Processing Matt Papers

Why do matt papers require special attention?

Processing Matt Papers

Why do matt papers require special attention?

Content

sappi

Introduction

Matt papers were developed in order to improve readability, since gloss calendered papers reflect light at certain angles of incidence. Thus the early period of matt papers was peaceful, with good readability being provided for the literature sector. Over the years, however, publishers, creative people and printers became steadily more adventurous and printed works became more colourful. During the same period the consumption of matt coated paper increased by over 50%

As is the case everywhere, rationalisation has become essential in everyday printing activities. This involves, for example, using “fresh inks” and related systems in order to reduce washing times and reduce non-productive time. There is no drying out of ink in the ink fountain or on the rollers, even after a machine shut-down of many hours (overnight).

All these measures have had nothing but positive effects on gloss coated papers. For matt coated papers, however, printing inks of a duct-fresh nature or type are not the ideal starting situation.

As in the case of successful printing on matt papers, the materials ink and paper, and the processing conditions at the printers and bindery, have a significant influence on the result.

Lack of knowledge about the different paper surfaces and the resulting technical limits in printing and processing have led to significant problems in the use of this demanding grade of paper.

In this brochure we will try to illustrate the mentioned factors.

I Matt coated papers and rub resistance

The terms matt coated paper and rub resistance seem to be inherently linked. Although paper makers, ink makers and printers are moving closer together in tackling problems connected with printing matt coated papers, the same old problems still continue to show up occasionally. Even though these days such problems are far more exceptional than they were in the past, problems with rub resistance are usually the most troublesome and costly in printing.

This is not just because these problems usually occur in the finishing stage, when a lot of time and money has already been invested in the process up to that point, but also because at this final stage, the delivery deadlines are tight and the opportunities for recovery are limited.

Generally speaking, rub resistance is a factor of three complex process ingredients: the ink, i.e. the resistance of the printed ink film, the paper, i.e. the toughness and roughness of the sheet when submitted to rubbing motions, and the mechanical motion which causes the actual rubbing. Each of these ingredients in turn, is made up of a complex structure of properties and dependencies. In most cases, the imperfections of each of these ingredients can be compensated for by one or both of the other two. However, sometimes the unfortunate choice of one or an unfortunate combination of two or all three of them can be the cause of such serious problems that no remedy is possible.

Coated papers

Various types of coated papers are available, from lightly coated papers where the coating does not completely cover the paper surface to papers where the surface is completely covered with an optimally regular coating, sometimes up to three coating layers per side. Some measure of order has been established by a distinction based on the weight of the coating layer applied per square meter, the method of application and the quality characteristics. In spite of this, there are still significant differences in papers that fall within the same category.

One of the most significant advantages of coated papers over uncoated papers is that the layer of mineral coating which covers them provides a smoother, more even surface. Papers that have a 100% mineral surface are generally considered to be the most ideal for printing purposes.

The even, smooth surface of coated paper requires less printing pressure to be applied and, partially as a result of its microporosity, less ink to be used. Also, because of the more uniform and more closed surface, higher printing gloss and more contrast can be achieved.

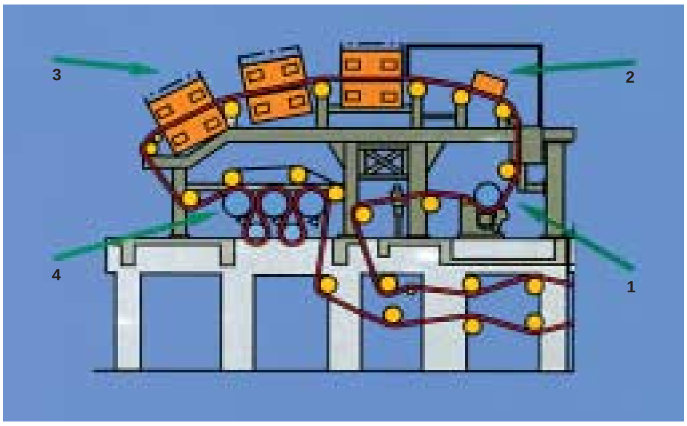


Fig. A1 *Coating machine:*
1 Coating unit *3 Hot-air drying*
2 IR drying *4 Cooling*

In order to apply thin and at the same time even layers of coating to the paper surface, various application methods have been developed. Practical tests have shown that blade coaters produce the best results in terms of surface smoothness.

Blade coating involves the application of an abundant amount of coating on the paper by way of a roll or a nozzle (jet coating) filled with coating. Immediately after application, the excess coating is scraped off by a blade (comparable to the procedures used in gravure printing) which evens out the applied layer. The amount of coating to be applied is determined by the viscosity and dry solids content of the coating, by the speed of the machine, the distance between blade and paper and the pressure and angle of the blade. Modern blade coaters are running at operating speeds of up to 2000 m/min (Fig. A1 and A2).

