Technical Notes

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Defining Volatility

As a general rule, our testing laboratory sees a variety of offset printing complaints on a daily basis. However, it seems that problems like offsetting, poor ink drying, ink rubbing or marking in the bindery, and poor aqueous and UV coating adhesion are becoming more frequent. These problems are seen in both heatset and sheetfed jobs.

How often have you heard the following statements:

"It has been at least three days, and the ink is still wet," or "My outside supplier has to wait at least a week before UV coating the jobs we send to them," or "We never saw any problems here, and when the annual reports left out shop they looked great, but after being stored in boxes they have stuck together."

A typical scenario in most of these cases would be that, if tested by themselves, the paper (or board), ink, and fountain solution would all be "good". So why isn't the ink drying?

The answer may lie in the word *volatile* and what it means. By definition, a liquid that evaporates readily is said to be volatile. Some liquids are more volatile than others depending upon their boiling point, or the temperature at which the vapor escaping from the liquid equals the outside pressure. When the vapor pressure equals the outside pressure, bubbles of vapor begin to form in the liquid and, with the pressure of the vapor in the bubble equal to the pressure[ii] of the atmosphere, the bubble can push through the surface and move into the gas phase above the liquid.

The lower the boiling point, the more volatile the liquid. For example, here is a brief list of materials including some used in the printing process, listed from the most volatile ate the top, to the least volatile at the bottom:

Material	Boiling Point[iii]
Ammonia	-33.3°C
Ethanol	78.5°C
Isopropyl Alcohol	87.5°C
Water	100.0°C
Butyl Cellosolve	171°-172°C
520 Ink Oil	271.1°C
600 Ink Oil	315.5°C
Linseed Oil	Non-volatile
Tung Oil	Non-volatile
Soy Oil	Non-volatile

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With the increase in the use of alcohol replacements in the pressroom, it is imperative that everyone involved understands the material being run on a daily basis. Alcohol replacements are low-VOC (volatile organic compound) substances.

Therefore:

Alcohol replacements are slow to evaporate from the ink rollers.
Alcohol replacements are slow to evaporate from the printed job.

It is absolutely necessary to understand that these materials do not volatilize (evaporate) in the fountains on press, and for the most part, do not volatilize once applied to the paper with the ink[iv]. Their nonvolatile characteristics on press require complete and frequent wash-ups of the roller trains to ensure that these materials are being removed from the rollers. If they aren't removed they can build up on the rollers and interfere with ink and water balance, and in extreme cases, cause roller stripping.

If these materials can't volatilize out of the printed job, they can slow down the process of ink drying, so that the ink film never hardens. The result can be offsetting, marking, and sticking problems on completed jobs.

With the increase in the use of alcohol replacements in the press room, it is imperative that everyone involved understands the importance of only running the absolute minimum amount of alcohol replacement in the fountain system. This will ensure that the ink has the greatest potential for drying to a hard rub-free surface. The trick is to run the chemistry that offers the best balance of print quality and ink drying. This is a task that is most successful when your ink and fountain solution suppliers work together.

[i] Plowman, Nancy, Graphic Arts Monthly, "Print Clinic–Coating Adhesion Problems", March 1993, p. 101.

[ii] Keenan & Wood, General College Chemistry, 4th ed.

[iii] The Merk Index, 11th Edition.

[iv] Lustig, Theodore, Graphic Arts Monthly, "Ink", May 1993, p. 96.