Linotype-Hell Users Group Technology Committee

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# Diamond Screening Print Test

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This is the final report on printing tests of Diamond Screening run on a RIP 50/L330. This report includes results of three printers in my locale and one printer, Mid Ohio Graphics, Inc. which is a member of LHUG. There are several sets of films in the hands of other Linotype-Hell Users Group members; they might wish to run print tests with them, and compare their results with those reported herein. A preliminary report was submitted to Linotype-Hell through Jack Bruger on June 10, 1994. This final report is different from that preliminary report in two ways: the results from Mid Ohio Graphics, Inc. are included here, and this front page has been altered to reflect conclusions after all tests were evaluated. This report is now being distributed to all LHUG members. Included with it is a printed sample using the calibration called Alt 7 with Agfa GS712HN film.

The conclusion to these print tests is that Diamond Screening can print properly using Alt 7 calibration on Agfa GS712HN film or with Alt 10 calibration on Kodak S2000 film ("Alt 7" and "Alt 10" are the arbitrary names given to the calibration curves that worked best; the values for them are given elsewhere in this report). Further, the extreme emphasis being placed by Linotype-Hell on the need for Kodak S2000 hard-edge dot film for stochastic screening has little or no technical foundation. The print tests show that both films require a radical calibration curve to print properly, and that the calibration curve for each yields similar gray scale measurements on the film and on press. It is true that S2000 film yields a dot with a harder edge. It is also true that S2000 has a higher D-max at a lower density setting on the Linotype image setters in use here at In Tandem Design, Inc. S2000 also allows the L330 to image its theoretical 20 micron spot (the higher density setting used on our L330 for Agfa film yields about a 35 micron spot). However, if you look at the printed sheet, the difference is not great. The effect of extreme dot gain on press vastly outweighs the effect of hardness of dot. Getting Diamond Screening to print properly does not seem to be a film issue, nor a pre-press issue, nor a plate issue. ***It is a dot gain calibration issue***. We can deal with it at the RIP, or we can deal with it at the scanner, but we must deal with it.

In Tandem Design, Inc. feels that the proper way to deal with calibration is to get a good scan, and calibrate the RIP/Image setter so that the scan reproduces properly on press. The RIP calibration is changed for different press conditions or paper stocks. We feel strongly about this, since we do full page composition on Macs and image full page separations on our image setters. Since the pages have photographic elements as well as Postscript elements (tints, illustrations from Illustrator or Freehand, screened text, screen-built text and elements, etc.), we have to make sure all elements are treated the same way. The only place to do this is at the RIP. Other shops that do a lot of random separations, or do not do full page assembly in a Postscript environment, might treat calibration differently.

All tests were done with the intent of ***calibrating the RIP*** and ***changing nothing else***. The printers were told to expose plates the same and set up the press the same. Kodak has told some of the local printers that they should underexpose plates for stochastic screening. If you follow the calibration recommendations of these tests, ***DO NOT*** alter plate exposure. Also, there are some who recommend higher tack inks on press. The printers used their conventional ink sets for these tests. There should be further testing at press for higher tack inks. Reese Press, which did many tests for us and with their own Agfa Avantra with CristalRaster, now regularly uses higher tack inks for stochastic screening. This seems to enhance things, but it is not the major issue. ***Calibration is the major issue***.

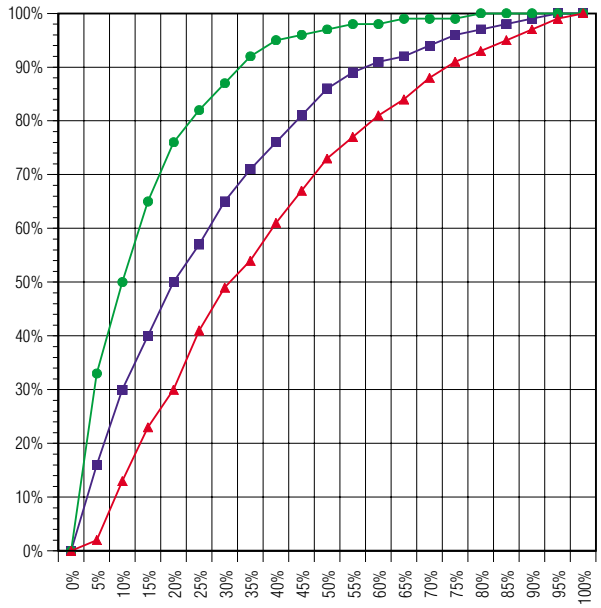
We have had several jobs printed since the Alt 7 curve was developed and tested. There is some indication that it prints too light in the quarter tone on high-quality, coated stocks. There is also some indication that it prints too dark in the quarter tone and mid tone on lower-quality, uncoated stocks. There is further indication that this is press and/or operator dependent. Alt 7 is a good starting point. It is a good place to be if you send film to many different printers over whom you have no control. If you control printing in-house, or if you have more control at press make-ready than we typically have, you might be able to more finely tune the curve.

I feel that Linotype-Hell should put a curve like Alt 7 into the Diamond Screening algorithm on the RIP, so that we can use our conventional screening calibration with Diamond Screening. In other words, fix the relationship between Diamond Screening and conventional screening. It will be impossible to image DS and conventional on the same page (as requested in the DS survey) without such a relationship built in. You must also allow the operator to choose this fixed relationship or to alter it manually. Agfa does both of these things now. I've seen it; it works.

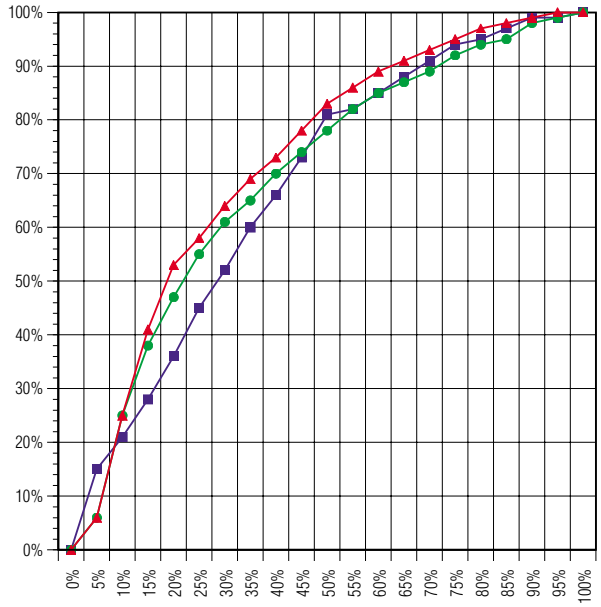
The remainder of this report includes all test data, and curves derived from measurements of actual negatives used to make plates, actual Iris proofs, and actual printed sheets. There are those who may try to tell you something different about Diamond Screening or Stochastic Screening than is indicated by these test results and measurements. Ask them for the numbers. Ask them to show you test results. If they do, please forward them to me. If they don't, be skeptical of their statements.

The task of getting your RIP to yield film which measures as the films for these tests measure is a difficult one. It is also different for each machinery configuration. It is possible to do, however. If you wish to try it and have difficulty, please, feel free to call me. I am only specifically familiar with a RIP 50/L330 combination for Diamond Screening. However, I can get the right people in touch with you for whatever machinery configuration you have.

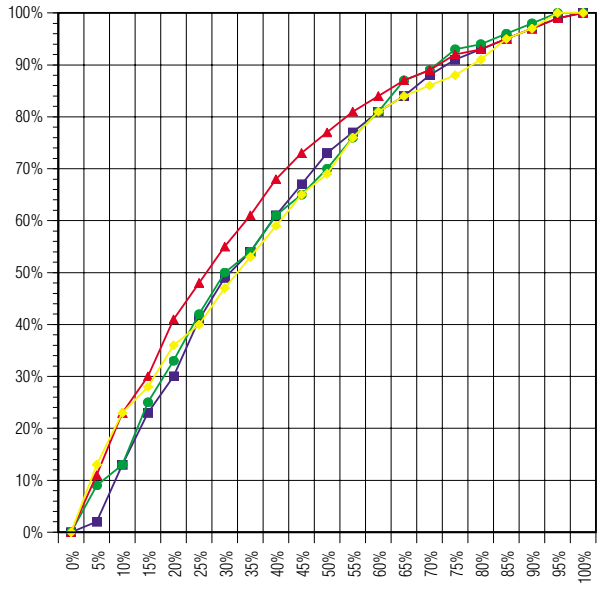
I hope the Diamond Screening Survey results were of interest and/or use to you. The next effort of the Diamond Screening subcommittee is to report on proofing Diamond Screening film. Tests have been made to compare four major proofing systems to the actual printed sheet of the test flats used by Reese Press. The report will follow soon; in the interest of time, it will not be reviewed by Linotype-Hell.




