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POST-PROCESSING

Step-By-Step Guide to Developing Black and White T-MAX Film

by [Darragh Sinnott](#) 14 May 2010 [17 Comments](#)



12



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This post is part of a series called [Film Photography](#).

◀ [A History of Photography Part 1: The Beginning](#)

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This tutorial will explain the process of developing T-MAX film as a simple step-by-step walkthrough. It's a great introduction to understanding how film development works, and how you can improve your photography by giving the process a try!

I strongly suggest that reading through the developing process before trying it. Chemicals require specific times and it is difficult to keep track of everything if you are not prepared and somewhat familiar to the process.

I choose T-MAX 100 because it has a very fine grain and it is the black and white developing process that I have had the best results with. This is what fully developed dense negatives look like. If results differ we will cover fogged flawed or thin negatives at the end of this tutorial.



Step 1: Gather Supplies

1. 1-2 rolls of exposed T-MAX film
2. Developing tank
3. [Can opener](#)
4. Beaker or measuring cup
5. Thermometer
6. Scissors

7. Containers (for mixed chemicals)
8. Negative carrier
9. 3 Containers for mixing chemicals

Chemicals:

1. Kodak T-MAX Developer
2. [Stop Bath](#)
3. Rapid fixer with hardening agent
4. Hypo Clearing Agent (HCA)
5. Photo Flo



Step 2: Load, Expose, Unload the Camera

It is important to remember the film is ISO 100 so make sure there is a strong light source for your photos. A tripod is recommended to take advantage of low shutter

speeds. T-MAX is known to be unforgiving with incorrect exposure so bracketing is worthwhile.



Step 3: Mixing the Chemicals

Once the film has been exposed and the supplies have been gathered, it is time to mix the chemicals.

Start by mixing the developer at a ratio of one part developer for four parts water (1:4). It takes about 10oz of this mixture for each reel that will be developed. In most cases, two reels get developed at a time. Only mix as much developer the tank requires (don't pre-mix and store). Once T-MAX is diluted it is important to regulate the temperature at 72°.

Next, mix the [stop bath](#). The stop bath should be diluted and stored in excess for later use. Mix with water at a ratio of 1:64. (stop ratio varies depending on the brand,

it is recommended you second check the directions).

Fixer and Hypo Clearing Agent (HCA) should be mixed according to the package instructions. Powder fixers often come with the hardener included in one package. Other liquid fixers require mixing of 2 elements. Fixer can be reused so keep it in a sealed container. HCA can be reused, but because it is difficult to determine when it is getting weak, some photographers will discard it after it has been in the developing tank.

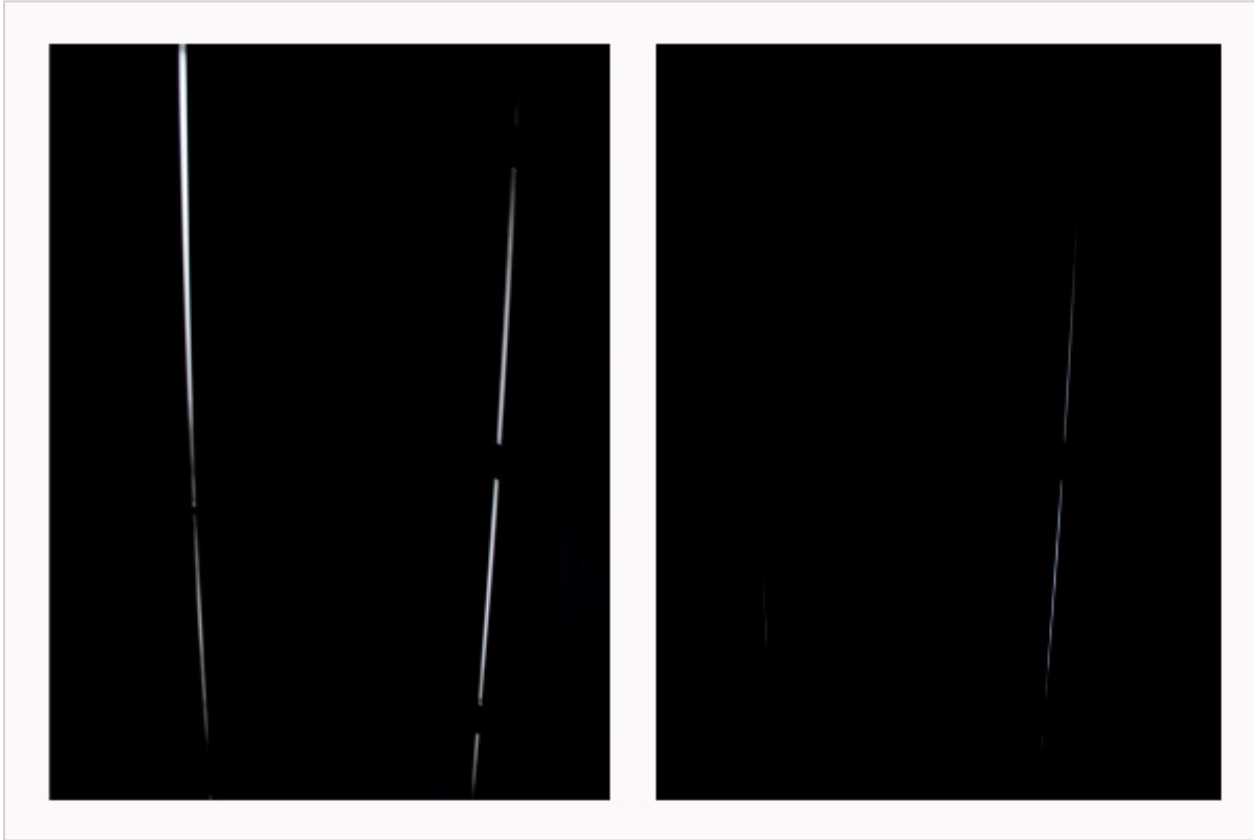


Step 4: Light Proof a Room

Light-proofing a room is one of the steps that is easiest to make mistakes. There can be no visible light, not a red or amber safe-light. It is a good idea to start by bathroom or a laundry room with no windows. Use [masking tape](#), foam weather stripping, towels or rags to block any light that may be spill into the work area.

Let your eyes adjust for a few minutes to be sure that there nothing visible.

