page 38.

Appendix

This appendix contains formulas for developers which are no longer in general use. These formulas are included because they may be of interest to some people, and may be used by others for special purposes. Remember, however, that some of these developers may not yield satisfactory results with modern emulsions.

In some cases, the original instructions recommend using the developer at 18.5° C (65° F). If you use it at a higher temperature, adjust the development time accordingly. You may also find, with modern emulsions, that an adjustment in the recommended time will give you better results.

KODAK Developer D-1 (Three-Solution Pyro Developer)

This developer is intended for general tank or tray use.

Stock Solution A

KODAK Sodium Bisulfite (Anhydrous)	9.8 grams
Pyro (pyrogallol)	60.0 grams
KODAK Potassium Bromide (Anhydrous)	1.1 grams
Water to make	1.0 liter

Stock Solution B

Water	1.0 liter
KODAK Sodium Sulfite (Anhydrous)	105.0 grams

Stock Solution C

Water	1.0 liter
KODAK Sodium Carbonate (Monohydrated)	90.0 grams

For tank use, take 1 part of Stock Solution A, 1 part of Stock Solution B, 1 part of Stock Solution C, and 11 parts of water. Develop for approximately 12 minutes at 18.5° C (65° F).

For tray use, take 1 part of Stock Solution A, 1 part of Stock Solution B, 1 part of Stock Solution C, and 7 parts of water. Develop for approximately 6 minutes at 18.5° C (65° F).

Prepare fresh developer for each batch of film.

KODAK Developer D-7 (ELON Pyro Developer)

This developer is recommended for use with professional films and plates.

Stock Solution A

Water, about 50° C (125° F)	500 milliliters
KODAK ELON Developing Agent	7.5 grams
KODAK Sodium Bisulfite (Anhydrous)	7.5 grams
Pyro (pyrogallol)	30.0 grams
KODAK Potassium Bromide (Anhydrous)	4.2 grams
Water to make	1.0 liter

Stock Solution B

Water	1.0 liter
KODAK Sodium Sulfite (Anhydrous)	150.0 grams

Stock Solution C

Water	1.0 liter
KODAK Sodium Carbonate (Monohydrated)	90.0 grams

For tank use, take 1 part of Stock Solution A, 1 part of Stock Solution B, 1 part of Stock Solution C, and 13 parts of water. Develop for approximately 10 minutes at 20° C (68° F).

For tray use, take 1 part of Stock Solution A, 1 part of Stock Solution B, 1 part of Stock Solution C, and 8 parts of water. Develop for approximately 7 minutes at 20° C (68° F).

This developer can be used for two or three weeks if the volume is maintained by adding fresh developer in the proportion of 1 part each of Stock Solutions A, B, and C to 4 parts of water. It is usually necessary to increase the developing time as the developer ages.

KODAK Developer DK-15 (Tropical Developer)

This developer is intended for film and plate developing under tropical conditions.

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	5.7 grams
KODAK Sodium Sulfite (Anhydrous)	90.0 grams
KODALK Balanced Alkali	22.5 grams
KODAK Potassium Bromide (Anhydrous)	1.9 grams
*KODAK Sodium Sulfate (Anhydrous)	45.0 grams
Cold water to make	1.0 liter

*If crystalline sodium sulfate is preferred to the anhydrous form, use 105.0 grams instead of the 45.0 grams listed.

The average time for tank development is about 10 minutes at 20° C (68° F) and 2 to 3 minutes at 32° C (90° F). These times apply when the developer is fresh. Vary the time to produce the desired contrast.

When you are working at temperatures below 24° C (75° F), you may omit the sodium sulfate in order to obtain a more rapidly acting developer. The development time *without* the sodium sulfate is approximately 6 minutes at 20° C (68° F).

When you are developing film in trays, shorten the developing times given above by about 20 percent.

When development is completed, rinse the film or plate for just 1 or 2 seconds, and then immerse it in KODAK Hardening Bath SB-4 for 3 minutes. Omit the rinse if you find that the film tends to soften. Fix the film for at least 10 minutes in an acid hardening fixing bath, such as KODAK Fixing Bath F-5, and wash for 10 to 15 minutes in water not over 35° C (95° F).

