Testing the Waters: The Importance of pH

Lithography is a chemical process with the potential for many variables to affect the quality of the printed job. The most common facet of printing prone to variation is fountain solution, but understanding it and controlling it can pay immediate dividends.

The main function of fountain solution is to efficiently wet and desensitize the non-image areas of the plate in order to keep ink from being deposited. It also helps lubricate the plate to promote longer life while aiding in blanket release and minimizing ink piling. To ensure that the fountain solution is doing its proper job, it is critical that two measurements are monitored and controlled -- pH and Conductivity.

The “potential for Hydrogen” or pH, which is a measure of the hydrogen ion concentration, has for years been the only measurement taken with respect to fountain solution. The measurement of pH is performed on a logarithmic scale from 0 to 14 with seven being neutral. A solution with a pH below 7 would be acidic while a solution with a pH greater than 7 would be alkaline. Since the scale is logarithmic, a solution with a pH of 4 would be ten times more acidic than one with a pH of 5 and one hundred times more acidic than a solution with a pH of 6. It is evident that a seemingly small change in pH can actually represent a considerable change in acidity or alkalinity.

There are several reasons pH is monitored. One reason is its role in metal plate desensitization. The idea of using gum arabic to maintain the hydrophilic (water loving) film surface of a metal plate can be credited to Alois Senefelder, the inventor of offset lithography. He discovered that gum arabic had a great affinity for water. He also discovered that gum arabic absorbed especially well to the plate surface when it reacted with a mild acid (between 3.5 and 4.5).

Another reason is its effect on ink drying. When the pH of a fountain solution becomes too acidic (below 3.5), ink drying is severely retarded. This is because the excessive acidity prevents drying agents such as cobalt or manganese from reacting or mixing with the drying oils of the ink. It has been suggested that an increase in acidity from 4.0 to 2.0 can actually lengthen drying time by 400%.

Excessive acidity often adversely affects the ink by breaking down its water resistance and causing problems such as tinting and piling. Conversely, a fountain solution found to be too alkaline can result in scumming, loss of plate desensitization and difficulties in re-starting clean after a press stop.

There are basically two methods for measuring pH levels: chemically coated pH strips and electronic pH meters. Paper pH indicator strips (4-1101) are immersed in a solution which changes its color. The color is then compared to reference colors on the dispenser. Keep in mind that these strips are only accurate within 1/2 a step (+/- .5 units) and readings are subject to lighting conditions and one's color perception. An electronic pH meter (TK082900) is considerably more accurate but does need to be recalibrated periodically with a buffer solution of a known pH. Accordingly, pH meters are common to many larger commercial establishments where measurements are integral to keeping the quality process in control.

Generally speaking, the pH range for most offset printing should be between 3.5 and 5.5. Achieving the proper pH level varies with the fountain solution manufacturer's recommendations but also with the chemical composition of the water that is being used. Unfortunately, a pH reading alone often will not give a true indication of a fountain solution's strength or concentration. That is better accomplished by measuring conductivity, which is discussed in another article.