US Ink® A Division of Sun Chemical Corporation

Factors Affecting Rub Off

Volume I

A series of twenty to thirty commercially printed samples of newspapers, which were stated to be using a low rub product, were randomly selected from around the United States and were tested for rub-off qualities. The range of rub reduction obtained from all of these samples was determined and is plotted in Figure 1. The upper line represents the best of the samples measured and the lower line the poorest of the samples measured. Obviously, the wide variation between the poorest and best suggests that several parameters influence the rub-off levels in a newspaper.

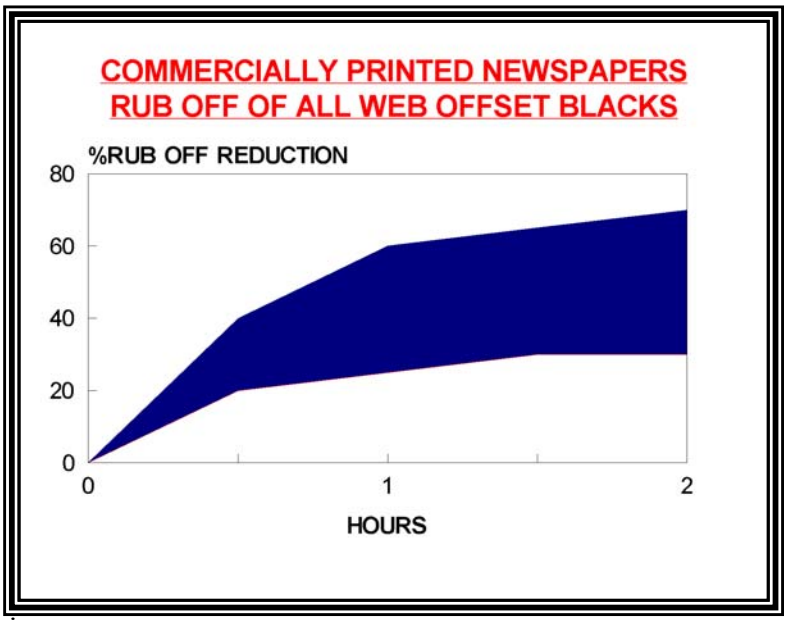

Figure 1

The drying or setting process in newspaper printing is by the absorption process. There are no external drying assists, which can aid this process. Therefore, the factors involved with rub-off have to affect this absorption process. We have attempted through laboratory and field tests to determine what factors affect the rub-off qualities in a newspaper. The following list (Figure 2) contains the factors that we have determined to have a direct impact on the level of rub-off.

Figure 2

1. Type of Formulations:

Currently US Ink offers three general types of low rub ink formulations. These are Super Standard, Low Rub, and RubPruf. The rub resistance qualities of these inks increase as the resin content increases and this is illustrated graphically in Figure 3.

Ink viscosity will also have an effect on the penetration rate into the stock that will affect the rub-off values. Higher viscosity inks will yield greater rub-off.

In Figure 3 it will be noted that there still is a range of values of rub reduction within each formulation type. This is due to variations in the remaining parameters listed.