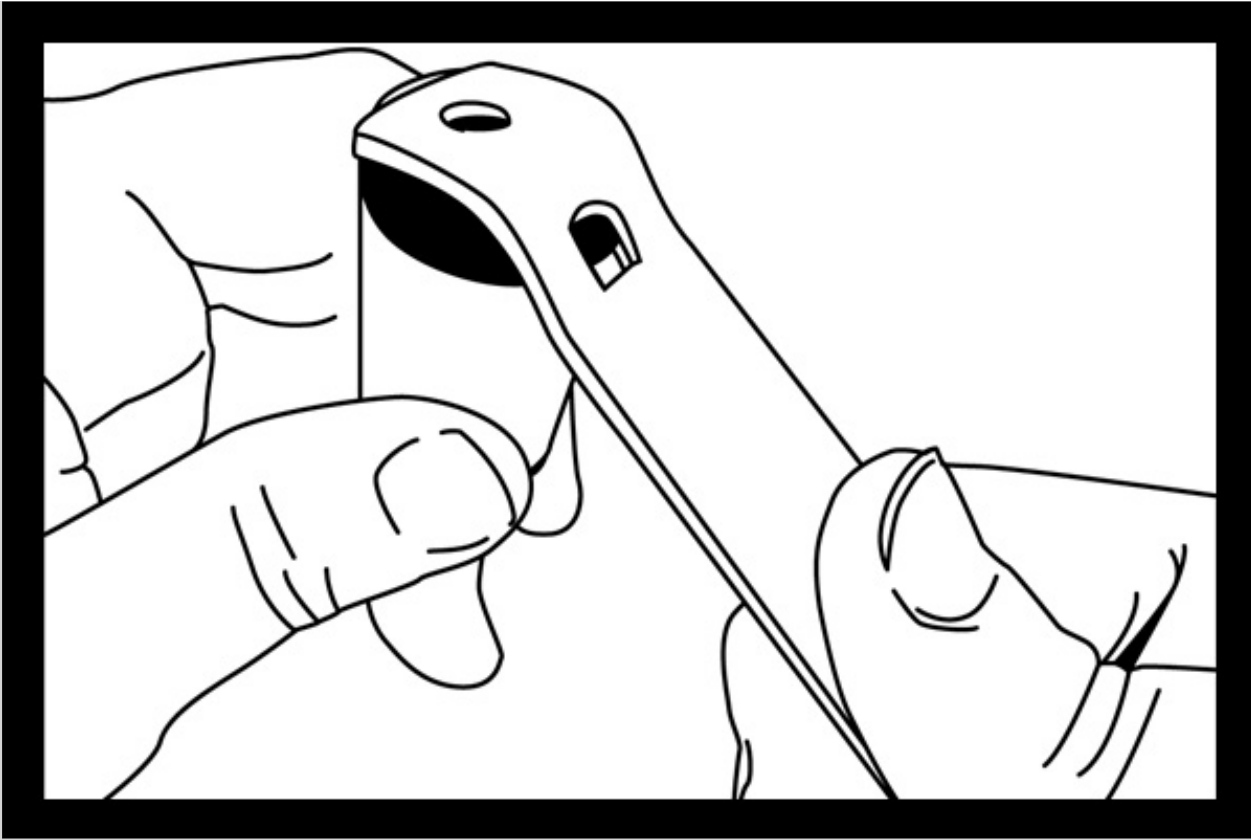
Remember to get all the cracks where light might get in. Both of these photos show a door with enough light getting through to fog your negatives. At first it would seem that the door on the right is light safe but once your eyes adjust there is still a crack of light getting through.



Step 5: Open the Film Canister

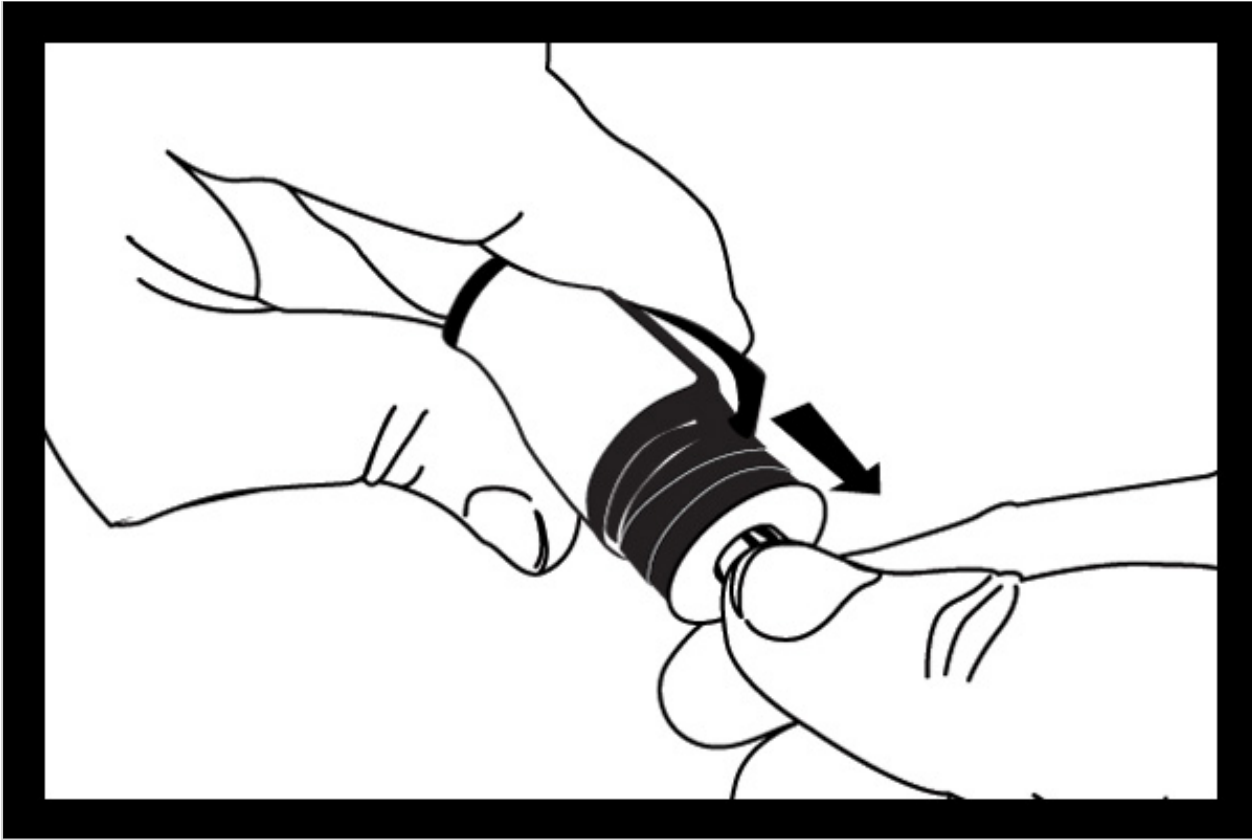
Once you have found a light-safe a spot, get the developing tank, reels, film, a [bottle opener](#) and a pair of scissors.

Turn off all lights and use the [can opener](#) to pry the top off the film canister. (It is not a bad idea to make a second check for any sources of light before this step)



