Reversal Processing the T-Max Films

By Hans F. Dietrich

A variety of direct reversal films for copying purposes are available on the market today. These films are slow, blue sensitive (orthochromatic), and not suitable for general photography. Except for some motion picture films in long rolls, Kodak Direct Positive Panachromatic film and Agfa Dia Direct are the only camera speed films available for making black-and-white transparencies.

According to Kodak literature and substantiated by my experiments, 35mm Panatomic-X may be processed with the Kodak Direct Positive reversal chemistry to make black-and-white slides. However, the literature also states that medium-format Panatomic-X is unsuitable for reversal. Incidentally, I was recently assured by a Kodak representative that Panatomic-X will not be discontinued in the near future, but economics might decide otherwise in the future, due to the introduction of the T-Max films. Frankly, I think T-Max too may be a better choice for making slides: It has twice the speed of Panatomic-X, finer grain, and other improvements.

Look through some fairly recent catalogs and you'll find many films that have disappeared, ones we thought we could not live without, but usually new emulsions are introduced to fill the void. The tendency to reduce the number of different films is understandable, dictated by pure industrial economics. It's certainly possible that Panatomic-X will belong to this group of extinct films one of these days. I think it's a good idea not to wait until you're forced to move to a new emulsion. After a few satisfactory tests, I easily made the switch to T-Max.

Like many people, I need continuous tone black-and-white slides only occasionally. My reversal experiments were prompted by the simple need for good black-and-white continuous tone slides. I also wanted to limit the number of films on hand for this and other applications.

Certainly, T-Max 100 and 400 may be processed to slides in both 35mm and 120 formats. One added benefit of the 120 size is the film's thicker base. This added base thickness offers far greater stability. which is a tremendous asset when you get around to projecting your slides. T-Max films are coated on a clear emulsion base, as opposed to Panatomic-X, which is coated on a tinted base. Finally, don't underestimate the importance of the 2 to 4 stop exposure advantage offered by the T-Max films: Believe me, it makes life a little easier.

In testing some of the many formulas for reversal processing conventional films I found that most formulas are only suitable for one particular film, especially if the rated speed and a high image quality are important considerations. The aim point for best screen quality of a good black-and-white slide is a 0.2 density above the base, negligible fog and an approximate maximum density ranging from 2.2 to 2.6.

At the onset of my experiments I decided to limit the processing options to readily available formulations and materials. I don't go in for anything that can't be found in any well-equipped black-and-white darkroom.

Reversal processing conventional black-and-white film starts with a first developer. In addition to having the usual ingredients, the first developer also contains a silver halide solvent. This solvent is essential to obtain clear highlights in the final transparency. Potassium (or sodium) thiocyanate or sodium thiosulfate are commonly employed as solvents. After first development and a rinse, the film is bleached to remove the silver formed in the first step. The silver is converted to a chemical soluble in the bleach step. The silver must be eliminated here, otherwise it will redevelop. In the dichromate and permanganate bleach formulas I have provided, the silver is converted to soluble silver sulfate, due to the presence of sulfuric acid.

The bleaches I have provided here are known as non-rehalogenating formulas because they do not convert the silver to a silver salt (halide). Alternately, the bleaches used in most color processes are retialogenating bleaches, and they convert the silver to (usually) silver bromide or silver chloride, either of which is soluble in thiosulfate fixer. You can easily tell a rehalogenating bleach formula, since most have a small amount of bromide or chloride salt.

After a clearing bath, the film is normally re-exposed and a second developer is employed. Finally, a traditional fixer and wash complete the process. See Table 1 for a more complete breakdown of the process.

The first developer is the cornerstone of any reversal process and usually the source of trouble when things aren't working properly. Washed-out slides, often resulting from improper first developer time or temperature, may also be caused by an excess of silver halide solvent. Although many people don't realize it, one way to adjust the contrast in your slides is to vary the hydroquinone content of the first developer.

First Developer

Metol sulfite	2 g
Sodium ~~sulfate~~ (anhydrous)	100 g
Hydroquinone	5 g
Sodium carbonate monohydrate	60 g
Sodium thiosuffate pentahydrate	16 g
Potassium bromide	4 g
Water to make	1 liter

If you have ever compared the chemical compositions of photographic solutions, the first developer formula should look familiar to you. It is, of course, simply D-76 with the addition of the sodium carbonate, sodium thiosulfate, and potassium bromide. In the traditional D-76 formula, 2g borax is used. If you do not wish to mix this developer from scratch, you may use prepacked D-76 or Ilford 1D-11+ and safely ignore the borax possibly present in the prepared formula.

