ENLARGER PRINT TIMES, CALCULATOR ONLY VERSION
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Test Details and Process

This version assumes the reader is not familiar with spreadsheets or computers in general and requires no more than a low cost scientific calculator. Calculations involving logarithms will be explained at the appropriate point in the text,

There are three fundamental questions that have to be asked when printing a negative :-

1). **Have I managed to print the extreme highlights correctly ?**
2). **Have I managed to print the shadow areas correctly ?**
3). **Is it possible to print highlights and shadow images correctly, simultaneously ?**

The problem is controlled mainly by the gamma of the film characteristic curve being incorrect. For example if the gamma is too high the density of the highlights will demand excessive print times causing the toe region to quickly loose detail. Tests have shown that gammas need to be kept as low as 0.55 or lower, to get close to simultaneous print times at the extremes of film characteristic curves. There are also other advantages to optimising print times.
See below on the final page.

There are two simple tests that can be carried out in the darkroom to answer the above questions 1 to 3.

STEP 1 USES A CALIBRATED FILM SAMPLE OF KNOWN DENSITY Approx. 1.2 and a Base + Fog sample. These are available, as a pair, at low cost from b-wtechnik. An alternative is to use your own base + fog sample.
The process is as follows :-
STEP 1

Set up your enlarger as if you were intending to print a 35mm format image onto an 8x10 paper.
Include Grade 2 enlarger filter and the calibrated sample negative, density 1.2, base+fog = 0.3
Cut a 50 x 50 mm sample of your paper and place it in the centre of the enlarger easel.
Secure with masking tape or similar.
Place a small coin on the edge of the paper and expose using your expected exposure time.
Develop and process the paper. The size of the sample allows 2 times to be fitted on one test.
Remove and process as normal. Examine the result in 500 - 1000 lux light level, approx. 5000K
The ideal result is if the exposed area is just noticeable.
If there is no image of the coin, increase the exposure by 5% steps and repeat the process until an image is just noticeable. If the image is too strong, do the opposite.
We can call the end result the uncorrected Standard Print Time or SPT, for density = 1.2
The corrected SPT is calculated below with typical values as an example below.

Uncorrected SPT	30	seconds
Calibrated Film density	1.25	Density calibration value provided (typically 1.2)
base + fog density	0.28	Use base + fog calibration value or assume a value of 0.28 for 35mm film, 0.12 for 120 film
Corrected SPT	29.0	seconds
Target Density	1.2	

The corrected SPT = SPT x (Target density + b+f level) / (Calibrated film density + b+f density)

= 30 x (1.2+0.28) / (1.25 + 0.28)
= 29 seconds

STEP 2 USES A CALIBRATED SAMPLE OF Base + Fog only, the same value as STEP 1

STEP 2

Change the film to a Base + Fog sample only and repeat the exposure routine as in step 1. Use the SPT as a starting point and it would help if a sample of paper were first exposed to a normal light level (500 lux) for 15 seconds and then processed. This sample is your reference for a maximum black. The point at which the maximum black is almost reached we will call the BPT or Black Print Time.

STEP 3

The Standard Print Time from Step 1 should be close to the Black Print Time.
If there is a significant difference, the development time has to be adjusted.
To check your processing, create your own test samples as follows.

Photograph a white card
Move on the film one more frame. In the darkroom, enable the film rewind, open the camera, let the film cassette fall out and cut off the film close to the cassette and load it into your processing tank. Process as normal.

REPEAT STEP 2 and 3 to find your SPT & BPT again USING YOUR IMAGE of the white card

If the Step 3 SPT is greater than the Step 1 SPT :-
reduce the FILM development time giving a lower gamma and repeat Step 3
If the Step 3 SPT is less than the Step 1 SPT :-
increase the FILM development time giving a higher gamma and repeat Step 3

DO NOT try to use an alternative film speed to correct the gamma.
(Film speeds provided by manufacturers are accurate)
An effective gamma of 0.55 is suggested as a target.

A log density of 1.2 is normal when a condenser enlarger is used.

Why Optimise Print Times

For many years, since the research work carried out by Jones and his colleagues at Kodak during the 1940's and 50's, with negative monochrome film, the recommendation has been to use most of the toe of the characteristic curve. This involves correct exposure and correct development times. The advantages of adopting this method are as follows :

1. When aligned correctly, the curve in the toe compensates some of the non linearity in the toe of the paper which is also repeated for the shoulder of the curve.
2. It maximises the film speed.
3. Film grain is minimised due to the low densities.
4. Enlarger print times are minimised.
5. Callier effects are minimised due to the low densities.
6. Minimum halation.
7. Minimum loss of definition from light scatter.

The above test method does not involve the use of densitometers. Its main parameter revolves around photographing a white card and ensuring the processed outcome representing the white card has a density of 1.2 . If the film overall gamma is 0.55 from a density of 0.1 to 1.2, it is likely that the overall dynamic range will be 100:1, a suitable target. It is often possible to estimate short development times for a gamma of 0.55 from manufacturers data sheets.
For example, Ilford data sheets show 3 development times. Select the lowest time but ignore the film speed shift. This gives a gamma close to 0.55 to 0.59. Ilford standard times appear to

give the same as the speed test gamma of 0.61. Other examples are Kodak TMAX 100, use 6 minutes with D76 stock and Kodak data sheets show useful contrast index graphs.

Finally, the print time tests above are primarily regarded as extra tests to follow 2 frame 6.66 stop tests.