Tech Talk From Prisco®

Tech Talk #14

THE ROLE OF WATER CHEMISTRY IN OFFSET PRINTING

Most printers would agree that ink, paper, plates and blankets are all key variables in offset lithography. Another key variable, the fountain solution, is often taken for granted and not given the attention it deserves despite the critical role it plays in the printing process.

At **PRINTERS' SERVICE**, the pressroom is our only business and fountain solution concentrates form a major part of our pressroom chemistry product line. Mixing fountain solution concentrates with water results in the fountain solution that is used on-press. Since mixed fountain solution is over 95% water, the quality of the water plays a key role in determining how well the fountain solution performs on press for you, the printer.

In this **Tech Talk** we will discuss the important properties of water, how they can affect our choice of fountain concentrate and influence the mixed fountain solution used on press. We'll also discuss what the printer can do to correct poor quality water.

Why is pH important?

pH is a number that tells you whether a substance is acid, neutral or alkaline. The pH scale runs from 0 to 14 but when discussing pressroom water we are usually dealing with numbers in the 6 to 8 range. Water with a pH of 7.0 is neutral; a pH value of less than 7 means the water is slightly acidic, and above 7, slightly alkaline.

Generally, the pH of water is not an important consideration since the chemical buffering employed in fountain solutions serves to minimize any water pH problems. However, when it comes to fountain solutions it's a different story. For fountain solutions, the control of pH is very important to press performance and printing quality. Because the pH scale is logarithmic, each whole number is 10 times different than the one next to it. For instance, an acid-type fountain solution with a pH of 4.0 is 10 times as acidic as one with a pH of 5.0. To get the best results, fountain solution pH must be maintained within the optimum operating range.

At **PRINTERS' SERVICE**, we design our acid-type fountain solutions for the European market to run in a narrow range somewhere between pH 4.6 and 5.2. As the press runs, the fountain solution absorbs contaminants from the paper and ink; many of these are alkaline and will to raise its pH. All modern acid-type fountain solutions however, contain a buffer system that is designed specifically to resist the effect of these contaminants and maintain a constant pH.

PRINTERS' SERVICE also produces a range of neutral (pH close to 7.0) and alkaline (pH 7.0 and above) fountain concentrates. These fountain concentrates are used mainly in the newspaper and cold web markets, and their operating pH is relatively unaffected by water quality

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Buffered fountain solutions must be matched to the water characteristics to ensure a pH within the optimum operating range. Because the pH of buffered solutions changes very little with concentration, the crrect dosage (ounces/gallon) must be measured and maintained using conductivity as a guide.

What is conductivity?

Conductivity measures the ability of water or fountain solution to conduct electricity. Generally speaking, as the amount of dissolved materials (ions) increases, so does the conductivity. The units we use to measure conductivity are "microsiemens". When dealing with a fountain solution, conductivity is important because it allows us to measure the amount of fountain concentrate that is mixed with water. Regardless of the type of fountain concentrate (acid, neutral or alkaline), each additional percent raises the conductivity by a specific amount.

Water in its purest form, such as good quality distilled water or water from a reverse osmosis type water management system has a conductivity of near zero. In contrast, tap water can range from near zero to over 1,000 microsiemens. Regardless of what type of water is being used we need to know its conductivity because the correct conductivity for the mixed fountain solution is the sum of contributions from the water and the fountain concentrate.

Your **PRINTERS' SERVICE** technical representative will measure conductivity before and after installing a fountain solution on press and then as an aid in diagnosing any problems that arise.

Hardness and alkalinity

Earlier we made reference to matching the fountain concentrate to a specific water type. This is done by measuring the hardness and alkalinity of the water to be used. These two very important properties are independent, but each measures a specific property of water and both values must be known to fully characterize the water quality and select the right fountain solution.

Hardness is a measure of the amount of calcium, magnesium and iron dissolved in the water. We use a test that correlates the total hardness content to an equivalent amount of alkaline calcium carbonate, which is the most common hardness salt. For this reason, hard water is usually thought of as neutralizing the fountain solution (raising its pH) even though this is not really the case.

Why is hardness harmful? At home, hard water is responsible for the soap scum that forms while washing. In the pressroom, hard water interacts with inks, particularly rubine types, to form insoluble calcium and magnesium soaps. These soaps are greasy and may deposit on either the plate non-image area (causing tinting and toning) or on the roller train (causing stripping or glazing).

Although **PRINTERS' SERVICE** has many fountain concentrates that are specifically designed for use with hard water, the printer may be better off installing a **PriscoTech® AquaFlo® II** process water system that delivers consistent quality water that is free of harmful hardness ions. Your **PRINTERS' SERVICE** sales or technical representative can help you with this decision.

It is important to note that conductivity does not accurately reflect the hardness of the water. Many potassium and sodium salts, for instance, yield high conductivity along with zero hardness. For this reason, it is important to actually measure the hardness content using the appropriate test.

