

Tanol & Co

On the characteristics of “staining developers”

Apart from the ABC Pyro Formulation and PMK – the formulation of Gordon Hutchings – there are a number of different recipes for the preparation of pyrogallol developers. The most commonly used today is still the PMK formulation – the standard, without a doubt! With no reservations but one – that pyrogallol is toxic. This constantly highlighted warning by Hutchings is laudable. On the other hand, I believe it is unnecessarily daunting. Pyro developers are unfit for consumption, and you would not want to add them to your bath water. Here in Germany, nobody would have the idea to drink that stuff. On the other side of the Atlantic you probably need an explicit warning, may it be a question of product liability regulations or one of sanity and reason (or a lack of the latter).

You can obviate the health risk of absorbing the substance through the skin by wearing protective gloves. Tanol does not contain pyrogallol but pyrocatechol. If used improperly, this substance is not exactly a health benefit. But this is also true for hydroquinone, a substance that appears in numerous ready made developers in shops. From my point of view, there is no reason to be deterred from the use of these developers in terms of health risks.

Chemistry as such is of no evil. Without it we could not reflect about how to use it.

Developing means reducing exposed silver salt to metallic silver. Proportionally to the blackening (the increase in silver density), formulations with pyrogallol or pyrocatechol and a low content of sulphite, build up an ancillary density of a dye – which is called the “stain”. Pyro developers achieve exceptionally sharp negatives, without the usual disadvantage of a pronounced grain. Especially in the lighter areas of an image, accentuated grain is often distracting. Overexposure and overdevelopment cause agglomerations of grain. The shorter the time of development, the less accentuated will the grain be. The dye accumulates between the silver grains. Its density depends on the amount of exposure. Exactly there, where the grain is eye-catching – in the areas of a high silver density – the stain fills up the gaps between the grain. The area becomes more homogenous.

Differences between the formulations of these developers are not so much about how much sharpness they can achieve, but more about the colour of the stain and the speed they can bring out of the film.

PMK produces a yellow-green stain. Depending on the film you use, the stain of Tanol is greenish, but can also reach red-brown.



PMK



Tanol

Tanol achieves more light sensitivity than PMK. The densities of the highlights are more or less the same.



The raw contact print of these identically exposed negatives on one sheet of paper clarifies the difference. If you printed the negatives individually with optimal filtering, their tonal values would not be identical, but both would lead to a satisfying result.

In zones II to IV the PMK print would show less delineation. Filtering in a harder gradation, the shadows would turn out better, but the sky would lose its delineation. A third of a stop - half a stop at most - is what is missing in this PMK negative. In large format photography this tiny difference in speed is negligible, at least when using high-speed film. Those who carry a heavy load of equipment know their material and can measure the contrast precisely and then develop the negatives accordingly.

By nature, on roll-film and 35mm film you have fewer opportunities to control the contrast. We have to accept smaller differences in contrast on the film. If bigger differences occur between several negatives, we eventually have to change the film regardless whether it is full or not. This way the loss of material is smaller than in an orgy of trying to print an unprintable negative.

If you use Tanol for the recommended times, your silver curve is slightly bent in the sector of the highlights. If this is not ideal for your workflow – e.g. you always have to filter with a gradation of more than 3 – you can increase the time of development by 10%. The shadow zones will remain unimpressed, only the higher densities increase considerably.

Calibration

If you measure with a (colour-blind) black and white densitometer, you can only determine the densities of the silver! The density of the stain increases proportionally to that of the silver, but it cannot be measured this way.

The density of the base-fog is lower on negatives developed in Tanol than on those developed in PMK Pyro- or Tanol Speed. This is only an advantage if you either print in larger formats or if you use original negatives to print in alternative printing techniques like platinotype or cyanotype. In UV light, the yellow stain of pyrogallol requires significantly longer exposure times than the brown stain of Tanol.

The new Speed version of Tanol achieves twice the light sensitivity of PMK. Depending on the dilution you use, it is a plus of 1-3°DIN towards conventional Tanol.

To determine your individual film speed, you need to prepare a series of exposures of a grey card (or any other homogenous surface of any body colour). You have to illuminate it uniformly! Turn the focus of your lens to infinity.

zone	I	II	III	IV	V	VI	VII	VIII	IX	X
exposure	-4	-3	-2	-1	grey card reading	+1	+2	+3	+4	+5

On roll film you have two more shots left for picture photographs to control the sharpness and the structure of the grain.

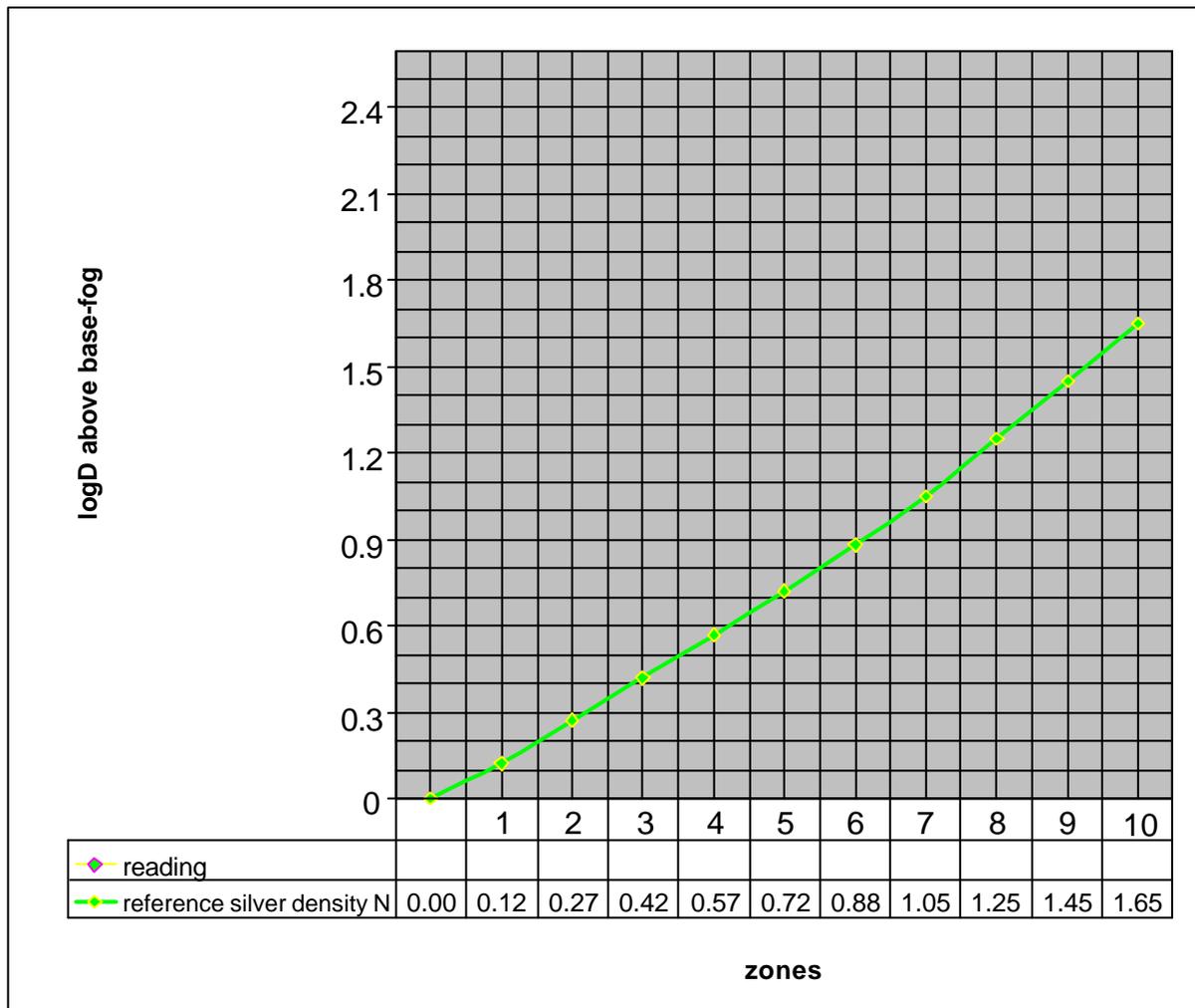
After development, calibrate the base-fog to zero on your densitometer and measure all exposures. Compare your result to the nominal curve on the chart.

