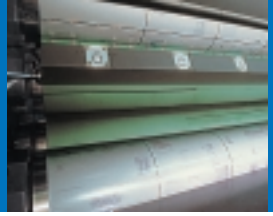
SCHWEGMANN

Fountain Water in Offset Printing



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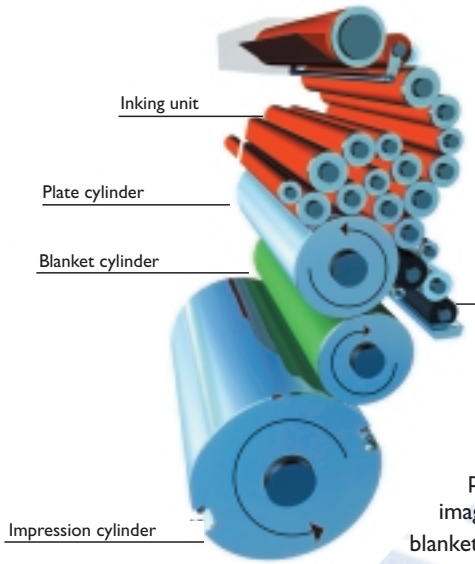
Task

The operating principle of offset printing is based on the natural reaction that grease and water will repel each other. Whereas the printing areas accept the "greasy" printing ink, the damping water will be repelled. The non-printing areas are hydrophilic and will repel the printing ink.



First the printing plate will be wetted by the damping unit with a thin damping water film, then the printing areas are inked up with printing ink by means of the plate inking rollers. The printed image is then transferred to a blanket cylinder and transferred from there to the printing material. This is why offset printing is also called an indirect printing method.

Fountain additives are concentrated additives taking over a series of functions and tasks. Apart from various protecting functions, the fountain additive will influence the physical-chemical properties of the fountain water, will facilitate and optimize the printing process.

In the following the most important components and tasks of a fountain additive are listed. The composition and development of these additives is based on a maximum of competence and know-how. In most cases more than 25 raw materials and their combined effects are responsible for an optimum functioning of a fountain additive such as Schwego® Soft.

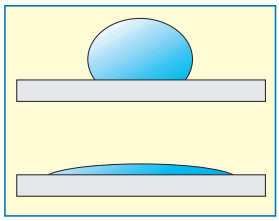
Components

Buffer System

The buffer system sets a pH-value of 4,8 - 5,2 favourable for printing. In spite of various influencing facts such as quality of water, contamination by ink, washing agents or similar factors the pH-value is "buffered" – i.e. a constant value is maintained as requested.

Tenside-/Emulsifying Agent System

It will control the chemical and physical reaction of the interaction between printing ink, fountain additive and printing plate. Among them are, for instance, the water-absorbing capacity of the printing ink (amount and speed) and the optimum limit and surface stress.



Water drops above: high surface tension
Water drops below: low surface tension

Complexing Agents

Reactions between the materials will be caused by various deposits from printing ink, paper and fountain water, and might considerably disturb the production process.

Important Characteristic Features of the Offset Printing Method:

Sheet-fed offset
The printing material is printed sheet by sheet. Apart from some speciality printing processes the main production method is job printing. The printing inks will dry by absorption/oxidatively.

Web offset:
The printing material is printed continuously from the "reel". There are three possibilities – newspaper printing (coldset), commercial printing (heatset) and continuous stationery printing. Whereas in newspaper printing the ink will dry by absorption, in heatset printing the ink is dried physically by a hot-air dryer. The continuous stationery printing process is similar to sheet-fed offset printing considering the process with just one difference: the printing material is printed "continuously".

An essential factor in this context is the calcium and magnesium hydrogen carbonate. There is a possibility that it will accumulate and disturb the ink transport by its hydrophilic characteristic. Chosen complexing agents will bind these salts and reduce the deposits.

Preservatives

The fountain water will contain a large number of foreign substances especially by the printing process, and these substances will contain the nutrients preferred by germs, such as paper dust. In addition, the formation and increase of bacteria, yeast and mold fungi is assisted by the development of heat, long fountain water circulations and idle operating conditions in the fountain water circulation.
In order to prevent the formation of germs, conservation agents are added to the fountain solution. The biggest risk of germ formation is in newspaper printing. In job printing in most cases alcohol (IPA) is added to the fountain additive. Apart from the relief offered from the point of view of printing technology, alcohol will also impede the formation of germs.