What is alkalinity?

Alkalinity is the opposite of acidity. Alkaline type materials such as carbonates act to use up the buffer and raise the pH of an acid-type fountain solution, a process called neutralization. A specific test,

different from the one used to determine hardness, is used by your **PRINTERS' SERVICE** technical representative to determine how much alkalinity is in your pressroom's water.

All **PRINTERS' SERVICE** acid-type fountain concentrates contain a buffer system designed to counteract the effects of water alkalinity. The buffer system employed in our fountain solutions is designed to resist the effect of these contaminants and maintain the fountain solution pH at a nearly constant level. Since only a finite amount of buffer capacity can be built into each fountain concentrate, it is important to test the water before selecting the appropriate fountain concentrate. The alkalinity in tap water uses up part of the buffer capacity even before the mixed solution is used on the press; therefore we must choose fountain solutions carefully.

As the press runs, the fountain solution absorbs contaminants from the paper and ink. Many of these contaminants are alkaline and will raise the pH of the fountain solution. Once the buffer system is used up, the pH of the fountain solution will rise rapidly, and the fountain solution will no longer work properly.

As the pH of an acid-type fountain solution increases, it gradually becomes less effective and eventually can no longer perform its main function – that of desensitizing the non-image area of the plate. Increasing water-metering speeds to compensate leads to a "spiral" type effect that eventually results in fat dots, waterlogged ink and roller stripping.

Effect of water quality on pH and conductivity

We have examined the four most important properties of water; pH, conductivity, hardness and alkalinity. Now, let's see how they affect our choice of fountain concentrates.

Consider two fountain concentrates called A and B. Product A is designed for use in water with low to moderate alkalinity – generally, 200 ppm or less total alkalinity. Product B is a version with more buffer and is designed for water with high alkalinity – greater than 200 ppm.

The following chart shows how changing water quality affects the pH and conductivity that we get from these two fountain concentrates:

Fountain Solution pH / Conductivity

Type Water	Distilled	Tap	Softened	Well
pH	5.7	7.5	7.7	7.7
Conductivity (micromhos)	0	250	600	700
Hardness (ppm)	0	140	0	380
Alkalinity (ppm)	30	130	340	280
4 ounces/gallon A	**3.9/1300**	**4.0/1400**	**4.7/1750**	**4.5/1650**
4 ounces/gallon B	**3.3/1350**	**3.6/1450**	**3.9/1750**	**3.8/1750**

What conclusions can be drawn from the above?

Let us assume that the desired pH range in this case is 3.5-4.0.

- In the Distilled Water, fountain concentrate B is too "hot" and yields too low a pH; the correct choice in this water is ***fountain concentrate A***.
- In Tap Water, both pH values increase and we could choose ***either one***.
- In Softened Water with very high alkalinity, fountain concentrate A yields a very high pH and ***fountain concentrate B is the correct choice.***

- Comparing the Softened and Well Water shows that alkalinity, not hardness, has the greatest effect on pH. Despite being much higher in hardness, the Well Water, with its lower alkalinity, actually yields a ***lower pH for both fountain concentrates***.
- Overall conductivity generally increases as the conductivity of the water increases.

The case above is based a fountain solution technology with multiple varieties for various water conditions. New approaches to fountain solution design have enabled Prisco to produce formulas with very high buffer capacities. This has resulted in fountain solutions that may be used in a wider variety of water conditions.

Correcting poor quality water

Having seen the role that water quality plays in fountain concentrate selection and having discussed the harmful effects of hardness and alkalinity in the pressroom, let's discuss what the printer can do to correct a poor water quality situation.

Water quality plays a key role in determining the effectiveness of the fountain solution used in your pressroom. If it varies significantly with time (e.g. from season to season) or contains high amounts of hardness and/or alkalinity, your print quality may vary or be less than optimum.

From a lithographic point of view, the most important property in water to be used by the printer is consistency. No matter how bad the water, if it is consistent, **PRINTERS' SERVICE** can provide a fountain concentrate that can be used to obtain good results.

We have already seen in this **Tech Talk** how inconsistent water quality may make it impossible for the printer to maintain fountain solution pH within the correct operating range. If this is the case, or if the water has consistently high levels of harmful hardness and/or alkalinity, the printer will be much better off if he invests in a water treatment system to gain control over these key variables.

As a leading manufacturer of both fountain concentrates and pressroom water management and control systems, **PRINTERS' SERVICE** believes very strongly in the need for a consistent quality water supply in the pressroom. The **PriscoTech® AquaFlo® II** process water system can provide the needed control over this key variable by delivering a consistent supply of purified water that is designed for optimum use in your printing process. Your **PRINTERS' SERVICE** sales or technical representative can discuss this system with you and help you determine the correct size for your needs.

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As always, your local PRINTERS' SERVICE office is happy to answer your questions:

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