Of course the evenness of the base paper itself also determines the smoothness and evenness of the coating layer. Irregularities in the fibre distribution can cause inconsistencies in the density and thickness of the coating layer with the possible result of variations in ink acceptance and absorption, leading to a mottled printed image.

Coating mass

The composition of the coating material itself can vary greatly, depending on the requirements for the job at hand and the method used for application. Coatings are primarily made up out of pigments, binders and additives. The most important pigments are aluminium silicate (commonly known as China Clay), natural or synthetic calcium carbonate and magnesium silicate (talc). The major binding agents are starch, CMC and polyvinyl alcohol, but above all synthetic dispersions, also known as latex binders. Rheological properties, water retention and an even distribution of the applied coating layer are largely dependent on the properties of the (combination of) binders.

Apart from these, many auxiliary materials are necessary for the production of suspensions with high dry solids content, control of flow behaviour and pH, as well as colouring agents, preservatives, etcetera.

Fig. A2 *Coating machine PM 11 in Gratkorn*

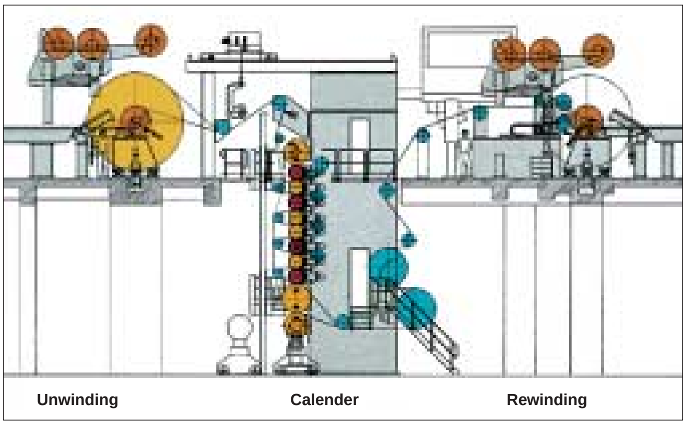


Fig. A3 *Janus calender:*
Working speed: 1000 m/min
Working width: 8360 mm

Glossy and matt paper

Gloss coated papers have a highly glossy appearance and a closed, even surface. Glossability is the overriding consideration in the very composition of the coating mass, which in many cases consists of extremely fine pigments, which leads to a smooth surface of low abrasivity. On top of that, the paper is passed through a supercalender (Fig. A3 and A4).

A high-gloss paper surface, however, has two disadvantages. In the first place, the high gloss can be a source of irritation. Papers with a less smooth surface reflect light in a diffuse manner, which is clearly an advantage inasmuch as it is less tiring and more comfortable to read text and view images printed on a matt surface. Obvious examples are textbooks and annual reports. Secondly, the high gloss of the paper itself makes it hard to realise a printing gloss that significantly exceeds the gloss of the paper itself. As a result the difference in gloss of printed parts of the paper and the unprinted surface of the paper itself, is usually much lower than that of matt papers and can occasionally even turn out negative. In general, high printing gloss emphasises form and colour and adds to the quality of the printed job, as is illustrated by most art and photography books.
Paper gloss and printing gloss are not correlated, by the way, since printing gloss is a result of many other factors.

Gloss is the degree to which a paper reflects a beam of light shining on its surface. To measure gloss, a beam of light of specific brightness is shone upon the paper surface under a certain angle and the percentage of light reflected is measured by means of a photoelectric cell.
Gloss is often used as a synonym for smoothness, but there is a distinction. A surface can possess a high gloss even if it is not smooth and smooth surfaces can be very low in gloss.

Roughness is the degree to which irregularities appear in the surface. There are a number of methods to measure roughness, some of which do differentiate successfully between smooth and rough surfaces, but give no indication as to the size of the irregularities themselves. The overall test result of a large number of small irregularities, in these methods, is the same as that of a small number of large irregularities.

Fig. A4 *Janus calender PM 11*

The concept of matt coated paper

As the term itself indicates, matt coated papers are papers with a matt surface, in other words, a low degree of gloss. To achieve a matt appearance, coarse pigments are used in the coating layer, preferably multi-edged particles that help disperse light diffusely in all directions. Surfaces that reflect less direct light, appear more matt. This is why calendering is not used in the production of matt paper (with the possible exception of a matt or soft calender), which has the additional effect of a usually higher paper thickness and stiffness than can be achieved with glossy papers.