Gas blisters will not form when this developer is used; KODALK Balanced Alkali does not evolve a gas

when it is treated with an acid. This is a distinct advantage when processing work must be done at high temperatures.

KODAK Developer D-16
(Tank Developer for Motion Picture Positive Film)

Water, about 50° C (125° F)	500 milliliters
KODAK ELON Developing Agent	0.31 gram
KODAK Sodium Sulfite (Anhydrous)	39.6 grams
KODAK Hydroquinone	6.0 grams
KODAK Sodium Carbonate (Monohydrated)	22.4 grams
KODAK Potassium Bromide (Anhydrous)	0.86 gram
Citric Acid	0.68 gram
Potassium Metabisulfite	1.5 grams
Water to make	1.0 liter

The average development time with D-16 Developer is 5 to 10 minutes at 18.5° C (65° F).

This formula is also recommended for negative development when medium or high contrast is required, for development of variable width sound negatives, and for both variable density and variable width sound prints.

KODAK Replenisher D-16R

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	0.3 gram
KODAK Sodium Sulfite (Anhydrous)	40.0 grams
KODAK Hydroquinone	9.0 grams
KODAK Sodium Carbonate (Monohydrated)	45.6 grams
Citric Acid	0.7 gram
Potassium Metabisulfite	1.5 grams
Water to make	1.0 liter

Add to the tank as needed to make up for the developer carried out by the film. When the replenisher is added in this manner, the developer activity will be maintained approximately constant with respect to positive film.

KODAK Fine Grain Developer DK-20

This developer is recommended for use with films and plates.

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	5.0 grams
KODAK Sodium Sulfite (Anhydrous)	100.0 grams
KODALK Balanced Alkali	2.0 grams
KODAK Sodium Thiocyanate (Liquid)	1.5 milliliters
KODAK Potassium Bromide (Anhydrous)	0.5 gram
Cold water to make	1.0 liter

The average development time with this developer is 15 minutes in a tank at 20° C (68° F).

The useful life of DK-20 can be increased 5 to 10 times by the use of KODAK Replenisher DK-20R.

KODAK Replenisher DK-20R

Water, about 50° C (125° F)	750 milliliters
KODAK ELON Developing Agent	7.5 grams
KODAK Sodium Sulfite (Anhydrous)	100.0 grams
KODALK Balanced Alkali	20.0 grams
KODAK Sodium Thiocyanate (Liquid)	7.6 milliliters
KODAK Potassium Bromide (Anhydrous)	1.0 gram
Cold water to make	1.0 liter

Deep Tank Replenishment: The replenisher should be added at a rate which will maintain constant development activity. Ordinarily, such activity will be maintained by adding 22.8 liters per 1000 rolls processed (approximately 516,000 square centimeters or 80,000 square inches), or 22 milliliters per roll. In many cases, this volume of replenisher will coincide with the quantity of developer lost through use. In other cases, you may find it necessary to remove some exhausted developer, or to add fresh developer, in addition to adding the replenisher, in order to maintain a constant level in the developer tank.

The replenisher should be added frequently and stirred in thoroughly when added. Replenish the developer after every batch of film developed, or after no more than 4 rolls (2064 square centimeters or 320 square inches) have been processed per 3.8 liters (1 gallon) of developer.

Small Tank Replenishment: After processing one roll (516 square centimeters or 80 square inches) of film, add 30 milliliters (1 fluidounce) of the replenisher to the empty KODAK Developer DK-20 stock solution bottle. Then pour enough used developer into the bottle to fill it to its original volume. Discard any excess developer. If you find you have less than the original volume, add fresh DK-20 to make up the difference. Repeat the replenishment procedure for each roll developed.

