Basic Split-Grade Printing

Alternative contrast control with VC papers

fig.1 final print

Split-Grade printing is a method by which a separate soft and hard exposure is used to make a print with an overall intermediate contrast setting on variable-contrast paper. Since photography shows some correlation between measurement and subjective evaluation, we can dispel some myths concerning this technique in this first part and ready ourselves for the more interesting uses in the next chapter. As a printing technique, split-grade printing is remarkable, for it can offer even and fine contrast control with either normalized shadow or highlight exposure and with relatively short exposures. Although at first it can feel cumbersome, with a little practice it can find favor with tricky printing situations. In photography there can be many tools and methods used to achieve the final result. As with many art forms, each method has its devotees and denouncers. While this makes for entertaining discussion, it does rather miss the point. Split-Grade printing is one of those alternative techniques that works all of the time for some and some of the time for all. After all, every B&W photographic printing technique uses blue and/or green light to expose the printing paper. So why do some printers prefer one grade controlling technique to another? What rules do they use to judge?

VC Filter Techniques

Split-Grade printing only works with variable-contrast (VC) paper. These papers use the relative energy of blue and green exposure to change the effective contrast of the print. There are several ways of controlling these exposures. In addition to the methods described in the chapter 'Contrast Control with Color Enlargers', we note that a color head allows fine contrast control but has the disadvantage of being unable to reproduce the highest filter settings. However, as we shall recognize later, there are

also some ergonomic disadvantages (all that messing about to change the dials in-between exposures) that can discourage some printers from multiple contrast grade printing with color enlargers.

Alternatively, under-lens contrast filter kits or specialized variable-contrast heads offer quick contrast changes over a wide range with even grade spacing, sometimes at the expense of fine control around the 'normal' grades. Another option is to use a mixture of blue and green-filtered light, either in the form of a Wratten 47b (deep blue) and 58 (green) filter or with dual cold-cathode bulbs using separate lamp intensity controls to alter the contrast setting.

As previously described, split-grade printing is a technique where the overall print exposure is made of two separate controlled exposures. Normally, one exposure is made at the highest available contrast setting and the other at the lowest. Each exposure on its own would either give a very hard or very soft print. These two components can be formed by either:

1) changing filtration with a single light source and using two separate, timed exposures,
2) altering the intensity of two different colored light sources and printing the combination for a common time or
3) two light sources printed separately.

For my own work, I prefer the speed and consistency of the Ilford under-lens filter kit, using just the 00 and 5 filters in combination with a StopClock dual-channel enlarger timer. In any other darkroom, depending upon the type of color head being used, I use full magenta filtration and about 3/4 full yellow filtration. This works fine with almost all enlarger light sources except for blue rich cold-cathode light sources for which I adopt the opposite strategy of 3/4 magenta and full yellow filtration to give a similar range. As long as I am consistent within a printing session, the actual filter values are not critical, since, as we shall see later, knowing the contrast setting is almost irrelevant.

The Value of Graphs

A graph is a wonderful thing. In fig.2, with just a few measurements and a smooth line, any print density can be calculated for a specified exposure or any exposure for a known density. Throughout this book the exposure and the relative reflection or transmission density is shown in logarithms. The higher the density is, the darker the print or negative is. Fig.2 also gives useful exposure information. By drawing a horizontal line at a given print density, the exposure difference between filter settings required to make this print tone can be determined from horizontal distance between the points at which each curve crosses the line. For instance in fig.2, the exposures for a constant midtone print reflection density of 0.6 (the ISO speed point) are approximately the same for filters 00-3 and about a stop more for filter-4 and 5 settings. Keep in mind that one stop of exposure is equivalent to 0.3 relative log exposure.

The slope of each curve gives yet more information. As the line of the curve becomes steeper so does the local contrast. Clearly every curve has a range of slopes, so this local contrast or separation is changing according to the overall print density. Notice how the slope of each curve becomes less near the highlight and shadow ends of the print scale. This accounts for the reduced tonal separation in the shadow or highlight areas of a print.