For developing one 36-exposure roll of 35mm film using 250ml solution in a stainless steel tank, start with 250ml D-76 stock solution and add 15g of sodium carbonate, 4g sodium thiosulfate, and 1g potassium bromide. This solution makes an excellent first developer in reversal processing the T-Max films. First development should be carried out for 10 minutes at 68F, and use the solution one-shot.

My choice of a second developer couldn't have been any simpler: Kodak Dektol Developer diluted 1:2. Time in the second developer is 3 minutes at 68F.

Table 1. T-Max Reversal Processing.

Summary of Steps:

1. First developer; 10 minutes at 68F.
2. Water rinse at room temperature for 1 minute.
3. Dichromate bleach; 3 minutes.

Remainder Done in Room Light:

4. Rinse in water for 1 minute.
5. Sulfite clearing bath; 1 minute.
6. Rinse in water for 2 minutes.
7. Re-expose each side of the film for 1 minute, using a 150-watt light bulb at a distance of 1 foot. Be careful: Splashing water onto a a hot light bulb is dangerous.
8. Second developer (Dektol 1:2) for 3 minutes.
9. A short water rinse or acetic acid stopbath.
10. Fix, final wash, wetting agent and dry as usual.

Substitution:

When using the potassium permanganate bleach all the steps are identical except those listed below:

3. Bleach for 5 minutes using freshly mixed solution.
4. Rinse in water for I minute.
5. Metabisulfite clearing bath; 2 minutes.

Dichromate Bleach

Potassium dichromate	9.5 g
Sulfuric acid (concentrated)	12 ml *
Water to make	1 liter

*** CAUTION:** Always add acid to water.

Sulfite Clearing Bath *

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Sodium sulfite **              50 g
Water to make                   1 liter
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* Use only with potassium dichromate bleach.
** Sulfite concentration is sufficient for five rolls of 35mm film, then discard.

You can fix in any black-and-white acid fixer, but I recommend a hardening fixer since slides are usually subjected to rough handling.

The potassium dichromate in the bleach is an allergen for some people, and a suspected carcinogen. From an environmental standpoint, potassium dichromate is also an undesirable chemical. Therefore, I have provided a substitute potassium permanganate/sulfuric acid bleach formula.

Permanganate Bleach

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Stock Solution A:

        Potassium permanganate                4 g
        Water to make                         1 liter

Stock Solution B:

        Sulfuric acid (concentrated)          20 ml *
        Water to make                          1 liter
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*** CAUTION:** Always add acid to water.

For the permanganate bleach, make up Stock Solutions A and B using deionized or distilled water, since this bleach must not be contaminated by chlorine or bromine. Both stock solutions are stable for a long time. For use, mix one parf each of Stock Solutions A and B. Use the bleach one-shot: discard after bleaching one roll of film; never reuse permanganate bleach.

I have also provided a special clearing bath formula to be used with the permanganate bleach. Always use the sulfite clearing bath only with the dichromate bleach and the metabisulfite clearing bath only with the permanganate bleach.

Metabisulfite Clearing Bath *

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Potassium or sodium metabisulfite         30 g
Water to make                              1 liter
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* Use only with permanganate bleach. Discard after clearing ten rolls of 35mm film.

There is no end to the list of possible substitutions and alternatives. Instead of the second developer, you can use 2g / liter of sodium sulfide (Na2S-9H20: not *sulfite*), which will produce sepia toned slides. Also, you can certainly use Kodak Direct Positive Film Redeveloper. If you do, omit Step No. 7, re-exposure, because this developer contains a chemical fogging agent (combination of sodium hydrosulfide and 2-thiobarbituric acid).

Finally, if you need more contrast for some applications, omit the first developer I described and substitute Kodak D-19 with 5g/liter potassium thiocyanate added. Develop 10 minutes at 68F This first developer increases contrast appreciably. However, the exposure latitude is considerably less, so 1/2 stop exposure bracketing may be necessary. All other processing steps remain the same.

Excellent continuous tone black-and-white slides, anyone? Try T-Max. You can't imagine how great it is working with E.I.s 100 and 400.

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