



Introduction to Specific Processes

Please read all the information below about the specific process you are going to use. Doing so will give you valuable insight on the process and rotary specific issues.

There are many 'standard' processes, and many more variations of standard processes. The process procedures listed below are the specific recommendations from JOBO for rotary processing with a JOBO processor. Other processing chemicals, equipment or techniques may require modified instructions for best results. These process procedures should produce optimal processing with your processor. It is unlikely that you will need to significantly modify the times or procedures listed below. If you have questions or concerns about your processing, when using these recommendations with a JOBO processor, contact JOBO for assistance.

JOBO distributes a line of photo chemicals manufactured in Germany by Tetenal, a world-renowned supplier of quality and innovative photo chemicals for over 70 years. Tetenal makes a complete line of color and black and white chemicals. In Germany, Tetenal has been working in close cooperation with JOBO research and development personnel for many years, to produce chemicals that are ideal for rotary processing.

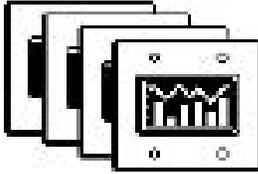
We list in this section the most popular Kodak and Tetenal chemical processes. You may use virtually any brand or type of photo chemicals with your processor. If you are using a color chemical not listed in this section, use the Kodak equivalent process listed below. Nearly all 'clone' or compatible type chemicals will process correctly with the Kodak equivalent times and temperatures. Always test the procedure with non-critical materials before committing irreplaceable materials with an untried process procedure and chemical combination. If a manufacturer's recommendations vary significantly from those listed in this section, contact the manufacturer for rotary-specific instructions.

For information about obsolete processes such as EP-2, C-22, E-2, E-3, or E-4, contact the supplier of the chemicals for assistance.

Note:

All photo processing chemicals and rinse water contain ingredients and by-products from the chemicals and processed materials. These components may be regulated by local, state, or federal agencies. There may be governmental regulations requiring certain procedures for the disposal of photo processing effluent. JOBO, understandably, cannot be aware of all possible requirements or restrictions. We therefore urge you to be informed, and follow any regulations in your specific location. Please check with your local government, or water control authority concerning these requirements. You may get Material Safety Data Sheets (M.S.D.S.) from your photo dealer, or from the chemical manufacturer. These sheets list the ingredients, and contain important information on proper storage and handling of specific chemicals. They also contain emergency phone numbers and information on poisoning and spillage. You may be required by law to have M.S.D.S. for all your chemicals, if used in a business. JOBO urges you to have Material Safety Data Sheets for every photo chemical you use, as reference.

Color Transparency Film Process (Slides)



There are two families of E-6 processing chemistries. The original and standard is a six chemical step process. The other family of 'rapid' or 'hobby' type chemistries use three chemical steps. Both families of chemicals will process E-6 type films. The choice of which chemical type to use revolves around the issues of convenience and control of the process. The three step chemicals are easier to use. You can 'fine tune' a six-step process with adjustments not available in the three step processes. Stabilizer, the final step of the process is not counted in the quantity of steps described above. Hence, a 'six' step process really requires seven chemical steps, and a 'three' step process really requires four chemical steps.

Process E-6, Six-Step

Recommended Process Times for Kodak E-6 and Tetenal E-6:

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2500 tanks, 4'/50 for 3000 drums
 - Temperature 38°C (100°F)
1. Pre-Warm 5:00
 2. First Developer 6:30 (All Fuji films only: use 7:30)
 3. Rinse 2:00 (4x 0:30)
 4. Reversal Bath 2:00
 5. Color Developer 4:00
 6. Conditioner 2:00 (or Pre-Bleach)
 7. Bleach 6:00
 8. Fixer 4:00
 9. Rinse 5:00 (10x 0:30)
 10. Stabilizer 1:00 (or Final Rinse) (Off processor at room temperature.)
 11. Dry As Needed

▲ [Back to Top](#)

Process Sequence for E-6 (six step)

Pre-Warm

A dry 'incubation' of the tank and film allows the tank and film to rise to the process temperature. The film is loaded and in the tank. No water or chemicals are put in the tank. It is rotated in the tempered water bath. This warms up and stabilizes the temperature of the film, reel, and tank. Doing this prevents a chilling of the first developer and underdevelopment of the film.

First Developer

In the first developer, the exposed silver halides of the film coating are reduced to metallic silver. The first developer represents

the most critical phase of the process. Time, temperature, and agitation, as well as storage of the working solutions affects density, contrast, maximum density, and fog.

First Rinse

The first rinse quickly interrupts the development and prevents first developer contaminating the reversal bath (or color developer in three bath chemicals). Insufficient first rinse can lead to changes in density as well as color.

Reversal

The reversal contains a chemical fogging agent that prepares the film for the color developer. Faults in this step can lead to an incomplete reversal and a general loss of density. There should be no rinse between the reversal bath and the color developer. The emulsion enters the color developer soaked with the reversal bath.

Color Developer

In this processing step, the remaining silver salts are converted to metallic silver. The color developing substances react with the film's color couplers and dyes. Changes in the color developer step affect color balance, contrast, minimum and maximum density, and evenness of the development.

Conditioner (Pre-bleach)

In the conditioner, the metallic silver is prepared for the bleach stage. The conditioner maintains the pH value of the bleach by avoiding a carryover of color developer into the bleach bath.

Note: Kodak has changed some of the chemicals in their E-6 process. The step that we are calling conditioner is now called 'Pre-bleach.' The same conditioner actions take place. The work previously done by the formaldehyde in the stabilizer step (the last step of the process) now takes place in the pre-bleach step. (As of this writing, only Kodak and L. B. Russell have made this change in the E-6 process.)

Bleach

In the bleach, the metallic silver is transformed to silver halide that is removed by the fixing bath. Changes in the bleach produce the following problems: Silver residue, low maximum density in reds, fogging in yellows, and high maximum density in blues.

Fixer

In the fixer, the silver halide in the emulsion is removed. Insufficient fixer times or incorrect dilution may lead to the following problems: Excessive blue density, and yellow fog, with spots caused by silver halide residues that become visible in low density areas.

Second Rinse

The second rinse removes the remaining chemicals and should continue for at least five minutes. (Ideally, 10 changes of water, each lasting about 30 seconds.)

Stabilizer (Final Rinse)

The stabilizer increases dye stability and contains a wetting agent. To avoid drying spots or damage on film surfaces, the stabilizer should be replaced at regular intervals. In the Kodak (and L. B. Russell) E-6 process, the stabilizer is replaced by the final rinse step, which contains no formaldehyde, only a surfactant (wetting agent).

▲ [Back to Top](#)

Process Information for E-6 (six step)

If you are using the six-step E-6 Chemicals, we suggest you get Kodak's Manual Z-119. It contains detailed information on E-6 chemicals, steps, and process control.

Determine the first developer time. Although both chemical manufacture's recommend a first developer time of 6:00, JOBO USA recommends 6:30 as a starting time (7:30 for Fuji films only). You should test for your best first developer time. The time of the first developer is critical, but our customers reports satisfactory results with first developer times ranging from 5:30 to 7:30 for normal exposures. You may need a longer first developer time for Fuji brand films than other brands of film.

Kodak reversal bath should be mixed to a 60% solution. The recently released Kodak 5 Liter Kit should **not** have the reversal diluted, use it a full strength. Tetenal reversal is used at full strength.

Note: Example of a 60 % solution: Start with 1000 ml of normal strength (mixed as instructions direct) reversal bath. Add to it 600 ml of water. This yields a total of 1600 ml of a 60% solution.

Color developer is used for a reduced time of four minutes because of the effect that constant agitation has on it. Any time from four to six minutes will work.

With all rinses, the numbers of changes of water are more important than the time. We suggest changing the rinse water every 30 seconds for the duration of the rinse time. It is critical to maintain the correct temperature in the first rinse. Deviations from the prescribed first rinse temperature could cause a shift in the color balance of the film. The first rinse should be maintained at plus or minus 1°C (2° F). The remaining rinse should be maintained at plus or minus 5° C (10°F).

