# Paper quality and print parameter influences on the dimensional stability in web offset printing

Dr. Rainer Klein, Beatrix Genest, Beatrix Mair

## Abstract

Quality requirements to sheet-fed offset prints have increased enormously in recent years, accompanied by growing cost pressures. The latter are addressed by using higher printing speeds and larger sheet sizes (1.5 m x 2.0 m). Larger sheet sizes, however, aggravate the problem of paper elongation during printing, which leads to register deviations. Even though register deviations have multiple causes in complex print processes, the paper has been thought to be a major influence so far. Its dimensions change when moisture is introduced by damping water or ink-damping water emulsions, causing its fibres to swell.
Aim of a collaborative research project performed by PTS-IZP, SID and PTS-PTI (VESTRA) was the detailed study of dimensional changes when varying the following print parameters:

- motif (blank, halftone, solid tone),
- print direction (narrow web, broad web),
- printing ink (oxidation-drying, UV),
- amount of damping water and IPA additions (standard damping water quantity, +5 % damping water),
- impression pressure in the printing machine

First, 22 industrial art papers with grammages of 90, 115, 135, 150, 170 g/m² and surface finishes ranging from matt to glossy were printed with specially designed forms on a Speedmaster XX. The resulting dimensional changes were analysed by means of a LUCHS register measuring system.
In a second step, two coating base papers were coated with different formulations using a blade and Curtain Coater on the VESTRA pilot coater and applying both single and double coatings. The papers – base paper, intermediate and end products – were subsequently treated in a supercalender. All 29 variations obtained on the VESTRA coater were printed and analysed.
Next, all printed papers were tested by conventional and advanced methods (coat thickness analysis, surface tension, topography, Hg porosimetry).
The results have shown that the impression pressure and type of printing ink are of only secondary importance to dimensional changes.
An important finding was that not only the transversal elongation (width increase) but also the usually or often neglected longitudinal elongation was changed significantly in the printing press.
It could be demonstrated that the paper grade (grammage) and print motif have significant effects on dimensional changes. The greater the grammage of the paper, the smaller were its dimensional changes.
On average, the longitudinal extension was greater than the transversal one. When printing on narrow webs, the longitudinal extension was usually greater than the transversal one whereas the latter was predominant in broad web printing. Higher amounts of damping water led to greater dimensional changes, but the effect was more pronounced in the transversal direction.
However, not all dimensional changes could be explained by water being introduced into the paper. Possible causes became visible when analysing the VESTRA variations:
In addition to the aforementioned effects, the importance of surface quality became visible. The greatest dimensional changes occurred in the coated or coated and calendered variations and not in coating base papers where water was able to cause swelling immediately. This means that besides water, the forces generated by interactions between the blanket and paper surface must contribute significantly to dimensional changes. This effect has been unknown or largely unknown so far.
The project work has not yet been completed.