**First Test: Linotype-Hell Calibration (Dia Avg T1), vs Conventional 0% Dot Gain from Reese Press and Iris Proof**




**Second Test: Agfa Alt 5 & Alt 6 from Reese Press**




**Agfa Alt 7, Kodak Alt 10, & Agfa Con 8% from Reese Press**

Upon installing Diamond Screening on a RIP 50/ L330, Lino Utility 7 was used to get the negatives to read as the Linotype-Hell book said they should. For this, dot gain was built into the 3/4 tone (nominal up to 50%, allowance for 6% dot gain at 75%). A print test was conducted in which a color photograph, 2 b&w photographs, and a gray scale each with 150 lpi conventional screening and Diamond Screening on our standard film, which is Agfa GS712HN. On the same sheet was a different color photograph done by Agfa in conventional 150 lpi and CristalRaster. The CristalRaster printed fine, although there seemed to be a color shift between the two images. The Diamond Screening was extremely dark, and it was plugging @ the 70% dot.

It was immediately apparent that there was a major calibration issue with Diamond Screening. It was also apparent that our conventional screening did not give the pressman enough latitude on press. We decided to test inducing dot gain into conventional screening to allow the pressmen to more closely match our Iris proof with higher ink densities on press.

A second press test was run with gray scales only. Two calibrations were tested: Diamond Screening Alt 5 and Alt 6. They were closer to the conventional screening, but were still too dark in the midtone.

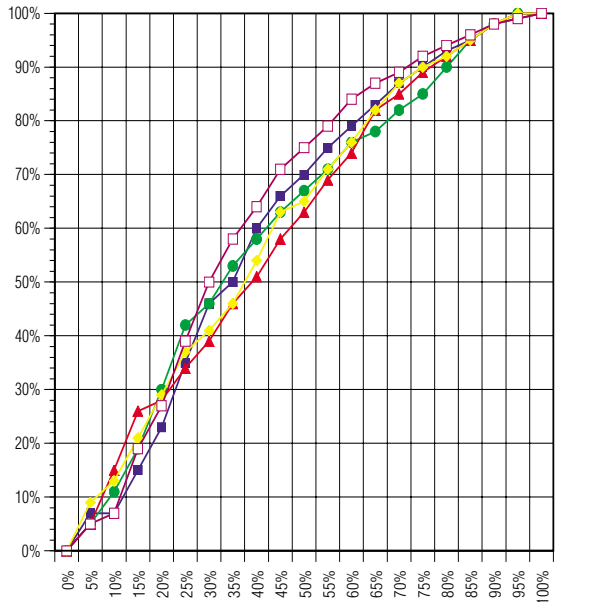
A minor alteration to the calibration for Agfa GS712HN was made, resulting in Diamond Alt 7 to closely match Conventional with 8% dot gain built in, and to match the Iris proof. Kodak S2000 film was calibrated so that a gray scale with S2000 read close to the same as Agfa GS712HN. Also, two other curves were generated for Diamond Screening: Alt 8 for Agfa and Alt 11 for Kodak. These were intended to match conventional screening with 15% dot gain built in.

Printing tests were done at three local printers and Mid-Ohio Graphics, Inc. All Kodak film was run on one day; all Agfa in one day; all copies of any given calibration were run in succession. There was no variation within a set of films for a given calibration or film. Not all printers had or used all calibration and film combinations. Mid Ohio Graphics also borrowed the test image files and ran them to their Crossfield at 150 lpi and 300 lpi.

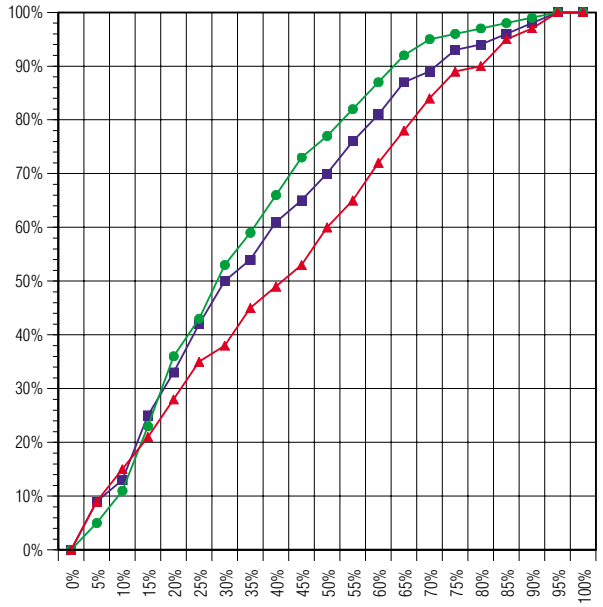
Please note that these tests were meant to compare Diamond Screening to conventional screening. They were ***not*** intended to match theoretical readings on press. They were ***not*** intended to yield a good looking print job.

At Reese Press, all eight of the different film and calibration combinations were stripped up on a single flat, and run to the same ink densities. The results confirmed the predictions: 1) Agfa Alt 7, S2000 Alt 10, and Conventional 8% should all be extremely close to each other and to the Iris proof; 2) Agfa Alt 8, S2000 Alt 11, and Conventional 15% should all be extremely close to each other, and light when compared to the Iris.

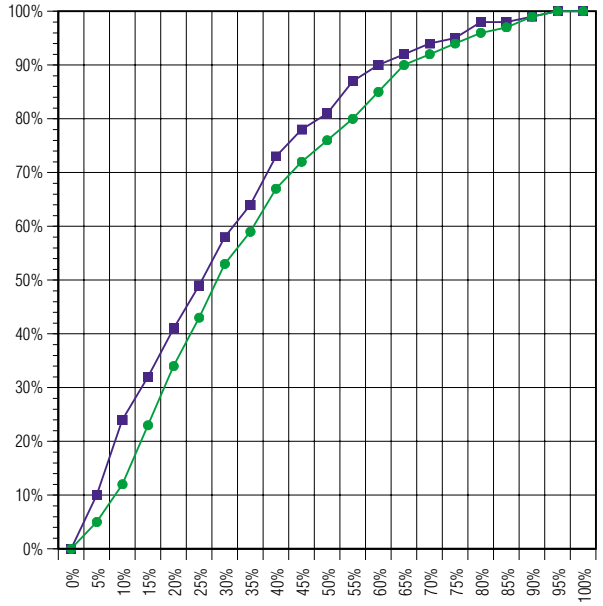
The results of the same Agfa Alt 7 run at the three different printers shows some variation. All three used a coated offset sheet. Reese Press, Inc. ran the test on a Komori 40" with Fuji plates. H&N Printing and Graphics, Inc. ran the test on a Heidelberg GTO with Kodak plates. Collins Lithographing, Inc. ran the test on a Miller 40" with Kodak plates. By some coincidence, all three use Braden Sutphin inks, but not the same ink specs. The Collins sheet was a little light; however, there was more room to go with ink densities. The H&N sheet had some density variation across the sheet, and some problems with the magenta plate (they had to hand-develop the plates; their plate processor wouldn't clean out the




**Agfa Alt 8, Kodak Alt 11, & Agfa Con 15% from Reese Press & Crossfield Con 15%, & Kodak Alt 11 from Mid-Ohio Graphics**




**Agfa Alt 7 from 3 Printers: Reese Press; H&N Printing; & Collins Litho**




**Agfa Alt7 & Agfa Con 8% on Uncoated Stock from H&N Printing**

Diamond Screening well on the lighter-weight GTO plate material).

At H&N an uncoated stock was run for each of the two tests. The % dot readings show conventional screening to be about 5% darker, yet ink density for the conventional was lower. This confirms the marketing statements that Diamond Screening has more latitude, and can be run with higher ink densities, on uncoated stocks.

At Reese all the gray scales were run on a beige uncoated stock. Agfa Alt 7, Kodak S2000 Alt 10, and Conventional 8% all performed similarly (and each had a weird step in the curve ... this might relate to how the densitometry deals with colored paper ... or it might reflect careless measurements .. or something else, who knows).

My conclusion thus far is that Alt 7 is a good calibration for Agfa GS712HN film, and that Alt 10 is a good calibration for Kodak S2000 for coated stocks. We have since run a job on uncoated stock with Agfa Alt 7. We should have used Agfa Alt 8; halftones tended to be a little dark.

It is interesting that results from different printers on different equipment in different states support the same conclusion.

The following are the measurements of film for Agfa Alt 7 and Kodak Alt 10, along with the curve I was actually trying to hit with each.