The problem is that there is no exact definition of the concept “matt“ and this makes it impossible to draw fine lines. Around the world, all sorts of coated papers are being produced with a specification of “matt“, regardless of rather large differences in gloss and smoothness. Some of these papers are distinctly matt, with a Tappi 75° gloss value*) of around 10%, while others are slightly glossy, with gloss values of up to 50%. It only goes to show that “matt“ does not always mean “matt“ in the proper sense of the word, but is used to include “demi-matt“ as well.
Demi-matt paper, also known as “satin“ or “silk”, is a compromise between high-gloss paper and truly matt paper. It is a paper with a silky surface, which favours readability. It is less coarse than matt papers, which makes it perform somewhat better in terms of ink rub resistance, and it lends itself fairly well to surface finishing.
To produce a classic matt quality paper with good printability characteristics, the surface of the paper should combine a high macro-smoothness and evenness with a low micro-smoothness in order to obtain the diffuse reflection which is essential to the overall matt appearance of the paper. The advantage of the higher specific volume should be maintained.
The properties mentioned above will basically result in a lower degree of rub resistance – the high macro-smoothness and low micro-smoothness causing increased static and dynamic friction resistance because of the larger contact surface, coupled with a stronger coherence of micro-irregularities.

*) *Gloss Tappi is a method for measuring the specular gloss of paper at 75° (15° from the surface of the paper) according to the method Tappi T 480. This method is widely used as a partial measure of the surface quality and shiny appearance of coated paper.*

High micro-roughness of a paper leads to a higher surface porosity, which in turn results in faster ink absorption. If the ink strikes into the paper too quickly, the diluting agents may take some of the resin with them. This can leave the pigments on the surface of the ink film with very little resin to protect and hold them. In other words, the decreased presence of binders will make the ink film less rub resistant.

This adds up to two possible causes for reduced ink rub resistance.

Adjustments

To improve the degree of ink rub resistance, a number of measures can be taken, all, however, to some extent influencing the essential characteristics of matt paper and all producing certain negative side-effects.
The production of a matt coated paper with a high degree of surface smoothness and outstanding printability and processing properties proves all in all to be a big challenge for the paper producer.

One possibility, for instance, is adjusting the pigments. One of the most obvious ways to produce a matt coated paper with the desired degrees of macro-smoothness and micro-roughness, is to use a coating layer with a high percentage of rather coarse calcium carbonate. On the other hand, reduction of the calcium carbonate share in order to produce better rub resistance performance, significantly compromises the overall matt appearance of the paper.
Partially replacing the calcium carbonate with aluminium silicate adds to the gloss and increases the danger of gloss stripes at the slightest friction or touch. An additional problem is that, due to the high whiteness of calcium carbonate, it is very difficult to obtain a certain light-fast whiteness.
It should, incidentally, be understood that there is no one-on-one connection between the chalk content of the paper and the rub resistance of various types of papers.

It is also possible to make adjustments to the binders in the coating layer. The synthetic or thermoplastic binders in the paper surface basically produce the smallest amount of lasting surface deformation if the volume of binders, is say,

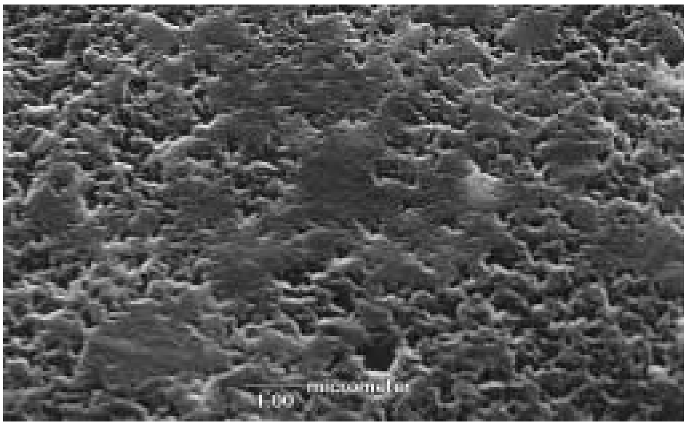


Fig. A5 *10,000-fold magnification of the paper surface of Magno Star.*

doubled. Doing so would not affect the principal properties of the rough, matt surface. The adherence of pigments to the paper would be improved and the decreased absorption of binders contained in the ink would lead to a less sensitive printed image. Unfortunately, this would also mean that the printing ink would take significantly longer to dry, which would cancel out all advantages achieved by the improved rub resistance.

The search for the ideal combination of properties goes on, but so far, every new adjustment has only produced yet another compromise that could very well have negative effects on other properties and lead to loss of quality in terms of requirements set by other sectors of the industry.

