Divided D-76 Developer

Viable T-Max Option

Divided D-76

Bath A

Water (120°F)	750ml
Metol	2g
Sodium sulfite (anhy.)	100g
Hydroquinone	5g
Potassium bromide	1g
Water to make	1 liter

Bath B

Borax	60g
Water to make (100°F)	1 liter

Use only a quick water rinse before pouring in fixer. By the time you get to the fixer, most development will have stopped already. Fix as normal.

Divided Phenidone Developer

Bath A

Water (95°F)	800ml
Phenidone	0.3g
Sodium sulfite	100g
Hydroquinone	5g
Potassium bromide	1g
Benzotriazole	0.2g
Sodium bisulfite	18g
Water to make	1 liter

Bath B

Borax	60g
Water	1 liter

By Neil Lipson

One of the lesser known versions of the world's best-known film developer is Divided D-76. Its performance is similar to straight D-76, or D-76 1:1, but has some substantial advantages. You can mix it yourself or order it premixed from Photographer's Formulary (P.O. Box 5105, Missoula, MT 59806-5105, 800-922-5255.) You can't modify off-the-shelf D-76 for two-bath development.

Divided D-76 is a two-bath developer. It is this that gives it most of its advantages. Many photographers refer to it as being "forgiving." It has this reputation because, by design, it works against excessive highlight densities. Possibly, Divided D-76 provides the solution for a photographer finding it difficult to adjust to T-Max.

The main advantages of Divided D-76 include the following: reduction in highlight densities; ease of use; longer-lived developer solutions; low cost; auto-elimination of air bells; and fewer temperature restrictions.

History of Divided D-76

I first read about Divided D-76, invented by Robert J. Starks of Dayton, Ohio, in Paul Farber's column in the August 1966 issue of *U.S. Camera & Travel*. It was only three paragraphs, but made quite a stir at the time, because there were two follow-up articles in the December 1966 and March 1967 issues. I could not find any references to this technique before this date. The two follow-up articles by Farber deal with formula modifications and instructions for its use. There were many variations to the original formula, and all seemed to work fine, which is a tribute to the original D-76 formula. There was also a discussion on how contrast could be controlled with the times in Bath B. Very little was printed on the formula until Patrick Dignan's book *150 Black-and-White Popular Photographic Formulas* which had three articles on the process. If you do not have this book, I highly recommend it. It is available from Zone V (Stage Road, South Strafford, VT 05070, 802-765-4508). The Bertram Merritt article, "Another Look at Divided Development" suggests rating Tri-X at 200, and experimenting with the developing times to fit your needs, with which I fully agree. Finally, the article recommended that you do not use a pre-rinse or short stop. A quick water rinse saves fixer.

Processing Information

Start by pouring in Bath A, which saturates the emulsion with the developing agents, bromide and sulfite. For all films, a 3-minute soaking is enough. There is some development here, but not much, so there is very little in the way of oxidation or reaction byproducts. Bath A can be used over and over and really does not wear out. It has a shelf life of four to six months depending on how much oxygen is in the bottle. Refrigerating Bath A extends the life to possibly one year.

Most development occurs in Bath B. The time in Bath B is critical. This may vary depending on a variety of factors which I'll discuss later in this article. My general guidelines are as follows: slow speed films (EFKE 14 or 17, Pan F, Agfapan 25, etc.) for 2 to 3 minutes; medium-speed films (FP4, Plus-X, etc.) for 2½ to 3½ minutes; fast films (HP5, Tri-X, etc.) for 3 to 4 minutes. T-Max 100 and 400 ought to have Bath B times in the range of 3 to 4 minutes.

For some reason, the developing times are quite consistent regardless of solution temperature. They remain fairly constant in the 65° to 80°F range, which makes life easy.

The way the developer reduces blocked highlights is quite ingenious. The film can only absorb a fixed amount of developing agents from Bath A. Depending on the level of exposure, the developer will either be exhausted quickly (high exposure—highlights) or will continue for a long time (little exposure—shadows). This produces a density compression. Even areas that are overexposed by 20 stops will still be free of blocked highlights. Amazing, but true. This principle is similar to D-76 1:3, or any highly dilute developer. However, a dilute developer will continue developing even after it is mostly exhausted, although at a slower rate. Divided D-76 will not, and once the developer in the heavily exposed areas is exhausted, it is completely exhausted and that is that. There will be no more developing.

The same principle also will give you better grain in some instances. Since you can't overdevelop in the classical sense, highlight grain is limited. The short developing times in Bath B also help in this respect.