Nominal:
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Target:
2 4 5 6 7 10 12 17 22 26 28 31 34 38 42 47 52 63 78 100

Agfa Alt 7:
2 3 5 7 9 11 13 16 19 22 25 29 34 39 45 50 56 66 80 100

S2000 Alt 10:
2 5 7 9 12 15 17 19 22 24 27 30 34 38 42 46 51 59 73 100

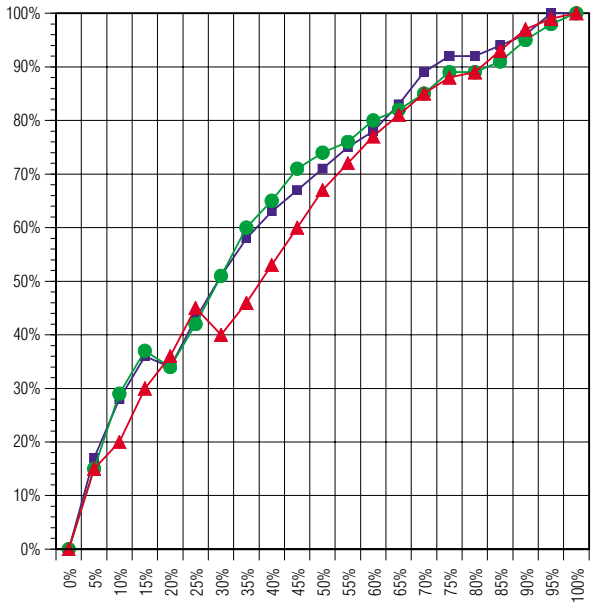
Please, note that Agfa Alt 7 and Kodak Alt 10 are attempts at the same calibration: each grayscale is meant to read the same with a transmission densitometer. They are not the same, but are quite similar (getting the RIP 50 to give precisely the numbers desired was difficult, to say the least). Therefore, calibrating for Diamond Screening may be ***independent of film type***.

Also, the density settings on the L330 were very different for the Agfa and Kodak films. An L330 increases dot size as density setting increases. The Agfa film has a spot size of about 35 microns. The Kodak film has a spot size of about 20 microns. Therefore, the nominal calibration for Diamond Screening may be ***independent of spot-size***. Some tests should be run with different image setters, so that the relationship between dot size and press performance can be determined.

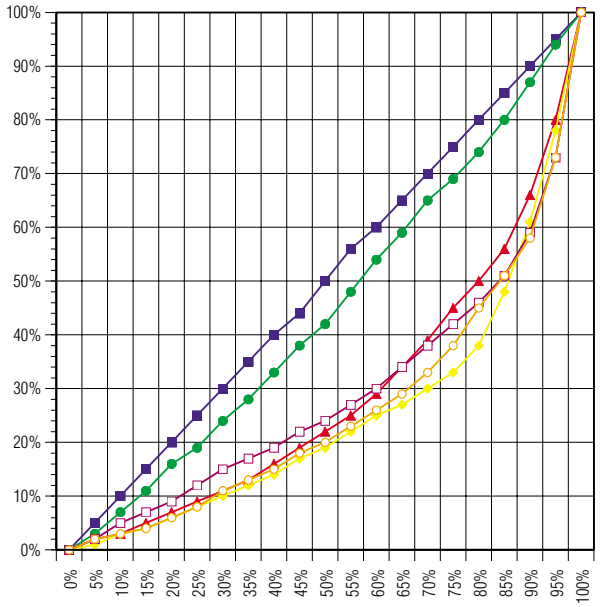
The bottom chart to the left shows the numbers keyed into LinoUtil 7.0 - Image setter - Calibration - Manual. These probably only apply for our RIP, our image setter, our processor, etc. But they make obvious an important problem. The RIP would not deal with numbers greater than 100. Therefore, to induce as much dot gain in the 3/4 tone as required, I had to put in 96, 97, 98, and 99 values of 100. The actual readings were a crap shoot. Also, at the low end, getting the RIP to accurately give 2, 4, 5, 6, 7, 10 (10 being the 30% dot) was not easy nor very controllable.

**Other Issues:**

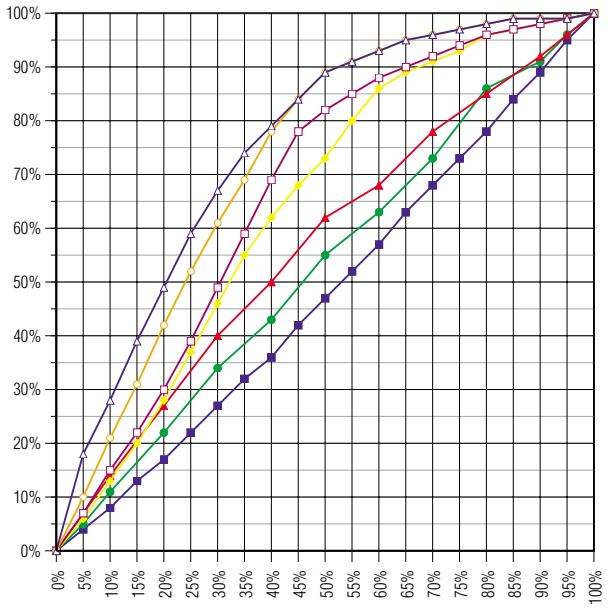
For those readers who get to see the printed sheets and/or the negatives, the graduations look horrible in DS. This is a problem between QuarkXPress and FreeHand 4.0, not a problem with Diamond Screening. Subsequent tests show DS graduations to be superior to conventional graduations. If you




**Agfa Alt 7, Kodak Alt 10, & Agfa Con 8% on Uncoated, Beige Stock from Reese Press**




**Film Gray Scales Measured with Transmission Densitometer**




**Numbers Keyed Into Linotype Utility 7 Manual Calibration**

are using FreeHand in QuarkXPress with DS on a RIP 50/ L330, set the printer resolution to 1270 and the line screen to 150 in the Quark page set up dialogue box.

Also, for those who get to see the printed sheets, there is no huge difference between the printed results from Agfa GS712HN and Kodak S2000. There is a little more detail in the highlight with S2000. But look at the calibration curve: more differentiation exists in the low percentages with the S2000 film *because I couldn't get Lino Utility to give the same results for each.*

During the first press runs of live jobs in DS, there appears to be a difference between Postscript elements and pixel-based elements. The Postscript flat tints and screen builds appear lighter than they should, even if the photographs look correct. This may be DS, it may be calibration, it may be perception, or it may be something about the DS software.

The RIP 50/L330 went berserk during the imaging of a large DS job from PageMaker with Illustrator 5.0 elements in it. The entire page of one or several colors went herringbone, sort-of (maybe it was hounds tooth). Single pages printed more consistently than multiple pages. This is not an anomaly of that file, since it has happened several times since then.

Also, it is not uncommon for the RIP 50 to lock up during the second negative of the first DS job run immediately after setting the RIP from conventional to DS screening.

These may indicate (a) DS software problem(s), or they might be related to pipelining or the RIP. The new version of RIP 50 software arrived in our shop this week; I do not know what it includes, nor whether these problems are solved.

# Key to abbreviations:

**Con Avg T1** Test 1, average of 2 readings, conventional screening, dot-for-dot calibration

**Dia Avg T1** Test 1, average of 2 readings, Diamond Screening, book calibration)

**Con Avg T2** Test 2, average of 2 readings, conventional screening, dot-for-dot calibration

**Dia A5 Avg T2** Test 2, average of 2 readings, Diamond Screening, Alt 5 calibration curve

**Dia A6 Avg T2** Test 2, average of 2 readings, Diamond Screening, Alt 6 calibration curve

**Reese S2000 Alt 11C** All of the data set labels are of similar format. The first name is the printing company which ran it. The next word is film type. The Alt number is the calibration curve used for DS. Con means conventional screening, and the % that follows is dot gain built into the film (8% implies that the 50% dot reads 42% on the film negative). The last letter(s) define printer and paper stock:

| | |
|---|---|
| **C** | Coated stock at Reese Press |
| **UB** | Uncoated beige stock at Reese Press |
| **CHN** | Coated stock at H&N Printing |
| **UHN** | Uncoated stock at H&N Printing |
| **CCOL** | Coated stock at Collins Lithographing |
| **COH** | Coated Stock at Mid-Ohio Graphics, Inc. |