The nature of this tonal separation is extremely important to the richness of a print. Since at a given illumination, the human eye is about 5 times more sensitive to small variations in highlight print tones than shadows, highlight detail is especially critical. Under household lighting conditions, anything above a reflection density of about 1.9 appears to be black, but at the same time, the eye can distinguish

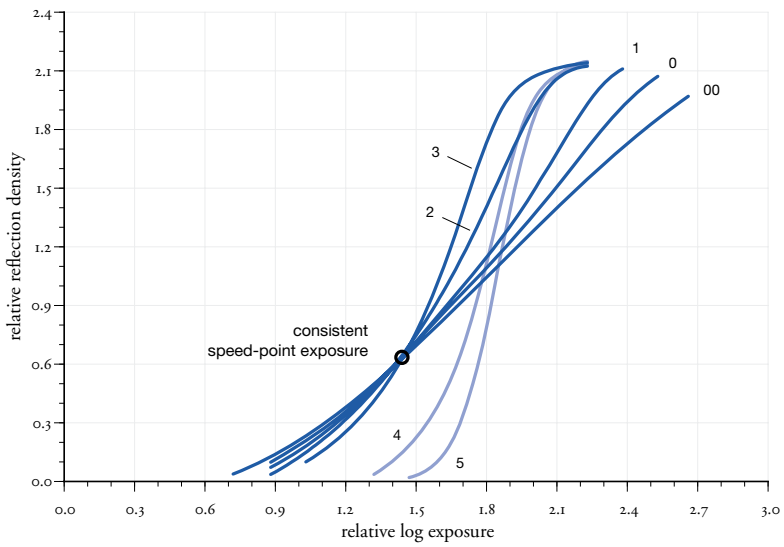


fig.2 These are the characteristic curves for Ilford's Multigrade IV RC paper printed with under-lens filters and a constant exposure time through each filter. The speed-point exposure is consistent, but shadow and highlight exposures differ significantly.

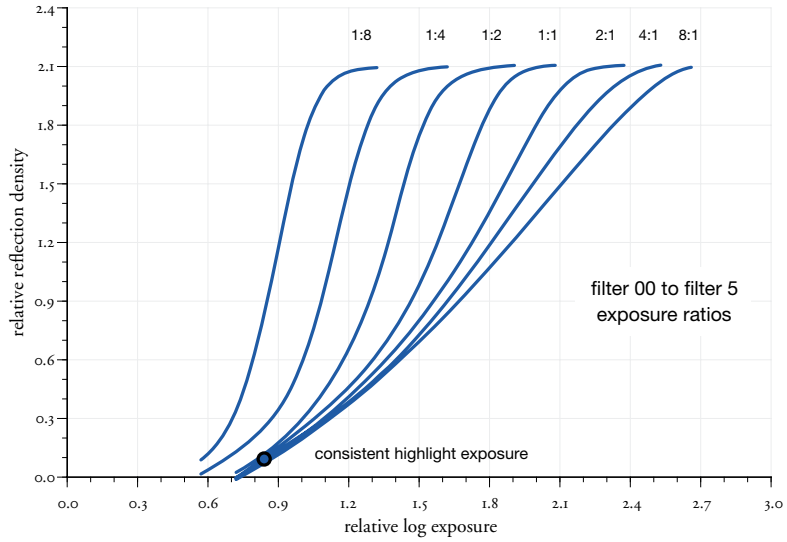


fig.3 These are the characteristic curves for Ilford's Multigrade IV RC paper, printed by combining fixed filter-00 exposures with halving ratios of filter-5 exposures. Note the difference in contrast, the consistency of highlight exposure and even spacing of shadow tones.

near white tones that a densitometer cannot separate. Under strong illumination, our ability to distinguish shadow detail improves and, at the same time, the intense reflection from the highlight areas actually decreases our ability to distinguish faint highlight details. For more detailed information on the subject of optimized print tones, see the chapter 'Fine-Tuning Print Exposure and Contrast'.

Convention, Contrast Changes Exposure

Fig.2 shows the density/exposure characteristics of Ilford's Multigrade IV using their own under-lens filters. These are not 'ideal' curves but actual measurements under typical darkroom conditions. For these materials, the lower filter numbers 00-3 have the same exposure requirement (all the lines cross over) for a reflection density of 0.6, which corresponds to the ISO speed point for papers. The graph also shows that a different exposure is required for each contrast setting at highlight densities below 0.10, a crucial issue for a consistent highlight appearance. In practice this shows that once a highlight or shadow exposure has been determined for a given filter, any subsequent change in filter will require a new exposure test before the contrast change can be evaluated.