One of the drawbacks of concentrated D-76 is that as it ages, the pH increases, and you get more grain and contrast from the increased activity. It's likely the pH changes occur due to byproducts from reactions related to the hydroquinone and borax. To get the best results, you must mix it fresh frequently and use it one-shot. This is not the case with Divided D-76, because the developing agents are separated from the accelerator (borax) and this type of deterioration just does not occur. This gives you beautifully consistent results every time.

Use deionized or distilled water for Bath A. It increases the life of the solution substantially. If you live in a big city and your water has tertiary treatment, this water is fine. If your source is a well, watch out for especially hard water.

Use Bath B one-shot and discard. Borax is cheap and it's easy to mix a large supply of Bath B in advance. The only exception is when you use Bath B *immediately* to process a second roll. Bath B can usually be made with tap water.

Keep all baths, fixer, and washes at the same temperature. Temperature differences cause reticulation, and expansion and contraction of the emulsion may aggravate the grain.

Use amber glass to store the dry chemicals such as the metol, hydroquinone, and potassium bromide. Using wax on the tops will guarantee long life of the dry chemicals. Keep away from heat, light and humidity. For the sodium sulfite and borax, the killer here is humidity. Use a dessicant and store in a tight container. The chemicals break down when exposed to humidity.

Never allow solution B to get into solution A. This should be an easy rule to observe. It is difficult to do unless you have open beakers where mistakes can occur.

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Phenidone Version of Divided D-76

If you prefer Phenidone (longer life, lower toxicity, and fewer allergy problems) to metol, then try the formula on page 29.

The Phenidone formula is a slightly modified version of the one published in *150 Black-And-White Popular Photographic Formulas* by Patrick D. Dignan, that appeared in an article written by D. William Reichner.

Developing times are the same as the metol formula, and results are just about the same.

Modifying the Orignal Formula

You can modify the original Divided D-76 formula to give higher activity, which produces increased contrast and (for me) higher effective film speeds, at the expense of grain by using the formulas (Baths A, B, Mod-A, Mod-B) in various combinations, as I will explain. These formulas were originally published in the Paul Farber articles cited earlier.

For a moderate increase in activity (about two stops for me), use Bath Mod-A and normal Bath B. For very active development (four to five stops), use Bath Mod-A and Bath Mod-B. Farber referred to lighting conditions requiring Bath Mod-A and Bath Mod-B as "available darkness."

Discussion

There are some aspects of the Divided D-76 formulas that have not been fully researched to my knowledge. In discussing the original formula with Pat Dignan, he suggested checking to see if there really is no development in Bath A as some authors have suggested. With 100g sodium sulfite in the formula, it has been suggested that the Bath A pH will be more than 7. As it turns out, this is true, meaning that there is a high probability that development occurs if you leave the film in Bath A too long.

After some experimentation, I found some development occuring in the exposed film leader in Bath A after about 1 minute. After 5 minutes, I saw evidence of development in areas of lesser exposure. This means that you can't just drop your film into Bath A, take a walk, and expect everything to be fine. Mr. Dignan suggested buffering Bath A to bring the pH down, which is exactly what is done in D. William Reichner's Phenidone version. Mr. Reichner used 18g sodium bisulfite, which brings the pH down from 8 to about 7, at which point development stops. You could probably use the same idea with the original version and add 18g of sodium bisulfite. This does not seem to be critical, and I am very satisfied with the formula without the bisulfite. However, I suspect the effect will be more pronounced at higher development temperatures. If you wish to experiment, try adding the bisulfite slowly until the pH drops to 7. Use a pH meter and record this bisulfite amount for future formulations. I recommend using distilled water even though the buffering action of the bisulfite is designed to hold the pH at 7. My rule: fewer variables, fewer problems.

To solve 90-percent of the pH problems with standard metol formulas, start with 90g sodium sulfite and add 10g sodium bisulfite. Water pH might make a difference, but I've had great success with the 90-10 combination.

By way of conclusion, I would like to thank Pat Dignan and Bill Wilson of Photographer's Formulary for their assistance in preparing this article. □

Modified Divided D-76

Bath Mod-A	
Water (120°F)	750ml
Metol	4g
Sodium sulfite	100g
Hydroquinone	7.5g
Potassium bromide	1g
Water to make	1 liter
Bath Mod-B	
Water (100°F)	750ml
Kodalk (sodium metaborate)	50g
Water to make	1 liter

Photographer Neil Lipson is deeply involved with research and experimentation in areas concerning black-and-white photochemistry. He also consults on matters relating to microcomputer applications.