# Actual Density Measurements & Dot % Calculations

| NOM % | Gray Density | White Density | Black Density | Dot% |
|---|---|---|---|---|
| **iTD** | | **IRIS PROOF** | | |
| 5% | 0.12 | 0.11 | 1.54 | 2% |
| 10% | 0.17 | 0.11 | 1.54 | 13% |
| 15% | 0.22 | 0.11 | 1.54 | 23% |
| 20% | 0.26 | 0.11 | 1.54 | 30% |
| 25% | 0.33 | 0.11 | 1.54 | 41% |
| 30% | 0.39 | 0.11 | 1.54 | 49% |
| 35% | 0.43 | 0.11 | 1.54 | 54% |
| 40% | 0.49 | 0.11 | 1.54 | 61% |
| 45% | 0.56 | 0.11 | 1.54 | 67% |
| 50% | 0.63 | 0.1 | 1.54 | 73% |
| 55% | 0.7 | 0.11 | 1.54 | 77% |
| 60% | 0.76 | 0.1 | 1.54 | 81% |
| 65% | 0.83 | 0.11 | 1.54 | 84% |
| 70% | 0.92 | 0.1 | 1.54 | 88% |
| 75% | 1.01 | 0.1 | 1.54 | 91% |
| 80% | 1.1 | 0.11 | 1.54 | 93% |
| 85% | 1.2 | 0.11 | 1.54 | 95% |
| 90% | 1.31 | 0.11 | 1.54 | 97% |
| 95% | 1.44 | 0.11 | 1.55 | 99% |
| 100% | 1.54 | 0.11 | 1.54 | 100% |
| **REESE** | | **S2000 ALT 11C** | | |
| 5% | 0.09 | 0.06 | 1.72 | 7% |
| 10% | 0.11 | 0.08 | 1.73 | 7% |
| 15% | 0.15 | 0.08 | 1.72 | 15% |
| 20% | 0.19 | 0.08 | 1.71 | 23% |
| 25% | 0.26 | 0.08 | 1.73 | 35% |
| 30% | 0.32 | 0.06 | 1.72 | 46% |
| 35% | 0.37 | 0.08 | 1.72 | 50% |
| 40% | 0.44 | 0.06 | 1.72 | 60% |
| 45% | 0.51 | 0.06 | 1.73 | 66% |
| 50% | 0.58 | 0.08 | 1.74 | 70% |
| 55% | 0.66 | 0.08 | 1.77 | 75% |
| 60% | 0.72 | 0.08 | 1.77 | 79% |
| 65% | 0.81 | 0.08 | 1.77 | 83% |
| 70% | 0.91 | 0.08 | 1.8 | 87% |
| 75% | 1.02 | 0.08 | 1.78 | 90% |
| 80% | 1.12 | 0.08 | 1.78 | 93% |
| 85% | 1.27 | 0.08 | 1.8 | 95% |
| 90% | 1.43 | 0.06 | 1.79 | 98% |
| 95% | 1.64 | 0.06 | 1.81 | 99% |
| 100% | 1.85 | 0.06 | 1.81 | 100% |
| **REESE** | | **AGFA ALT 8C** | | |
| 5% | 0.1 | 0.08 | 1.83 | 5% |
| 10% | 0.14 | 0.09 | 1.85 | 11% |
| 15% | 0.18 | 0.09 | 1.84 | 19% |
| 20% | 0.23 | 0.08 | 1.87 | 30% |
| 25% | 0.29 | 0.06 | 1.86 | 42% |
| 30% | 0.34 | 0.08 | 1.86 | 46% |
| 35% | 0.4 | 0.08 | 1.85 | 53% |
| 40% | 0.45 | 0.08 | 1.86 | 58% |
| 45% | 0.5 | 0.08 | 1.86 | 63% |
| 50% | 0.55 | 0.08 | 1.85 | 67% |
| 55% | 0.61 | 0.09 | 1.84 | 71% |
| 60% | 0.68 | 0.09 | 1.85 | 76% |
| 65% | 0.73 | 0.09 | 1.85 | 78% |
| 70% | 0.8 | 0.09 | 1.85 | 82% |
| 75% | 0.88 | 0.09 | 1.86 | 85% |
| 80% | 1.02 | 0.09 | 1.86 | 90% |
| 85% | 1.28 | 0.09 | 1.86 | 95% |
| 90% | 1.53 | 0.09 | 1.84 | 98% |
| 95% | 1.83 | 0.09 | 1.83 | 100% |
| 100% | 1.89 | 0.09 | 1.83 | 100% |

| NOM % | Gray Density | White Density | Black Density | Dot% |
|---|---|---|---|---|
| **REESE** | | **AGFA ALT 7C** | | |
| 5% | 0.1 | 0.06 | 1.67 | 9% |
| 10% | 0.14 | 0.08 | 1.69 | 13% |
| 15% | 0.18 | 0.06 | 1.69 | 25% |
| 20% | 0.23 | 0.06 | 1.66 | 33% |
| 25% | 0.29 | 0.06 | 1.69 | 42% |
| 30% | 0.35 | 0.06 | 1.69 | 50% |
| 35% | 0.4 | 0.08 | 1.67 | 54% |
| 40% | 0.45 | 0.06 | 1.71 | 61% |
| 45% | 0.52 | 0.08 | 1.72 | 65% |
| 50% | 0.58 | 0.08 | 1.73 | 70% |
| 55% | 0.67 | 0.08 | 1.76 | 76% |
| 60% | 0.75 | 0.06 | 1.74 | 81% |
| 65% | 0.88 | 0.06 | 1.75 | 87% |
| 70% | 0.97 | 0.08 | 1.76 | 89% |
| 75% | 1.13 | 0.08 | 1.77 | 93% |
| 80% | 1.2 | 0.08 | 1.77 | 94% |
| 85% | 1.29 | 0.06 | 1.78 | 96% |
| 90% | 1.48 | 0.08 | 1.78 | 98% |
| 95% | 1.71 | 0.08 | 1.78 | 100% |
| 100% | 1.82 | 0.06 | 1.8 | 100% |
| **REESE** | | **S2000 CON 8%C** | | |
| 5% | 0.14 | 0.06 | 1.88 | 17% |
| 10% | 0.2 | 0.06 | 1.87 | 28% |
| 15% | 0.25 | 0.06 | 1.88 | 36% |
| 20% | 0.3 | 0.06 | 1.88 | 43% |
| 25% | 0.36 | 0.06 | 1.88 | 51% |
| 30% | 0.42 | 0.06 | 1.88 | 57% |
| 35% | 0.49 | 0.06 | 1.88 | 64% |
| 40% | 0.55 | 0.06 | 1.87 | 69% |
| 45% | 0.62 | 0.06 | 1.88 | 74% |
| 50% | 0.69 | 0.06 | 1.86 | 78% |
| 55% | 0.77 | 0.06 | 1.86 | 82% |
| 60% | 0.84 | 0.06 | 1.88 | 85% |
| 65% | 0.93 | 0.06 | 1.88 | 88% |
| 70% | 1 | 0.06 | 1.88 | 90% |
| 75% | 1.1 | 0.06 | 1.87 | 92% |
| 80% | 1.25 | 0.06 | 1.88 | 95% |
| 85% | 1.4 | 0.06 | 1.88 | 97% |
| 90% | 1.58 | 0.06 | 1.86 | 99% |
| 95% | 1.79 | 0.06 | 1.86 | 100% |
| 100% | 1.88 | 0.06 | 1.86 | 100% |
| **REESE** | | **S2000 ALT 10C** | | |
| 5% | 0.11 | 0.06 | 1.74 | 11% |
| 10% | 0.17 | 0.06 | 1.76 | 23% |
| 15% | 0.21 | 0.06 | 1.76 | 30% |
| 20% | 0.28 | 0.06 | 1.77 | 41% |
| 25% | 0.34 | 0.06 | 1.77 | 48% |
| 30% | 0.4 | 0.06 | 1.77 | 55% |
| 35% | 0.47 | 0.08 | 1.76 | 61% |
| 40% | 0.54 | 0.06 | 1.78 | 68% |
| 45% | 0.61 | 0.06 | 1.8 | 73% |
| 50% | 0.67 | 0.06 | 1.8 | 77% |
| 55% | 0.75 | 0.06 | 1.83 | 81% |
| 60% | 0.81 | 0.06 | 1.82 | 84% |
| 65% | 0.9 | 0.06 | 1.83 | 87% |
| 70% | 0.98 | 0.08 | 1.84 | 89% |
| 75% | 1.08 | 0.08 | 1.84 | 92% |
| 80% | 1.15 | 0.08 | 1.83 | 93% |
| 85% | 1.26 | 0.06 | 1.82 | 95% |
| 90% | 1.42 | 0.08 | 1.86 | 97% |
| 95% | 1.67 | 0.06 | 1.84 | 99% |
| 100% | 1.88 | 0.06 | 1.83 | 100% |