Note:

All modern color process bleach or bleach-fix chemicals (with the exception of Ilfochrome bleach) require oxygenation (exposure to oxygen) to perform its function properly and completely. Unlike developer or other chemistries, you should intentionally introduce air (with its oxygen) to the bleach or bleach-fix. Oxygenation is easily accomplished while diluting the stock solution. Place the bleach or bleach-fix in a larger (about twice the volume of the mixed solution) sealable container. Seal the container and shake vigorously for about thirty seconds. For situations where this procedure is not practical, an inexpensive aquarium 'bubbler' may be used to aerate the solution. Leave the bubbler on for about a half hour. If the bleach or bleach-fix has not been aerated for a week or longer, repeat the procedure before using the chemical. If you re-use the bleach (not recommended) it is even more important to do this procedure.

Film should be stabilized (or immersed in final rinse) outside the processor, out of the tank, off the reels and at room temperature. Do not agitate.

WARNING: Stabilizer contains formaldehyde, a known carcinogen. Use only with good ventilation. We suggest that you use rubber or neoprene gloves and apron, and eye goggles.

Note:

Kodak and L. B. Russell E-6 Conditioners have been changed to 'Pre-Bleach' and contain the formalin treatment that stabilizes the film. The stabilizer was changed to 'final rinse.' The final rinse in the Kodak and L. B. Russell chemicals do not contain formaldehyde. It is a rinse that contains a surfactant. It acts much like Kodak Photo-Flo, helping to prevent water spots on the film while drying. Do not use final rinse as a substitute for stabilizer in other (non Kodak E-6 or L. B. Russell) processes.

Caution: Stabilizer (or final rinse, or any Photo-Flo type surfactant) should always be used in the following way: Use a dedicated container for the solution. This solution should be stored and used off the processor (at room temperature). Remove the film from the reels before immersing the film in the solution. If reels or tanks are immersed in these solutions, they will eventually cause processing contamination effects. The reels will become difficult to load. Rinsing or cleaning the reels or tanks after processing will not eliminate this problem.

Note:

If you are using stabilizer, you do not need an additional wetting agent. Stabilizer contains a wetting agent. Do not rinse the film after treating it with stabilizer or wetting agent, as this would remove the surfactant included for spot-free drying.

It is good practice to be consistent in processing procedures. However, it may be useful to know that with the exception of the developers, all steps in the E-6 process (both 3 bath and 6 bath) are 'taken to completion.' That is, once the action of the chemical or rinse has done what it is supposed to (had its effect), further time in the bath or rinse will have no additional benefit or harm. If you are to err in the timing of the process steps other than the developers, it is safer to go longer, not shorter. Be aware however, that very long (over one hour) immersion times in any solution or water could cause excessive softening of the emulsion or other problems, and should be avoided.

Caution: We have had a few reports of poor color quality when processing Fuji E-6 films with Kodak E-6 films in the same tank in the same process run (same batch of chemicals). There may be a harmful interaction between emulsion types of different brands when processed in a small volume of chemicals. To be as safe as possible, do not mix brands of film in the same tank in the same process run for E-6 processing. If you reuse chemicals (not recommended), do not mix film brands in the same batch of chemicals. This caution does not include stabilizer, final rinse, or wetting agent.

 [Back to Top](#)

Process Times for E-6 (three-step)

Caution: Both Kodak and Fuji do not recommend processing Lumiere, Elite, Velvia, Sensia, Provia and other tabular grain-type films in any three-step E-6 type chemicals. For these films, or any critical work, JOBO recommends using the six-step E-6 process (see above). For some amateurs and small volume professional photo processors, the three-step chemical may produce acceptable results. However, the color balance may not be optimal, and the complete clearing of residual silver in the film may take longer in the bleach-fix step than the recommended times.

▲ [Back to Top](#)

Recommended Process for Tetenal Three Step:

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2500 tanks, '4'/50 for 3000 drums
 - Temperature 38°C (100°F)
1. Pre-Warm 5:00
 2. First Developer 6:30 (All Fuji films only: use 7:30)
 3. Rinse 3:00 (6x 0:30)
 4. Color Developer 4:00
 5. Rinse 1:00 (2x 0:30)
 6. Bleach-Fix 6:00
 7. Rinse 5:00 (10x 0:30)
 8. Stabilizer 1:00 (Off processor at room temperature.)
 9. Dry As needed

▲ [Back to Top](#)

Process Sequence for E-6 (three step)

All that takes place in the full six-step E-6 Process also takes place with this three bath process. However, some of the actions of the chemicals are combined in one chemical step with the advantage of fewer items to mix and handle to process film. The disadvantage is the lack of fine control of color produced with the combination of chemical steps.

For the action taking place in each of the baths, refer to the Process E-6 six-step sequence.

The first developer is the same for both. The work of the reversal, color developer, and conditioner is all done in the color developer in the three-step Chemicals. The work of the bleach and the fixer is done in the single bath bleach-fix in the three-step chemical agent. Also note the recommended first developer time change for all Fuji brand films.

▲ [Back to Top](#)

Process Information for E-6 (three step)

Determine the first developer time. Although some chemical manufacture's recommend a first developer time of 6:00, JOBO USA recommends 6:30 as a starting time (7:30 for Fuji films only). You should test for your best first developer time. The time of the

first developer is critical, but our customers reports satisfactory results with first developer times ranging from 5:30 to 7:30 for normal exposures. You may need a longer first developer time for Fuji brand films than other brands of film.

With all rinses, the number of changes of water is more important than the time. We suggest changing the water rinse every 30 seconds for the duration of the rinse time. It is critical to maintain the correct temperature in the first rinse. Deviations from the prescribed first rinse temperature could cause a shift in the color balance of the film. The first rinse should be maintained at $\pm 1^{\circ}\text{C}$ (2°F). The remaining rinses should be maintained at $\pm 5^{\circ}\text{C}$ (10°F).

Note:

All modern color process bleach or bleach-fix chemicals (with the exception of Ilfochrome bleach) requires oxygenation (exposure to oxygen) to perform its function properly and completely. Unlike developer or other chemistries, you should intentionally introduce air (with its oxygen) to the bleach or bleach-fix. Oxygenation is easily accomplished while diluting the stock solution. Place the bleach or bleach-fix in a larger (about twice the volume of the mixed solution) sealable container. Seal the container and shake vigorously for about thirty seconds. For situations where this procedure is not practical, an inexpensive aquarium 'bubbler' may be used to aerate the solution. Leave the bubbler on for about a half hour. If the bleach or bleach-fix has not been aerated for a week or longer, repeat the procedure before using the chemicals. If you re-use the bleach-fix (not recommended) it is even more important to do this procedure.

We strongly suggest that a stabilizer be used. Failure to use stabilizer will result in rapid fading of the image. A formaldehyde-based stabilizer solution should be used. (All Tetenal E-6 Kits include stabilizer.)

WARNING: Stabilizer contains formaldehyde, a known carcinogen. Use only with good ventilation. We suggest you also use rubber or neoprene gloves and apron, and eye goggles.

Note: Stabilizer has a wetting agent (surfactant) in it to promote spot-free drying. It is not necessary to add a wetting agent to the stabilizer, or use any other bath, treatment, or rinse, after the stabilizer. The residual formaldehyde in the emulsion will help to inhibit the growth of microorganisms.

Caution: Stabilizer (or Kodak Final Rinse, or any Photo-Flo type surfactant) should always be used in the following way: Use a dedicated container for the solution. This solution should be stored and used off the processor (at room temperature). Remove the film from the reels before immersing the film in the solution. If reels or tanks are immersed in these solutions, they will eventually cause processing contamination effects. The reels will become difficult to load. Rinsing or cleaning the reels or tanks after processing will not eliminate this problem.