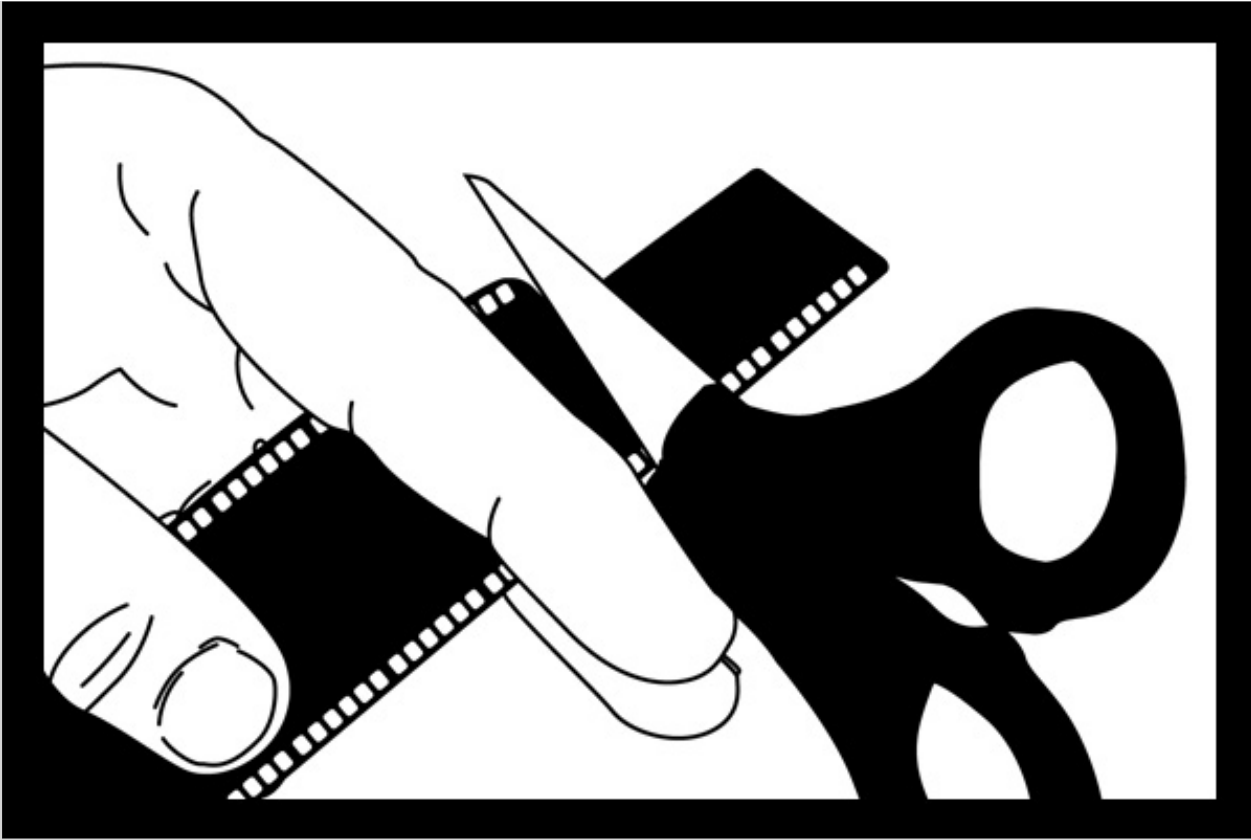
Step 6: Take the Film Out of the Canister

Touching the emulsion side of the film will affect the chemicals in the developing process, so try to remove the film without making any contact with the film itself. Holding only the plastic knob that sticks out of the canister, pull the film out of the canister. The film will unravel but try not to let it touch the ground.



Step 7: Even Off the End of the Film

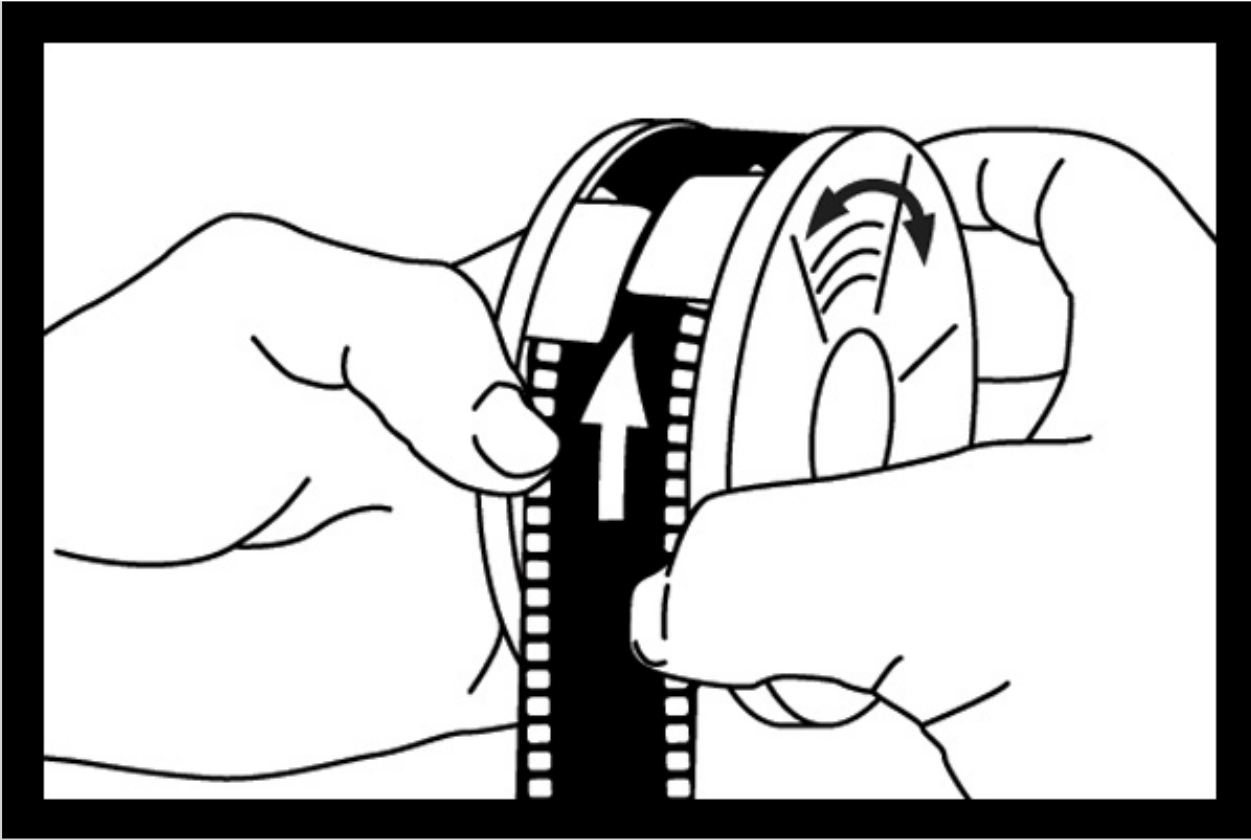
Without touching the emulsion side of the film, use your thumb and forefinger to grip the film by the edges and feel toward the end of the film. The end of your film has no exposures on it, so it is safe to touch. Using your fingers as a guide, find your scissors and cut the 'tongue' off your film.



Step 8: Load the Reel

Once the film has an even end, it can be loaded on the reel. Take a reel and feed the first piece of film onto it. It may resist at first but once it passes the [ball bearing](#) it seems to pop onto the track. (Remember not to touch the emulsion in areas where the film was exposed).

Most plastic reels have a self feeding oscillating mechanism that allows the user to feed the film without touching the film. Rotate one side of the reel about 1/8th of a turn and return it to its original position, as this action is repeated the film will wind around the track without any significant problems.