The reading in zone I determines the speed of the film. In the universally used ISO norm, zone I shall have a reading of 0.09 to 0.1. For many users this is not enough. Most of the time, the bottom of the curve is sagging. The shadows show less delineation than you want.

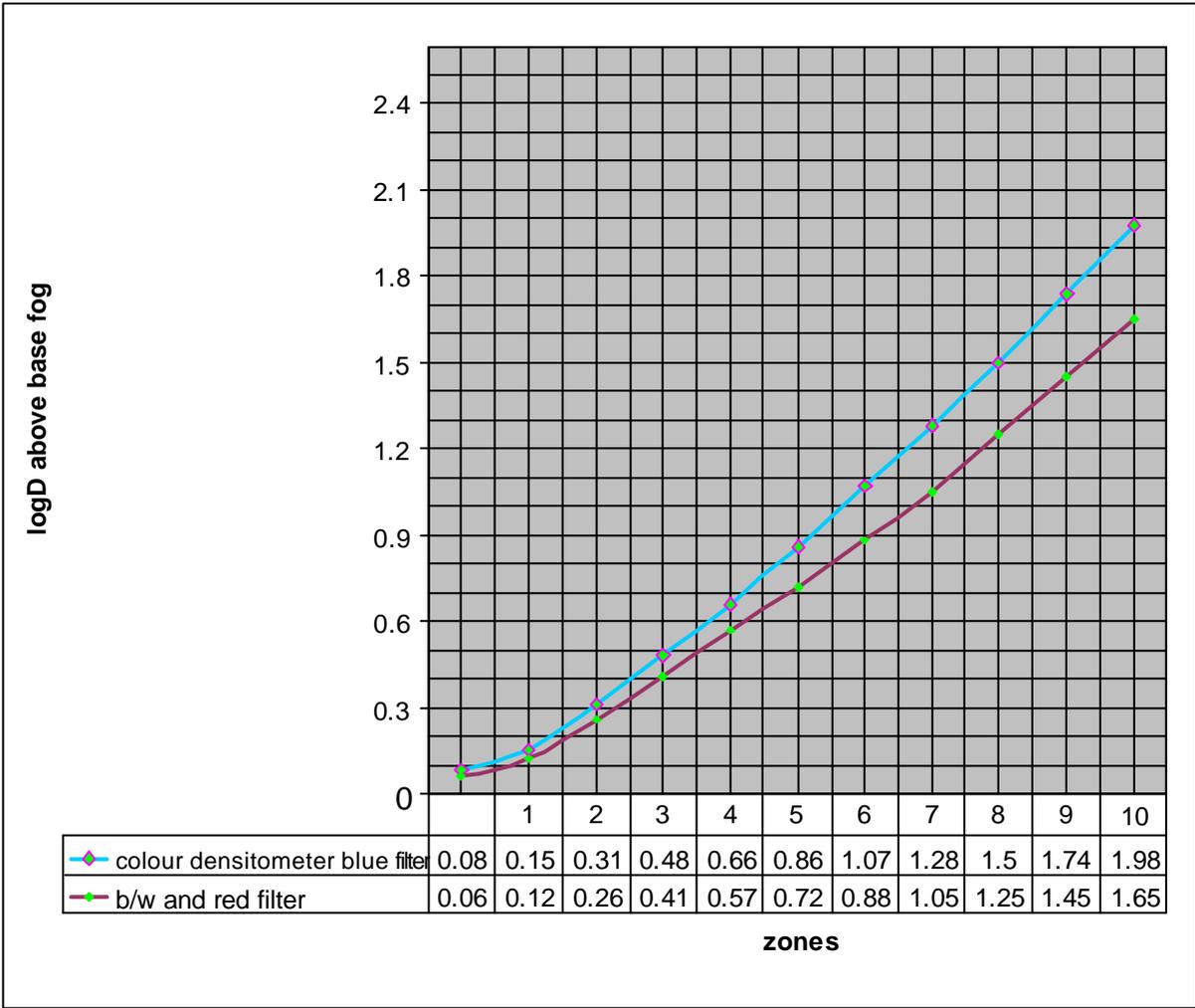
For the lower part of the curve you should aspire for a straight lined ascent. It can be an advantage if the curve is slightly bellied upwards towards the mid tones. Too steep ascents in the higher zones will definitely result in problems in rendering the highlights.

Not all film and developer combinations can be forced into the corset of the nominal curve. However, paper is a lot more limited than film in terms of range of contrast. For a correct depiction of all tone values, it is important to at least observe the upper and lower nominal values.

If your evaluation for zone I is slightly higher than 0.12 (ISO 0.10logD) above base-fog, or if all values are above the nominal curve, you have to keep the exposure settings and develop a little bit shorter. If the values of the upper zones are distinctively higher while the lower values are only a bit higher, you have to develop a lot shorter. If your measured curve is above the nominal curve going more or less parallel, you have to increase the ISO setting on your light meter. If your values fall short of the nominal curve in the shadow zones, you have to switch to a lower film speed. If the ascent of your curve is lower than the ascent of the nominal curve, you have to keep the ISO setting while developing longer.