Caution: We have had a few reports of poor color quality when processing Fuji E-6 films with Kodak E-6 films in the same tank in the same process run (same batch of chemicals). There may be a harmful interaction between emulsion types of different brands when processed in a small volume of chemicals. To be as safe as possible, do not mix brands of film in the same tank in the same process run for E-6 processing. If you reuse chemicals (not recommended), do not mix film brands in the same batch of chemicals. This caution does not include stabilizer, final rinse, or wetting agent. Also note the recommended first developer time change for all Fuji brand films.

Caution: Repeated use of stabilizer on plastic reels and tanks can lead to the buildup of a sticky residue which makes the reels difficult to load and increases the possibility of back contamination (stabilizer contamination of first developer). Rinsing alone will not remove all stabilizer from a reel or tank. Stabilize your film off the reel in a tray or tank used only for stabilizer. Failure to use stabilizer will result in rapid fading of images. (In Kodak six-step E-6, pre-bleach and final rinse together meet the chemical need for image stability.)

 [Back to Top](#)

Process Control for E-6 (six and three step)

For most purposes, the information included in this manual is sufficient for you to produce reliable and excellent quality E-6 films. Complete coverage of process control with the E-6 process is an involved subject. It would be impossible to cover all aspects of E-6 process control in this instruction manual. For critical fine tuning of the E-6 process, there are many techniques and monitoring procedures that are employable. The bulk of these procedures are covered in depth in several excellent books, available from Kodak, Fuji and others. Some of these publications are:

- Kodak E-6 Manual, publication number Z-119
- Processing Manual for Process CR-56/E-6, from Fuji

▲ [Back to Top](#)

General things to note about E-6 films and process:

Each slide film has its own specific characteristics. There are noticeable differences from brand to brand, 'pro' to 'amateur,' family or speed group. The way colors are rendered (warm, cool or neutral), the saturation of the colors (richness or vividness), the contrast (high, low or medium) each contribute to a unique 'personality.' Be aware that the color balance or speed (effective exposure index) can change slightly from one emulsion batch to another within the same film type. Small changes can sometimes be noted within a single emulsion batch if storage conditions have changed or the film has aged.

All films designated 'Process E-6' are indeed able to be processed in E-6 chemicals (See the caution about three step process of certain films in on page 41 and the caution about mixing brands of film on page 41.) However, to achieve the most demanding control and accuracy, you may want to adjust your procedure specifically to the film type and emulsion batch being processed. If you work with a variety of emulsions you may want to find the best compromise in process procedure that produces satisfactory results for the different emulsions, or alternatively, segregate and fine-tune for each emulsion type. Commercial establishments that may have any type of film come to them for processing will most likely wish to standardize on a process procedure proven satisfactory for the most commonly presented film types.

Using test exposures and test developing, it is possible to optimize processing control for a specific emulsion batch. For critical applications, buy a large batch of a specific emulsion number. Fine-tune your process for this emulsion. Another method of correcting color balance of films is to use correcting filters on the camera lens.

Process Control Strips are available from Kodak, Fuji, and Agfa. These strips, when used with proper monitoring equipment and logging are useful to get and keep an E-6 process 'in control.' However, the use of control strips without essential equipment (such as a densitometer) is of limited practical use. If you wish to use process control strips you should have at least one of the books from Kodak or Fuji mentioned above. These manuals cover the correct use and interpretation of process control strips. If you do not have the proper equipment for control strip analysis, you are better off using your own test procedures (outlined above). Use the film(s) that you normally shoot or process to evaluate the appropriateness of your processing procedure. Also note that a process which is indicated as 'in control' by monitoring control strips may not be optimum for your specific film choice or personal preference.

▲ [Back to Top](#)

Push or Pull Processing for E-6 (six or three step)

Push or pull processing (one or more F-stops) of E-6 films should be considered a salvaging procedure to correct for incorrect exposure of the film. Under poor lighting conditions (or the lack of an appropriate speed film) it may be necessary to underexpose the film and 'correct' for the under-(or over-) exposure with adjustments in the processing.

The best quality processing will be derived from a combination of correct camera exposure and normal processing. The greater the push or pull, the more likely the results will be unsatisfactory. Use push or pull processing only when necessary to accommodate exposure deficiencies, or to exploit the 'artistic quality' (less realistic appearance) of the altered images.

Adjustments made to the E-6 process for push or pull processing are essentially the same for both the six and three step versions. The length of time in the first developer determines the effective exposure index. Note that some film types or brands may have different 'normal' first developer times, thus the modified first developer times for pushing or pulling these films will be different also. The color developer time is adjusted for significant pushing of the film only. All other steps and times are unchanged.

Changing the first developer time causes a change in sensitivity in the following way:

- A 'Push' of one F-stop (2 x ASA) is obtained by a 30% increase in normal first developer time.
- A 'Push' of two F-stops (4 x ASA) is obtained by an 80% increase in normal first developer time.
- A 'Pull' of one F-stop can be compensated for by reducing the normal first developing time by 30%.

Fractional F-stop push or pull first developer times may be calculated by adding or subtracting 10% for 1/3 F-stop, 15% for 1/2 F-stop, and 20% for 2/3 F-stop. A fractional F-stop adjustment may be added or subtracted to the full F-stop(s) Push or Pull times as required.

For all push processes of one or more F-stops, increase the color developer Time to six minutes. Do not decrease the color developer time for pull processing.

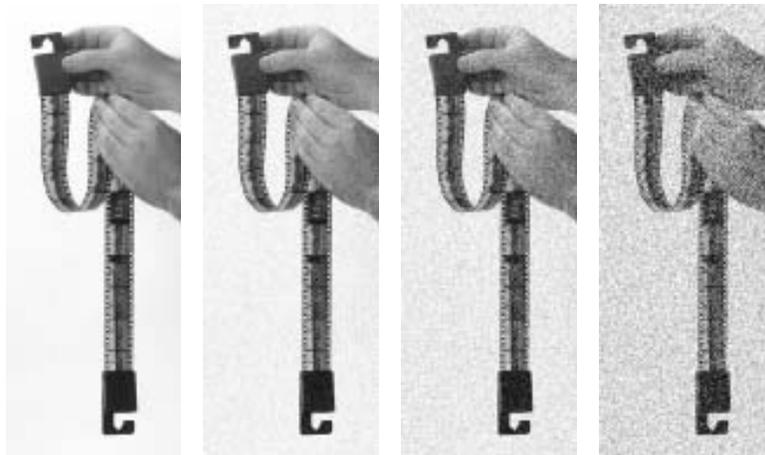
Caution: The above processing information should not be used with Kodak Ektachrome P800/1600 professional film, or Fujichrome 1600. ('Normal' use of these films requires push processing.) We suggest you get specific processing information from the manufacturers, or refer to Kodak Manual Z-119, or Fuji Processing Manual for Process CR-56/E-6.

Caution: Any process which changes the effective exposure index (ASA) of the film may produce less than optimum images. There could be color balance shifts. Contrast and maximum density will be altered. The need for accuracy of the camera exposure necessary for a correct exposure is increased. The correct exposure for a push process may need to be a compromise, sacrificing shadow detail for highlight, or vice versa. Higher levels of contrast in the lighting during exposure may make it impossible to render all portions of the picture (darkest to lightest) with a distinct image. Highlight details could go 'clear' and/or shadow details could lack density and discernible content. Any push process will decrease, to some extent, the maximum density of the image. The apparent 'grain' structure of the images will be enlarged. Color shifts may occur. With any pull process, contrast is decreased. Color saturation is diminished. Color shifts may occur. The apparent 'grain' structure of the images will not be reduced.

Since there can be color shifts and contrast changes when using different first developer times, we recommend determining the proper first developer time (for push or pull processing) by test developments using the same film exposed under the same lighting conditions, using the same exposure metering techniques. Camera-mounted filtration may be required to produce the most accurate color balance. If it is not possible to test a specific film, lighting, and exposure combination, use the recommendations listed above. Generally, they will produce acceptable results.