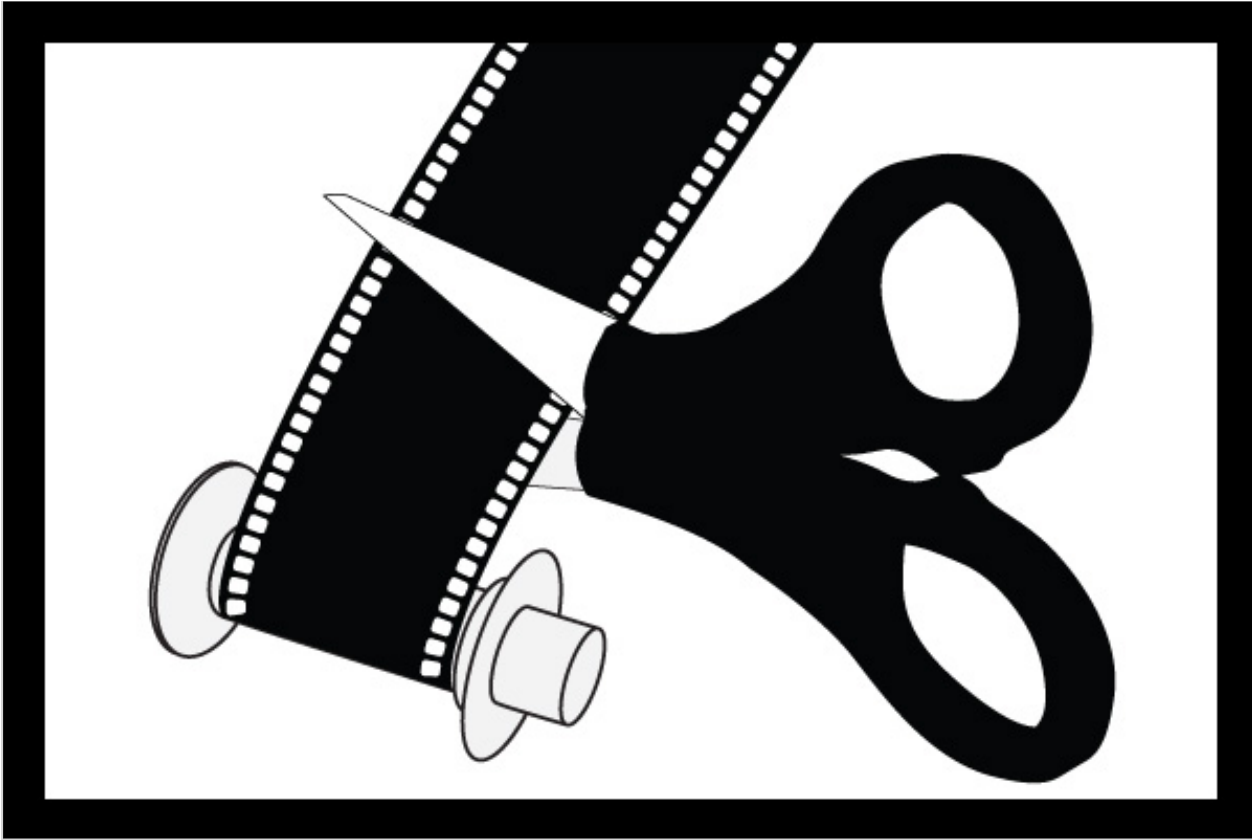


Step 9: Cut Off the Plastic End of the Reel

Toward the end of the reel, you will feel the plastic spindle that was used to pull the film out of the canister. It will find its way into your palms as you wind up your film. Take the scissors and cut this plastic spindle free and continue to load the rest of your film.

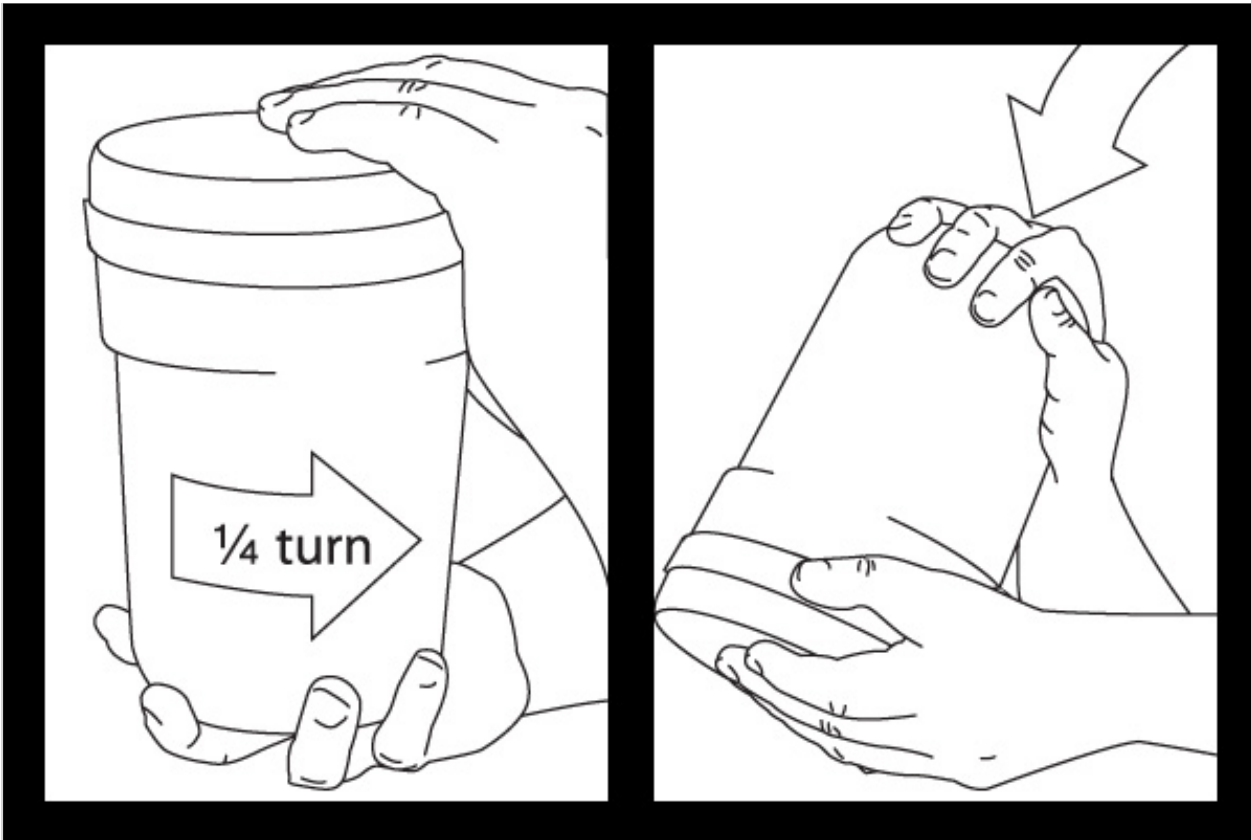
Do not pull the tape off the film, as it can cause a small amount of static that can fog your negatives. Once all your film is loaded onto reels place the reels inside your light safe tank and close it up. Be sure that it is secured and all reels are safely inside.

At this point it is safe to turn on the lights and clean up the canisters, lids spindle and discarded film that you have dropped.



Step 10: Before the Developing Process

There are a few techniques that should be covered before beginning the developing process. The quarter turn and tilt agitations are an essential part of developing T-MAX. The quarter turn inversions are used to make sure that all parts of the film get exposed to the chemicals (see the image below). These inversions should take about 1 second and will be repeated several times in the process, so practicing before you start the process is advised.



Because timing of chemical baths must be precise when developing film, it is important to have all your chemicals measured out ahead of time. When one chemical has been exposed to the film for the suggested time you should be able to pour it out and have it replaced within 10 seconds.

It is also important to remember that, while most developing tanks take about 20 fl. oz to cover reels, your tank may differ. Check the recommended volume of the tank before pouring chemicals. There is a guide on the bottom of most plastic developing tanks with the recommended amount of chemicals.