| NOM % | Gray Density | White Density | Black Density | Dot% |
|---|---|---|---|---|
| **REESE** | | **AGFA CON 15%C** | | |
| 5% | 0.1 | 0.08 | 1.91 | 5% |
| 10% | 0.15 | 0.08 | 1.92 | 15% |
| 15% | 0.19 | 0.06 | 1.93 | 26% |
| 20% | 0.22 | 0.08 | 1.93 | 28% |
| 25% | 0.26 | 0.08 | 1.93 | 34% |
| 30% | 0.29 | 0.08 | 1.93 | 39% |
| 35% | 0.34 | 0.08 | 1.93 | 46% |
| 40% | 0.38 | 0.08 | 1.93 | 51% |
| 45% | 0.45 | 0.08 | 1.94 | 58% |
| 50% | 0.5 | 0.08 | 1.93 | 63% |
| 55% | 0.57 | 0.08 | 1.94 | 69% |
| 60% | 0.65 | 0.08 | 1.93 | 74% |
| 65% | 0.79 | 0.06 | 1.95 | 82% |
| 70% | 0.88 | 0.08 | 1.93 | 85% |
| 75% | 0.98 | 0.08 | 1.95 | 89% |
| 80% | 1.1 | 0.08 | 1.95 | 92% |
| 85% | 1.27 | 0.08 | 1.94 | 95% |
| 90% | 1.53 | 0.06 | 1.93 | 98% |
| 95% | 1.85 | 0.08 | 1.92 | 100% |
| 100% | 1.96 | 0.06 | 1.94 | 100% |
| **REESE** | | **S2000 ALT 7C** | | |
| 5% | 0.15 | 0.06 | 1.72 | 19% |
| 10% | 0.24 | 0.06 | 1.74 | 35% |
| 15% | 0.33 | 0.06 | 1.73 | 47% |
| 20% | 0.42 | 0.06 | 1.72 | 58% |
| 25% | 0.5 | 0.06 | 1.73 | 65% |
| 30% | 0.59 | 0.06 | 1.74 | 72% |
| 35% | 0.67 | 0.06 | 1.72 | 77% |
| 40% | 0.74 | 0.06 | 1.73 | 81% |
| 45% | 0.79 | 0.06 | 1.74 | 83% |
| 50% | 0.87 | 0.06 | 1.75 | 86% |
| 55% | 0.97 | 0.08 | 1.77 | 89% |
| 60% | 1.09 | 0.06 | 1.74 | 93% |
| 65% | 1.19 | 0.06 | 1.76 | 94% |
| 70% | 1.3 | 0.06 | 1.77 | 96% |
| 75% | 1.44 | 0.06 | 1.77 | 98% |
| 80% | 1.5 | 0.06 | 1.78 | 98% |
| 85% | 1.53 | 0.06 | 1.78 | 98% |
| 90% | 1.67 | 0.06 | 1.79 | 99% |
| 95% | 1.76 | 0.06 | 1.77 | 100% |
| 100% | 1.81 | 0.06 | 1.76 | 100% |
| **REESE** | | **AGFA CON 8%C** | | |
| 5% | 0.13 | 0.07 | 1.86 | 13% |
| 10% | 0.18 | 0.07 | 1.85 | 23% |
| 15% | 0.21 | 0.07 | 1.87 | 28% |
| 20% | 0.26 | 0.07 | 1.88 | 36% |
| 25% | 0.29 | 0.07 | 1.87 | 40% |
| 30% | 0.34 | 0.07 | 1.86 | 47% |
| 35% | 0.39 | 0.07 | 1.86 | 53% |
| 40% | 0.45 | 0.07 | 1.85 | 59% |
| 45% | 0.51 | 0.07 | 1.86 | 65% |
| 50% | 0.56 | 0.07 | 1.87 | 69% |
| 55% | 0.67 | 0.07 | 1.86 | 76% |
| 60% | 0.76 | 0.07 | 1.87 | 81% |
| 65% | 0.83 | 0.07 | 1.88 | 84% |
| 70% | 0.89 | 0.07 | 1.88 | 86% |
| 75% | 0.96 | 0.07 | 1.88 | 88% |
| 80% | 1.06 | 0.06 | 1.89 | 91% |
| 85% | 1.26 | 0.07 | 1.88 | 95% |
| 90% | 1.44 | 0.07 | 1.86 | 97% |
| 95% | 1.76 | 0.07 | 1.86 | 100% |
| 100% | 1.88 | 0.07 | 1.87 | 100% |

# Actual Density Measurements & Dot % Calculations

| NOM % | Gray Density | White Density | Black Density | Dot% |
|---|---|---|---|---|
| **REESE** | | **S2000 ALT 11UB** | | |
| 5% | 0.22 | 0.17 | 1.02 | 13% |
| 10% | 0.25 | 0.17 | 0.99 | 20% |
| 15% | 0.28 | 0.17 | 1 | 26% |
| 20% | 0.25 | 0.17 | 1.01 | 20% |
| 25% | 0.33 | 0.17 | 1.02 | 36% |
| 30% | 0.38 | 0.17 | 1.02 | 45% |
| 35% | 0.43 | 0.17 | 1.02 | 52% |
| 40% | 0.49 | 0.17 | 1 | 61% |
| 45% | 0.52 | 0.17 | 1.01 | 65% |
| 50% | 0.57 | 0.17 | 1.02 | 70% |
| 55% | 0.62 | 0.17 | 1.01 | 75% |
| 60% | 0.65 | 0.17 | 1.02 | 78% |
| 65% | 0.7 | 0.17 | 1.01 | 82% |
| 70% | 0.73 | 0.17 | 1.01 | 85% |
| 75% | 0.77 | 0.17 | 1.02 | 87% |
| 80% | 0.84 | 0.17 | 1.03 | 91% |
| 85% | 0.89 | 0.17 | 1.01 | 95% |
| 90% | 0.91 | 0.17 | 1.01 | 96% |
| 95% | 0.99 | 0.17 | 1.02 | 99% |
| 100% | 1.03 | 0.17 | 1.03 | 100% |
| **REESE** | | **AGFA ALT 8UB** | | |
| 5% | 0.22 | 0.18 | 1.01 | 10% |
| 10% | 0.27 | 0.18 | 0.96 | 22% |
| 15% | 0.31 | 0.17 | 0.97 | 33% |
| 20% | 0.36 | 0.17 | 0.98 | 42% |
| 25% | 0.34 | 0.18 | 0.98 | 37% |
| 30% | 0.38 | 0.18 | 0.98 | 44% |
| 35% | 0.44 | 0.19 | 0.98 | 52% |
| 40% | 0.48 | 0.18 | 0.98 | 59% |
| 45% | 0.51 | 0.18 | 0.98 | 63% |
| 50% | 0.55 | 0.18 | 0.97 | 68% |
| 55% | 0.58 | 0.17 | 0.98 | 72% |
| 60% | 0.63 | 0.18 | 0.98 | 77% |
| 65% | 0.66 | 0.19 | 0.99 | 79% |
| 70% | 0.66 | 0.18 | 0.99 | 79% |
| 75% | 0.71 | 0.18 | 0.97 | 84% |
| 80% | 0.76 | 0.18 | 0.97 | 88% |
| 85% | 0.86 | 0.18 | 1.01 | 93% |
| 90% | 0.93 | 0.18 | 0.99 | 97% |
| 95% | 0.99 | 0.18 | 1 | 100% |
| 100% | 1 | 0.18 | 1 | 100% |
| **REESE** | | **AGFA ALT 7UB** | | |
| 5% | 0.24 | 0.17 | 1.05 | 17% |
| 10% | 0.29 | 0.17 | 1.05 | 28% |
| 15% | 0.33 | 0.17 | 1.03 | 36% |
| 20% | 0.32 | 0.17 | 1.05 | 34% |
| 25% | 0.37 | 0.17 | 1.03 | 43% |
| 30% | 0.42 | 0.17 | 1.03 | 51% |
| 35% | 0.48 | 0.18 | 1.05 | 58% |
| 40% | 0.51 | 0.17 | 1.04 | 63% |
| 45% | 0.55 | 0.17 | 1.04 | 67% |
| 50% | 0.59 | 0.18 | 1.04 | 71% |
| 55% | 0.63 | 0.18 | 1.04 | 75% |
| 60% | 0.66 | 0.18 | 1.03 | 78% |
| 65% | 0.73 | 0.18 | 1.05 | 83% |
| 70% | 0.8 | 0.17 | 1.02 | 89% |
| 75% | 0.84 | 0.18 | 1 | 92% |
| 80% | 0.86 | 0.18 | 1.03 | 92% |
| 85% | 0.91 | 0.18 | 1.04 | 94% |
| 90% | 0.95 | 0.18 | 1.05 | 96% |
| 95% | 1.06 | 0.18 | 1.06 | 100% |
| 100% | 1.04 | 0.18 | 1.05 | 100% |