Optionally, you may 'tweak' the density of the processed film by making very small (fractional F-stop) adjustments to the first developer time. Usually these minor adjustments will not adversely impact the quality of the processed image. This type of adjustment is usually done to fine tune all the small variances in a specific processing setup and procedure. Once this adjustment has been determined, the new first developer time becomes your 'normal' time. All push and pull calculations are then derived from the new 'normal' time.

See illustrations below for a sample of a 'pushed grain effect.'



Approximate representation of increased grain with push processing, under a magnified view.

Color Negative Film Process

● Process Times for C-41 Compatible Chemicals

Recommended Process for Kodak C-41, Tetenal C-41 13.5 Liter Kit:

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2500 tanks, '4'/50 for 3000 drums
 - Temperature 38.0°C. (100.4°F)
1. Pre-Warm 5:00
 2. Developer 3:15
 3. Bleach 6:30
 4. Rinse 3:00 (6x 0:30)
 5. Fixer 6:30
 6. Rinse 5:00
 7. Stabilizer 1:00 (Off processor at room temperature.)
 8. Dry As Needed

Recommended Process for Tetenal Mono C-41 (discontinued during 2001):

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2500 tanks, '4'/50 for 3000 drums
 - Temperature 38.0°C (100.4°F)
1. Pre-Warm 5:00
 2. Developer 3:15
 3. Bleach-Fix 3:30
 4. Rinse 3:00 (6x 0:30)
 5. Stabilizer 1:00 (formaldehyde-free) (Off processor at room temperature.)
 6. Dry As needed

Recommended Process for Tetenal C-41 Press Kit:

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2500 tanks, '4'/50 for 3000 drums
 - Temperature 38.0°C (100.4°F)
1. Pre-Warm 5:00
 2. Developer 3:15
 3. Bleach-Fix 6:00
 4. Rinse 3:00 (6x 0:30)
 5. Stabilizer 1:00 (Off processor at room temperature.)
 6. Dry As needed

Recommended Process for Tetenal C-41 Rapid and Tetenal 5 Liter C-41 kits:

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2500 tanks, '4'/50 for 3000 drums
- Temperature 38.0°C. (100.4°F)

1. Pre-Warm 5:00
2. Developer 3:15
3. Bleach/fix 4:00
4. Rinse 3:00
5. Stabilizer 1:00 (formaldehyde-free) (Off processor at room temperature.)
6. Dry As Needed

Process Sequence for C-41 Compatible Chemicals

Pre-Warm

A dry 'incubation' of the tank and film allows the tank and film to rise to the process temperature. The film is loaded and in the tank. No water or chemicals are put in the tank. It is rotated in the tempered water bath. This step warms up and stabilizes the temperature of the film, reel, and tank. The pre-warm prevents a chilling of the developer and underdevelopment of the film.

Color Developer

Contrast and density are determined by color development.

Bleach

In the bleach, the metallic silver is converted to silver salts to be removed by the fixing bath.

Rinse

The bleach is removed from the film.

Fixer

In the fixer, the silver converted by the bleach, and all remaining silver salts are removed from the film.

Rinse

The rinse washes out the remaining chemicals and should be at least three minutes long. (Use six changes of water.)

Stabilizer

The stabilizer serves as a wetting agent, preserves the dyes, inhibits bacteria, and hardens the film.

Dry

As needed.

With all rinses, the number of changes of water is most important. We suggest that you change the rinse water at 30-second intervals for the full time of the rinse.

The above description of the process is for Kodak Flexicolor and Tetenal C-41 chemicals. However, in the time charts we have included Tetenal Mono C-41 and Tetenal Press C-41. In these products, the bleach and Fix are combined in a single step called 'Bleach-Fix.' All of the rest of the information applies.

Process Sequence for Tetenal Mono C-41 and [JOBBO C-41 Press Kit](#)

Pre-Warm

A dry 'incubation' of the tank and film allows the tank and film to rise to the process temperature. The film is loaded and in the tank. No water or chemicals are put in the tank. It is rotated in the tempered water bath. This step warms up and stabilizes the temperature of the film, reel, and tank. The pre-warm prevents a chilling of the developer and underdevelopment of the film.

Color Developer

Contrast and density are determined by color development.

Bleach-Fix

In this step the silver and silver salts are removed from the film.

Rinse

The rinse washes out the remaining chemicals.

Stabilizer

The stabilizer serves as a wetting agent, preserves the dyes, inhibits bacteria, and hardens the film.



Process Information for C-41

There are many different brands and types of C-41 compatible chemistries. All of the major brands have been tested with JOBO processing equipment, and found to produce excellent processing. The process procedures listed below are specifically optimized for rotary processing with JOBO equipment. If you are using chemicals in this list, use the times and procedures in the tables. If you are using a different chemical, find the closest equivalent in the list and use its times to test the process.

Tetenal provides four families of C-41 type chemicals. Tetenal C-41 is a clone type chemical that duplicates the Kodak C-41 Flexicolor process quite closely. It is the only version that is designed for replenishment procedures. Tetenal C-41 Press Kit is an all-powder concentrate ideal for travel and field use. Tetenal C-41 Rapid is designed for the shortest process time possible. The instructions packaged with the Tetenal C-41 type chemical kits may include alternate (not listed below) process procedures for faster, or lower temperature processing, or other special considerations. If you decide you want to utilize these techniques, be sure to read the instructions and understand the limitations that may be imposed by these other procedures. Test all alternative processes for the suitability to your specific needs.

WARNING: Many stabilizers contain formaldehyde, a known carcinogen. Use it only with good ventilation. It is suggested that you use rubber or neoprene gloves and apron, and eye goggles. All stabilizers supplied in the Tetenal C-41 kits are formaldehyde-free.

Caution: If reels or tanks are immersed in these solutions, they will eventually cause processing contamination effects. The reels will become difficult to load. Rinsing or cleaning the reels or tanks after processing will not eliminate this problem.

Note:

If you are using stabilizer, you do not need an additional wetting agent. Stabilizer contains a wetting agent. Do not rinse the film after treating it with stabilizer or wetting agent, as this would remove the surfactant included for spot free drying.

Color films contain organic dyes to produce the colors recorded in the film image. These dyes are subject to deterioration or fading with the passage of time. In order for these dyes to be as permanent as possible, a stabilizing bath is used to 'fix' or 'tan' the dyes. Modern improvements in color negative film emulsion technology have produced some emulsions that the manufacturers state do not require this stabilizing treatment to achieve maximum stability in the dye structure. Some 'amateur' films fall into this category. If you want to process a specific film without using a stabilizer, check with the film manufacturer to find out if it requires the stabilizing treatment for maximum post-process dye stability. If you are in doubt about this requirement, it is safest to use the stabilizer treatment. Stabilizer will not harm any C-41 process film. The stabilizers supplied in the Tetenal Rapid C-41 and Mono PK C-41 kits are formaldehyde-free. Unless you use one of these specially formulated stabilizers, the stabilizer will contain formaldehyde (see warning above). Substituting a wetting agent for stabilizer will not preserve the dyes in the film.

With all rinses (except the pre-rinse), change the rinse water at 30-second intervals for the duration of the rinse.

Caution: For most reliable results, do not add a stop-bath and/or rinse between the developer and the bleach (or bleach-fix) steps. Doing so may produce significant increases in contrast and density of the image. The film may not print correctly.

Note:

It is good practice to be consistent in processing procedures. However, it may be useful to know that with the exception of the developer, all steps in the C-41 process (both 2 bath and 3 bath) are 'taken to completion.' That is, once the action of the chemical or rinse has done what it is supposed to (had its effect), further time in the bath or rinse will have no additional benefit or harm. If you are to err in the timing of the process steps other than the developer, it is safer to go longer, not shorter. Be aware however, that very long (over one hour) immersion times in any solution or water could cause excessive softening of the emulsion or other problems, and should be avoided.