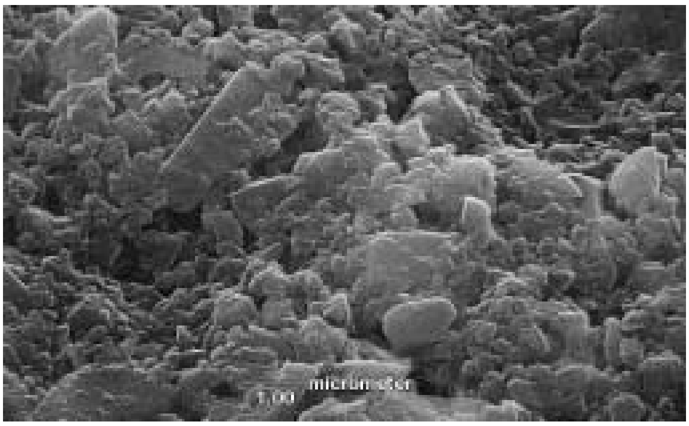


Fig. A6 *10,000-fold magnification of the paper surface of Magno Satin.*

Printing on matt paper

Due to the surface characteristics of matt papers mentioned above, printing and especially binding of this type of paper, continues to pose problems to many professionals.
Invariably, the low degree of rub resistance is mentioned as the major source of difficulties.

Rubbing is the effect of repeated relative shifting of two touching surfaces under a certain amount of pressure. The measure of resistance of a material to this rubbing effect is known as rub resistance.
During different operations in the printing process, the ink layer on a printing sheet comes into contact with various surfaces, but mostly, under normal conditions, with another sheet of paper. When two printed sheets of paper touch, the only thing separating the two is a layer of ink. When mechanical forces are put to bear upon these touching sheets of paper, the resistance of the ink layer and, more important, the topography of the surface becomes a vital factor. Strongly magnified, the topography of a matt paper has the appearance of a landscape with numerous hills and valleys. In the case of two sheets of paper grazing (rubbing) each other, the mechanical forces released concentrate on the tops of the hills, easily leading to damages to the relatively thin film of ink in those positions and to contamination of non-printed parts of the paper (Fig. A5 and A6).

This presents a continuous challenge to the resistance of the print job, not only at the actual output of paper from the printing machine, but even more so in consecutive stages, such as stacking, wrapping, transport and all binding operations. Unfortunately, the topography of a matt (relatively coarse) surface does not allow for maximum rub resistance. The best that can be attained is optimal rub resistance within the given limits.