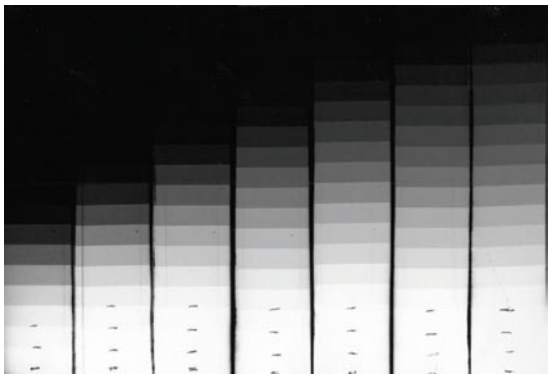


fig.4 This is a typical result of a split-grade exposures test.

The technique of split-grade printing can overcome this cerebral problem of juggling between exposure and contrast settings. It uses the idea that it is easier to find two exposures, one for highlights and one for shadows, than it is to go around in circles deciding on adjustments and corrections to print exposure and contrast settings. The second advantage, which is a by-product of the above, is one of fine contrast control. Since both exposures are within one's control, it is possible to print at any intermediary grade by one small exposure adjustment. However, to make split-grade printing viable, we need two things, a solid technique that does not require an exposure adjustment when the contrast setting is changed and easy to remember settings that allow repeatable results over a wide contrast range.

To determine the contrast/exposure relationship an Agfa step tablet was contact printed several times onto Ilford's Multigrade IV paper with different combinations of high-contrast (filter 5) and low-contrast (filter 00) exposures. Since most things in photography follow numbers that double each time, each subsequent contact print doubled the contribution of the high-contrast exposure. The transmission step tablet has nineteen 1/2-stop (0.15 density) increments and spans a density range of 2.6, enough to give a full tonal range on the lowest contrast setting. The print densities of each step for each combination of filter-00 and 5 exposures are shown in fig.3. This graph shows the print densities obtained with a 16-second exposure through filter 00 and additional 2, 4, 8, 16, 32, 64 and 128-second exposures through filter 5. So far, the results of similar tests with other VC papers have given very similar results. Another contact print using a different paper, in this case Agfa's Multicontrast Premium, is shown in fig.4.

Split-Grade, Exposure Changes Contrast

The curves in fig.3 have three remarkable features. First, each curve has a different slope and, hence, effective print contrast, which if taken in isolation are very similar in shape to one of the curves in fig.2.

The second feature is that, unlike the curves with individual filters, the highlight exposure remains virtually unchanged for most of the lower contrast combinations and at worst requires about 1/2 stop (0.15 density) less exposure for the highest contrast setting. This can also be seen visually by examining

the highlight end of the contact prints in fig.4, where all but the two high-contrast strips have a similar highlight appearance.

The third feature is the remarkably even spacing of the curves at a typical print shadow tone (around 1.9 reflection density). This can be clearly seen on the contact print, fig.4. Here the position of the same typical shadow tone moves one step on the next strip. Practically, if we continually change the ratio of the two exposures by two, we can produce sensible and even increases in print contrast. To show this, the effective paper exposure range (R) for each exposure combination is shown in fig.5. The vertical axis represents the paper exposure range and the horizontal axis shows the hard versus soft filter exposure ratio. This graph was calculated from the curves in fig.3 by noting the difference in exposure between a relative print reflection density of 0.04 and 1.84. To calculate the exposure range (R), each log exposure difference was multiplied by 100. In this figure, the contrast variation simply changes linearly with the ratio of the two exposures measured in stops. This figure now allows the photographer to find the ratio of the filter-5 and 00 exposures to reproduce any contrast setting. If your enlarger timer has an f/stop mode, then clearly the two times can be conveniently set up with a few button presses between the two exposures. When a low or normal print contrast is expected, the exposure is most accurately judged with a test for the highlights using filter 00, followed by a test for the shadows using filter 5 to set the overall print contrast.