| NOM % | Gray Density | White Density | Black Density | Dot% |
|---|---|---|---|---|
| **REESE** | | **S2000 ALT 10UB** | | |
| 5% | 0.23 | 0.17 | 1 | 15% |
| 10% | 0.3 | 0.18 | 0.99 | 29% |
| 15% | 0.34 | 0.18 | 0.98 | 37% |
| 20% | 0.32 | 0.17 | 0.99 | 34% |
| 25% | 0.37 | 0.18 | 0.96 | 42% |
| 30% | 0.41 | 0.17 | 0.94 | 51% |
| 35% | 0.47 | 0.17 | 0.95 | 60% |
| 40% | 0.52 | 0.17 | 0.98 | 65% |
| 45% | 0.57 | 0.18 | 0.97 | 71% |
| 50% | 0.6 | 0.18 | 0.97 | 74% |
| 55% | 0.62 | 0.17 | 0.98 | 76% |
| 60% | 0.66 | 0.18 | 0.96 | 80% |
| 65% | 0.69 | 0.18 | 0.98 | 82% |
| 70% | 0.71 | 0.18 | 0.95 | 85% |
| 75% | 0.76 | 0.18 | 0.95 | 89% |
| 80% | 0.77 | 0.18 | 0.97 | 89% |
| 85% | 0.82 | 0.18 | 0.99 | 91% |
| 90% | 0.87 | 0.18 | 0.98 | 95% |
| 95% | 0.92 | 0.18 | 0.96 | 98% |
| 100% | 0.98 | 0.18 | 0.98 | 100% |
| **REESE** | | **AGFA CON 15%UB** | | |
| 5% | 0.22 | 0.17 | 1 | 13% |
| 10% | 0.25 | 0.17 | 0.96 | 20% |
| 15% | 0.28 | 0.17 | 0.98 | 26% |
| 20% | 0.24 | 0.17 | 1 | 17% |
| 25% | 0.28 | 0.17 | 1.01 | 26% |
| 30% | 0.31 | 0.17 | 1.01 | 32% |
| 35% | 0.36 | 0.17 | 1 | 42% |
| 40% | 0.39 | 0.17 | 0.99 | 47% |
| 45% | 0.44 | 0.17 | 0.99 | 55% |
| 50% | 0.49 | 0.17 | 0.99 | 61% |
| 55% | 0.52 | 0.18 | 0.99 | 64% |
| 60% | 0.57 | 0.17 | 0.99 | 71% |
| 65% | 0.63 | 0.17 | 0.99 | 77% |
| 70% | 0.68 | 0.17 | 1.01 | 81% |
| 75% | 0.73 | 0.17 | 1 | 85% |
| 80% | 0.77 | 0.18 | 0.99 | 88% |
| 85% | 0.84 | 0.17 | 0.98 | 93% |
| 90% | 0.9 | 0.17 | 0.98 | 96% |
| 95% | 0.97 | 0.17 | 0.98 | 100% |
| 100% | 0.98 | 0.17 | 0.99 | 100% |
| **REESE** | | **S2000 ALT 7UB** | | |
| 5% | 0.27 | 0.17 | 0.98 | 24% |
| 10% | 0.28 | 0.17 | 1 | 26% |
| 15% | 0.36 | 0.17 | 1 | 42% |
| 20% | 0.44 | 0.17 | 1.02 | 54% |
| 25% | 0.49 | 0.17 | 1.02 | 61% |
| 30% | 0.55 | 0.18 | 0.98 | 68% |
| 35% | 0.61 | 0.17 | 0.98 | 75% |
| 40% | 0.62 | 0.18 | 0.99 | 75% |
| 45% | 0.66 | 0.17 | 0.98 | 80% |
| 50% | 0.68 | 0.17 | 0.99 | 81% |
| 55% | 0.72 | 0.17 | 1 | 84% |
| 60% | 0.78 | 0.17 | 0.98 | 89% |
| 65% | 0.8 | 0.17 | 0.99 | 90% |
| 70% | 0.85 | 0.17 | 1.01 | 92% |
| 75% | 0.87 | 0.17 | 0.99 | 94% |
| 80% | 0.93 | 0.17 | 1.01 | 97% |
| 85% | 0.94 | 0.18 | 1.01 | 97% |
| 90% | 0.95 | 0.17 | 1 | 98% |
| 95% | 1 | 0.17 | 0.97 | 101% |
| 100% | 1.02 | 0.17 | 1 | 101% |

| NOM % | Gray Density | White Density | Black Density | Dot% |
|---|---|---|---|---|
| **REESE** | | **AGFA CON 8%UB** | | |
| 5% | 0.23 | 0.17 | 0.99 | 15% |
| 10% | 0.26 | 0.18 | 0.97 | 20% |
| 15% | 0.3 | 0.17 | 0.99 | 30% |
| 20% | 0.34 | 0.18 | 0.99 | 36% |
| 25% | 0.38 | 0.17 | 1.01 | 45% |
| 30% | 0.35 | 0.17 | 1.02 | 40% |
| 35% | 0.39 | 0.17 | 1.02 | 46% |
| 40% | 0.44 | 0.18 | 1 | 53% |
| 45% | 0.48 | 0.17 | 1 | 60% |
| 50% | 0.53 | 0.17 | 0.98 | 67% |
| 55% | 0.58 | 0.18 | 0.97 | 72% |
| 60% | 0.63 | 0.18 | 0.97 | 77% |
| 65% | 0.68 | 0.17 | 0.99 | 81% |
| 70% | 0.72 | 0.17 | 0.98 | 85% |
| 75% | 0.74 | 0.17 | 0.95 | 88% |
| 80% | 0.78 | 0.18 | 0.97 | 89% |
| 85% | 0.84 | 0.18 | 0.98 | 93% |
| 90% | 0.89 | 0.18 | 0.95 | 97% |
| 95% | 0.94 | 0.18 | 0.96 | 99% |
| 100% | 0.95 | 0.18 | 0.93 | 101% |
| **H&N** | | **AGFA CON 8%CHN** | | |
| 5% | 0.12 | 0.09 | 1.46 | 7% |
| 10% | 0.17 | 0.09 | 1.47 | 18% |
| 15% | 0.21 | 0.09 | 1.48 | 25% |
| 20% | 0.25 | 0.09 | 1.51 | 32% |
| 25% | 0.29 | 0.09 | 1.54 | 38% |
| 30% | 0.35 | 0.09 | 1.54 | 47% |
| 35% | 0.41 | 0.09 | 1.56 | 54% |
| 40% | 0.48 | 0.09 | 1.59 | 61% |
| 45% | 0.55 | 0.09 | 1.61 | 67% |
| 50% | 0.62 | 0.09 | 1.61 | 73% |
| 55% | 0.72 | 0.09 | 1.64 | 79% |
| 60% | 0.78 | 0.09 | 1.64 | 82% |
| 65% | 0.88 | 0.09 | 1.66 | 86% |
| 70% | 0.95 | 0.09 | 1.67 | 89% |
| 75% | 1.08 | 0.09 | 1.68 | 92% |
| 80% | 1.21 | 0.09 | 1.69 | 95% |
| 85% | 1.38 | 0.09 | 1.71 | 97% |
| 90% | 1.57 | 0.09 | 1.71 | 99% |
| 95% | 1.66 | 0.09 | 1.72 | 100% |
| 100% | 1.74 | 0.09 | 1.74 | 100% |
| **H&N** | | **AGFA ALT 7CHN** | | |
| 5% | 0.11 | 0.09 | 1.6 | 5% |
| 10% | 0.14 | 0.09 | 1.63 | 11% |
| 15% | 0.2 | 0.09 | 1.66 | 23% |
| 20% | 0.28 | 0.09 | 1.71 | 36% |
| 25% | 0.33 | 0.09 | 1.73 | 43% |
| 30% | 0.41 | 0.09 | 1.73 | 53% |
| 35% | 0.46 | 0.09 | 1.78 | 59% |
| 40% | 0.54 | 0.09 | 1.81 | 66% |
| 45% | 0.64 | 0.09 | 1.81 | 73% |
| 50% | 0.71 | 0.09 | 1.83 | 77% |
| 55% | 0.81 | 0.09 | 1.83 | 82% |
| 60% | 0.93 | 0.09 | 1.83 | 87% |
| 65% | 1.09 | 0.09 | 1.83 | 92% |
| 70% | 1.24 | 0.09 | 1.84 | 95% |
| 75% | 1.37 | 0.09 | 1.84 | 96% |
| 80% | 1.46 | 0.09 | 1.86 | 97% |
| 85% | 1.53 | 0.09 | 1.86 | 98% |
| 90% | 1.67 | 0.09 | 1.84 | 99% |
| 95% | 1.76 | 0.09 | 1.85 | 100% |
| 100% | 1.87 | 0.09 | 1.84 | 100% |