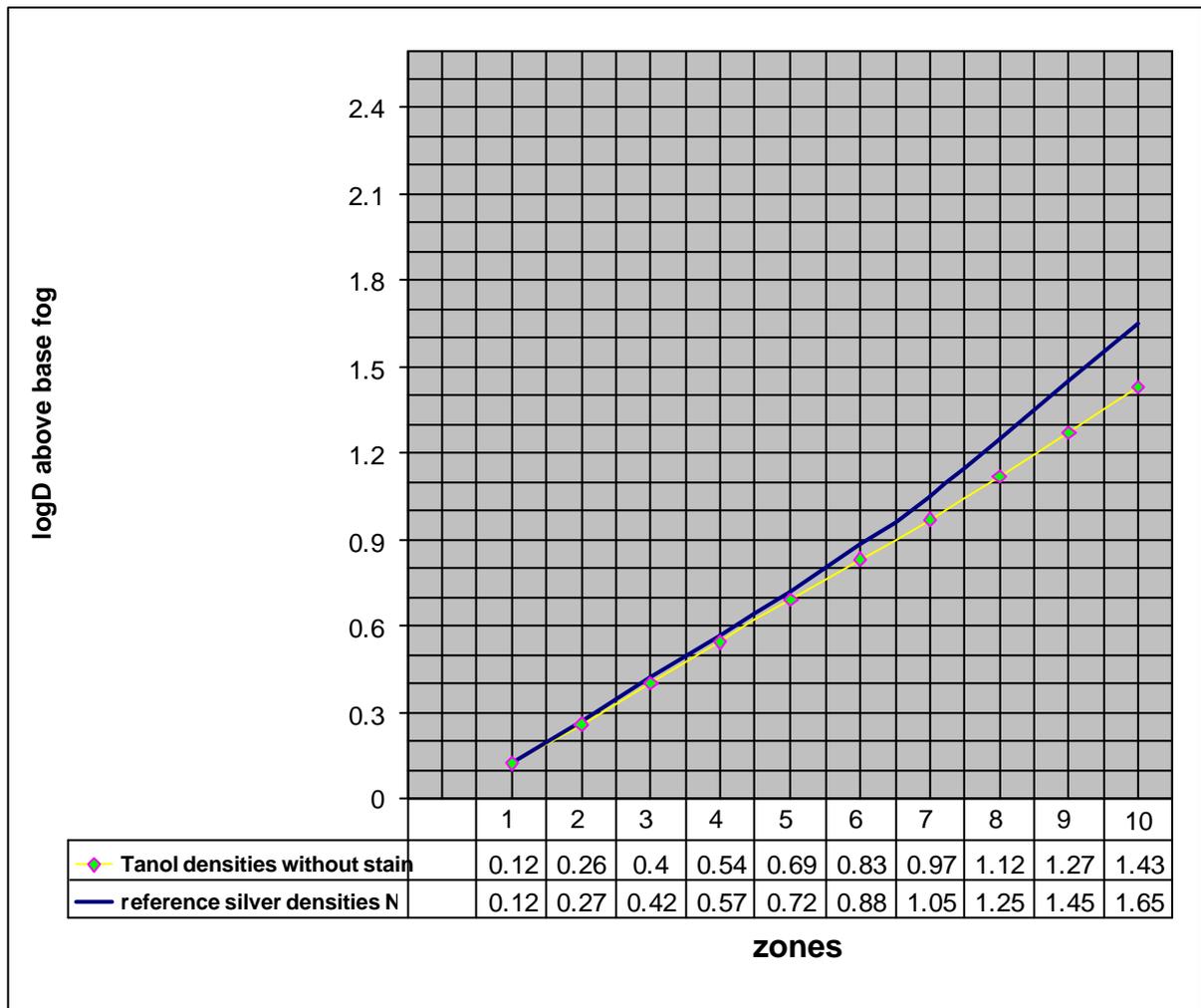


This is my nominal curve for the development of negatives taken in a normal contrast situation. For determining the light sensitivity and the gamma and beta values it is not at all necessary to make an exposure for zone 0.



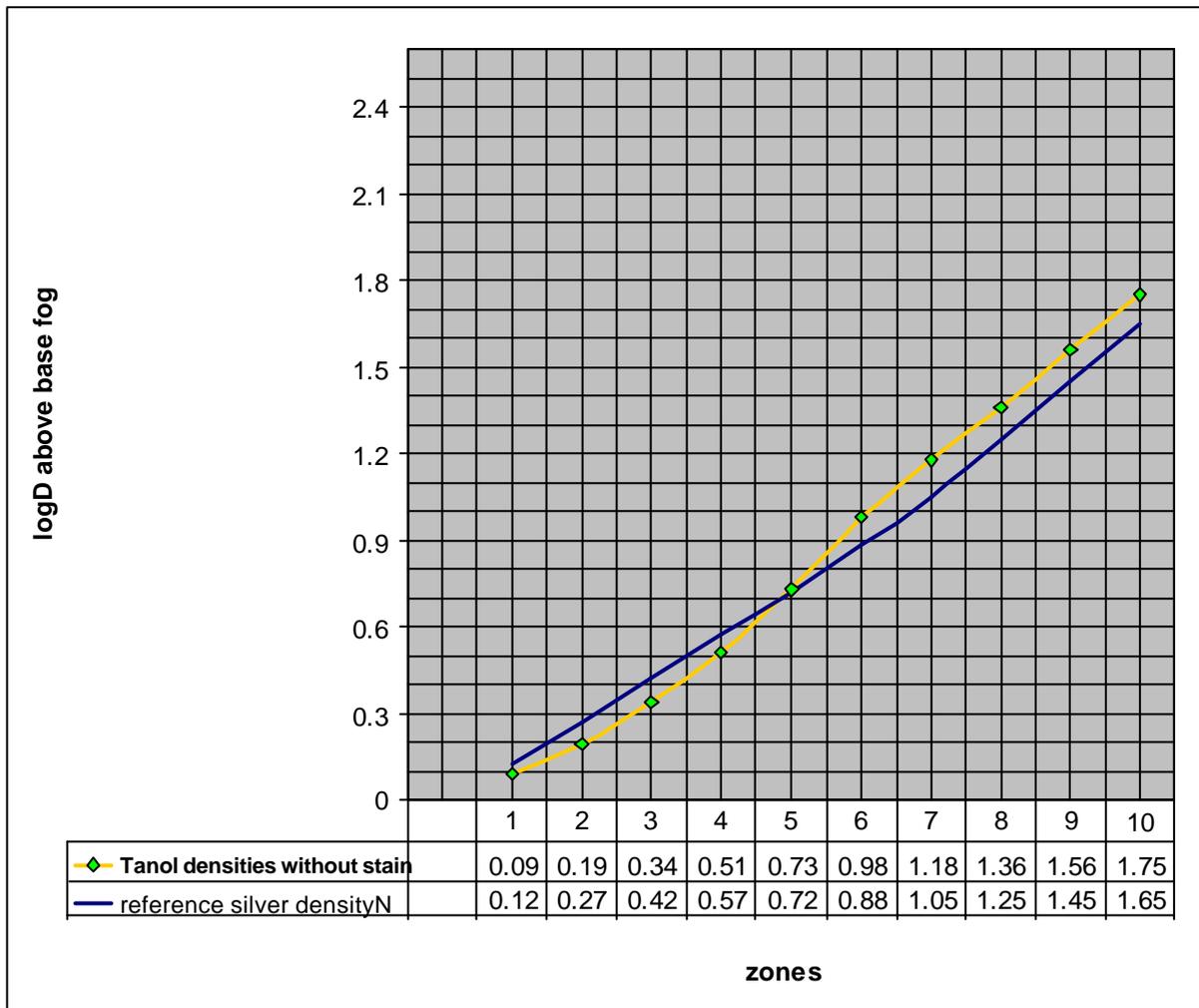
If your readings on a black and white densitometer match the nominal curve, the effective densities in UV light fall within the area of the blue curve. This enables us to use the negative for printing on VC paper as well as for printing in alternative methods like platinotype and kallitype.