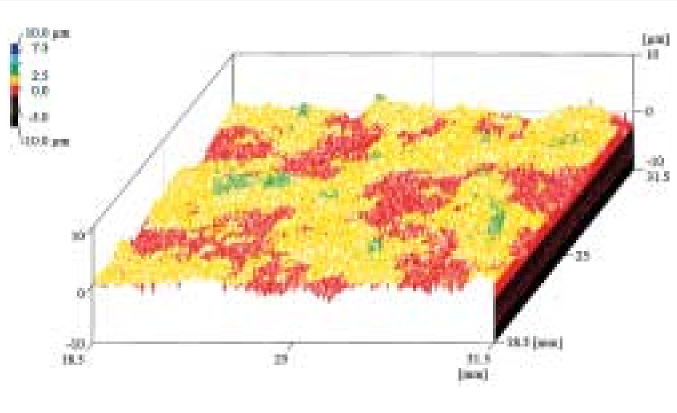


Fig. A7 *Magno Star 135g/m²*

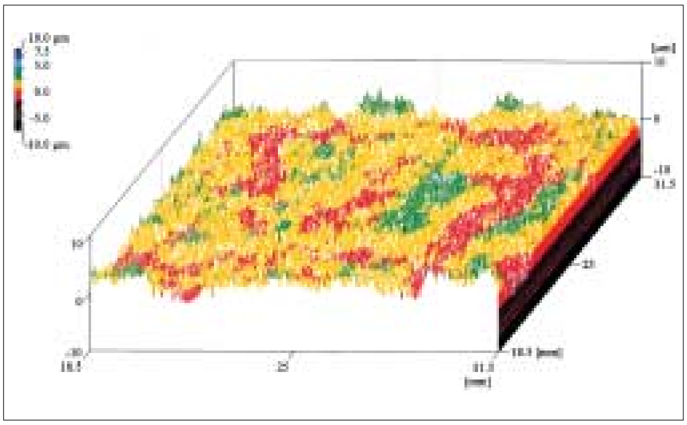


Fig. A8 *Magno Satin 135 g/m²*

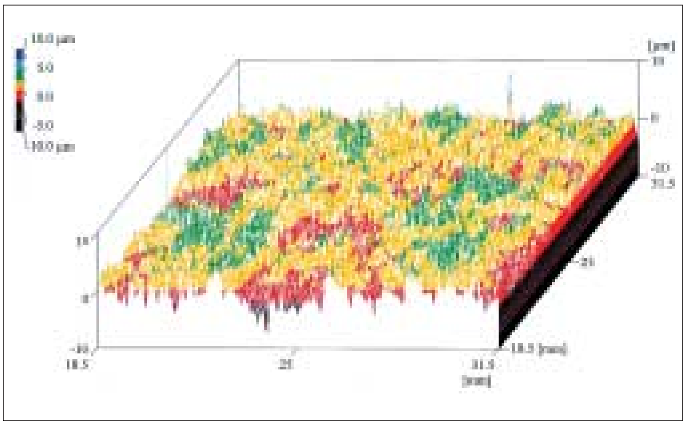


Fig. A9 *Magno Matt Classic 135g/m²*

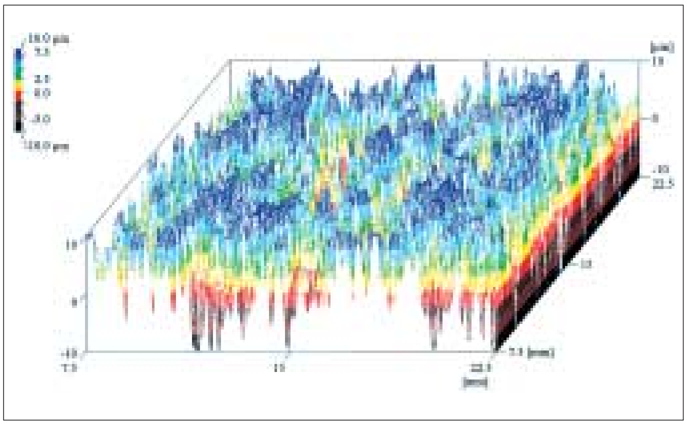


Fig. A10 *Uncoated base paper 80 g/m²*

Topography of the paper surface

The figures on this page display the differences in topography of different types of paper. To produce these images the surface of the paper is scanned with a laser.

Fig. A7 shows the surface of Magno Star 135 g/m2. This paper passed a supercalender. The image is in accordance with this very smooth and glossy paper showing some slight humps.
In comparison with Magno Star, the Magno Satin (Fig. A8) is already somewhat rougher.
The grade showing the best matt effect, Magno Matt Classic (Fig. A9) is still rougher as can be clearly seen from the jagged profile of peaks. Also the surface of an uncoated base paper is shown in Fig. A10. Clearly the very high roughness of this paper comes to the fore.

Rub resistance refers to the property of printed materials to withstand a mechanical stress. This stress can include both the rubbing together of two printed pages, and the rubbing of one page against other objects, e.g. the guide elements of a book-binding machine.

Magno Star	Magno Satin	Magno Matt Classic
135 g/m²	135 g/m²	135 g/m²

Abrasion test after 48 hours, 5x

Fig. A11 *For comparison, the paper surfaces illustrated above after the abrasion test according to Fogra specifications.*

Fig. A11 shows that the different paper surfaces also exhibit different behaviour. The rougher the surface of the paper, the more pronounced the abrasion. The abrasion test was done according to Fogra specifications after 48 hours.

Printing and printing inks

In cases of damage to a print job caused by conveyors or grippers in a binding unit or ink set-off on opposite sheets, it is often assumed that the printing ink has not completely dried. Although the nature of the damage may warrant this assumption, in many cases it is not correct.
Whereas it is certainly true that insufficiently dried inks have poor rub resistance, the reverse is not necessarily true. In general, printing inks that have completely dried, can be insufficiently rub resistant for a number of other reasons. Also, there are many cases of poor rub resistance where insufficiently dried ink may indeed be the cause of the problem, but where the drying process has been disturbed by external influences which are in no way connected to the ink itself.

Not all types of ink are suited to be used with matt papers.
For optimal results, it is necessary for the ink, after it has been transferred to the paper, to set quickly on the coating layer. Usually, depending on film thickness, temperature, etcetera, this setting process is accomplished in a matter of minutes. Drying however, is a chemical process, requiring thicker, drying oils to ensure a solid ink film. The absorption of oxygen triggers a polymerisation process which leads to the ultimate encapsulation and bonding of the pigments. Subject to the proportion and the measure of the oils used in the ink and depending on general conditions, this process of oxidative drying can take a few hours to a full forty-eight hours.

Comparing different types of ink and various matt papers, it generally turns out that inks with a higher proportion of components which dry by oxidation produce a more solid and more rub resistant ink film and, in most cases, a higher degree of gloss as well. On the other hand, the drying process itself takes a little longer.

Usually, the inks involved are those which have been developed for printing of packages, boxes, etcetera.

When it comes to rub resistance, the choice for a particular type of ink, such as a ductfresh, depends on the paper used – and the other way around. Various combinations of paper and ductfresh inks produce ink rub resistance results that range from good to substandard. Although it cannot be said up-front that poor rub resistance is a direct result of ductfresh inks (depending on the paper used), they do owe this otherwise useful characteristic to the fact that they contain anti-drying components. In most cases, as has been mentioned before, this will lead to a lower degree of rub resistance. This also means that any modification in the combination of paper and ink and any change in the general conditions, may have unpredictable effects. Overnight inks need even more time to dry, which means that the use of this type of inks significantly increases the risk involved.
With inks that dry by oxidation, all these problems are avoided and the results are generally satisfactory. Therefore, the use of press-open and duct-stable inks is definitely not recommended when rub resistance is a requirement.