Step 11: T-MAX Developer

When all of the chemicals are prepared and your film is loaded in the developing tank, you are ready to start the developing process. Pour enough water to fill your tank and let your negatives soak for 1 minute.

You should have already measured out the amount of developer that it takes to cover your reels. The developer should be maintained at 72° but if you are finding it difficult to do that the container has this chart. Pour out the water and pour in the T-MAX Developer.

Once your solution is poured agitate by giving your developing tank the quarter turn and tilt agitations shown in Step 10. Repeat this process 30 times in 30 seconds. Tap to the bottom of your tank, allow the tank to sit for 25 seconds. Agitate again for 5 seconds, tap the bottom again and allow to sit for 25 seconds.

This process of 5 inversions followed by 25 seconds of idleness should be repeated until the developer has had 6 1/2 to 7 minutes in the tank. Pour out and discard your developer.

FOR ROLL FILMS ONLY
 Mix 1 part developer concentrate with 4 parts water.
Agitation—Small tank:
 Provide vigorous agitation (5 inversions in 5 seconds) for 5 seconds every 30 seconds.
Recommended Starting Point Development Times For Small Tank In Minutes:

35mm and Roll Film	E.I.	20°C • 68°F	22°C • 72°F	24°C • 75°F*
PROFESSIONAL T-MAX 100 Film / 100TMX	100/200	7 1/2	6 1/2	6 1/4
	400	12 1/4	10 3/4	10
	800	NR	NR	11 3/4
T-MAX 400 Professional or PROFESSIONAL T-MAX 400 Film / 400TMY	400/800	7	6 1/2	6
	1600	10	8	8
	3200	NR	NR	9 1/2
PROFESSIONAL PLUS-X Pan / 125PX	125/250	5 3/4	4 3/4**	4 1/4**
	500	8 3/4	7 1/4	6 1/4
PROFESSIONAL TRI-X 400 Film / 400TX	400/800	6	5 1/2	4 3/4**
	1600	8 3/4	7 3/4	7
	3200	NR	NR	8 1/4

*Primary Temperature Recommendation
 ** Development times shorter than 5 minutes may not provide satisfactory uniformity.
 NR—Not Recommended
 For more information, see KODAK

Step 12: Stop Bath

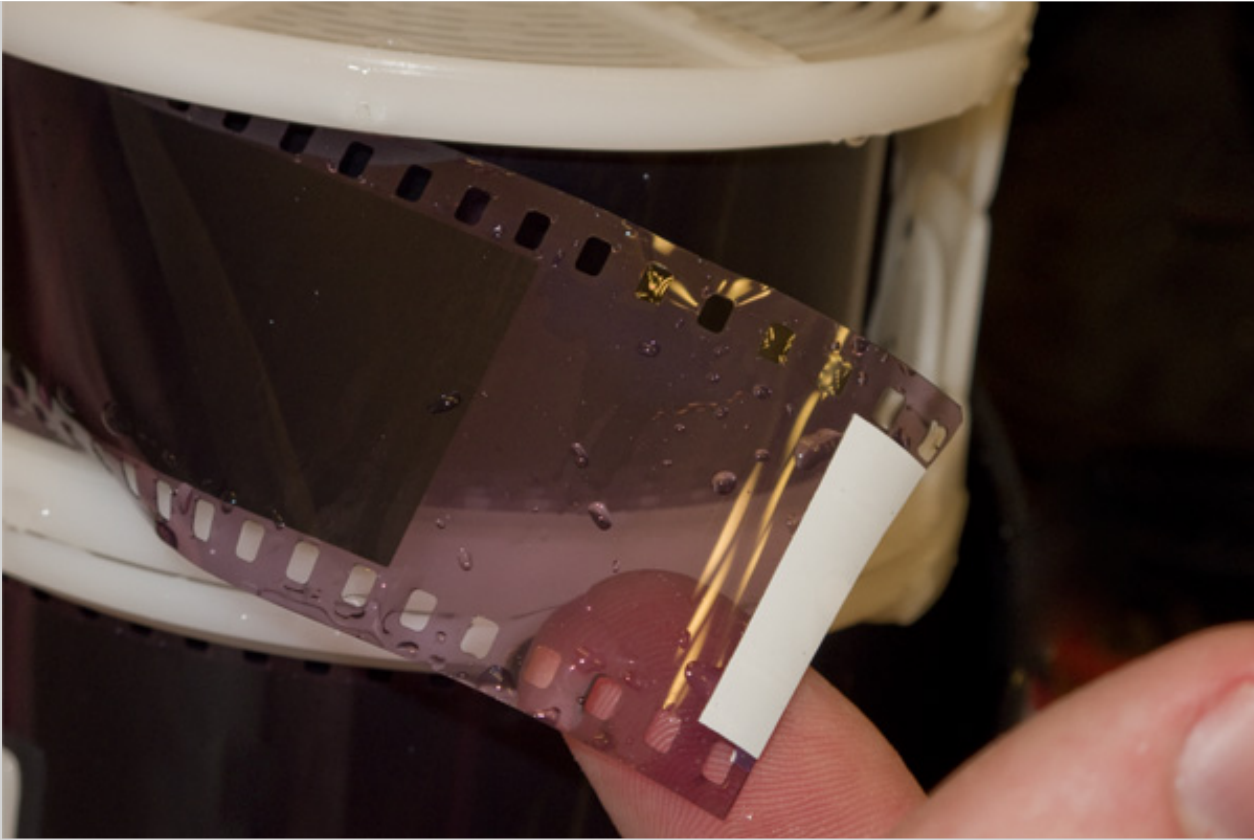
Pour in 20oz of [stop bath](#) and agitate with 1/4 turn inversions for 30 seconds. Pour out and discard.



Step 13: Fixer

Pour in 20oz of fixer. Complete 3 1/2 to 8 minutes of cycles that consist of 15 one second inversions, 3 taps and 45 second rests. Once this step is complete you can open your light safe tank to observe your negatives. If your negatives appear purple and thick continue this process for another cycle and check again.

New fixer takes about 3 1/2 minutes, and as you recycle your fixer it will take up to 8 minutes to properly fix your negatives. Once your negatives are similar to the ones shown pour your fixer back into it's container. If it takes more than 8 minutes for your negatives to clear up it is probably time for new fixer!



Step 14: One Minute Wash

Refasten the lid to your tank and give your negatives a 60 second water wash, then discard the water.



Step 15: Hypo

Use enough HCA to cover your reels. Follow by 1 full minute of full agitation (1 second 1/4 turn inversions). Hypo can be recycled, but it is difficult to tell when the mixture is getting weak.



Step 16: Five Minute Running Water Wash

Give your negatives a 5 minute running water wash. Remove light safe lid and let water pour directly onto the reels.



