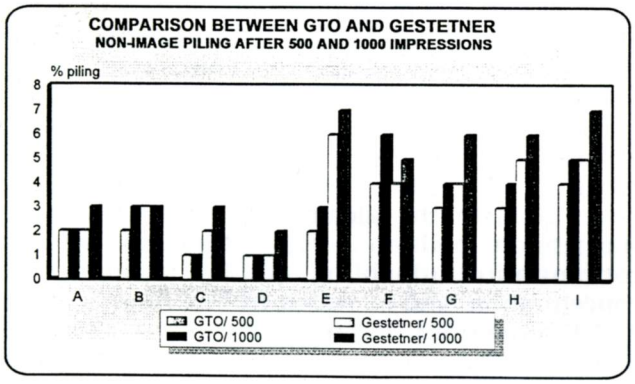
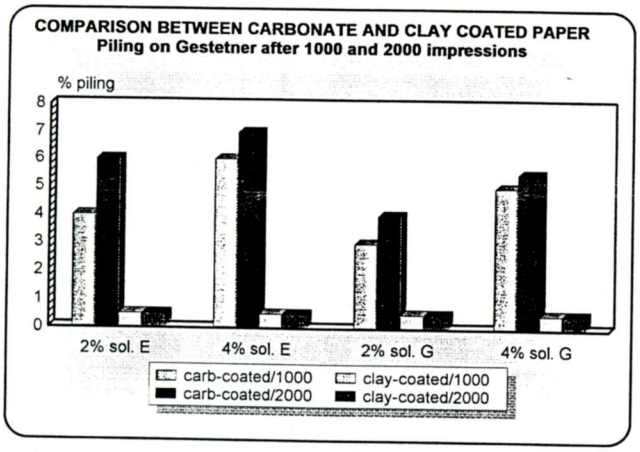


ABOVE: Figure 5

BELOW: Figure 6



The conductivity, measured in micro-Siemens is an important parameter in offset printing, revealing the ion-concentration, *i.e.* concentration of dissolved salts, in the system. Figure 2 shows clearly that all of the commercial fountain solutions have a high conductivity which, when diluted down to dampening strength, is decreased accordingly, but remains nevertheless on a level of rather high ion-concentration. This can be due to the implemented buffer system or/and salt-extraction out of the paper during printing.

Surface tension

The static surface tension of the solutions and tap water samples was measured using the DuNouy ring method. Demineralised water has a high surface tension of approximately 74 dyn/cm. The lower the surface tension, the greater wetting power a fluid exhibits and the thinner a film of water can be formed. Substances in the fountain solution which are responsible for decreasing the surface tension are: tensides (surfactants), certain salts and organic hydrocolloids.

Figure 3 demonstrates differing surface tensions of the fountain solutions which, upon dilution to dampening strength, still differ quite substantially from each other. It can be expected that the dampening solutions with the lowest surface tension, if overdosed, will penetrate into the paper more readily, thus compromising the surface strength of the paper and/or setting off a chemical reaction with the chalk filer or coating pigment if the solutions contains compatible acids.

Water hardness

The general recommendation for trouble-free offset printing, as far as water hardness is concerned, is to lie in the region of 12 °dH.

Figure 4 shows the hardness of the respective solutions and tap water, determined by EDTA-titration. In the case of the solution with extreme hardness, it must be pointed out that the method is somewhat susceptible to other metal salts and alcohol which may be present. Despite this, it can be recognised that several solutions contain hardness regulators, which can then be diluted down to dampening strength set the solution to a generally accepted hardness level. Other fountains exhibit an extreme hardness after printing, giving evidence, in this case, that calcium has been extracted out of the paper. These fountain solutions could be seen as unsuitable for chalk-filled or chalk-coated papers. The third group of solutions exhibits no or very little hardness after printing and could be expected to contain complexing agents.

Qualitative analysis of components

A number of spot tests and titrations were carried out on the fountain solutions to determine their composition:—

sol.Nr.	acid	base	calcium	gum arabic	EDTA	reacts w.chalk	IPA
A	?	amine	yes	no, glycole	no	no	no
B	citric	hydroxide	yes	yes	no	no	no
C	acetic/citric	?	yes	yes	no	yes	no
D	boric	hydroxide	no	no, glycerine	no	no	no
E	phosphoric	hydroxide	no	no, citrate	v.little?	yes	yes
F	citric/phosph.	hydroxide	no	yes	no	yes	no
G	phosphoric	hydroxide	no	yes	no	yes	no
H	acetic/citric	hydroxide	no	yes + glycerine	yes	yes	no
I	citric	amine ?	no	glycerine	yes	yes	no

N.B. The analyses are relatively simply conducted spot-tests and titrations and can, therefore, prove difficult to interpret when dealing with formulae containing a variety of different salts, acids, *etc.* D is the control (author's formulation).

Offset printing

Printing trials were carried out on three different offset presses:—

- ❑ single-colour Gestetner office press
- ❑ single-colour Heidelberg GTO
- ❑ two-colour Heidelberg GTO

The first task was to find a reproducible method to quantify non-image piling after printing a defined number of sheets. A method was found, which entailed measuring the optical density of a number of pre-designated positions on the rubber blanket, prior to and after the printing operation, with a Gretag D 186 densitometer. The difference in density (decrease in the case of build-up) was then calculated into percentages and correlated well with visual assessment by a panel of printers. A value of 5% and over, suggests unacceptably grave piling where, according to several printers, wash-ups would have to be carried out after approximately every 4,000 impressions.

All printing trials were carried out without any