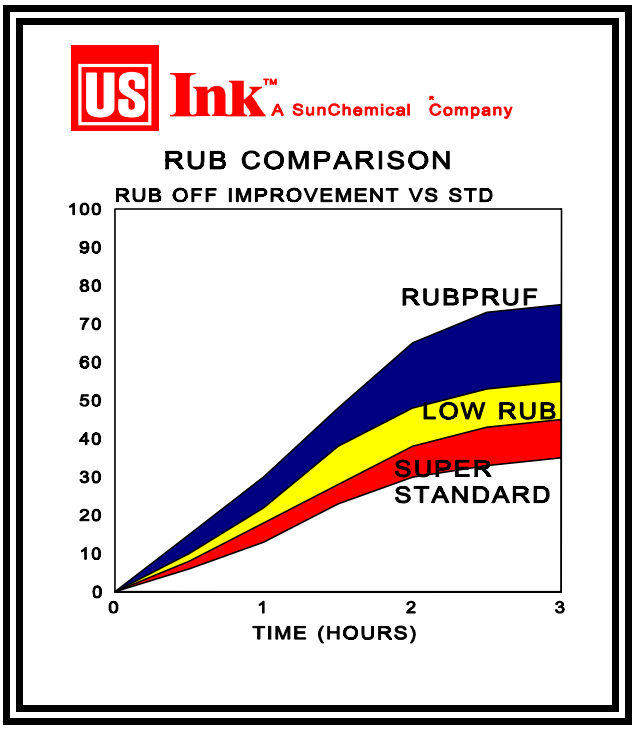

Figure 3

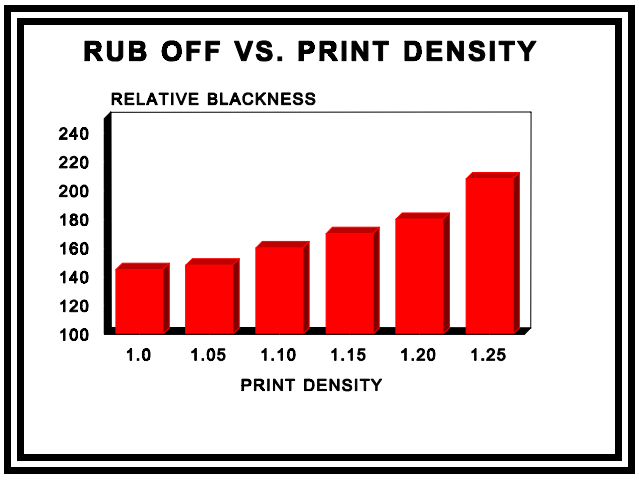

Figure 4

2. Ink Film Thickness (Print Density):

The amount of rub-off of a newspaper print is highly dependent on the print density or the ink film thickness. As can be seen in Figure 4, this varies exponentially with film thickness and becomes particularly bad when the density exceeds 1.10.

Figure 5 lists these values as a percentage increase in terms of rub-off from a print density of 1.0. As you can see, if you raise the print density from 1.0 to a density of 1.25 (an increase of 25%) the rub-off of the printed sheet increases approximately 45%.