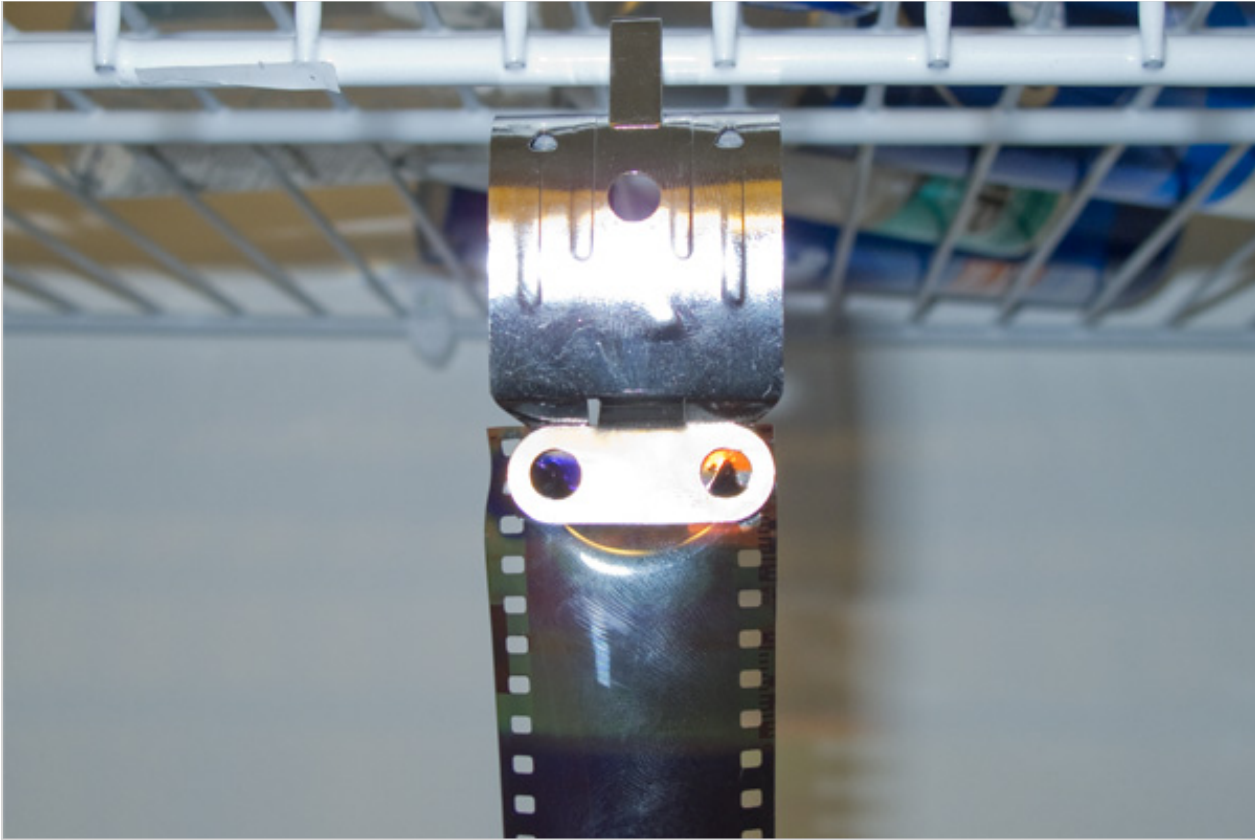
Step 17: Photo Flo

Toward the end of the water wash apply 2 drops of Photo Flo. Rotating your negatives in this solution helps to distribute the Photo Flo.



Step 18: Drying and Hardening

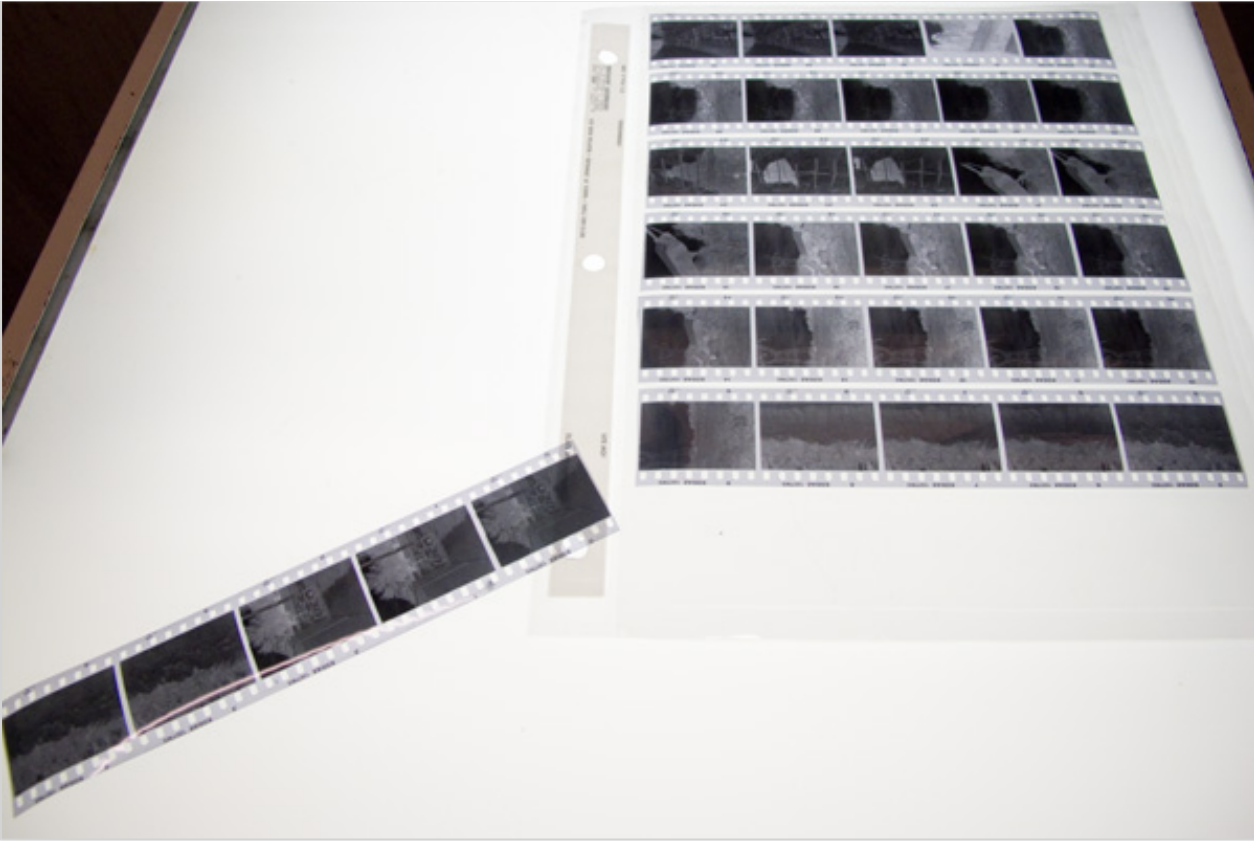
Remove the negatives from their reels and hang them in a clean dust free area. Do not touch the negatives with dry fingers, but wet your hands in Photo Flo solution and lightly run fingers along drying film to remove excess water. Negatives should be given at least 2 hours before you touch them again.



Step 19: Cutting and Archiving Your Negatives

Once you have your negatives, you will probably want to put them into a archival sleeve whether you are using an enlarger to make a contact sheet and prints later, or you are just scanning them to a digital format.

I use Print File's Contact proofing preserver because I like to store the contact sheet right on top of the negatives for easy proofing. You will probably cut after either every 5 frames or 6 frames depending on the negative preserver.



Step 20: Examine Your Negatives

It helps if you have access to a light table here, but you can just as easily hold your negatives into any light source to examine them. A well developed negative has both areas that are fully thick but still has areas where the negative is completely transparent.