In itself, there is nothing wrong with the addition of extra drying agents to the ink in order to stimulate a faster and tougher final drying result – as long as it is taken into consideration that the ink will dry faster in the press as well. Additional binding agent can lead to a better fixation of the pigment particles, but will also reduce the ink's concentration, thus requiring increased layer thickness and extended drying time. Addition of waxes to improve the gliding properties can lead to better results, but can also cause varnishing problems later on. Advantages in one aspect of the process generally go hand-in-hand with disadvantages in another. Apart from that, it is not unusual that too little attention is given to manufacturers' instructions. "Too much" usually means that the results will be the reverse of those intended. Some printers surround their core equipment with veritable chemist's shops of compounds and agents, a situation that can easily lead to the wrong choice of components. For ink adjustments, it is always the best policy to consult the supplier. The ink supplier is better informed than anyone else on the actual composition of the ink and can offer valuable advice or even customise the ink to the application intended (Fig. A12).

If a thicker layer of ink is applied to a print job or if the job is printed with a higher density, rub resistance generally is more of a problem than with lower densities. It should be remembered that the larger specific surface of matt paper alone leads to increased ink usage. Up to a certain thickness of ink layer (roughly 2 g/m^2), problems are normally not to be expected. But as the thickness of the ink layer in-

Fig. A12 *A variety of printing inks*

creases, so does the danger of diminished rub resistance. The reason for this is that printing with higher densities also leads to the necessity of powdering or additional powdering. When this is done, the effect of the spray powder almost invariably exceeds the effect of the ink layer thickness by far. One possible solution is the application of achromatic or UCR.

Insufficient ink application affects drying unfavourably. During the printing process, the ink absorbs water, causing the relatively low proportion of ink to acquire a higher tendency to emulsify. This will, in turn, lead to diminished rub resistance. To counter this, it is recommended to use ink absorption strips on the tail edge of the print sheet, if there is room on the paper to do so.

Just as insufficient ink application can affect drying unfavourably, so does excessive application of water. Obviously, correct composition of dampening solution is an important factor and although this requires extra attention during the printing process, minimal application of dampening solution also contributes to optimal final drying.

Many designers seem to have a pronounced preference for colours such as Warm Red, Reflex Blue, Fluorescents and metallic touches in gold and silver. For Warm Red and Reflex Blue, alternative pigments are available with better rub resistance characteristics. The other inks mentioned require maximum care in printing, since their poor rub resistance can even lead to problems on glossy papers.

Forced drying involves the risk of only the top layer of the ink actually drying. Depending on circumstances, this can have a negative effect on the overall drying result and on rub resistance. It is important to regularly check the temperature of the stack and to make sure it stays within certain limits. Too much heat during the drying process can also mean negative effects for subsequent processing. The result could be tight edges and an increased brittleness of the paper which can lead to problems in creasing and folding.

The use of spray powder

To prevent ink set-off, each sheet that is output by a printing machine is usually powdered. The powder serves to maintain a minimal distance between the stacked sheets, preventing direct contact between the ink applied to one sheet and the bottom side of the sheet directly above it in the stack. It also serves as an aid in the drying process.
Many types of powder are available, different in composition (grain structure) and degree of coarseness and purity. Some have a vegetable basis, some are inorganic insoluble minerals, others are organic insoluble natural starches or natural soluble powders on a sugar basis.
One advantage of a soluble powder is that it gradually dissolves under the influence of moisture from the printing ink, resulting in a surface free of disturbing irregularities. Unfortunately, some of these so-called soluble anti set-off powders turn out in practice not to dissolve at all or only partially.
Some types of powder have grains of a distinctly angular shape. Research has shown that these powder types, such as calcium carbonate and sugar, clearly have a negative effect on rub resistance.
Apart from this, special attention should be given to ensure that the powder is not contaminated with anomalous, larger grains which may cause scratches.

There are many technical remedies, some of them very advanced, to help control the doses and the even distribution in powdering the sheets as they leave the printing machine, but none of these provide a security that can take the place of personal attention. So far, nothing has come along to change the fact that setting the right doses, amounts and even distribution of spray powder is still primarily a matter of professional instinct and manual inspection. To make sure that the powder is doing what it is supposed to do and that no incidental set-off effects occur, continuous inspection of the stacks of printed sheets is still necessary. One of the reasons why it is so difficult, in practice, to use the exactly right amount of powder, is the fact that there is always interaction of paper and ink absorption / thickness of ink layer. In many cases, this leads to excessive use of powder, which certainly does not improve rub resistance. Conservative powdering and laying out in smaller stacks may imply more work, but in the end, it can pay off.