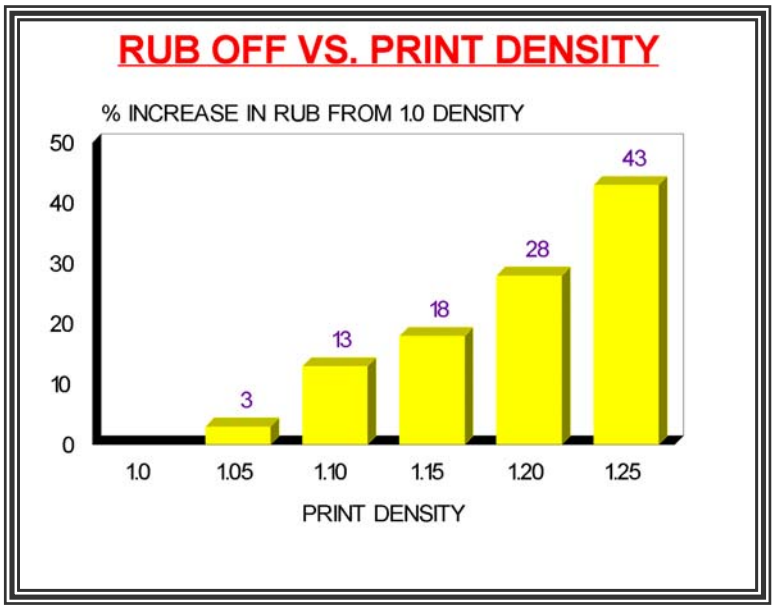

Figure 5

INK FILM WEIGHT VS. DENSITY

DENSITY	FILM WT.	% INCREASE
1.00	115	---
1.07	128	11
1.14	151	31
1.22	182	58
1.30	200	74

Figure 6

In addition to the adverse effect on rub-off, higher print density has other consequences leading to poorer ink mileage. This relationship is illustrated in Figure 6, where it can be seen that very little increase in density is achieved when excessive amounts of ink are printed. For example, an increase in print density of 20% (from 1.0 to 1.2) requires an ink film weight increase of 58%. This is over double the percentage increase of ink required to accomplish this change. As we explained before the drying or setting process for newsprint is by absorption, and as the volume of ink is increased, the newsprint can only absorb a fixed amount, so more ink will remain on the surface to rub-off.

3. Lithography:

The compatibility of the ink and fountain solution being used is of great importance in maximizing the low rub qualities of the final print. In general, it is desirable to have a moderate emulsification capacity between 40 - 70g/100g of ink. This offers good control of density and no blanket buildup. Minimal change in rheology of the emulsion is critical to produce good transfer and no "boiling over the rail."

The Ink/Water balance is critical in terms of rub-off. Not only is the newsprint absorbing the ink, but also the fountain solution. The newsprint only has a certain capacity for absorption, and if the balance is set high the newsprint will not absorb this material. Thus, more ink will be left on the surface to rub-off.

Different types of dampening systems can cause the rub-off to vary. The level of fountain solution applied via a spray dampener vs. an ink train brush can be quite different, thus affecting the ink/water balance which results in greater rub-off.

4. Paper Quality:

A study of the newsprint vs. ink rub-off was also conducted. Figure 7 shows a comparison of various stocks tested under laboratory conditions with the same ink formula and batch. The prints were prepared to equal print density and tested three hours after printing. As you can see from the graph there was a 52% difference in the rub-off level with the various stocks. The same study was also done by a major newspaper over a two week period, and similar results were found. The values were not as great as the laboratory, but a 40% difference was found in this field test.

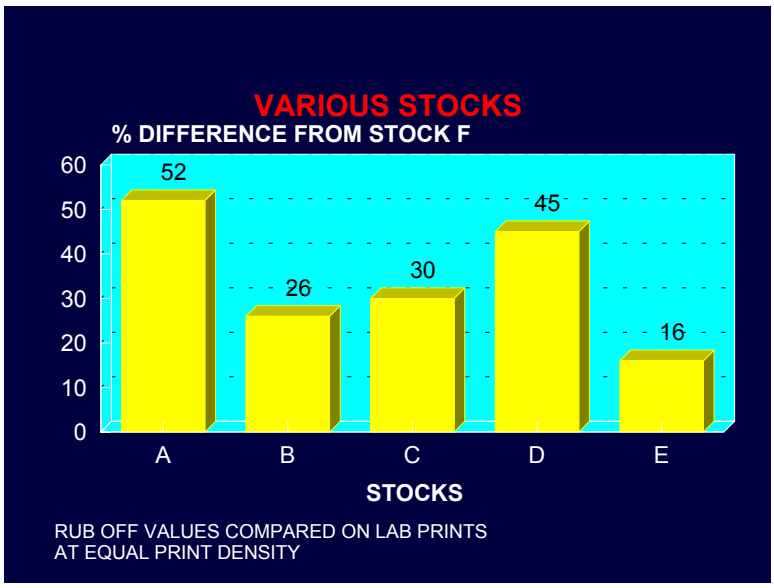

Figure 7

In testing these stocks further in the laboratory, it was found that various paper parameters indicate that absorptivity of hydrocarbon oil has the most effect on rub-off qualities. Higher absorptivities lead to better rub-off in all cases.

5. Elapsed Time After Printing:

Because news inks set by absorption, the time after printing has a significant effect on the rub-off qualities of the print. After two hours there is only a small improvement in reduction of rub-off. Most of the change occurs in the first hour after printing. This is shown graphically in Figure 8. Even after 24 hours, almost no further reduction was observed. Typically the industry standard for testing rub-off is three hours after printing.

