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There is an old saying that oil and water don't mix, however in lithography if the two don't properly mix, you will not be able to print. In order to make the system work, you need a proper marriage among all the variables. All lithographic inks need to emulsify fountain solution in order to work correctly. If a lithographic ink did not emulsify fountain solution, the ink would not even transfer to the plate. Too much emulsification will result in scumming, too little will cause water marking. In the lithographic process, the plate is composed of two different types of areas. The non-image is a water loving area (hydrophilic) while the image area is oil loving (oleophilic). While this means that the water or oil will preferentially like one area greater than another, it does not prevent the water phase from going to the image area. The fountain solution for instance will wet out uniformly on the non-image area and bead up on the image area. When this occurs, if the ink was not able to emulsify the fountain solution, the ink would not transfer to this spot and thus cause snowflaking in the solids or missed dots in the halftones. Thus, the need for emulsification.

SIGNS OF IMPROPER INK AND WATER BALANCE

1. Ink build-up on water form.
2. A very wet, shiny plate.
3. Ink spitting onto guards, floors, etc.
4. Solids look mottled, not uniform in density.
5. Solids appear weak, lack density.
6. Dots lack density.
7. Loss of detail in shadow portion of pictures.

Figure 1

While all lithographic inks need to emulsify fountain solution, there is a need to control this level on press. All inks will have a Awindow@ for optimum press performance.

However, this does not mean that the ink will not print with varying levels of fountain solution emulsified. Thus, comes the term Ink and Water balance. If this balance is not properly maintained, various press problems will result.

There is no "universally correct" ratio. The correct ratio is dependent on the products in use, and on the various interacting systems on the press. As a rule it is usually safe to assume that near-optimal transfer will occur with minimal dampening and ink levels. To determine if you are not at this optimum level see Figure 1.

Dampening systems can have an effect on ink water balance also. In an ink train dampening system, the process of emulsification provides the means where the fountain solution is transported from the dampening system in both finely emulsified and large droplets in the ink roller train, to the surface of the plate. At the surface of the plate, the large droplets break down, partially due to the pressure differences set up, and partially due to the physics and physical chemistry of the plate surface. The free water released, forms the aqueous film on the non-image area and thus aids the repulsion of the oily ink. This creates additional concerns in setting the proper ink water balance ratio.

FACTORS THAT INFLUENCE WATER SETTINGS ON PRESS

1. **Size of image area on plate.** The amount of coverage on a particular page will be critical in setting the ink and water balance. The amount of water necessary will vary depending on the coverage. Many press operators will look to a dial setting for the fountain solution as a way to gauge if they are at the correct ratio during a run. The amount will vary depending on the need. Thus, the levels of ink and water will vary.

2. **Image area, solid or screened.** Similar as above, a solid will require different settings vs. a screened area.

3. **Overall printing area across a cylinder.** This will be more prominent on process color units when dummy plates are being utilized, especially when brush or sock type dampening systems are being used. These types of dampening systems are more difficult to control since there are no page-to-page settings.

4. **Temperature**. This is a major variable in a pressroom that is not controlled. Varying temperature will have an effect on the level of fountain solution being used. A lot of heat is generated on press. The only way for the press to cool down is by evaporating the fountain solution. Some presses (typically heatset) have water cooled rollers to aid in this process. Uncontrolled humidity in the pressroom will also cause varying evaporation rates. Temperature variation will also create different demands on the ink for emulsification, because of varying emulsion stability.

The above lists some of the factors which occur on press with a given set of products being utilized. Ink and water balance will shift also, depending on the consumable products used in the pressroom. We are not trying to list all of the variables here, but just to alert you that they exist. One of these, for example, would be the fountain solution type and concentration. Some fountain solutions promote clean running at low levels of emulsification, while with others the exact reverse occurs. The same is true of the ink, with different formulations requiring different levels of dampening to run cleanly.

Figure 2 shows the effect of different types of fountain solutions with a typical ink formulation. As you can see from the chart, the selection of fountain solution can be critical in determining your ink and water balance. The same can be true for different inks and a single fountain solution.

When an ink over-emulsifies, or takes up too much water, it changes its flow properties, with the effect that transference is adversely affected. This leads to the need to run with an excessive ink film (just to achieve somewhere near the correct density) and all the problems which are associated with that.

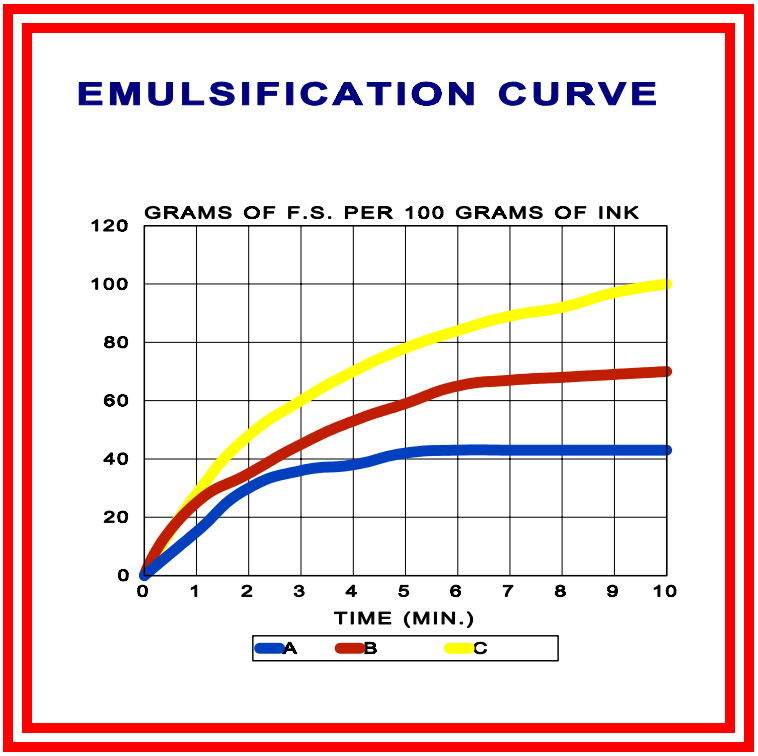

Figure 2

HOW TO ACHIEVE THE CORRECT INK AND WATER BALANCE

The following steps should be used as a guide on setting the proper ink and water balance on your press:

1. At the unit reduce water level 5 points at a time. Allow 3 to 5 minutes for the press to react.

2. Observe ink level and reduce as necessary to maintain proper density.

3. Continue this process until you reach the minimum water settings. Minimum settings are when the background looks dirty and the ink density is in specification or slightly below.

4. If you get toning in background, bring water level up slightly.

5. Once water settings are correct, proceed to adjust ink to proper density.

   Check with a densitometer, don't guess.

When the proper ink and water balance is achieved on press one will gain many advantages. The following are some of the benefits in achieving this proper balance:

ADVANTAGES OF PROPER WATER/INK BALANCE

1. When water and ink are at minimum levels, ink settings are more consistent (less fluctuation) throughout run.

2. Trapping of solids is better.

   Example: Solid magenta - solid yellow = reds better
   Solid cyan - solid yellow = greens better

3. Single Color - signatures are better.
   Laydown smooth, not mottled.

4. Better 4-color reproduction.

5. REDUCED build-up on ink rails.

6. REDUCED misting.

7. REDUCED lint build-up on blankets.

8. REDUCED plate wear.

9. Optimal pages per pound of ink.

10. Lower cost, less waste, increased productivity.

11. Reduce rub off of ink.

12. Reduced pipe roller buildup

13. Reduced set-off.

14. Reduced Dot Gain