# Actual Density Measurements & Dot % Calculations

| NOM % | Gray Density | White Density | Black Density | Dot% |
|---|---|---|---|---|
| **H&N** | **AGFA CON 8%UHN** | | | |
| 5% | 0.13 | 0.09 | 0.92 | 10% |
| 10% | 0.19 | 0.09 | 0.91 | 24% |
| 15% | 0.23 | 0.09 | 0.92 | 32% |
| 20% | 0.28 | 0.09 | 0.94 | 41% |
| 25% | 0.33 | 0.09 | 0.95 | 49% |
| 30% | 0.39 | 0.09 | 0.93 | 58% |
| 35% | 0.44 | 0.09 | 0.95 | 64% |
| 40% | 0.52 | 0.09 | 0.96 | 73% |
| 45% | 0.58 | 0.09 | 0.96 | 78% |
| 50% | 0.62 | 0.09 | 0.97 | 81% |
| 55% | 0.7 | 0.09 | 0.98 | 87% |
| 60% | 0.75 | 0.09 | 0.97 | 90% |
| 65% | 0.8 | 0.09 | 0.98 | 92% |
| 70% | 0.83 | 0.09 | 0.99 | 94% |
| 75% | 0.87 | 0.09 | 0.99 | 95% |
| 80% | 0.93 | 0.09 | 1 | 98% |
| 85% | 0.94 | 0.09 | 0.99 | 98% |
| 90% | 0.97 | 0.09 | 1 | 99% |
| 95% | 1 | 0.09 | 1 | 100% |
| 100% | 1.01 | 0.09 | 1.02 | 100% |

| NOM % | Gray Density | White Density | Black Density | Dot% |
|---|---|---|---|---|
| **COLLINS** | **AGFA ALT 7CCOL** | | | |
| 5% | 0.13 | 0.09 | 1.79 | 9% |
| 10% | 0.16 | 0.09 | 1.79 | 15% |
| 15% | 0.19 | 0.09 | 1.81 | 21% |
| 20% | 0.23 | 0.09 | 1.82 | 28% |
| 25% | 0.27 | 0.09 | 1.77 | 35% |
| 30% | 0.3 | 0.1 | 1.67 | 38% |
| 35% | 0.34 | 0.09 | 1.73 | 45% |
| 40% | 0.37 | 0.09 | 1.75 | 49% |
| 45% | 0.42 | 0.1 | 1.72 | 53% |
| 50% | 0.48 | 0.1 | 1.73 | 60% |
| 55% | 0.54 | 0.1 | 1.74 | 65% |
| 60% | 0.62 | 0.09 | 1.72 | 72% |
| 65% | 0.71 | 0.09 | 1.72 | 78% |
| 70% | 0.82 | 0.08 | 1.71 | 84% |
| 75% | 0.97 | 0.08 | 1.68 | 89% |
| 80% | 1 | 0.09 | 1.7 | 90% |
| 85% | 1.2 | 0.09 | 1.7 | 95% |
| 90% | 1.39 | 0.09 | 1.72 | 97% |
| 95% | 1.63 | 0.1 | 1.68 | 100% |
| 100% | 1.78 | 0.09 | 1.73 | 100% |

| NOM % | Gray Density | White Density | Black Density | Dot% |
|---|---|---|---|---|
| **MID OHIO** | **S2000 ALT 11COH** | | | |
| 5% | 0.09 | 0.07 | 1.62 | 5% |
| 10% | 0.11 | 0.08 | 1.62 | 7% |
| 15% | 0.16 | 0.07 | 1.64 | 19% |
| 20% | 0.20 | 0.07 | 1.67 | 27% |
| 25% | 0.28 | 0.07 | 1.68 | 39% |
| 30% | 0.36 | 0.07 | 1.71 | 50% |
| 35% | 0.43 | 0.07 | 1.69 | 58% |
| 40% | 0.50 | 0.07 | 1.70 | 64% |
| 45% | 0.58 | 0.07 | 1.70 | 71% |
| 50% | 0.64 | 0.07 | 1.74 | 75% |
| 55% | 0.72 | 0.07 | 1.75 | 79% |
| 60% | 0.80 | 0.05 | 1.77 | 84% |
| 65% | 0.87 | 0.05 | 1.75 | 87% |
| 70% | 0.96 | 0.07 | 1.75 | 89% |
| 75% | 1.09 | 0.07 | 1.76 | 92% |
| 80% | 1.17 | 0.07 | 1.75 | 94% |
| 85% | 1.29 | 0.07 | 1.74 | 96% |
| 90% | 1.44 | 0.07 | 1.74 | 98% |
| 95% | 1.60 | 0.07 | 1.73 | 99% |
| 100% | 1.70 | 0.07 | 1.73 | 100% |

| H&N | AGFA ALT 7UHN | | | |
|---|---|---|---|---|
| 5% | 0.11 | 0.09 | 1.06 | 5% |
| 10% | 0.14 | 0.09 | 1.07 | 12% |
| 15% | 0.19 | 0.09 | 1.07 | 23% |
| 20% | 0.25 | 0.09 | 1.09 | 34% |
| 25% | 0.3 | 0.09 | 1.09 | 43% |
| 30% | 0.37 | 0.09 | 1.09 | 53% |
| 35% | 0.42 | 0.09 | 1.11 | 59% |
| 40% | 0.49 | 0.09 | 1.1 | 67% |
| 45% | 0.55 | 0.09 | 1.12 | 72% |
| 50% | 0.6 | 0.09 | 1.11 | 76% |
| 55% | 0.65 | 0.09 | 1.11 | 80% |
| 60% | 0.73 | 0.09 | 1.11 | 85% |
| 65% | 0.82 | 0.09 | 1.11 | 90% |
| 70% | 0.87 | 0.09 | 1.11 | 92% |
| 75% | 0.92 | 0.09 | 1.11 | 94% |
| 80% | 0.96 | 0.09 | 1.1 | 96% |
| 85% | 1 | 0.09 | 1.11 | 97% |
| 90% | 1.08 | 0.09 | 1.1 | 99% |
| 95% | 1.1 | 0.09 | 1.11 | 100% |
| 100% | 1.12 | 0.09 | 1.11 | 100% |

| MID OHIO | CROSSFIELD CON 150COH | | | |
|---|---|---|---|---|
| 5% | 0.11 | 0.07 | 1.52 | 9% |
| 10% | 0.17 | 0.07 | 1.55 | 21% |
| 15% | 0.21 | 0.08 | 1.58 | 27% |
| 20% | 0.27 | 0.08 | 1.62 | 36% |
| 25% | 0.32 | 0.07 | 1.62 | 45% |
| 30% | 0.39 | 0.08 | 1.64 | 52% |
| 35% | 0.46 | 0.08 | 1.66 | 60% |
| 40% | 0.52 | 0.08 | 1.69 | 65% |
| 45% | 0.63 | 0.07 | 1.70 | 74% |
| 50% | 0.73 | 0.07 | 1.73 | 80% |
| 55% | 0.80 | 0.07 | 1.73 | 83% |
| 60% | 0.93 | 0.08 | 1.76 | 88% |
| 65% | 1.08 | 0.08 | 1.77 | 92% |
| 70% | 1.22 | 0.06 | 1.80 | 95% |
| 75% | 1.34 | 0.07 | 1.78 | 97% |
| 80% | 1.46 | 0.07 | 1.82 | 98% |
| 85% | 1.58 | 0.08 | 1.82 | 99% |
| 90% | 1.74 | 0.08 | 1.83 | 100% |
| 95% | 1.79 | 0.08 | 1.82 | 100% |
| 100% | 1.84 | 0.08 | 1.77 | 100% |

**ACTUAL FILM MEASUREMENTS**

| Nominal | Con Film | Con 8 Film | Alt 7 Film |
|---|---|---|---|
| 5% | 5% | 3% | 2% |
| 10% | 10% | 7% | 3% |
| 15% | 15% | 11% | 5% |
| 20% | 20% | 16% | 7% |
| 25% | 25% | 19% | 9% |
| 30% | 30% | 24% | 11% |
| 35% | 35% | 28% | 13% |
| 40% | 40% | 33% | 16% |
| 45% | 44% | 38% | 19% |
| 50% | 50% | 42% | 22% |
| 55% | 56% | 48% | 25% |
| 60% | 60% | 54% | 29% |
| 65% | 65% | 59% | 34% |
| 70% | 70% | 65% | 39% |
| 75% | 75% | 69% | 45% |
| 80% | 80% | 74% | 50% |
| 85% | 85% | 80% | 56% |
| 90% | 90% | 87% | 66% |
| 95% | 95% | 94% | 80% |
| 100% | 100% | 100% | 100% |

| COLLINS | AGFA CON 8%CCOL | | | |
|---|---|---|---|---|
| 5% | 0.15 | 0.09 | 1.68 | 13% |
| 10% | 0.19 | 0.09 | 1.66 | 21% |
| 15% | 0.23 | 0.09 | 1.68 | 28% |
| 20% | 0.29 | 0.1 | 1.71 | 36% |
| 25% | 0.33 | 0.09 | 1.7 | 44% |
| 30% | 0.38 | 0.09 | 1.61 | 50% |
| 35% | 0.42 | 0.09 | 1.64 | 55% |
| 40% | 0.5 | 0.09 | 1.65 | 63% |
| 45% | 0.59 | 0.09 | 1.66 | 70% |
| 50% | 0.63 | 0.09 | 1.64 | 73% |
| 55% | 0.76 | 0.1 | 1.63 | 80% |
| 60% | 0.83 | 0.09 | 1.62 | 84% |
| 65% | 0.92 | 0.09 | 1.62 | 88% |
| 70% | 1 | 0.09 | 1.62 | 90% |
| 75% | 1.08 | 0.09 | 1.61 | 93% |
| 80% | 1.21 | 0.09 | 1.63 | 95% |
| 85% | 1.38 | 0.09 | 1.64 | 98% |
| 90% | 1.5 | 0.09 | 1.64 | 99% |
| 95% | 1.61 | 0.09 | 1.65 | 100% |
| 100% | 1.69 | 0.09 | 1.7 | 100% |