If you compare your readings with the filters red, green and blue to those measured in black and white mode, you see that the curve with red filtration is nearly congruent to the b/w curve. The curve with green filtration is slightly higher and the curve with blue filtration ascents steeper.



If you print exclusively on graded paper, you need to flatten the curve a bit by developing for shorter times. The range of contrast with the yellow green stain (of PMK and Tanol Speed) is too high for blue sensitive graded paper. The flattened curve in turn would not be ideal for VC paper. As a result you would have to filter towards gradation 3½ – 4 (magenta).

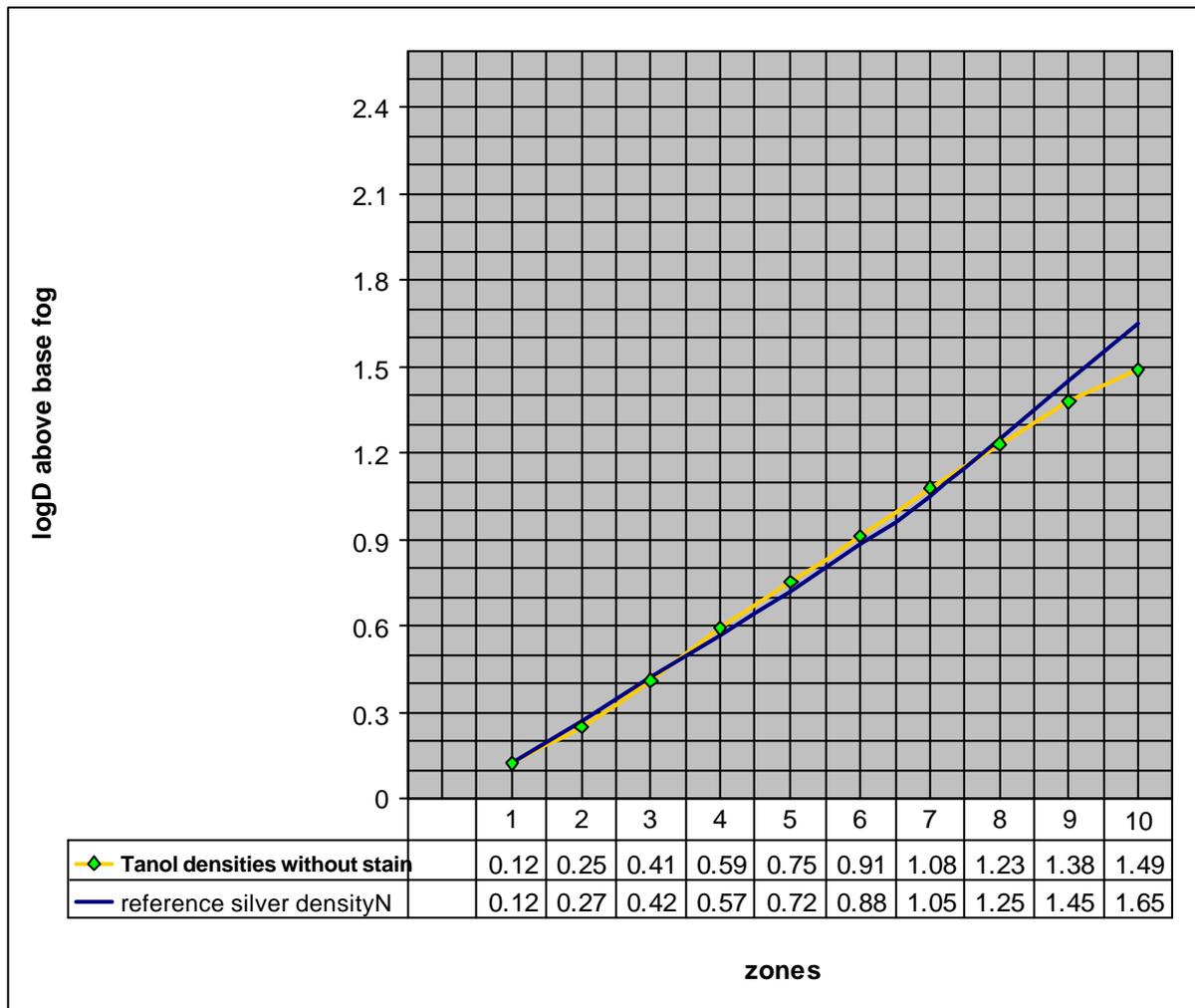
In the normal dilution of 1+1+100 both Tanol developers – like all other developers – react to changes in exposure and time of development.



This is Delta 100, exposed with 80ASA and developed for 11½ minutes. A curve like this one is all but optimal. To the increased silver density in the highlights comes the density of the stain. The shadows are too flimsy.

The highlights need soft filtering and a huge amount of light, while the shadows drown completely.

In case of results like this one, you have to expose in a lower ISO setting and develop the film for a shorter time.



Exposed with 64ASA and developed for 9½ minutes this curve is a match.
To bring out more film speed, the developer has to be diluted further (see below).

PMK : Tanol : Tanol Speed

Without oxidation there is no stain!

Apart from differences of the substances used for the different developers, the varying pH-values of the working solutions cause different effects.

Pyrogallol oxidises comparably quickly in an alkaline solution. The pH-value of the PMK working solution is around 9.85. Its alternative for development in a rotation tank (Rollo Pyro) by Harald Leban has a lower pH-value, so that it is more stable in an oxidation promoting rotation tank.

Pyrocatechol needs a pH-value significantly higher to achieve a similar level of silver reduction and to cause a stain. Tanol has a pH-value of 11.30. Despite this high level of alkalinity the working solution is active a lot longer. This is an advantage when developing N+ with its long developing times.