KODAK Developer D-51
(Amidol Developer for Bromide Papers)

Stock Solution

Water, about 50° C (125° F)	750 milliliters
KODAK Sodium Sulfite (Anhydrous)	120.0 grams
Diaminophenol Hydrochloride (Amidol)	37.5 grams
Cold water to make	1.0 liter

To Use: Take 180 milliliters of stock solution, 3 milliliters of 10% potassium bromide solution, and 750 milliliters of water. Develop for 1½ to 3 minutes at 21° C (70° F). The solution must be used immediately after the water is added; it oxidizes rapidly on exposure to air.

KODAK Developer D-61a

This developer is recommended for tank or tray use with professional films and plates.

Water, about 50° C (125° F)	500 milliliters
KODAK ELON Developing Agent	3.0 grams
KODAK Sodium Sulfite (Anhydrous)	90.0 grams
KODAK Sodium Bisulfite (Anhydrous)	2.0 grams
KODAK Hydroquinone	6.0 grams
KODAK Sodium Carbonate (Monohydrated)	14.0 grams
KODAK Potassium Bromide (Anhydrous)	2.0 grams
Cold water to make	1.0 liter

For tray use, dilute 1 part of stock solution with 1 part of water. Develop for about 6 minutes at 20° C (68° F).

For tank use, dilute 1 part of stock solution with 3 parts of water. Develop for about 12 minutes at 20° C (68° F). Add stock solution (diluted 1:3) at intervals to maintain the volume, or use the replenisher, KODAK Replenisher D-61R, to maintain the strength of the tank solution.

KODAK Replenisher D-61R

This formula is designed to replenish the *tank* dilution of KODAK Developer D-61a.

Stock Solution A

Water, about 50° C (125° F)	3.0 liters
KODAK ELON Developing Agent	6.0 grams
KODAK Sodium Sulfite (Anhydrous)	180.0 grams
KODAK Sodium Bisulfite (Anhydrous)	4.0 grams
KODAK Hydroquinone	12.0 grams
KODAK Potassium Bromide (Anhydrous)	3.0 grams
Cold water to make	6.0 liters

Stock Solution B

KODAK Sodium Carbonate (Monohydrated)	280.0 grams
Water to make	2.0 liters

To Use: Take 3 parts of Stock Solution A and 1 part of Stock Solution B, and add to the tank dilution of developer as needed. Do not mix Solutions A and B until you are ready to use them.

KODAK Developer D-78 (Glycin Negative Developer)

Water	750 milliliters
KODAK Sodium Sulfite (Anhydrous)	3.0 grams
Glycin (Athenon) (*p*-hydroxy phenylaminoacetic acid)	3.0 grams
KODAK Sodium Carbonate (Monohydrated)	7.2 grams
Water to make	1.0 liter

The average development time, using D-78, is 15 to 25 minutes at 18.5° C (65° F).

KODAK Developer D-79 (Pyro Tank Developer)

Water	750 milliliters
KODAK Sodium Sulfite (Anhydrous)	25.0 grams
Pyrogallol	2.5 grams
KODAK Sodium Carbonate (Monohydrated)	6.0 grams
KODAK Potassium Bromide (Anhydrous)	0.5 gram
Water to make	1.0 liter