| MID OHIO | CROSSFIELD CON 150 15% COH | | | |
|---|---|---|---|---|
| 5% | 0.09 | 0.05 | 1.46 | 9% |
| 10% | 0.13 | 0.07 | 1.50 | 13% |
| 15% | 0.17 | 0.07 | 1.52 | 21% |
| 20% | 0.20 | 0.06 | 1.54 | 29% |
| 25% | 0.25 | 0.06 | 1.56 | 37% |
| 30% | 0.29 | 0.07 | 1.56 | 41% |
| 35% | 0.33 | 0.07 | 1.59 | 46% |
| 40% | 0.38 | 0.06 | 1.63 | 54% |
| 45% | 0.46 | 0.05 | 1.63 | 63% |
| 50% | 0.50 | 0.06 | 1.66 | 65% |
| 55% | 0.57 | 0.05 | 1.68 | 71% |
| 60% | 0.66 | 0.07 | 1.68 | 76% |
| 65% | 0.79 | 0.08 | 1.70 | 82% |
| 70% | 0.89 | 0.08 | 1.71 | 87% |
| 75% | 0.98 | 0.06 | 1.73 | 90% |
| 80% | 1.07 | 0.07 | 1.72 | 92% |
| 85% | 1.23 | 0.07 | 1.68 | 95% |
| 90% | 1.43 | 0.07 | 1.69 | 98% |
| 95% | 1.62 | 0.07 | 1.68 | 100% |
| 100% | 1.69 | 0.07 | 1.68 | 100% |

| Nominal | Alt 8 Film | Alt 10 Film | Alt 11 Film |
|---|---|---|---|
| 5% | 1% | 2% | 2% |
| 10% | 3% | 5% | 3% |
| 15% | 4% | 7% | 4% |
| 20% | 6% | 9% | 6% |
| 25% | 8% | 12% | 8% |
| 30% | 10% | 15% | 11% |
| 35% | 12% | 17% | 13% |
| 40% | 14% | 19% | 15% |
| 45% | 17% | 22% | 18% |
| 50% | 19% | 24% | 20% |
| 55% | 22% | 27% | 23% |
| 60% | 25% | 30% | 26% |
| 65% | 27% | 34% | 29% |
| 70% | 30% | 38% | 33% |
| 75% | 33% | 42% | 38% |
| 80% | 38% | 46% | 45% |
| 85% | 48% | 51% | 51% |
| 90% | 61% | 59% | 58% |
| 95% | 78% | 73% | 73% |
| 100% | 100% | 100% | 100% |

# Printing Experience of In Tandem Design, Inc.

In Tandem Design, Inc. has printed with Diamond Screening many jobs of varying characteristics (4 color, spot color, coated stock, uncoated stock). There is a need to use Alt 8 for uncoated stock to prevent mid-tones from getting too dark. Generally, press operators have no particular problem with Diamond Screening. Good printing companies are getting good results; a "quick printer" got good results with a Ryobi (sp?) bearer-less press. However, more of the "conventional wisdom" about stochastic screening should be questioned and proved or disproved scientifically.

1. Kodak had told a printer to burn the plates light for stochastic screening. We had to re-burn all the plates normally and replace them on press, before the job would come up to color.
2. Although there is more latitude on press for ink densities, we had horrendous problems with the Motorsports job when we started with high ink densities. The densities on the final press sheets were about the same as for conventional 150 lpi printing.
3. Flat tints look fine (almost exceptional) in stochastic screening.
4. Register is at least as critical, if not more critical, in stochastic as with conventional.
5. Resolution of the scan must be at least as high as it would have been for 150 lpi conventional. With much better reproduction of detail and edge lines, aliased edges and stair-stepping would be visible with stochastic screening.
6. I think more black-line-white-line unsharp masking (as suggested in the L-H DS Manual) is a bad idea. We are using our normal settings.

What follows is a report on the enclosed sample. As a matter of convention, when a color is capitalized (Yellow) I am referring to the ink and/or press unit; when the color is not capitalized (green) I am referring to the hue as it looks on the printed sheet.

| | |
|---|---|
| Job: | *Maryland Motorsports Park* |
| Printer: | Reese Press (our vendor) |
| End Client: | Maryland Motorsports Park (our client) |
| All scans: | Cromagraph S2000 |
| RIP calibration: | Alternate 7 |
| Film: | Agfa GS712HN |
| Image Setter: | RIP 50/L330 @ 1270 dpi |
| Plates: | Fuji |
| Press: | Komori 5 Color, 40" Sheetfed |
| Inks: | Braden Sutphin Inks, 4 Color Process |

The intent of this color OK was to match the Iris proofs as closely as possible. Several conditions of the design and press make-ready made this impossible.

I had asked the press foreman to run the inks heavy right from the start. We wanted to see if we could get the really saturated color and depth of shadow attributable to heavy ink coverage. The first sheet looked horrible. The magenta car on the cover was beet red. The yellow Pennzoil car on page 5 had no shape at all; it was solid, saturated yellow. The roof of the club house illustration was green. The grass behind the cars on pages 2 & 4 was lime green. We backed off on the Yellow and Magenta in an attempt to get the cover color closer to the Iris proof. This shifted the neutrality of the road surfaces and tires of the small car shots (the job was laid out as a work-and-tumble). Nearly three hours later we had color close to the Iris proofs. The ink densities measured just slightly higher than conventional screening (Y @ 100, M @ 160, C @ 150, K @ 180). Clearly, a better approach to make-ready for stochastic screening is to get the press up to normal densities, and add from there if necessary.

**Note:** all comments on color are with respect to the Iris proofs, not with respect to aesthetics.

The cover has slightly too much Magenta and Yellow. It was in line with page 2 in the direction of travel on press, and the Mobile and Collini cars don't have enough Magenta and Yellow. We had to compromise, allowing the cover to rule.

The yellow Pennzoil car on page 5 had no contour when Yellow density was too high. The contour is provided primarily by Magenta, the dirtying color for the shading, and secondarily by Black and Cyan. We could never get enough Magenta to show the shading as on the proof. We added more and more Magenta to densities in the 170 range, but couldn't get the shading. When Magenta density was extreme, the red shirt of the fan behind the car had weirded-out transitions rather than smooth gradients. And the blurry flesh tones of the background fans were never dark enough. We increased bearer pressure on the Magenta, which did some good. We also tried saturating the Cyan and the Black, so that the shadow/contour detail would improve. This helped the Pennzoil car, but adversely affected page 4 (balloons & Toyota car). We considered packing the Magenta blanket under the car, but were concerned about affects on register and color on the rest of the piece. We then reduced Yellow density to achieve the final piece as you see it.

Reese Press normally prints Black first, Yellow last. For this job they ran Yellow first and Black last, worrying about Black first with so much Black coverage. The pressman, the foreman and I all agree that the problem with the Magenta on the Pennzoil car (and the blurry flesh tones behind it) was the wet trap of the Magenta (and the Cyan and Black to a lesser degree) onto the Yellow ink. The car is virtually 100% Yellow all over. Therefore, the Magenta lays on top of the wet Yellow ink. This same condition effects the cover as well, because there is a lot of Yellow in the magenta car. We don't know, and may never know, whether the tack of the Yellow should have been increased (they were using a higher tack yellow, anyway, because of ink lay-down order), or the Magenta should have been laid down before the Yellow. We do think that the issue of wet trapping stochastic spots, and therefore the order in which inks are printed, is very important. This might confirm the Agfa position of using higher tack inks with stochastic screening. It is also possible that the calibration takes too much out of the quarter tone, thereby always making it harder for the dirtying color to provide the necessary shading.

The Pennzoil car was in line with page 4 (balloons and the Toyota car). Please note that the first balloon has a light orange band with which we had the same problem as the Pennzoil car. The Toyota car, however, is too saturated, since we bumped the Magenta (and Cyan and Black) so high. The effect on the aesthetics of the Toyota car was considered positive.

**Conclusions**

We were unable to get exact color on this job. However, doing so with conventional screening might have been difficult, also. There doesn't seem to be any indication of a systemic shift or flaw in our scanning. The Iris is consistently heavier than the printed piece in the quarter-tones (especially of a dirtying color). This may imply that Alternate 7 takes too much out of the quarter tones, or that the Iris puts too much in, or that wet trapping light coverage to heavy coverage inks is a problem.

The job is good looking. The client is extremely happy. The printer is comfortable with the new screening method. Refinement will only occur if we get more feedback from more people on more jobs. We need to get Alternate 7 calibration installed and running on a few more image setters and see what happens. Please, respond to this analysis and this job as soon as possible.