

Film Development Testing with a Densitometer

I don't know about you but I hate film testing. It really is one of the burdens of analog photography. I would much rather be out making photographs. But I also hate not being able to try out different types of emulsions, considering the large amount of time and money needed to test each new emulsion. I disliked testing film so much that initially I just followed the manufacturers' recommendations, developing all my negatives by hand in tanks or trays. Manual development, however, is not for the faint of heart. It is tedious and for the most part must be performed in complete darkness. That said, I had great success with tray and tank development. It works beautifully and can produce very repeatable results, but efficiency is not its strong point.

Why Choose Rotary Processing?

I have since moved on to rotary processing. First a Jobo and finally to Unicolor drums, both offer consistent performance and lights on - hands free operation. I made the move to rotary processing for two reasons. First, Murphy's Law seems to be ever present in all aspects of photography from the field to the darkroom. Rotary processing keeps a lid on Murphy creeping into the process and ruining a good negative. Second, N+3 in a tray is very boring.

Rotary processing links:

<http://www.jobo.com/web/Darkroom.333.0.html>

<http://www.largeformatphotography.info/unicolor/>

<http://unblinkingeye.com/Articles/Rotary/rotary.html>

*A few notes about rotary processing. Published rotary processing times are really not very accurate. Temperature accuracy and stability are also more critical, considering the shorter development cycles and increased agitation.

The Magic of a Densitometer

The densitometer is a tool that is used to measure the density of both film and paper. These instruments were commonly used by photo labs and with the switch to digital these labs no longer have a use for their machines. They are easily found on the used market. They have relatively few moving parts and replacement bulbs are still available for most units. I use an X-rite 820. The densitometer allows you to measure film density very accurately, eliminating the time consuming step of testing on black and white paper. With the aid of a densitometer it is possible to use just three sheets of film to determine times for N, N+1, N+2, N+3, N-1, and N-2. As a side note, when using this method Effective Film Speed or EFS is just an estimate. You should do in camera testing to determine EFS for each emulsion.

The following spreadsheet is based on the method explained by Gerry Russell in ViewCamera Jan/Feb 2001. This is also similar to Phil Davis' method, <http://btzs.org/> and <http://www.viewcamera.com/pdf/2007/btzs.pdf>

Materials required:

- Enlarger
- Contact Printing Frame
- Digital Enlarger Timer capable of very short exposures ($1/10^{\text{th}}$ of a second) or an enlarger lens with a shutter. A shutter is much more accurate especially if you use a halogen enlarger.
- Stouffer 21 Step Tablet
- Densitometer

Procedure:

1. Contact print Stouffer 21 Step Tablet to 3 sheets of film to be tested, at an exposure that will give .10 + film base and fog, for step 21, with an N development. (see, Finding N Development Time, below for a more detailed explanation)
2. Give one sheet N development, one N+ (30-45%), and one N- (20-30%).
3. When your film is dry, measure the densities and enter the data into the red fields of the above spreadsheet.
4. Enter your target Zone VIII density. (I use 1.3, most emulsions will show separation far above this 3.0+)

Download my spreadsheet from the link below (My data for Delta 100 in Xtol 1:1 @ 68 degrees Fahrenheit with continuous agitation in Unicolor drum on a Unicolor roller has already been entered):

<http://www.willwilson.com/filmdev/FTC.xls>

If your processing and exposure is consistent you should end up with developing times for N, N+1, N+2, N+3, N-1, N-2. The N+3 times are estimates only, you typically need specific testing for anything more extreme than N+2 or N-2, some emulsion will not give a true N+3 no matter how long you soup them. Having a perfectly clear area of film for discerning your film base plus fog measurement is critically important with respect to the accuracy of your data. I use a folded over piece of aluminum foil tape to the top of my Stouffer wedge.

Finding N Development Time and Stouffer Wedge Contact Print Exposure Time

If you need to know N development time to test your film for N, N+, N-1, development time where do you start. Well, I guess. I know what you are thinking: *Guessing? Will, you are crazy. I am a photographer. Photographers don't guess they meter and calculate.* Well, .10 + film base and fog is a very low density. This means the film in this area has been sensitive by light just slightly. You can develop that area all day long and you won't get much more density. These areas on negative of low exposure develop within the first 30-40% of development. This means that you can use the manufacturers' recommended times and temperatures (remember to reduce the time by ~25% if you are rotary processing) or make a general guess.

Calculating the exposure for the Stouffer wedge contact print is a little more difficult. Several things come into play, enlarger height, aperture, exposure time, focus, etc. I suggest starting at your 11x14 full frame distance, focused, f11, for one second. Then make six different exposures around f11 in one stop increments. Next, develop these six sheets for your N development time. You might need to repeat this process to hone your 21st step density. I suggest making smaller adjustments with the aperture instead of height or exposure time. Once you have your exposure set it is relatively easy to adjust for different emulsions that have higher or lower speed.

Good Luck!

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