Apart from pyrocatechol and two other developing substances, Tanol Speed contains a small amount of pyrogallol. In a pH-value of 10.25, this pyrogallol oxidises extremely quickly, but causes a strong stain. After half the developing time it has only very little capacity to develop, while all the other developing substances go on

developing for another while. Since the remaining active substances have little super additivity, this does not lead to unwanted steeping of the curve. Or in other words, with the same agitation Tanol Speed works softer than all pyrocatechol developers that I know of. Be it with metol, phenidone or dimezone-S, all formulations containing pyrocatechol steep up the curve with more agitation. Without a partner the film speed would go down. With the partners above, a pattern of agitation of more than two tank inversions a minute does not lead to an increase in film speed, but to an increase in density of the highlights. It is often propagated to use "semi-standstill" development, which leads to a stronger development of the lower zones. In the higher zones – the areas of the film that received a high amount of light – the developer is exhausted faster. Unfortunately, for some motives this method has to be ruled out. In homogenous areas (e.g. a blue sky) the quickly exhausted developer can cause streaks of uneven development. PMK does not know this problem. Agitation every 15 seconds is mandatory and fresh developer constantly reaches the emulsion. When using pyrocatechol developer (with metol or phenidone) you must not exaggerate agitation. This would not only cause steeper gradation but also a loss of sharpness. The sharpness that you get processing by hand cannot be reached in a rotation tank, even if this is only visible in direct comparison. Tanol Speed in a dilution of 1+1+100 needs two tank inversions every 30 seconds. If diluted higher, increase agitation to up to 6 tank inversions. Since more agitation is necessary here, such a dilution is also suitable for processing in a rotation tank.

For the development in PMK an alkaline bath is recommended after fixing. This way the density of the stain increases and intensifies even more during prolonged rinsing. Using a pyrocatechol developer like Tanol, this after-treatment is of no use. Rinsing for a longer duration does not change anything about the stain. This is also true for Tanol Speed. In neutral or alkaline fixer, the dye caused during development is not reduced. Avoid very acidic fixer, or only use it if the base-fog got too dense, due to long developing times and the resulting formation of too much dye.

An acidic stop bath can be used to stop development without dire consequences. For this purpose a ½% solution is sufficient. Stop-bath and fixer change their colour towards red-yellow already after only one use. This has no consequences, though. Both are still good for further use.

If you prefer a water bath over an acidic stop bath, you need to change the water twice after 30 seconds of agitation each time. A higher concentrated stop bath can be used to reduce the stain before as well as after fixing.

The range of contrast and the stain while printing

As you can see in the curves with stain (above) the range of contrast is significantly higher than indicated on the b/w densitometer. This is true for both stain-colours, the mostly brownish tone of Tanol and the yellow-green tone of Tanol Speed.



Both developers produce an ancillary density that is almost equivalent to doubling the silver density when using blue or UV sensitive material. In terms of range of contrast, both negatives are suitable for the platinum print technique. The negative to the left has less base-fog, which results in shorter exposure times. You can make platinum prints as well as silver prints of both negatives.

Since only few users own a colour densitometer, you have to take into account that the silver density stays below the normal value on graded paper. The range of contrast of the silver densities is identical in both negatives at $0.75 \log D$. This would not be enough for conventional negatives. With stain the range of contrast is around $0.35 \log D$ higher. The print on gradation 2 is correct in terms of tone values.



photographer: Willi Morali
paper and developer:
Adox Nuance G2, Separol HE

On variable-contrast paper the effect of the stain is different. The more the colour shifts towards yellow or green (Tanol: brown-green, Tanol Speed: yellow-green), the more does the stain act as a filter towards a softer gradation. With a range of silver densities of 1.05 logD, a correct print in terms of tone values is achieved by filtering to gradation 3. For graded paper such a range of contrast is too high (see example below). Only if the silver densities have a range of contrast of 0.80 logD at most, does the stain of Tanol Speed allow the use of both variable-contrast paper as well as graded paper. If you only use VC paper, your silver densities should more or less match the normal range of contrast. If they do, it is of no importance if you could not take the stain into consideration due to a b/w densitometer. Yellow and green both filter to a softer gradation. They will not block the highlights.

Heiland Splitgrade System

If you determine the filtration not by means of proof strokes, but with a standardised measuring system (like the Heiland Splitgrade Controller), a negative with a yellowish stain needs a harder gradation than indicated. Generally speaking, increase the filtration by around 0.5 to 1.0 gradations. You cannot make correcting adjustments on the controller, because the intensity of the stain largely depends on the film you use. Even the same emulsion in another format can produce a different colour. For instance, the stain of Tmax100 is less yellow on 120 film than on sheet film. Exposure times also need a correction, because the density of the base-fog is determined without the stain. If you always use the same film and develop it to the same gamma value, you can save a correction for filtration and exposure time. This can be done in the memory for papers on the second page of the controller.

As mentioned earlier, if you adjust your development to achieve a higher sensitivity of the film by using a more diluted developer, the density of the stain increases proportionally to the silver density. The density of the base-fog also increases. This results in doubled exposure times for the print.

To make this clearer two examples on TMY: to the left exposed with 400/27° ISO as recommended by the manufacturer; to the right exposed half a stop less. In conventional processing technique, underexposure in combination with longer development does not lead to a higher film speed. It only results in a steeper curve in mid tones and highlights and in a loss of separation in the shadows. If you change the ratio of Tanol Speed from 1+1+100 to 1+1+130 and increase the development time by 50% you gain 1-2°DIN in sensitivity. If you use ISO standard for your evaluation (0.10 logD for zone I) it is realistic to get twice the film speed, as long as you are printing on VC paper!

If you compare both negatives, you see a denser base-fog but also more delineation in the shadows on the negative to the right.



1+1+100 developed in a dish
for 10 minutes at 22°C



1+1+130 developed in a dish
for 15 minutes at 22°C



The contact print of both negatives on one sheet of VC paper (MCP) using the same exposure time allows us to see the difference. The right print is lighter, due to a higher base-fog. Even if you adjust the exposure time (resulting in a darker print), you retain more separation in the shadows.

Whether or not this is positive for the impression of the photo is irrelevant. If gaining more film speed is crucial, the right negative can be exposed to deep blacks without losing delineation in the highlights by increasing the magenta filtering. The high density of the stain in the highlights offers more resistance to the magenta filtering than the comparably weak stain of the shadows.



A print on graded paper shows us the limits. The contrast range of $1.05 \log D$ (of the silver) measured by the Heiland Controller plus the stain (of Tanol Speed) is too high for normal blue sensitive silver emulsions. You cannot print on G2 paper in a normal contrast developer. Even a soft working paper developer cannot cover this range of contrast!



The result on VC paper looks completely different.