Thin negatives will result in very gray prints concentrated in the mid tone range, whereas overly thick negatives will result either in prints that are too light and lack detail or gray negatives that appear blurry and fogged.

Inspect the negatives for watermarks, scratches and dust. Scratches to the emulsion side of the film are very difficult to fix. Dust and watermarks are easily removed with an anti-static or micro-fiber cloth (be careful to use clean lintless fabric that is free of grit or dirt they will scratch your negatives).



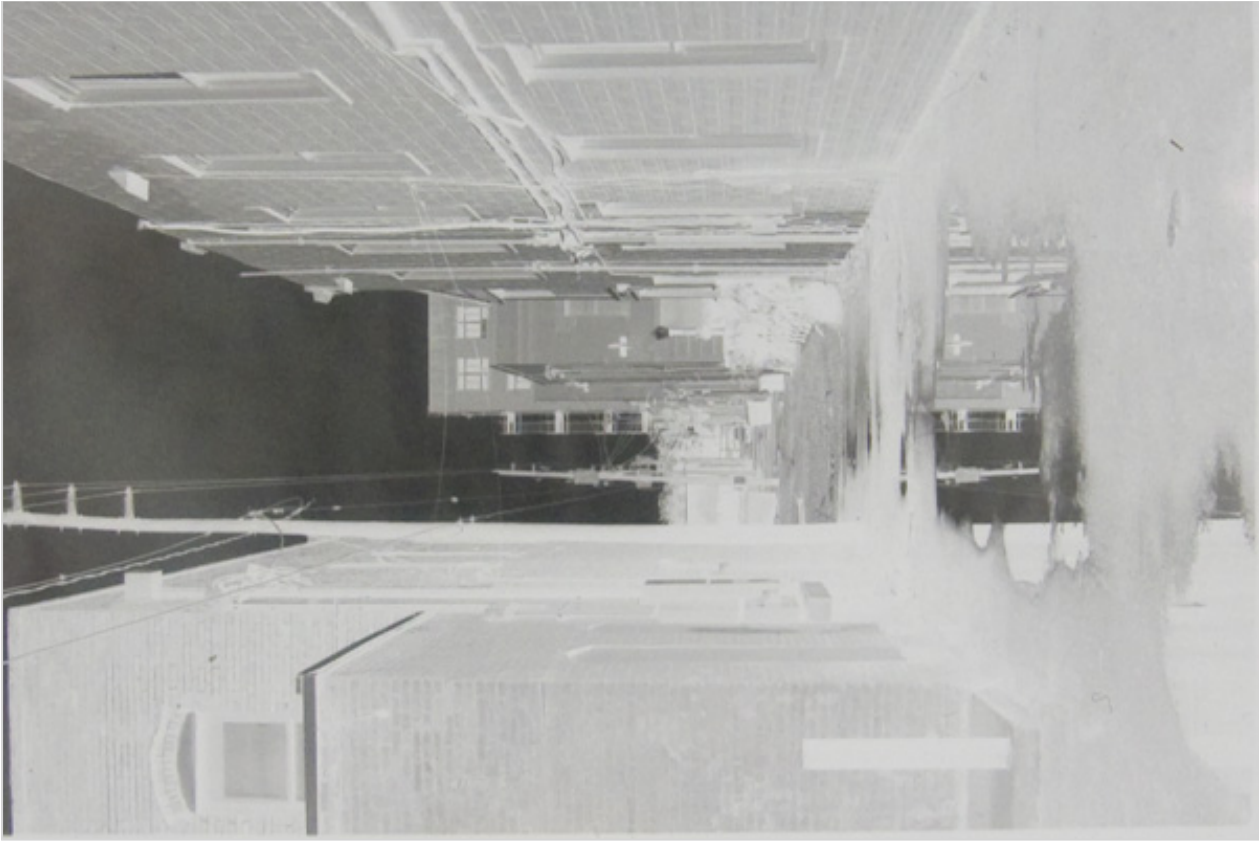
Well Exposed Negatives

Here is an example of a well developed film. Notice there are areas where the film is completely transparent and there are areas where the negative is completely black. This will result in a print with a full tonal range.



Thin Negatives

If your negatives are thin, you underexposed. If you have negatives similar to these you will end up having a print that is gray and muddy. In the printing process you can try to fix this with high contrast filters that but overall you will end up losing a lot of the grayscale. These values look unnatural compared with that of a well exposed negative.



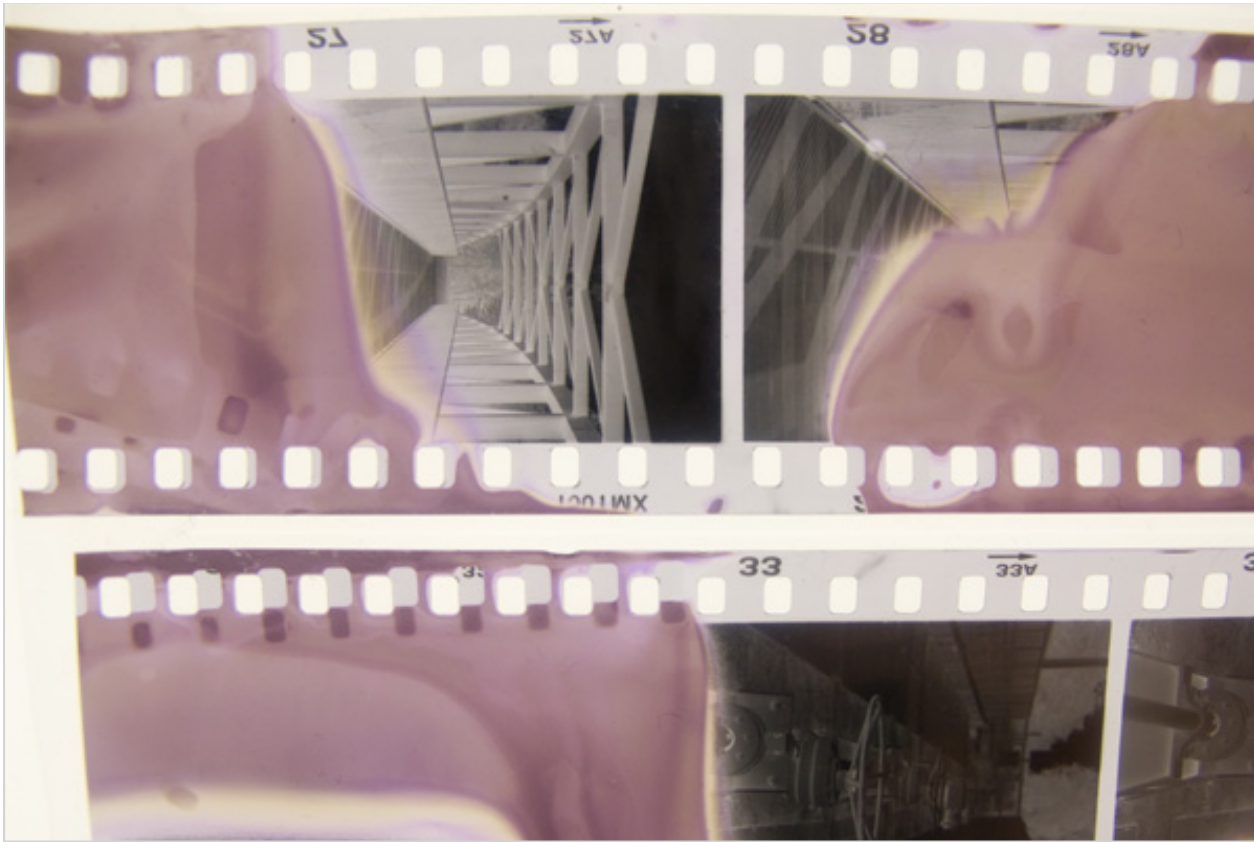
Thick Negatives

If your negatives are too thick, you overexposed. While slightly overexposed images have higher contrast prints overall you will lose a few mid-tones. Overly thick negatives will give you a gray print, but unlike underexposed negatives there will be a lot more dark tones. If a negative is very thick, reciprocity failure becomes an issue (this negative is also slightly fogged).