Fig. A13 *In-line varnishing unit with extended drying*

Varnishing

Obviously, if there is only a limited time span for the entire finishing process to take place in, the use of varnish as a protective layer is a virtual necessity. Sections with widespread and heavy ink coverage on the front page and white paper on the back page, which must undergo a number of finishing operations, give the binder zero chance of production without some marking problems. The same is true for print jobs where pages are printed down to the bottom edge of the paper, in cases where the printed content of pages varies in length or where the mechanical pressure is so high that a sufficient degree of rub resistance is practically impossible to attain. Varnishing is also necessary if a print job contains halftone reproductions, especially if these are positioned opposite to blank pages.

There is a huge number of varnishes that can be applied all over or partially. Partial application of a gloss varnish results in an even more pronounced contrast of the image to the blank paper. For a matt print on matt paper, matt varnishes can be used.

Just as inks, conventional print varnishes need to have very quick absorption, coupled with a drying behaviour based on oxidation. Their formulation must also facilitate for a long lasting and true matt effect. As a rule, but not without exceptions, good results are obtained by varnishing “wet in wet“. An unfavourable combination of varnish, ink and paper may result in even lower rub resistance, partially due to the fact that varnish and ink are absorbed simultaneously, thus reducing the effect to a quarter of what it would be when varnishing wet on dry. In general, these varnishes have low gloss and long drying times. Depending on the quantity applied, there is a risk of yellowing and detectable odour. Varnishing on dry ink produces clearly better results than varnishing “wet in wet”.

Dispersion varnishes are broadly applicable and provide excellent protection against mechanical influences. With these varnishes, drying is a result of absorption and evaporation. Film building begins as the carrier disappears and the varnish quickly seals the surface. Under the layer of varnish, the ink continues to dry. There are various types of dispersion varnishes that, on the one hand, hardly influence the matt effect of the paper and, on the other hand, do not diminish the print gloss to the extent a distinctly matt varnish would. For quick drying, IR-dryers with air knives are often used (Fig. A13).

The best protection is obtained by the use of UV varnishes. Here, radiation – provided the energy levels are high enough – immediately produces a highly glossy or matt surface. Applied with the proper system and in a sufficiently thick layer, on a glossy paper, this can provide protection equal to lamination. It is generally assumed that extremely rough surfaces prevent the varnish from hardening optimally. Depending on the type of varnish, the inks used and the operational procedures, there can also be problems with flow behaviour and adherence.
Once completely cured, however, these varnishes produce a relatively inflexible surface. During application, part of the varnish penetrates into the surface, which, after complete hardening and as a result of higher temperatures, leads to a general brittleness of the material. In further processing, such as creasing and folding, this can lead to cracking on the fold.

This last aspect applies to IR drying as well. IR drying has advantages in terms of the drying process itself and generally permits faster processing. The method also stimulates a quick final drying, but on the other hand, it does imply higher temperatures and lower paper humidity.

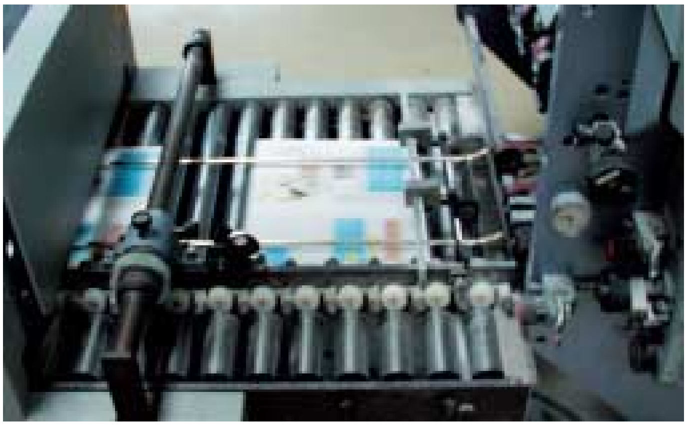


Fig. A14 *Transport and guide rollers of the folding machine*

Finishing

The largest problems with print jobs generally occur in the finishing stage, not only because this is where time lost in previous departments has to be made up for, but also because of the sheer number of operations that take place in this stage in order to produce the finished book or brochure. It cannot be avoided that, during these operations, the paper will come into contact with previous and following sheets in the stack or with the galvanised or non-galvanised machine parts that are necessary to guide, transport or grip the sheets. Apart from ink rub resistance problems, this can also lead to carbonising, the phenomenon of ink being deposited onto the next sheet as a result of high pressure not caused by any rubbing motions. This commonly occurs in cutting and folding, but also in drilling, die-cutting and perforating procedures.

During guillotining, rub resistance and carbonising problems can also occur. Rub resistance problems are a result of the knife moving vertically and sideways, leading to shifts in the individual positions of all sheets in the stack in front of the knife. A common effect of this is that the part of the stack cut in front of the knife, shows markings that do not appear in the part that is cut behind the knife. Therefore, although this requires additional process steps, it is strongly recommended to always guillotine behind the knife. Caused by the high local pressure of a not overly sharp knife, there is often a form of carbonising along the edges of the paper, especially where pages are printed beyond the bottom edge of the printed image of opposite pages. To avoid this, care should be taken to keep the cutter beam pressure as low as possible (depending on the material) and to keep the stack height limited.