All modern color process bleach or bleach-fix chemicals (with the exception of Ilfochrome bleach) requires oxygenation (exposure to oxygen) to perform its function properly and completely. Unlike developer or other chemistries, you should intentionally introduce air

(with its oxygen) to the bleach or bleach-fix. Oxygenation is easily accomplished while diluting the stock solution. Place the bleach or bleach-fix in a larger (about twice the volume of the mixed solution) sealable container. Seal the container and shake vigorously for about thirty seconds. For situations where this procedure is not practical, an inexpensive aquarium 'bubbler' may be used to aerate the solution. Leave the bubbler on for about a half hour. If the bleach or bleach-fix has not been aerated for a week or longer, repeat the procedure before using the chemical.

Caution: Alternate process temperature with resulting changed developer and other steps times, may have unpredictable results. Some films may not print correctly if processed at other than 38°C (100°F).

**Push or Pull Processing for C-41**

'Push' process is not normally done with process C-41. If it is necessary to correct for underexposure of the film, add 15% to the developer time for each F-stop of push (doubling the ASA). Pushing film not specifically designated by the manufacturer as 'pushable' may produce a negative that cannot be correctly color balanced in printing. In any case, grain size, the color balance and contrast of push processed C-41 film will be adversely affected to some extent. It is not advisable to 'Pull' process C-41 film. It is better to use the normal processing time for film that has been overexposed. An overexposed and normally processed color negative will print better than a color negative with the development time shortened to correct for overexposure.

Black and White Film Process

● Process Times for Black and White Film (Starting Point)

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2500 tanks, '4'/50 for 3000 drums
 - Temperature 68°F (20°C)
1. Pre-Rinse 5:00 Use same amount of water as the tank needs for the developer. Rotate on the processor for five minutes.
 2. Developer x:xx Use your normal time for hand inversion processing, or the film manufacturer's recommended time.
 3. Stop-Bath 1:00
 4. Fixer (rapid type) 5:00 Some film and fixer combinations require a longer fix time.
 5. Rinse 5:00 Use the same amount, or slightly more water than needed for developer. Change the rinse water every thirty seconds, and allow to rotate on the processor. A five minute rinse will be ten changes of water.
 6. Wetting Agent 1:00
 7. Dry As needed

▲ [Back to Top](#)

● Process Sequence for Black and White Film

Pre-Rinse

The tank and film are brought to process temperature. The emulsion is completely soaked with water.

Developer

Exposed silver salt is converted to metallic silver. Density and contrast are determined in the developer.

Stop-Bath

The stop-bath quickly and evenly ceases development. The emulsion is made acidic for the fixer.

Fixer

The fixer removes the unconverted silver salt.

Rinse

This rinse removes the fixer from the emulsion. Removal of the fixer is necessary for image permanence.

Wetting Agent

Wetting agent is an optional step that helps film dry spot-free.

Dry

As needed.

▲ [Back to Top](#)

Process Information for Black and White Film

Black and white film processing is easily done in the CPA-2 and the CPP-2. Since there are many film and developer combinations, you must determine the times with black and white film processing. It is easy to have a starting point that will quickly lead to negatives with a full range of tones, and are a joy to print. If you are unfamiliar with black and white film processing use the procedure listed above. If you are already experienced with black and white film processing, and want to know about alternative procedures, see the 'Black & White Film Processing In-Depth' section for details.

The rinse of five minutes is sufficient to achieve a commercial level of fixer clearing. A ten minute rinse should be sufficient to clear fixer from the film to 'archival' standards. Some people may prefer to use an additional procedure to maximize the removal of fixer from the film. You may optionally include a Hypo Clearing Agent, Wash Aid, or other product specifically intended for this purpose. If you choose to use one of these products, follow their instructions for the times of each step and additional rinses (if any). These clearing chemistries may be safely used in the processor.

 [Back to Top](#)

Black & White Film Processing In-depth

The type of negative desired in black and white varies with the film, your enlarger (condenser or diffusion type), the developer, and the desired print appearance.

For a condenser enlarger, you would normally desire a negative that is a little lower in contrast and density than one for a diffusion enlarger. The enlarger type will affect your developer choice and time.

If you are having prints made by a minilab ('One Hour' type lab), they usually print with machines that use diffusion enlarging equipment. Custom labs may offer both types of enlargement services. If you are unsure, ask the lab which type they provide.

A five minute pre-rinse of any black and white film works with the developer to produce a negative with manageable contrast and good tonal range, using the manufacturer's recommended 'hand process' (intermittent agitation) times. To pre-rinse, put a quantity of process temperature water in the tank, equal to, or slightly greater than, the amount of developer. Allow this loaded tank to rotate on the processor for five minutes. At the end of that period, pour out the pre-rinse water, and pour in the developer. Pre-Rinse times shorter than five minutes may produce irregular development, and should be avoided.

If you do not want to use a pre-rinse, you will need to determine the appropriate developer time for each specific situation. Rotary agitation affects different film and developer/dilution combinations to differing extents. Some developing times may be essentially the same, while others are significantly shortened or even extended. As a rough guide, try shortening the developer time by about 15%. This could vary by anywhere from about -25% to +10% from the original 'hand process' (intermittent agitation) times. A five minute 'pre-warm' is recommended when foregoing the pre-rinse. This time allows the film, reel(s), and tank to stabilize at the development temperature, before the developing begins.

The CPA-2 or CPP-2 can be used with chemicals manufactured by Kodak, Ilford, Agfa, and many others. JOBO also has a line of black and white chemicals made by Tetenal.

With these features in mind, let's set up a typical starting point for your favorite film and developer combination. If you have a developer time that has worked well for you with hand (inversion) processing, start with that time. If you do not have that time, look in the film or chemical manufacturer's information. Get the time they suggest for inversion (hand) processing. Set up your processor to work at 68° to 75°F (20°-24°C).

Some notes on the process:

You may have to experiment (test) to get the best negatives. To test, expose a roll of film. Use segments of that roll to process at various developing times to determine the developer time you want without great expenditures of film and time. Often the hand inversion time is very acceptable, and is an excellent starting point.

Keep your pre-rinse and rinse water at the same temperature as your water bath and chemicals.

Use the fixer time given by the chemical manufacturer, for the type of film you have chosen.

If you can't find a recommended fixing time for your fixer and film combination, use this procedure. Place a short length of film in a small container of fixer. Gently agitate the container. Time how long it takes for the film to turn clear. Use twice the time it took to clear as your fixing time.

For the final rinse, the number of changes of water is of more importance than the time. If you are going to complete the rinse in the processor, do a series of 30-second changes. Use a quantity of water slightly greater than the developer quantity for each of the changes. Pour in the water, allow to rotate for 30 seconds, dump, pour in fresh water, and repeat. The number of changes of water is ultimately more important than the timing of the rinse steps. If it takes you longer than 30 seconds to do a rinse cycle, be sure to do at least as many cycles as would be done if the rinse time were adhered to. For example, five minutes would require at least ten changes of water, even if it took longer than five minutes. Optionally, do several rinses on the processor, then remove the tank and use a constant flow rinse, with the JOBO Cascade Washer, #3350.

Hypo-clearing or hypo-eliminator products also may be used to reduce the rinse time required. Use the times and rinses recommended by the chemical manufacturer when using hypo-removing products.

Caution: Some black and white films are designed to be processed at temperatures between 20 and 24 degrees C (68 to 75 degrees F). If these black and white films are processed at a temperature beyond this range, it may damage or destroy the emulsion (images). Do not go higher or lower than the temperature range published for the specific film and developer combination. If you do process at extreme temperatures, be sure to follow the film and chemical manufacturer's instructions for special techniques and/or chemicals necessary to safely process your film.

Note:

It is good practice to be consistent in processing procedures. However, it may be useful to know that with the exception of the developer, all steps in the black and white film process are 'taken to completion.' That is, once the action of the chemical or rinse has done what it is supposed to (had its effect), further time in the bath or rinse will have no additional benefit or harm. If you are to err in the timing of the process steps other than the developer, it is safer to go longer, not shorter. Be aware however, that very long (over one hour) immersion times in any solution or water could cause excessive softening of the emulsion or other problems, and should be avoided. Fixer should not be used for more than twice the recommended time, as ultimately it will bleach the image.