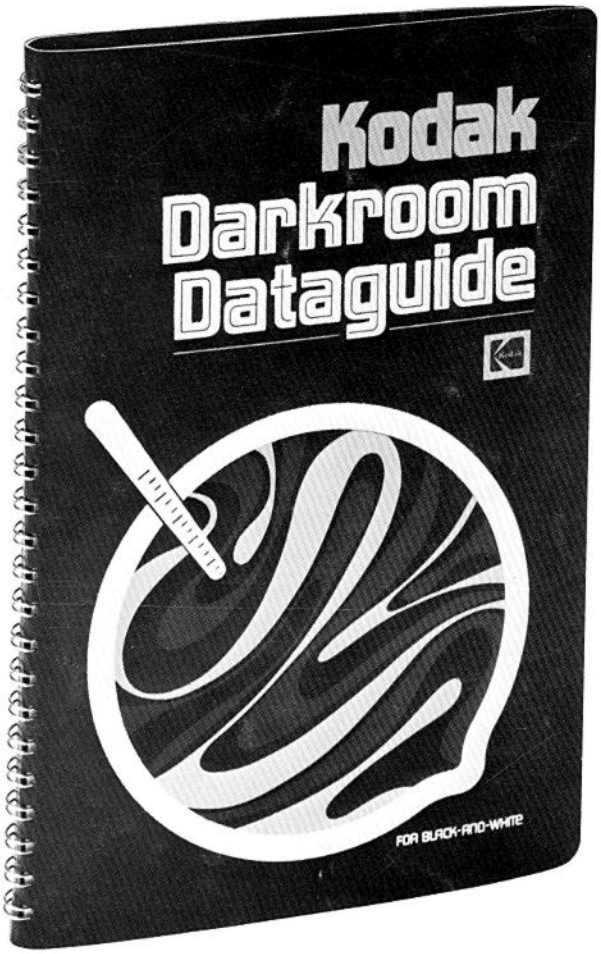
The average development time with D-79 is 9 to 12 minutes at 18.5° C (65° F). This solution oxidizes rapidly; use it within one hour after mixing.

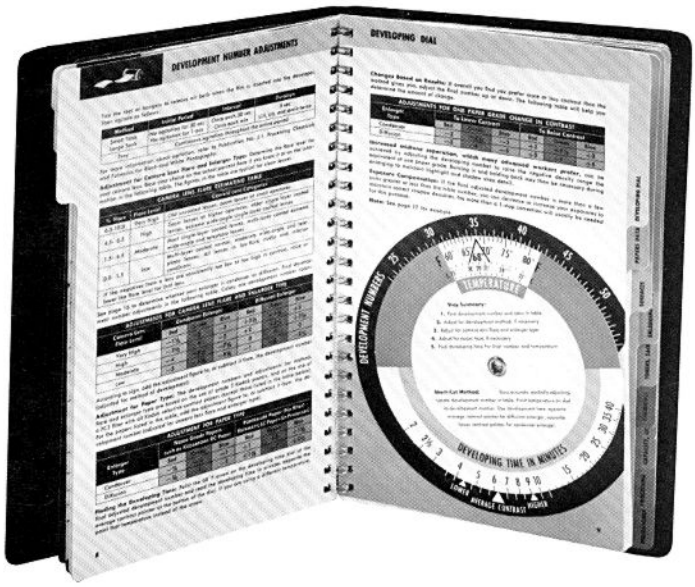
KODAK Developer D-82 (Maximum Energy Developer)

This developer is intended for use with badly underexposed films.

Water, about 50° C (125° F)	750 milliliters
Methyl Alcohol	48 milliliters
KODAK ELON Developing Agent	14.0 grams
KODAK Sodium Sulfite (Anhydrous)	52.5 grams
KODAK Hydroquinone	14.0 grams
KODAK Sodium Hydroxide (Granular)	8.8 grams
KODAK Potassium Bromide (Anhydrous)	8.8 grams
Cold water to make	1.0 liter

Use without dilution. Develop for 4 to 5 minutes in a tray at 18.5° C (65° F). The prepared developer does not keep for more than a few days. If methyl alcohol is not added, and the developer is diluted, the solution is not as active as in the concentrated form.





The KODAK Darkroom DATAGUIDE furnishes working information for the printing, processing and copying with black-and-white materials. As shown here, development times for various film and developer combinations can be easily determined with the Developing Dial that incorporates adjustments for camera lens flare, enlarger type, processing method, paper type, etc.

The KODAK Darkroom DATAGUIDE is a collection of useful information for anyone who processes black-and-white film or makes prints on Kodak black-and-white materials. There is a method of finding developing times that incorporates most of the contrast controlling factors in the photographic process. There is an enlarging dial that helps find the right exposure times for various *f*-numbers and at different magnifications. It also helps match the contrast grades of enlarging papers with negative density ranges. Further information is given on solution capacities and keeping times, tests for retained hypo, what toners work with what papers, and much more. In short, this is a complete encyclopedia of darkroom information for black-and-white printing and processing.

Professional and Finishing Markets Division

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