Another look at fig.3 shows that for the two highest contrast settings, the required highlight exposure decreases by about 1/2 stop (0.15 density), simply because the massive filter-5 exposure is starting to influence the highlight appearance. Since for this high-contrast condition most of the overall exposure is with filter 5, it makes sense to try the experiment in reverse, keeping the filter-5 exposure constant and varying the filter-00 exposure. Measured in the same way, the result is shown in fig.6. As expected, the shadow exposure for the two highest contrast settings is very similar and the addition of a small amount of filter-00 exposure on top of a filter-5 exposure has no appreciable effect on shadow rendition. This is doubly true, since our ability to distinguish shadow information is less than that at the white end. The added benefit of this exposure order is that soft exposures are easy

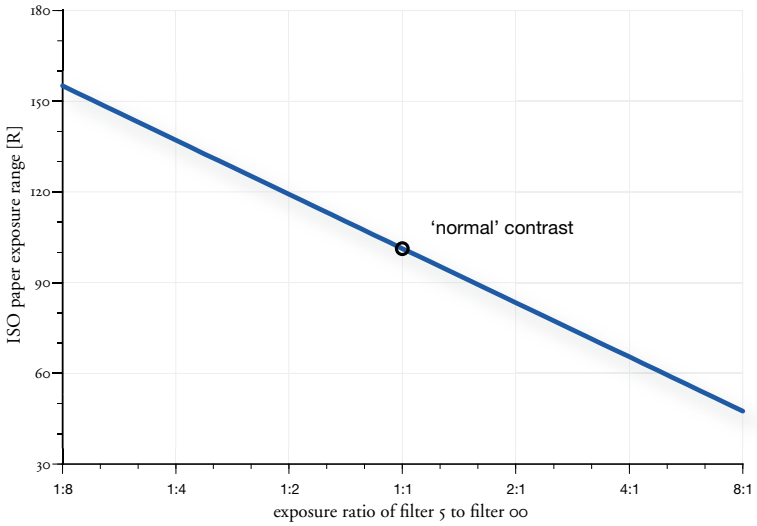
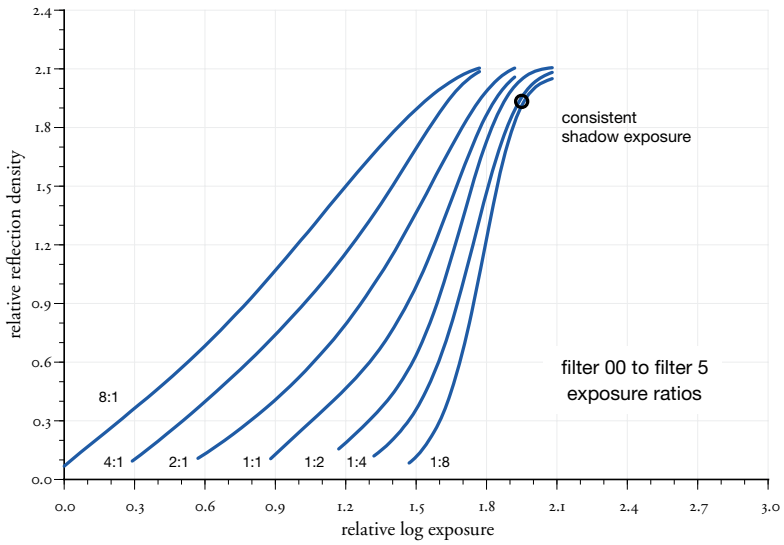


fig.5 The paper exposure range (contrast) depends on the exposure ratio of filter 5 to filter 00. Note that an equal exposure time through each gives a 'normal' paper contrast.

to burn in selectively without leaving telltale haloes on the print. As before, the lines on the graph fan out evenly, indicating regular grade spacing. Indeed as you might expect, the contrast/exposure graph is identical to that in fig.6, dispelling the myth that the order of exposures makes a visible difference. Thus, with expected high-contrast settings it is more accurate to work out the exposure for the shadows with the number-5 filter and then burn in the highlights with filter 00 for the right contrast effect. In theory, the curves in fig.3 and fig.6 show that it is possible

fig.6 Keeping filter-5 exposures fixed and varying filter-00 exposures have no appreciable effect on shadow rendition.



to start with a single highlight-based exposure, using filter 00 for all medium to soft contrast settings. For improved exposure consistency with hard to very hard contrast settings, a shadow-based exposure starting point is preferred using filter 5. Using conventional terms, in the first case, we are using filter 5 to burn in the shadows on top of a filter-00 exposure, and in the second case, we are using filter 00 to burn in the highlights of a filter-5 exposure. The contrast graph in fig.5, derived from either fig.3 or fig.6, clearly shows that if the soft versus hard exposure ratio is varied in stops, or fractions of a stop, there is a constant contrast change.