Protection of Printing Plate

In order to protect the surface of the printing plate against oxidation and foreign matters during any interruptions of the production process, chosen components will form a protective layer on the printing plate during a dead halt of the machine.

Drier

In contrast to web offset, penetrating/oxidatively drying inks are used in sheet-fed offset printing.
In order to speed up the oxidative drying process, it is possible to add a drying agent, such as Schwego® Drier 8141, to the fountain solution.
As an alternative we offer Schwego® Soft 8128/8129 and 8157, fountain additives with integrated drying agent with different pH-value settings. All the drying agents processed by us are free from cobalt which is detrimental to health and ecologically harmful.

Inhibitors

In order to protect machine parts from corrosion, inhibitors are added to the fountain additive. Schwego® Soft is always equipped with inhibitors, the function of which is tested and released by leading machine and plant engineering companies.

Solutizer

In order to stabilize all listed components in a solution over a prolonged period of time, suitable solutizers are used. These solvents often have got a decisive influence on the ecological compatibility of the fountain additive.

Environment

Due to the complex composition of a fountain additive the topic “environment” will play a comprehensive part in the development of the products as well. Especially VOC-contents, type of means of preservation, possibilities of waste disposal and product identification are catchwords permanently used. There is an EC-specification sheet for security which contains all safety references.
As Schwegmann company is an extremely environmentally aware company, we will always be a pioneer in the development of environmentally compatible products.

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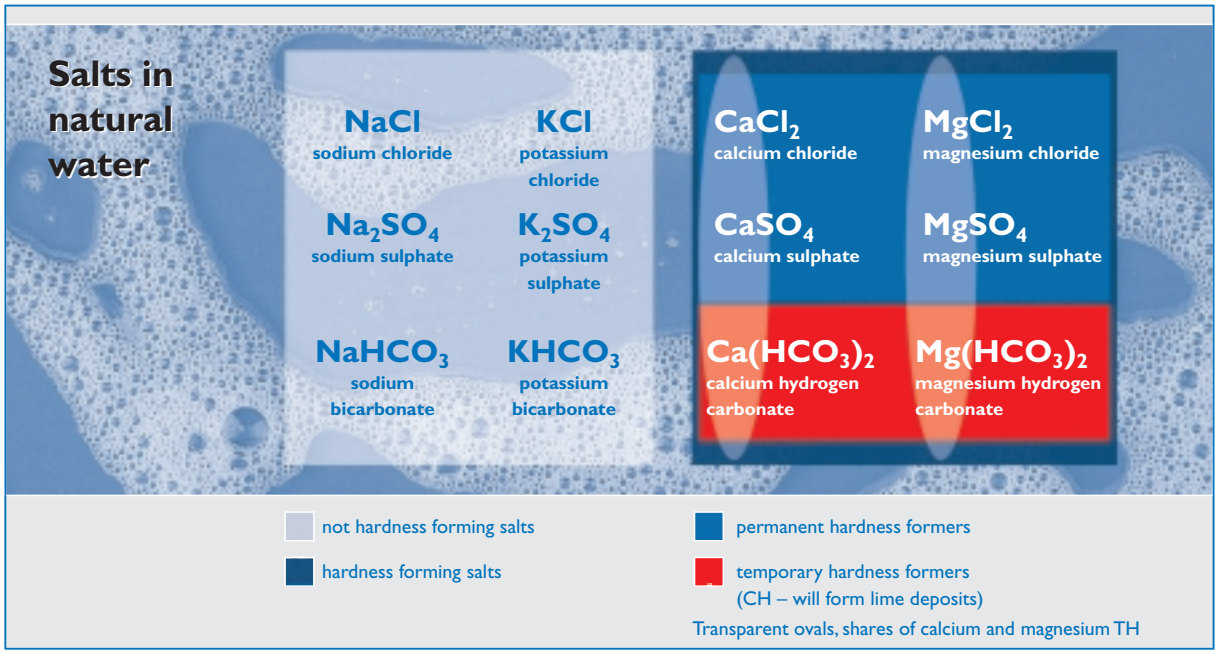


Parameter of the Fountain Waters

Water Quality

The basis of the fountain water is the industrial water used. From the point of view of printing technology special focus should be on the salt contents of the water as cause of its degree of hardness resulting from the two water hardness factors total hardness (TH) and carbonate hardness (CH).