Undeveloped Portions of Your Negative

In this case your film came off the track when we were loading the reels. It is rare to have this happen with plastic reels but if metal reels are used it is a more common mistake. If you continue to have these results try practicing with an exposed roll of film with the lights on.



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Fogged Negatives

If the negatives were exposed to any source of light, it is visible in the areas of darker tones (where the negatives should be transparent). Indirect or reflected light

that is a result of a poorly light-proofed room can be harder to detect.

Look at the edges of the negative. If you see patterns similar to those below it is possible that the room where the film was put onto the reels was not entirely lightproof. Fogged negatives will result in a loss of lighter tones and overall result in darker more muddy prints



Have Fun!

Though the idea of developing your own negatives certainly sounds a little daunting, it's a great experiment to try and certainly gives you a better understand of how photography works. There's a huge satisfaction to handling your own images from the initial shoot, through to a finished negative!

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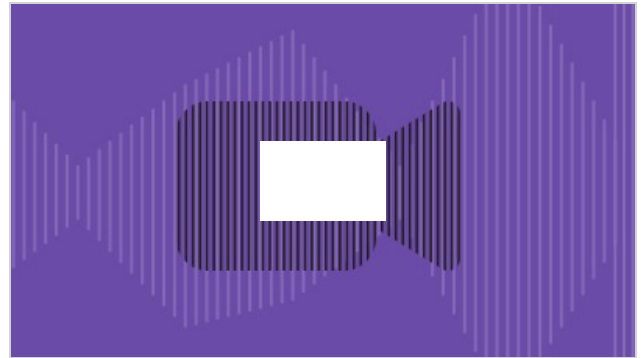
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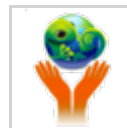
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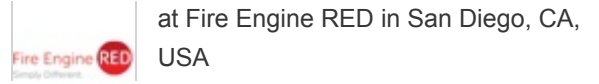


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Andres · 5 years ago

Stop bath can be reused and will change color when it has been depleted.

1 ^ | v · Reply · Share ›

Dedek Hajes · 8 months ago

simple yet powerful tutorial. thanks sir !

^ | v · Reply · Share ›

amandeep · 2 years ago

thankuuuuuuuu

^ | v · Reply · Share ›



sarra · 2 years ago

hey, this makes it look easy! but wait until you actually try it ... I keep having a problem with the reel :(I had my film falling 3 times and spend 2 hours in the dark room to just load it and it didn't work ... I think loading it is the hardest part.. mixing the chemicals were easier for me :(is there any advice to how to load the plastic reels ??? I need real help here

reels ??? I need real help here ...

^ | v · Reply · Share ›



Darin Heinz → sarra · 2 years ago

I found the plastic reels to be easier than the steel ones. If I feel for the loading ends (those rounded triangular wing thingies) I can gently pinch the film (curling it a little down the middle) and press the edges against the wings. pinch a little more, and the edges snap into the grooves. From there it's easy to wind the film along the tracks. Once it's loaded, I gently roll the film back and forth along the tracks. If it moves freely i can be sure to have no touchmarks when the development's done. hope this helps!

^ | v · Reply · Share ›



Andy · 3 years ago

What is the purpose of the pre-developer water soak? I haven't processed film in about 20 years, but back when I did it, I never remember anyone doing doing this soak.

^ | v · Reply · Share ›



Cameron Knight → Andy · 3 years ago

It's serves to purposes. First, it should knock off any dust the film picked up while being transported through your camera or wound on the reel. Secondly, it "should" cut down on air bubbles when the developer is added. Imagine a regular piece of paper. Dunk it in water one time, there will probably be a bunch of time bubbles on the surface. Pull it out and dunk the now wet paper into the water, there will be less bubbles. Obviously, this process on film is just on a much smaller scale. There's probably some viscosity/surface tension science explanation for this, but it not something I know about. Getting the dust off is a good enough reason for me.

^ | v · Reply · Share ›



C.Harvey → Cameron Knight · 3 years ago

I suggest that pre-soaking the film unnecessarily adds to the total "wet time" of the film. The longer the film is wet the more coagulation of the grain structure. It is another one of those delicate balances of giving up one asset for another. Bubbles are easily avoided by tapping the can on the counter just after injecting the developer. Don't know how water would remove dust any more than the developer would. ... just sayin'... i'll go for the finer grain and start with the dev.

1 ^ | v · Reply · Share ›



lady gaga · 3 years ago



marcus stop being dumb do not use liquid soap it is dangerous for your health how can you be so crazy

^ | v · Reply · Share ›



charles hill · 3 years ago

Does this same procedure apply to 120 roll film also and what is the self life of an unspurred bottle of t max concentrate?

^ | v · Reply · Share ›



raoul → charles hill · 3 years ago

TMAX will last 6+ months in an opened bottle if kept in a cool place. You can also mix your own D76 or similar from chemicals - not hard at all. Then you can have as much or as little, and nothing can go off.

This same process applies to 120 film - except the reels are a different size, and getting the film spooled is much easier (although remember to take off the paper backing, just separate it from the film, it's only taped on)

^ | v · Reply · Share ›



Hannah · 3 years ago

I could read a book about this without finding such real-world apporceaahs!

^ | v · Reply · Share ›



Marcus · 5 years ago

I normally use 2 drops of dishwashing liquid or shampoo in place of photo flo.

I use Rodinal developer but I want to experiment with D76 and Kodak developer. There are many combinations of film and developer that give you different grain structure.

^ | v · Reply · Share ›



trevor whitis · 5 years ago

Water can be substituted for stop bath, just rinse for 1 min rather than 30 sec, saves money and environment. I normally rinse with water for 15 sec dump the water out and rinse with fresh water for another 15 sec then dump that out and rinse with fresh water again for 30 sec, this has always worked for me and was taught to me by my professor.

^ | v · Reply · Share ›



ziggy · 5 years ago

An alternative to a completely dark room for opening the film canister is a dark bag that is made specifically for this stuff. (ex. [http://www.virtualvillage.com/...](http://www.virtualvillage.com/)

This is a nice cheap alternative. I frequently use dark bags in my high school photography class (its B&W class).

^ | v · Reply · Share >



Amanda · 5 years ago

Nice. Thanks for that, It'd been so long since I'd done it, I'd forgotten how.

^ | v · Reply · Share >



The importance of backgrounds · 5 years ago

thanks for a great article. ive only developed a black and white film once with an instructor in the room actually but it was a very nice experience. one day ill have my own dark room and will sure reference your article again then =)

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