Paper Select Ivory VC developed in Separol HE:

Left negative (400ASA) with Heiland Controller time (memory selection: Select VC) +1.3 stops and gradation +0.4

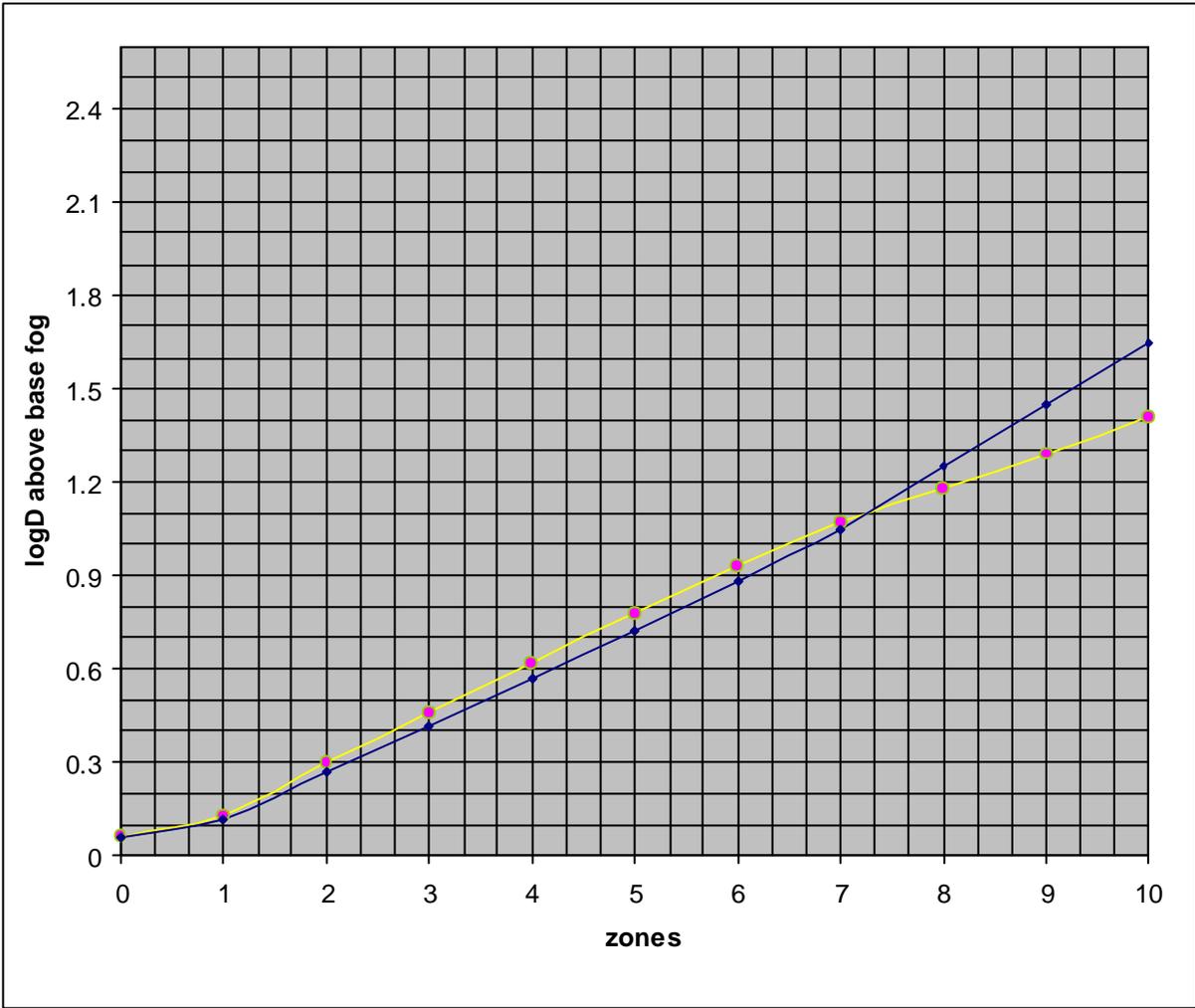
For comparison: Right negative without adjustment of the filtering but with a 40% increase of exposure time (+1.7 stops)

Developer Separol HE diluted 1+8 and developed for 3 minutes.

The developing times indicated on my data sheet have been determined with two minutes of prior rinsing. Without pre-rinsing the developing times have to be decreased by 15 to 20 seconds. Aside from a few exceptions (like Delta 400 or Adox CHS 50), prior rinsing is not mandatory. If N-development is carried out by the SLIMT method, you don't need to determine the N-time anew.

When developing in a tank in a dilution of 1+1+100 agitate permanently for the first minute. After that, agitate for two times every 30 seconds by tipping over the tank for a complete 180° – so that the tank is upside down – and back. Then rotate the tank a little bit around its axis and give it the second 180° inversion. It is not important how much you accelerate the tank, but to create a uniform movement for all developing processes to come.

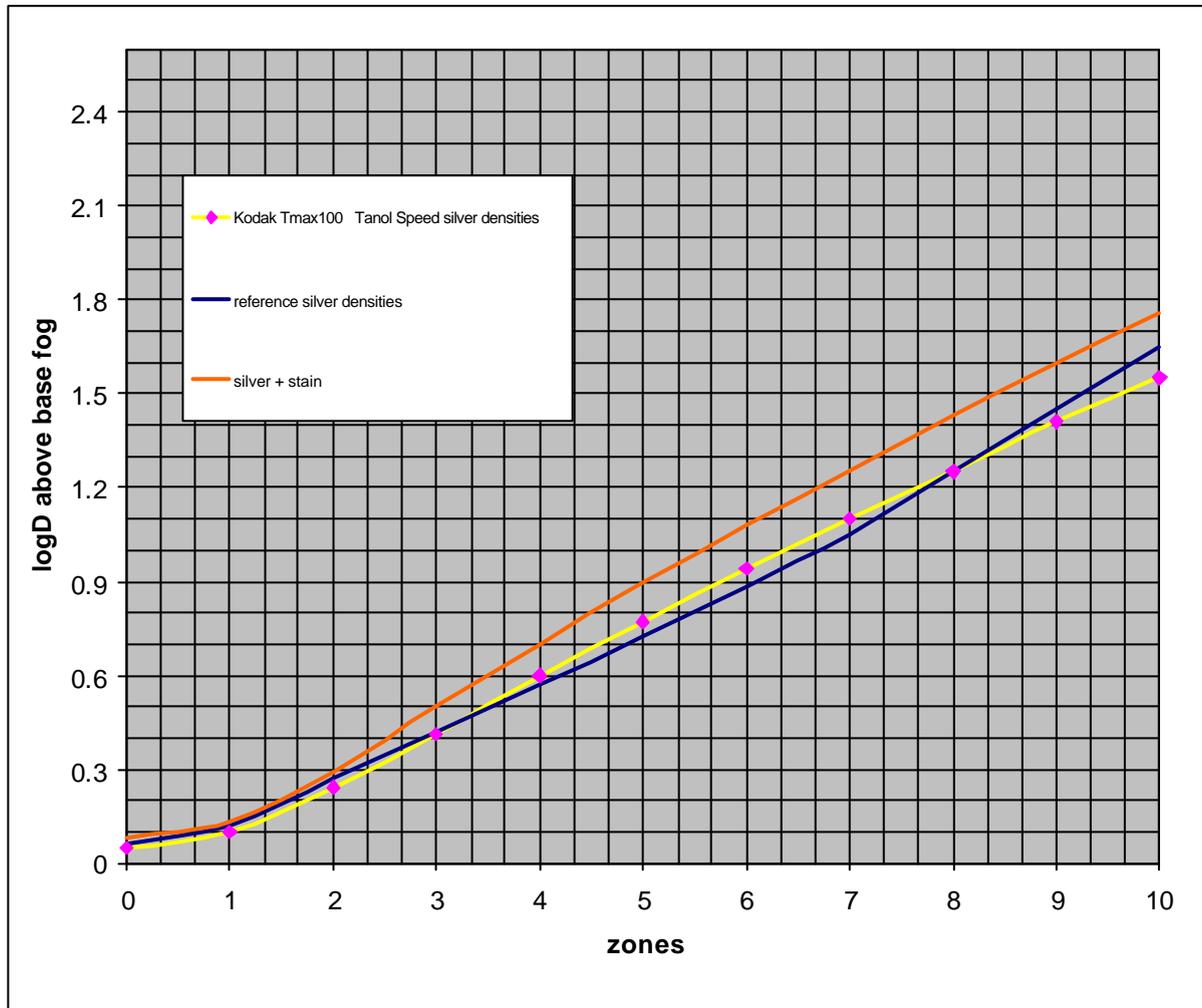
In a dilution of 1+1+130 more agitation is necessary, 3 to 6 inversions. There are two reasons for this. Developer in a higher dilution oxidises more quickly, so that you need a faster flow of "unexhausted" solution to prevent streaks of uneven development. In the highlights higher amounts of silver salt have to be reduced, so that the activity of the developer decreases more quickly in those areas. Without a constant flow of fresh solution, this would lead to a (mostly unwanted) loss of contrast