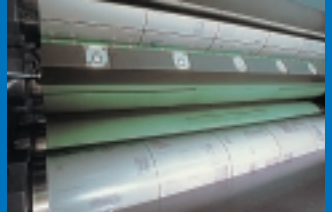
A constant water quality with a total hardness of 8-12° dH (illustration: all salts contained in the "hardness forming salts" area) is recommended. Our research and experience show that the emulsifying stability of printing ink and fountain water is positively influenced as from a total hardness of 8° dH.

The carbonate hardness consisting of the hydro carbonates (HCO_3) has got a decisive influence. (Illustration: all salts listed in the lowest line.)
On the one hand the naturally "alkaline" hydro carbonates will react with the "acid" component of the buffer system in the fountain water, which will lead to an increase of the pH-value. On the other hand calcium and magnesium bicarbonate (illustration: red area) will lead to undesired lime deposits. These deposits will be especially interfering on inking rollers and damping rollers. As described above, they will interfere with the emulsifying behaviour and the ink transport by their hydrophilic or ink-repellent characteristic.

In order to optimize the water hardness degrees for the printing process and to avoid any possible variations in the water quality of the local water supplier, quite often waste water treatment plants are used for standardizing the fountain water. For this purpose plants for softening or desalting the water are a possible solution.

Softening Equipment

When softening the water, calcium and magnesium (illustration: transparent oval) are replaced by sodium in an ion exchanger. The remaining hydrocarbonate (HCO_3) will then combine with sodium to form freely soluble, not hardness forming sodium bicarbonate ($NaHCO_3$).
After this process only "non hardness forming" salts or carbonates are left which will have the mentioned "alkaline" influence on the pH-value.
Please note: After the softening it is only possible to determine the carbonate contents in form of sodium bicarbonate and potassium bicarbonate, however, not the carbonate hardness or total hardness. As no hardness formers are left, conventional carbonate hardness tester will supply distorted results.



In order to reach again the total hardness recommended for printing, as a rule the softened water is diluted in defined quantities with water from the main.

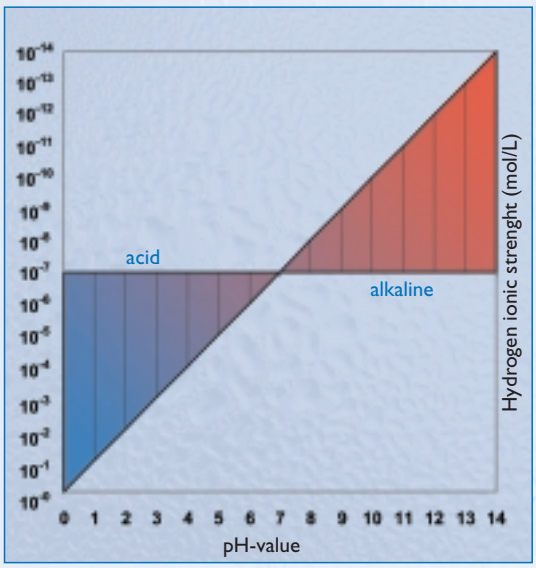
Desalting Plants:

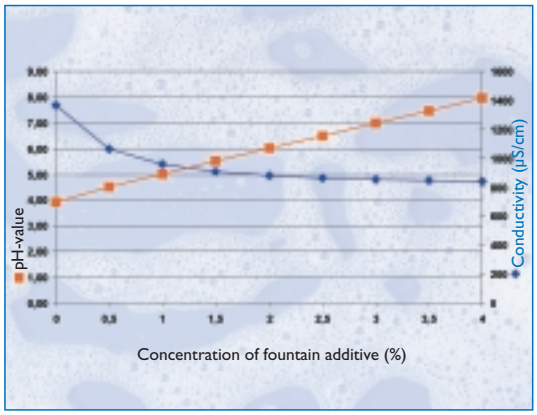
In most cases a reverse osmosis plant is used for desalting. In this case all salts in the water are removed. In order to reach the total hardness of about 10° dH which is recommended for the printing process, a hardness increasing agent such as Schwego® dH-Fix 8230 is added to the desalted water. These hardness increasing agents will form the desired total hardness only by means of "permanent" hardness salts.

pH-value

The pH-value indicates the strength of an acid (0) or alkaline solution (14) on a logarithmic scale of 0-14, with the neutral range being around pH 7. The special thing about the pH-value scale is that a 10-fold change will take place from one to the next pH-value. This means that a pH-value of 4 is 10-fold more acid than pH 5 and 100-fold as acid as pH 6.

pH-value-diagram





Dose Effect Curve

The pH-value of water from the main or of treated water is in most cased in the range between pH 6.5 and pH 9. In order to reach the optimum pH value for the printing process which is between 4.8 and 5.2 the above mentioned buffer systems are integrated in the fountain additive. Depending on the existing carbonate hardness the buffer capacity is adjusted to the desired pH-value and kept at a constant level.