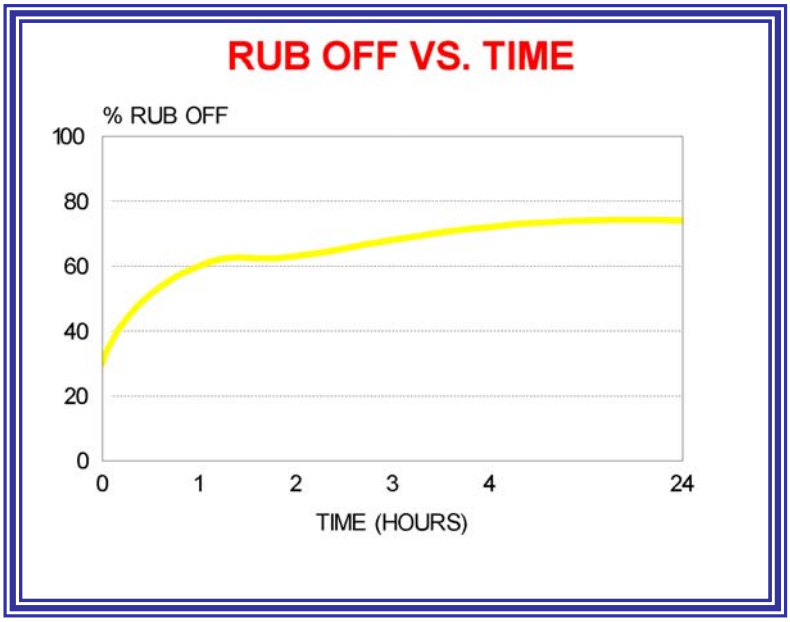

Figure 8

6. Blankets

Blankets have an effect on the rub-off in two ways. The first is the blanket type or surface. The blanket surface can come in different types which can affect the amount of water needed to properly run. This can affect the ink/water balance and thus affect the rub. The second way blankets can affect rub is through blanket height. A low blanket will change the printing pressures and thus more ink will have to be carried on press to achieve density. Also a low blanket will require a thicker ink film to be maintained, allowing for ink and paper lint to build up and act as a bridge between the blanket and paper. Thus, these factors will increase the amount of rub-off.

7. Fountain Solution

The marriage between the ink and fountain solution is very critical in achieving proper press performance. Different fountain solutions can have dramatically different emulsification properties with the same batch of ink. Therefore, once the proper print qualities are achieved, it is important to maintain both the pH and conductivity of the selected fountain solution. Higher pH or conductivity of the fountain solution can cause the ink to emulsify more fountain solution, which will ultimately affect the rub-off.

8. Roller Condition

The hardness of the rollers will affect rub-off in that harder rollers will affect the ink/water balance on press. Harder rollers will cause increased pressure in the nips while maintaining the same stripe. Thus this will affect the balance and then the rub-off.

9. Humidity in the Pressroom

The humidity in a pressroom can vastly affect both the runnability of the press and the rub-off. If a pressroom is too humid the paper stock will contain a lot of moisture, which will affect its ability to absorb ink, thus leaving more ink on the surface of the newsprint to rub-off. If a pressroom has too low humidity, it can affect the runnability of the web throughout the press and lessen the absorption of the paper by making it very dry and brittle. There needs to be a mid-range level of humidity (preferably 40% to 60%) in the pressroom for optimum performance.

10. Coverage

This is a simple point, however greater coverage in the paper will have more ink available to rub-off. It is important to note that when comparing two inks for rub-off value, equal coverage must be tested or the test will be invalid. For example, one cannot compare the rub-off of a sheet with solids vs. one with type or halftones. The comparison of rub-off should be done on two sheets with exactly the same coverage and with a solid area large enough to get a density measurement.