Tmax100 @125ASA developed in Tanol Speed 1+1+130 for 15½ minutes with 3 inversions every 30 seconds.

You see a typical curve for a development in this dilution, with a bellying up in the mid tones. The shadow densities are a bit too high and the highlights a bit too low. This flattening of the contrast is not necessarily wanted.

To get closer to the nominal curve in the highlights, you have to increase development time or agitation. Doing this, the shadows increase slightly further above the nominal curve. If you simultaneously set the film speed to 160ASA, zone 1 stays slightly below 0.12 logD, but the ascent of the curve is still steep enough to allow separation of the shadows.

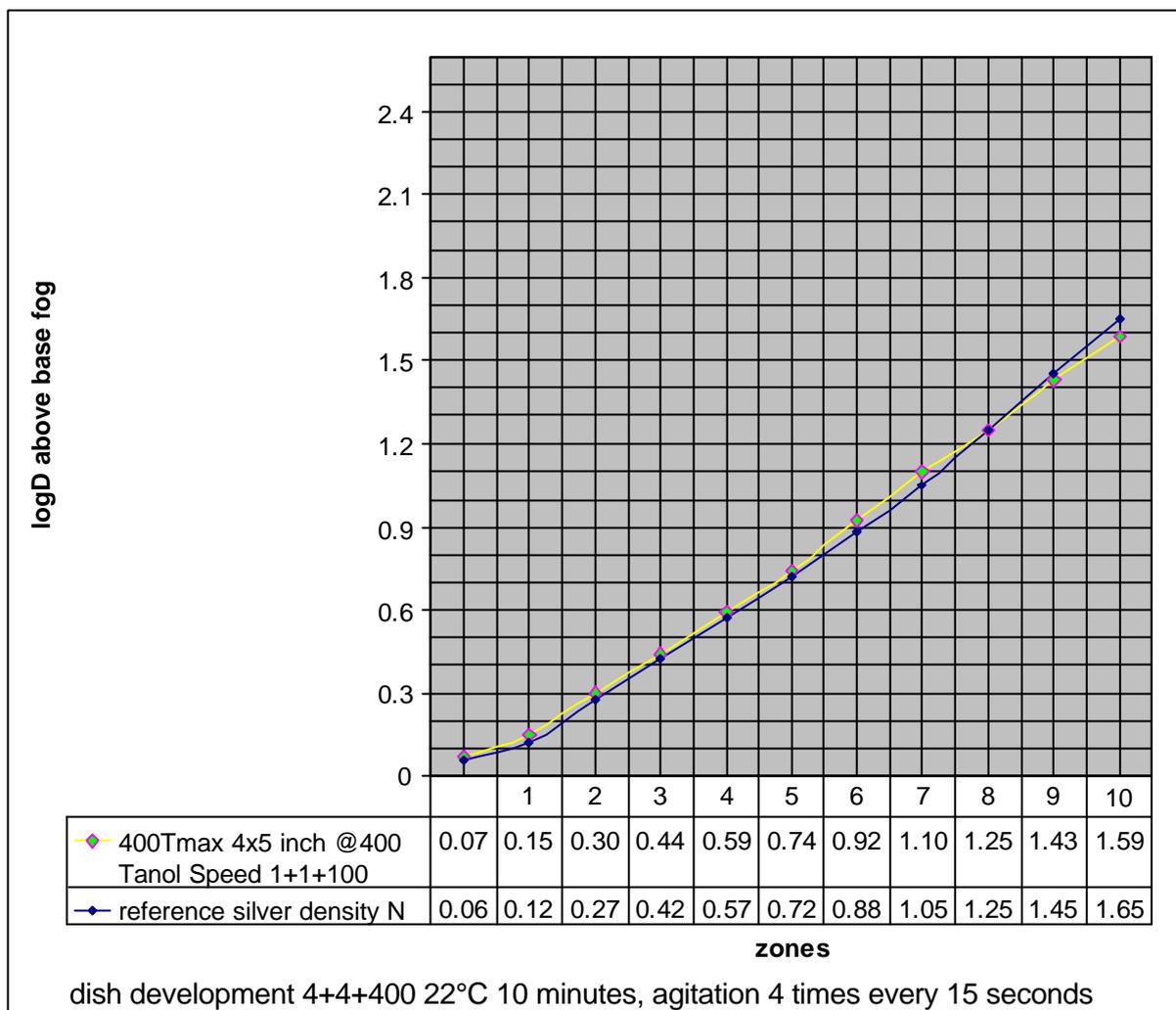


Tmax100 @160ASA developed in Tanol Speed 1+1+130 for 17½ minutes with 4 inversions every 30 seconds.

Sheet film

I recommend developing sheet film in a dish. This is the only way to ensure homogenous development across all areas of the film. A big size film demands for a lot of agitation. When developing in a tank the inversions cause turbulences on the edges of the sheet film. This results in higher densities in those areas. Developing with the emulsion side down seems to me the only logically correct way, but if you fear this to cause scratches, you may as well develop the print emulsion side up. Most important here is to cause enough agitation in the dish by abrupt movement. With this developer, gently swinging the dish does not lead to the wanted effect of carrying exhausted developer and its oxidation products away from the emulsion. If the dish is tilted and dropped, the film shoots up and down in the dish with every movement. The sound of the film hitting against the inner walls of the dish is a sign for "correct" agitation. You have to find your own cycle of agitation here. Slightly lifting all 4 corners of the dish is only twaddle.

Start a cycle of agitation every 15 seconds of clock time. Note: Not the interval between the agitation cycles, but one agitation cycle plus interval is 15 seconds long! To avoid turbulences and to achieve uniform waves in one direction, I tilt the dish 4 times from the short side in one cycle and 4 times from the long side in the next cycle, and so on!