In addition, by some curious stroke of luck, each doubling or halving in the ratio of the two exposures yields a paper contrast almost exactly equivalent to the next full paper grade! Therefore, the horizontal axis of fig.6 could read 8:1 = filter 00, 4:1 = filter 0, 2:1 = filter 1 and so on. Hence, an f/stop timer with a resolution of 1/12th stop will be able to control contrast to 1/12th of a grade with the minimum of fuss!

Practical Considerations

To demonstrate this technique, a bold portrait with plenty of highlight and shadow detail was chosen. This unusual portrait was deliberately lit to create drama and a bold effect, without losing the delicacy of the hair and skin.

In this case, I decided to determine the highlight exposure with filter 00 and then calculate the additional filter-5 exposure to make the shadows just right. To find the highlight exposure, I made four test

fig.7 (below left) Increasing filter-00 exposures, starting at 5 seconds increasing in 1/4-stop increments.

fig.8 (below right) Increasing filter-5 exposures, starting at 5 seconds increasing in 1/4-stop increments.

prints in 1/4-stop increments (fig.7) on an 8x10-inch sheet of Agfa's Multicontrast Premium paper. These test prints were made with a 105mm enlarger lens and a 35mm negative to keep the enlarger head at a comfortable height. After developing and drying the test print, I judged the second print to have just too much exposure to register the highlight tones with its 6-second exposure. A point of note, 'just enough' is the best adjective to describe the highlight exposure. It is better to choose on the light side rather than the dark, since any additional filter-5 exposure will always add some highlight tone. With coarse exposure test prints, which bridge the desired results, it may be appropriate to repeat the test with finer settings.

The second set of test prints (fig.8) shows the effect of increasing exposure with filter 5 and the third the overall effect when these are added to the chosen filter-00 exposure (fig.9). Each frame has 1/4 stop more filter-5 exposure than the previous; therefore, in fig.9 each frame is about a quarter grade different from its neighbor. Notice how the appearance of the shadows in fig.8 and fig.9 are almost identical and how the highlight appearance of the blonde hair in each of the test prints in fig.8 remains virtually unchanged by the increasing hard exposure.

In this case, a print exposure somewhere between frames 3 and 4 at around 8 seconds would just give a visual hint of the jacket and nothing more. The final straight print (fig.1) was made with a 5.3-second (filter 00) and an 8-second (filter 5) exposure, scaled to the new enlargement size.

Clearly, the balance of the picture can be improved, but it demonstrates the basic technique. For instance, some darkening of the hands and some lightening of the jacket on the right would help balance the picture, as would some careful burning down of the highlight on the cuffs and the corner of the collar.

Some quite distinguished photographers have made claims that the print quality obtainable with this technique is unique and cannot be accomplished with a single exposure system. In retrospect, this erroneous statement is probably based on human enthusiasm and the fact that the prints compared were not of exactly the same effective contrast or exposure. So far, there has been no evidence that demonstrates a difference between a split-grade exposure and a single-exposure print at the same ISO print contrast. If this is the case, what then are its advantages?

Recall what we have just done. We have determined the exposure and contrast setting of a print with just two test strips. At no time did we discuss the contrast of the print, merely the appearance of the shadow and highlight regions. For many, this avoidance of the contrast versus exposure cycle is reason enough to adopt split-grade printing. For others, it is the start of something altogether more powerful, which will be discussed in the next chapter, where we will use some more examples to show how split-grade printing creates unique opportunities for dodging and burning.

fig.9 Combined filter-00 exposure with increasing filter-5 exposure. Notice how the brightest highlights remain unchanged while the shadow areas become progressively darker.