Electric Conductance

The electric conductance indicates the material-specific electrical conductivity for the electrical current in µS (Micro Siemens).

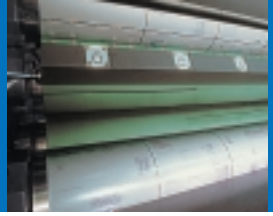
A fountain additive contains large quantities of chemical compounds which are good conductors when dissolved in water. This makes possible to determine the actual concentration of the fountain additive in a new compound formulation by means of the electric conductance.

When measuring in the fountain water circulation, you have to take into account that the measured value is distorted by foreign matters such as paper, ink and washing agent components.

The electric conductance will not give any information as to the quality with reference to the behaviour in printing technology. In this case the type of the used salt is important.

Temperature

The fountain water temperature should preferably be about 10-12°C. The constant temperature equalization will help to stabilize the production process by cooling the machine and ambient temperature.



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Printing process

Apart from the up to now description of the function and task of the fountain water, the industrial offset printing process also holds a series of difficulties concerning the technological process.

The special challenge in offset printing is the emulsion behaviour of printing ink and fountain water. The printing process requires that both materials will emulsify in a certain ratio and at a defined speed and will remain stable during production printing. The emulsion behaviour on the other hand is interacting with a number of variable parameters which make the printing process difficult to control and reproduce.

Apart from the printing ink and the fountain additive, mainly mechanical influences, materials used, their conditions of use and their state will play a decisive part. Among them are inking rollers and damping rollers, type of damping system, blanket, quality of water, temperature, printing substrate, type of machine and many more factors.

Effect of Isopropyl Alcohol (IPA):

- Quick, stable ink-water balance
- Lowers the surface tension
- Cools by latent heat
- Avoids germ formation
- Self-cleaning effect
- Increases the fountain water viscosity
- Impedes the formation of foam
- Decreases ink build-up on the damping rollers
- Damping of comb stripes (surface waves)

In addition process-caused alterations such as ink and paper coating build-up on the blanket or damping rollers, temperature changes in the printing press, intermediate washing at the blankets and/or damping system, wear and tear of the printing plate and many more factors will make impossible any production printing in a constant quality across long production runs.

The biggest influence has got the press operator in this case, who apart from his technical competence will sense by his experience and feeling for the printing process which "keys and screws" he will have to turn in order to get an optimum of quality and performance from the printing press. Unfortunately these personal characteristics are pushed into the background to an increasing degree because of the increasing degree of automation.

Alcohol reduction and elimination

In the field of job printing in offset printing (sheet-fed offset and heatset printing) in most cases isopropyl alcohol (IPA) is added to the fountain water. The alcohol will take over several functions and will facilitate the printing process.
Since the invention of the alcohol damping system it is tried to substitute the alcohol because of environmental and cost reasons. Whereas formerly the production was made with partly more than 20 % of IPA, nowadays a decreasing to 8 % is relatively unproblematic.

This was mainly realized by the latest technology in metering and proportioning technology for IPA in fountain water. In addition, the supplies for the printing industry adjusted their products to the requirements of the IPA-free printing process. We, too, offer special Schwego® Soft variations for this purpose.
If a considerable reduction or even an elimination of IPA in fountain water is to be carried out, an increased degree of care and sensitivity is needed. The success of alcohol reduction depends on the optimization of the whole printing process.

The mentioned functions of the IPAs will mainly bring about an increased production safety and stability, or expressed in another way, with IPA smaller deficiencies and a little carelessness within the production process can be concealed.

In the following some tips for use are given, which should be especially observed in case of IPA reduction and elimination, however, very often are neglected.

Tips for Use

Adjustment of the Inking and Damping Rollers

Too strong roller stripes (contact of the individual rollers with each other) will have a negative influence on the emulsion behaviour caused by the mechanical stress and development of heat. It is recommended to observe the instructions of the machine builder, whereas up to 20% lower values can be used in case of heated rollers. Transparent and flexible control stripes for the correct roller adjustment can be obtained by Schwego® Soft users free of charge.