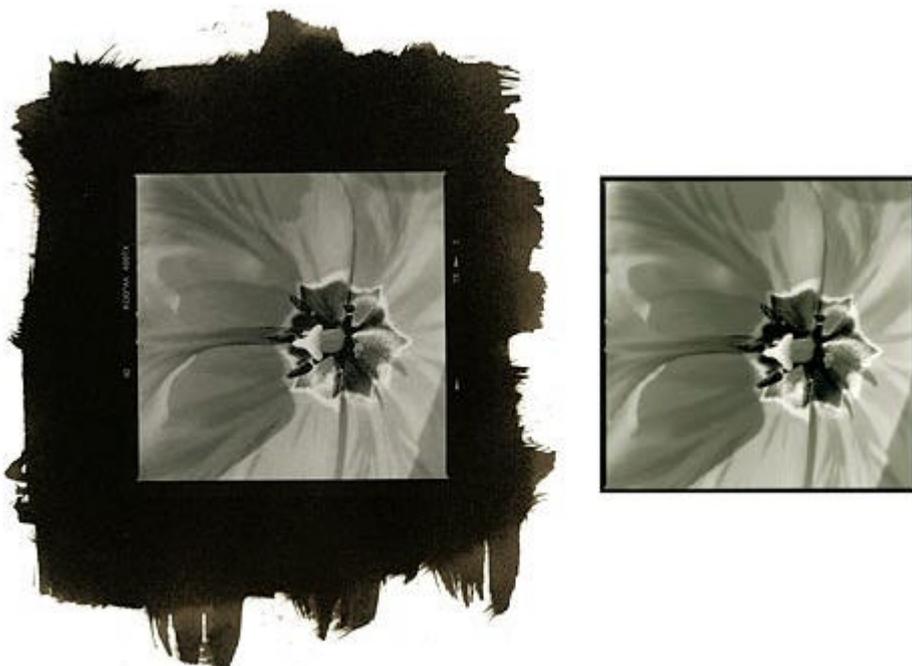


Ruck Zuck Edeldruck - alternative techniques in no time at all

As mentioned earlier, negatives developed in pyrogallol or Tanol are suitable for alternative techniques and processes that require a high range of contrast, such as platinotype, kallitype, or cyanotype.



kallitype - no toning - of a PMK negative

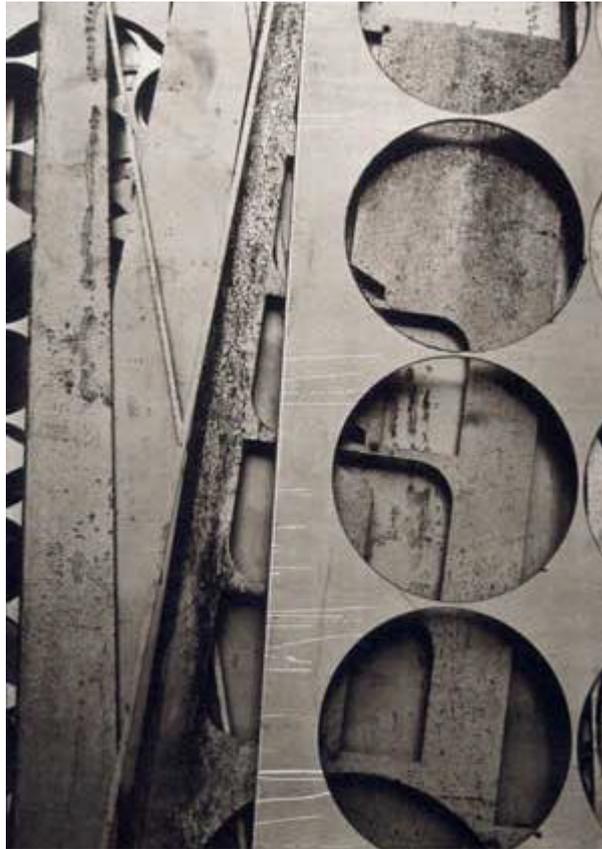


platinotype and silver print of the same negative, Tmax400 Tanol



Friedrich Saller

cyanotype of an original pyro negative size 8x10 inch



Jens Knigge platinotype of an original 13x18 negative developed in Tanol

If you want to make a copy of a negative on a larger negative format, you can also develop in Tanol to achieve the range of contrast required for the alternative printing techniques.

Orthochromatic film with a carrier as clear as possible is especially suitable for this purpose.



Gerhard Fuhs

cyanotype, print size 20x20cm copied from a roll film negative

Tanol or Tanol Speed?

Counterquestion: For which purpose? Any combination that you have under control is better than constant trying with new developers (however good they may be). Tanol has been in shops for a couple of years now and there may only be one reason to change to the Speed version. Gaining film speed can be an argument, but one third of a stop is not making the difference. As against other staining developers and traditional fine grain developers with reduced film speed, gaining one stop or more is not to be disdained, as long as other important characteristics are met, like sharpness, resolution and grain.

My given data should only be used as a starting point for your own attempts. Usually, users prove them to be true, but some results deviate upwards as well as downwards. If you want to have reliability in your process, you have to do some calibration work, unless the first attempt is already an exact hit. You cannot really count on once determined film speeds to be correct for all times. Small differences in film speed from one batch to another cannot be ruled out even with the biggest manufacturers.

Calibration may seem to be a mystery for most users, so that they don't even try. Yet there is help on the web – even for users without a profound knowledge of the background.

For everyone who never dared to try I recommend visiting Norbert Hein! Too easy – just download the Excel file for film testing, read his text and start.

<http://norberthein.de/tools/toolsidx.htm>

Your evaluation will come to higher film speeds than I indicated on my data sheets. The ISO norm is to blame – or me, because I ignore it in the foot of the curve. My nominal curve begins a bit higher.

Hand or processor?

My development times were determined processing by hand using a tank inversion method.

Those times can also be used for the **Heiland TAS-Processor**, if you agitate by hand for the first half minute. Especially the first seconds are crucial for a homogenous development!

It may only be a few seconds that elapse while the tank is fitted after filling and before the machine starts, but they can be enough for the bubbles on the uppermost reel to start an impeding effect. For instance, if a development time of 12 minutes is specified, switch the processor to 11½ minutes. I use speed 3 on the processor. Take the rotation cycles from hand development as stated above.

Rotation tank development with **JOBO ATL** can only be recommended when using Tanol Speed or better Finol. Because of its more vigorous agitation, development times have to be shortened accordingly.

Temperature

Although it may raise eyebrows, I don't want to follow the usual recommendation to use 20°C as a standard.

In summer cooling down all solutions is a hassle and with my developers there is no reason to miss out on the advantages of higher temperatures.

Even if the temperature of the developer is 4°C higher than the surrounding temperature, it cannot drop off as much as to result in underdevelopment, especially not, if you bring the tank to temperature by prior rinsing.

I would draw an upper limit at 26°C. Some films can still cope with temperatures between 28 and 30°C, but the resulting (too) short development times probably prevent any reproducible outcome.