Some comments on tanks and developers:

All JOBO tanks are labeled with the quantity of solution required to completely cover the film level in that tank on a rotary processor. If you process only one roll of film in a two reel tank, you still have to use the solution quantity specified for that tank. Any lower quantity will be too low to cover the film at the center of the reel. The solution quantity marked on the tank is the minimum quantity - the tank will hold more.

There are numerous black and white film developers on the market. Many different dilutions of these developers can be used. You must pay attention to the developer concentration and quantity of that specific dilution you plan to use. A specific area of film (square inches) will require a specific quantity of developer to process the film properly. If you use a more highly diluted developer, test to ensure the quantity of diluted developer used will properly develop your film. Not enough developer could cause underdevelopment. This type of underdevelopment cannot be compensated for by extending the developer time.

An example:

According to Kodak's instructions, 100 ml of Kodak D-76 stock solution will process one roll of 35 mm, 36 exposure film. A popular dilution of D-76 is to mix the stock solution 1:1 with water, and extend the development time. If you use the same quantity for the diluted developer as the original stock developer, the film will be underdeveloped. There is not enough active developer agent in the 1:1 solution to develop the film to the same density as the stock solution. When using a diluted developer, increase the quantity of the developer solution by at least 30%. The correct development time will be different with each dilution. Be sure to refer to the correct time (from the chemical manufacturer) for the dilution you are using.

You may find that extreme dilutions will require a reduced quantity of film in the tank. This reduction provides enough active developer to finish the development of the film. (An example is one roll of 35 mm film in a two reel tank.)

Maximum Volume:

Avoid volumes in excess of 1000 ml in a tank or drum. Using too high a quantity will ultimately damage the rotation mechanisms.

WARNING: It is possible to mount a tank, or tank and module combination on the processor that would require more than 1000 ml to properly cover the film contained inside. Although this tank would 'fit the processor,' doing so would strain the rotation motor, and should be avoided.

The 'inversion' quantity of chemicals marked on 1500 series tank labels is approximately the maximum amount of chemicals the tank will hold when processing with the magnet drive (or by hand).

The 2500 series tanks are not intended for inversion processing, and are not labeled with inversion quantities. To determine the maximum quantity for a 2500 series tank for use with magnet drive process, place an unloaded tank vertically and fill with water. Measure this volume of water and divide by two.

When using a JOBO Lift and any size tank, excess chemicals or water poured into the lift will immediately flow out the drain hose. Filling to overflow with water may be used with an unloaded tank, to determine the maximum volume of chemicals usable with the tank and lift combination. Drain, capture and measure the volume of water retained in the tank.

▲ [Back to Top](#)

Push or Pull Processing for Black and White Film

Push or pull processing (one or more F-stops) of black and white films should be considered a salvaging procedure to correct for incorrect exposure of the film. Under poor lighting conditions (or the lack of an appropriate speed film) it may be necessary to underexpose the film and 'correct' for the under- (or over-) exposure with adjustments in the processing.

The best quality processing will be derived from a combination of correct camera exposure and normal processing. The greater the push or pull, the more likely the results will be unsatisfactory. Use push or pull processing only when necessary to accommodate exposure deficiencies, or to exploit the 'artistic quality' (less realistic appearance) of the altered images.

The length of time in the developer determines the effective exposure index. Note that different films will have different 'normal' developer times, thus the modified developer times for pushing or pulling these films will be different also. All other process steps and times are unchanged.

The recommendations below are approximate. Some film/developer combinations may require more, or less change per stop. Tabular grain films specifically may require less adjustment. Try about half of the amount of percent of increase listed below for tabular grain films. If the film data sheet has differing recommendations, use them.

Changing the developing time causes a change in sensitivity in the following way:

- A 'Push' of one F-stop (2 x ASA) is obtained by a 30% increase in normal developer time.
- A 'Push' of two F-stops (4 x ASA) is obtained by an 80% increase in normal developer time.
- A 'Pull' of one F-stop can be compensated for by reducing the normal developing time by 30%.

Fractional F-stop push or pull developer times may be calculated by adding or subtracting 10% for 1/3 F-stop, 15% for 1/2 F-stop, and 20% for 2/3 F-stop. A fractional F-stop adjustment may be added or subtracted to the full F-stop(s) push or pull times as required.

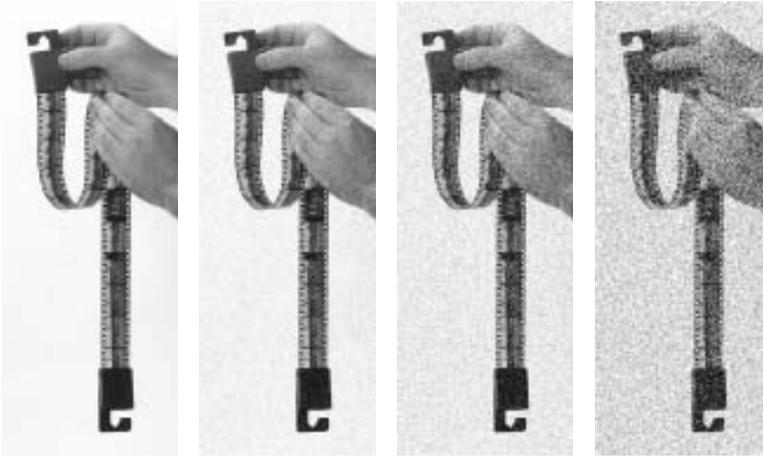
Caution: The above processing information should not be used with Kodak Microdol-X or other silver solvent type developers. Silver solvent 'fine grain' type developers do not push well if at all. It is better to use a 'high energy' type developer for better push process results. If you are in doubt about the suitability of a developer for pushing, check with the manufacturer of the developer.

Caution: Any process which changes the effective exposure index (ASA) of the film may produce less than optimum images. Contrast and maximum density will be altered. The need for accuracy of the camera exposure necessary for a 'correct exposure' is increased. The 'correct' exposure for a push process may need to be a compromise, sacrificing shadow detail for highlight, or vice versa. Higher levels of contrast in the lighting during exposure may make it impossible to render all portions of the picture (darkest to lightest) with a distinct image. Highlight details could 'block up' and/or shadow details could lack density and discernible content. The apparent 'grain' structure of the images will be enlarged. With any pull process, contrast is decreased. The apparent 'grain' structure of the images will not be reduced.

Since there can be tonal shifts and contrast changes when using different developer times, we recommend determining the proper developer time (for push or pull processing) by test developments using the same film exposed under the same lighting conditions, using the same exposure metering techniques. If it is not possible to test a specific film, lighting, and exposure combination, use the recommendations listed above. Generally, they will produce acceptable results.

Caution: There are many special purpose 'pushing' developers available from many manufacturers. These developers are specifically formulated for push processing. If you need to push process on a regular basis, or you want to do a substantial push process, use a developer specifically designed for push processing. These developers will almost always outperform a 'normal' developer when push processing. If the developer has specific instructions for processing that differ from what is presented here, use the manufacturer's recommendations as your starting point.

Optionally, you may 'tweak' the density of the processed film by making very small (fractional F-stop) adjustments to the developer time. Usually these minor adjustments will not adversely impact the quality of the processed image. This type of adjustment is usually done to fine tune all the small variances in a specific processing setup and procedure. Once this adjustment has been determined, the new developer time becomes your 'normal' time. All push and pull calculations are then derived from the new 'normal' time.



Approximate representation of increased grain with push processing, under a magnified view.

Color Transparency Print Process R-3 and R-3000

Process Times for R-3000 or R-3

Recommended Process Times for Kodak R-3000:

Making prints from transparencies (slides) using papers manufactured by Kodak, Fuji, and others.

1. Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2800 drums, '4'/50 for 3000 drums
2. Temperature 34°C (93°F)
3. Pre-Rinse 0:30
4. First Developer 1:50
5. Rinse 2:00 (4x 0:30)
6. Color Developer 3:15
7. Rinse 1:00 (2x 0:30)
8. Bleach-Fix 2:30
9. Final Rinse 2:30 (5x 0:30)
10. Dry As needed

Recommended Process Times for Tetenal Mono R 3:

Making prints from transparencies (slides) using papers manufactured by Kodak, Fuji, and others.