Regular Roller Treatment

The cleaning and maintenance of the inking and damping rollers with special cleaning agents is very effective. Soil particles, especially deposits of lime from fountain water, paper and printing ink, will lead to a hardening and surface smoothing of the inking and damping rollers. As a consequence the emulsion forming is disturbed, which, in turn, will lead to an instable production printing behaviour with little scope in the ink/water balance. A cleaning agent such as Schwego® Clean 8179 will remove the dirt and the lime deposits from the pores of the roller. The surface of the roller will get supple again and open-pored. Printing ink and fountain water will be taken up and transported again much better which will lead to a clearly more stable ink/water emulsion.

Reduced Flow of Ink/Water

Especially after the above described roller treatment it will become clear which potential is available concerning the production process stability. Quite often the ink and water values can be drastically reduced (-50 %) without any decreasing of the ink density. On the contrary the ink/water emulsion will not be that "greasy" any more, the tendency to scumming is less, the screen dot will print sharper, the ink build-up at the metering rollers and the blanket will be considerably reduced. Please note: "As little ink and water as possible!"

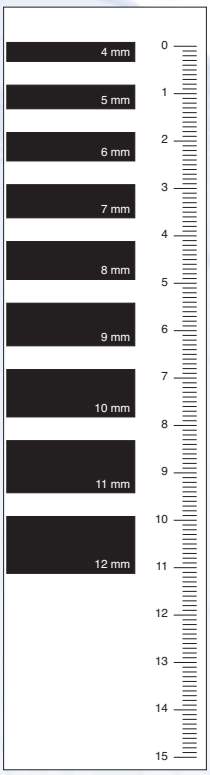
The best conditions for the production process are given, if the printing is done near to the "smearing limit" – the moment in which there is just enough water in order to keep the non-printing areas free from ink. In most cases the "smearing" will start at the outer edges of the printing substrate in printing direction. The causes are often not completely closed ink zones in the non-image areas or run in duct rollers which let too much ink into the roller frame at the edges.
Tip: Reduce the duct roller stroke, increase the ink key opening in the printing area!

In addition, it is recommended depending on the subject, to use the diagonal adjustment of the metering rollers for continuous-feed damping systems.

Temperature conditions

Special attention should be paid to the temperatures, especially on high-volume and fast running machines.
In general the heat development at the printing press is to be well conducted away. In contrast to this recommendation you will often see protecting gratings for rollers which are masked because of spraying and fogging ink in order to keep the machine clean. As a consequence, however, the whole roller frame will heat up which will cause disturbances of the emulsion behaviour in this case as well.

As far as a temperature equalization of the oscillating ink rollers is existing, it should be at about 26° C at the return movement.



Transparent, flexible control stripe for the roller adjustment

The fountain water temperature at the return movement should possibly not be more than about 12° C, whereas the lower temperature limit in web offset is limited in most cases by the formation of condensation water. Water drops falling down on the paper web might lead to annoying web breaks and consequently to production interruptions.

Fountain Water Maintenance

Oily or greasy components in the fountain water have to be avoided.
As described in the beginning, offset printing is based on the principle that ink (grease) and water are repelling each other. If oily cleaning agents which can be mixed with ink and fountain water get into the fountain water when the blankets are cleaned, the function of the fountain water will be reduced of course. If, however, ink and grease components float on the fountain water, it is recommended to use Schwego® Sorb 8225. This special fibre pad will float on the surface and bind the oily and greasy coatings.

If damping rollers are cleaned with oily cleaners, an ink-receptive film might form on the damping rollers in some cases. By this the renewed soiling by printing ink is supported and the formation of a water film is interfered with.

In case of a manual cleaning of the fountain rollers in the continuous-feed damping system a thicker layer of ink should be carefully squeezed with a spattle. After that it is possible to remove the ink with a quickly volatile cleaner such as Schwego® Damp 8174. After that it is recommended to rub the damping roller with a hydrophilic substance such as gum Arabic or printing plate gum.

In case of a considerable soiling of the fountain water especially by nucleation, the fountain water circulation will have to be rinsed or cleaned with a special cleaner such as Schwego® Fix 8110.

Use biocides safely. Always read the label and product information before use.

Pictures MAN Roland Druckmaschinen AG, Koenig & Bauer AG | S.Thiel, 09/2006

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