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2800 drums, '4'/50 for 3000 drums
 - Temperature 20°C (68°F)
1. Pre-Rinse 0:30
 2. First Developer 2:10
 3. Rinse 0:30 (Minimum)
 4. Color Developer 3:50
 5. Rinse 0:30
 6. Bleach-Fix 1:00
 7. Final Rinse 3:00 (6x 0:30)
 8. Dry As needed.

[!\[\]\(0b0636dbae614f97346d733ac650473d_img.jpg\) Back to Top](#)

Process Sequence for R-3000 or R-3

Pre-Rinse

The drum and paper are brought to the process temperature. The emulsion is completely soaked with water.

First Developer

In the first developer the exposed silver halides of the paper coating are reduced to metallic silver. The first developer represents the most critical phase of the process. Time, temperature, and agitation, as well as storage of the working solutions affects density, contrast, maximum density, and fog.

Rinse

This rinse quickly interrupts the development and prevents the first developer from contaminating the color developer. Insufficient first rinse can lead to changes in density as well as color.

Reversal Exposure

This step is used only when the color developer does not contain a self-fogging agent for reversing the image. The unexposed and undeveloped silver salts are exposed to light so the color developer can develop them.

Color Developer

In this processing step the remaining silver salt is converted to metallic silver. The color developing substances react with the film's color couplers and dyes. Changes in the color developer step affect color balance, contrast, minimum and maximum density, and evenness of the development. A reversal agent is usually contained in the color developer.

Rinse

This rinse removes the color developer and should be continued for at least 1 minute (2 changes of water, each lasting about 30 seconds).

Bleach-Fix

In the bleach-fix, the metallic silver is transformed to silver halide and is removed.

Last Rinse

The last rinse removes the remaining chemicals and should be continued for at least 2 minutes (4 changes of water, each lasting about 30 seconds.)

Dry

As needed.

▲ [Back to Top](#)

Process Information for R-3000 or R-3

Except for the pre-rinse, the numbers of changes of water are important. Change the rinse water completely every thirty seconds during the other rinses.

It is good practice to be consistent in processing procedures. However, it may be useful to know that with the exception of the developers, all steps in the R-3 or R-3000 process are 'taken to completion.' That is, once the action of the chemical or rinse has done what it is supposed to (had its effect), further time in the bath or rinse will have no additional benefit or harm. If you are to err in the timing of the process steps other than the developers, it is safer to go longer, not shorter. Be aware however, that very long (over 20 minutes) immersion times in any solution or water could cause frilling or discoloration at the edge of the paper and other problems, and should be avoided.

The R-3 and R-3000 type processes are direct positive color print processes. The color developer will only work properly in redeveloping the parts of the print not exposed initially under the enlarger, when the paper has been 'fogged' or re-exposed to light after the first developer and rinse. Most R-3000 type chemicals have an integrated fogging agent that does this automatically (chemically, without any actual exposure to light) while the print is in the color developer. Kodak R-3000 does contain a reversing agent in the color developer. Kodak R-3 does not have a reversing agent in the color developer. Tetenal Mono R gives you the option of mixing a reversing agent into the color developer or excluding it. You may use a reversal exposure with a process using a color developer that has a reversing agent in it, but it is not necessary.

As with all color prints, do not attempt to make any judgment of the colors while the print is wet. Color can only be judged correctly when the print is dry.

With R-3000 type processes, no chemicals are used that would require more solution quantity than that printed on the drum. You can safely use the quantity printed on your JOBO Drum.

All modern color process bleach or bleach-fix chemical (with the exception of Ilfochrome bleach) requires oxygenation (exposure to oxygen) to perform its function properly and completely. Unlike developer or other chemistries, you should intentionally introduce air (with its oxygen) to the bleach or bleach-fix. Oxygenation is most easily accomplished while diluting the stock solution. Place the bleach or bleach-fix in a larger (about twice the volume of the mixed solution) sealable container. Seal the container and shake vigorously for about thirty seconds. For situations where this procedure is not practical, an inexpensive aquarium 'bubbler' may be used to aerate the solution. Leave the bubbler on for about a half hour. If the bleach or bleach-fix has not been aerated for a week or longer, repeat the procedure before using the chemical.

▲ [Back to Top](#)

Reversal Exposure Procedure:

Be sure to complete the rinse after the first developer. Remove the drum from the processor. Open the lid of the drum. Hold the drum so that the room lighting completely illuminates the print(s) in the drum. You may need to move the drum around so that all parts are completely exposed. It should not be necessary to remove the paper from the drum. With normal room illumination the time required to completely fog the paper is about fifteen seconds to one minute. As long as the minimum level of exposure has been achieved, any additional light will not harm the procedure. You cannot over re-expose the paper. A lamp may be used to more quickly fog the paper. If a lamp is used, be sure to arrange positioning of lamp and drum so that there is no chance of water splashing or dripping on the bulb or electrical equipment! After the re-exposure, reseal the lid of the drum. Place the drum back on the processor. Pour tempered water into the drum, using the same procedure and time as a pre-rinse. Drain the water and pour in the color developer. Continue the process as outlined above in the appropriate process procedure.

Ilfochrome P-30 and P-30P

Process Times for Ilfochrome P-30 and P-30P

Color Prints from Transparencies (slides). Used with paper manufactured by Ilford.

Recommended Process at 24°C:

- Rotation Speed (with reversing directions) 'F'/25 for 1500, 2800 and 3000 drums (see note)
 - Temperature 24°C (75°F)
1. Pre-Rinse 0:30
 2. Developer 3:00
 3. Rinse 0:30 (Maximum)
 4. Bleach 3:00
 5. Fixer 3:00
 6. Final Rinse 3:00 (6x 0:30)
 7. Dry As needed

Recommended Process at 29°C:

- Rotation Speed (with reversing directions) 'F'/25 for 1500, 2800 and 3000 drums (see note)
 - Temperature 29°C (84°F)
1. Pre-Rinse 0:30
 2. Developer 2:00
 3. Rinse 0:30 (Maximum)
 4. Bleach 2:00
 5. Fixer 2:00
 6. Final Rinse 2:00 (4x 0:30)
 7. Dry As needed

 [Back to Top](#)

Process sequence for Ilfochrome P-30 and P-30P

Pre-Rinse

The drum and paper are brought to the process temperature. The emulsion is completely soaked with water.

Developer

The developer is a black and white type developer that contains special additives enabling the formation of a positive silver mask.

First rinse

This rinse interrupts development and avoids the spreading of undiluted developer into the bleach bath.

Caution: Do not extend the time of this rinse. Do not change the water or increase the volume of water in the rinse step.

Bleach

In the bleach, pigment and silver bleaching are completed. The bleach is a highly acidic solution. Handle with care.

Fixer

The fixer, an almost neutral pH, is well buffered to keep the pH value constant. In this bath, any remaining silver is removed from the print.

Final rinse

In the final rinse, all chemicals and soluble reaction products are removed. The temperature of the rinse water should be at least 24°C (75°F) ±1°C. Cooler water slows down the rinsing process.

Dry

As needed.

[▲ Back to Top](#)



Process Information for Ilfochrome P-30 and P-30P

Caution: With Ilfochrome, pay attention to Ilford's solution quantity requirements. They are greater than the quantity that the JOBO drum indicates. In all cases you should use the Ilfochrome recommendations as a minimum amount.

Ilford recommends:

- 8 x 10" print 75 ml for each print
- 11 x 14" print 150 ml for each print
- 16 x 20" print 360 ml for each print
- 20 x 24" print 540 ml for each print

Note:

As with all color prints, do not attempt to make any judgment of the colors while the print is wet. Color can only be judged correctly when the print is dry.

Ilfochrome may usually be processed by using a constant rotation speed of 'F/25'. If you have problems with evenness of processing using the rotation speed of 'F/25', you may try this alternative. Run the rotation in the developer step at maximum speed for the first thirty seconds, and then reduce the rotation speed to the lowest speed for the duration of the developer step. All the rest of the process should be run at 'F/25'.

'Ilfochrome' products were formerly marketed by Ilford as 'Cibachrome'. Many earlier published materials refer to the Cibachrome product name.

Color Negative Print Process

Process Times for RA-4

(Kodak RA-4, Tetenal Professional PK, and Tetenal Mono PK)

Recommended Process for Kodak RA-4, Tetenal Professional PK:

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2800 drums, '4'/50 for 3000 drums
- Temperature 35°C (95°F)

1. Pre-Rinse 0:30
2. Developer 1:00
3. Stop-Bath 0:30
4. Rinse 0:30
5. Bleach-Fix 1:00
6. Final Rinse 1:30 (3x 0:30)
7. Dry As needed

Recommended Process for Tetenal Mono PK:

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2800 drums, '4'/50 for 3000 drums
- Temperature 20°C (68°F)

1. Pre-Rinse 0:30
2. Developer 1:15
3. Stop-Bath 0:30
4. Rinse 0:30
5. Bleach-Fix 1:00
6. Final Rinse 3:00 (6x 0:30)
7. Dry As needed

▲ [Back to Top](#)

Process Sequence for RA-4

Pre-Rinse

The drum and paper are brought to the process temperature. The emulsion is completely soaked with water.

Developer

Contrast and density are determined by development.

Stop-Bath

The stop-bath ceases the development and prepares the paper for the bleach-fix. For some RA-4 type processes this step is not necessary. It will not harm the process if used.

Rinse

The rinse removes the stop-bath (or developer, if used without stop-bath). For some RA-4 type processes this step is not necessary. It will not harm the print or process results if used.

Bleach-Fix

In this step the silver and silver salts are removed from the paper.

Rinse

The rinse washes out the remaining chemicals. Rinse for at least one and a half minutes (three or more changes of water).

Dry

As needed.

Process Information for RA-4

Stop-bath is not supplied with most color print chemical kits. You may use Kodak Indicator Stop-Bath, or any common black and white process stop-bath. You may mix your own by diluting acetic acid to about a 2% solution. Stop-baths with indicators in them (yellow color) will not stain the print. Acetic acid (28%) diluted at a ratio of 1 part acid to 20 parts water will make a 2% solution.

The last rinse should be broken into thirty-second segments. Use a complete change of rinse water at each segment. The number of water changes is more important than the time of each segment. You may rinse longer (up to five minutes) without harming the processing. However, there is no benefit to extending the rinse times, or number of segments, beyond the recommendations.

RA-4 solution quantity: Kodak suggests using a minimum of 110 ml of developer per square foot of paper, or 61 ml per 8x10" print. The resulting quantity is greater than specified on the JOBO drums.

The revised quantities for JOBO Print Drums (filled to capacity with paper) are:

- Drum # 1526 61 ml minimum (1 8 x 10" print)
- Drum # 2830 122 ml minimum (2 8 x 10" prints)
- Drum # 2840 122 ml minimum (2 8 x 10" prints or 1 11 x 14" print)
- Drum # 2850 244 ml minimum (4 8 x 10" prints or 1 16 x 20" print)
- Drum # 3062 244 ml minimum (3 8 x 10" prints or 2 11 x 14" prints)
- Drum # 3063 366 ml minimum (6 8 x 10" prints or 1 20 x 24" print)

With RA-4 processes, you may use a greater volume of chemicals than the minimum recommendations. More than the recommended amount of chemicals is safe, and will not affect the process times.

All modern color process bleach or bleach-fix chemicals (with the exception of Ilfochrome bleach) requires oxygenation (exposure to oxygen) to perform its function properly and completely. Unlike developer or other chemicals, you should intentionally introduce air (with its oxygen) to the bleach or bleach-fix. Oxygenation is most easily accomplished while diluting the stock solution. Place the bleach or bleach-fix in a larger (about twice the volume of the mixed solution) sealable container. Seal the container and shake vigorously for about thirty seconds. For situations where this procedure is not practical, an inexpensive aquarium 'bubbler' may be used to aerate the solution. Leave the bubbler on for about a half hour. If the bleach or bleach-fix has not been aerated for a week or longer, repeat the procedure before using the chemical.

As with all color prints, do not attempt to make any judgment of the colors while the print is wet. Color can only be judged correctly when the print is dry.

It is good practice to be consistent in processing procedures. However, it may be useful to know that with the exception of the developer, all steps in the RA-4 process are 'taken to completion.' That is, once the action of the chemical or rinse has done what it is supposed to (had its effect), further time in the bath or rinse will have no additional benefit or harm. If you are to err in the timing of the process steps other than the developer, it is safer to go longer, not shorter. Be aware however, that very long (over 20 minutes) immersion times in any solution or water could cause frilling or discoloration at the edge of the paper and other problems, and should be avoided.

Caution: You must use RA-4 type chemicals for RA-4 type paper. Be sure that your paper and chemicals are compatible.

Black and White Print Process

Process Times for Black and White Prints

- Rotation Speed (with reversing directions) 'P'/75 for 1500 and 2800 drums, '4'/50 for 3000 drums
 - Temperature 20°C (68°F)
1. Pre-Rinse 0:30
 2. Developer 1:30 (Time will vary with choice of developer and paper)
 3. Stop-Bath 0:30
 4. Fix 1:00 (Time will vary with choice of fixer and paper)
 5. Rinse 2:00 (4x 0:30) (see note below)
 6. Dry As needed.

▲ [Back to Top](#)

Process Sequence for Black and white Prints

Pre-Rinse

The drum and paper are brought to process temperature. The emulsion is completely soaked with water.

Developer

Exposed silver salts are converted to metallic silver. Density and contrast are determined in the developer.

Stop-Bath

The stop-bath quickly and evenly ceases development. The emulsion is made acidic for the fixer.

Fixer

The fixer removes the unconverted silver salt.

Final Rinse

This rinse removes the fixer from the emulsion. Removal of the fixer is necessary for image permanence.

The rinse should be a series of 30-second changes of water. The 2:00 rinse would be four complete changes of water. Each change of water should be about 1 1/4 to 1 1/2 times the volume of chemicals used.

Dry

As needed.

Both the developer and the fix times will vary with the manufacturer's directions for the use of their product. For optimum results, select a paper developer type and dilution that has at least a one minute development time at the processing temperature used.

▲ [Back to Top](#)

Process Information for Black and White Prints

Making prints from negatives. The JOBO processor can also be used for papers and chemicals manufactured by Kodak, Ilford, Agfa, Oriental, etc. JOBO also has a line of black and white chemicals made by Tetenal.

JOBO does not recommend processing Fiber Based print paper in our print drums. The raised ridges on the inside of the drums may mark the paper, and rinsing in the drum may not be satisfactory.

It is good practice to be consistent in processing procedures. However, it may be useful to know that with the exception of the developer (or toner, if used), all steps in the black and white resin coated print process are 'taken to completion.' That is, once the action of the chemicals or rinse has done what it is supposed to (had its effect), further time in the bath or rinse will have no additional benefit or harm. If you are to error in the timing of the process steps other than the developer (or toner, if used), it is safer to go longer, not shorter. Be aware however, that very long (over 20 minutes) immersion times for resin coated paper in any solution or water could cause frilling or discoloration at the edge of the paper and other problems, and should be avoided.

JOBO paper drums have a chemical quantity printed on the side stating the minimum amount required to cover the paper during processing.

With black and white prints, there is no chemical (at recommended dilutions) that would require more solution quantity than printed on the drum. It is safe to use the quantity printed on your JOBO Drum. If you are using extended dilution of the processing chemicals, check with the manufacture's quantity requirements. In all cases use at least the volume required by the print drum or the chemical-dilution used.

You may add toning procedures to the black and white print process in your processor. Follow the manufacturer's recommendations on times for the additional steps.