Watch for marking during folding and gathering. Care should be given to the proper settings of all machine parts which come into contact with the paper. Most problems are caused by the higher line pressures of relatively narrow transport wheels and feelers (Fig. A14). In folding, proper setting of the cylinders is very important. The belts and rollers should not be set tighter than strictly necessary. Where the sheet is closed after folding, commonly at the top, it is usually thicker as well, which means that there will be more pressure at that position. In case of a printing image covering the entire page height opposite to a blank page, ink set-off can occur at the top. In case of roller marking or belt marking, a silicon spray should be used on the rollers or belt. While making ready for a new job, it is recommended to clean the guides, removing residual dirt and ink that may have piled up from the previous job and that can cause nasty streaks. Due to the side lay ball bearings, polish marks often show up, usually on the inside of the folded section. Most types of deliveries are prone to marking. This is due to the fact that the stream of printing sheets, transported over a short distance at relatively high speed, has to be slowed down to stack properly. Particularly in the case of the opposition of a page with solid all over and an almost unprinted page, markings caused by hold down wheels on reduced speed conveyor belts, can hardly be avoided. It is recommended to position the hold down wheels in such a way that they stay clear of the printed image, or fall in the trims. In gathering and stitching, most problems occur at the feeders, as they are usually of the bottom feeding type. Sufficient air and smaller stacks should provide more security.
The catch in all these operations, is that markings are not necessarily immediately visible. They can occur inside the folded sheet, or can be hidden from detection by the next sheet in a shuffled stream. To find such markings, all sheets would have to be unfolded again and carefully checked.

Transport also deserves due attention. The rule of thumb is to keep handling to a minimum. The importance of complete, final drying before transport takes place, is obvious. Boxes have to fit the size of the printed product, to avoid rubbing after the product has been packed. Correct stack building and proper packing to avoid shifting during transport, are the least of the precautions that can be taken. Care should also be given to proper banding and correct band pressure.

Test of processing in practice

From the perspective of the PM 11, one of the most modern and largest fine paper machines in the world, we at Sappi have optimised our matt coated paper. After studies it was decided to change not only a subtantial part of the paper, but the whole architecture.
So changes were carried through, not only concerning the coatings but also the base paper and the glazing.
After these measures had proved themselves in the laboratory and practical printing tests, a large-scale test was performed based on processing in practice. This was done to measure the improvement and outside influences. This unified test involved papers produced by Sappi before and after optimisation of the coating, together with several commercially available comparable grades and printed under different conditions.

These quantities of paper were each divided into two equal parts and processed under “positive” and “negative” conditions.
By “negative conditions” we mean a set of circumstances that repeatedly occurs in everyday work as a result of time pressure and an unfortunate choice of processing materials and procedures, such as too acid fountain solution and too short drying times.

Negative conditions:

Spray powder:	calcium carbonate powder
Printing inks:	4c fresh inks
Fountain solution:	Vegra Alco Damp, Blue 3860, 3%: pH 4.5, 12 % IPA
Bookbinding machine:	Müller Martini 3006, horizontal delivery
Processing after printing:	approx. 24 hours

By “positive conditions” we mean the situation which experienced operators know how to achieve through combined use of carefully selected materials and procedures, including oxidative drying inks, or inks optimised for matt coated papers, spray powder on a starch basis, fountain solution with pH greater than 5, appropriate drying time (48 hours), favourable bindery processing/vertical delivery.

Positive conditions:

Spray powder:	Dustoprint Fein (starch powder)
Printing inks:	Druckfarben Schmidt E4 8195 LZ (optimised for matt papers) black 8, magenta 3, cyan 4, yellow 2
Fountain solution:	Vegra Alco Damp, Blue 2860, 3%: pH 5.1, 12 % IPA
Bookbinding machine:	Müller Martini 3010 CS 14, vertical delivery
Processing after printing:	48 hours

The selected test form was a 16-page brochure printed in four colours with an overall degree of difficulty during further processing to represent a challenge for every professional (Fig. B1).

Pages with intense or heavy ink coverage facing white pages and black areas and screens were used deliberately for this test in order to demonstrate the feasibility limits (Fig. B2).

Fig. B1 *Test form 4C, 16 pages*

Printing method and further processing

The test was started on the printing press with the positive conditions. The press was then converted for the negative conditions.

After 24 hours the test sheets printed under "negative" conditions were cut and folded, and stitched with two staples in the gatherer-stitcher with horizontal delivery.

The test sheets printed under "positive" conditions were stitched after 48 hours with two staples in the gatherer-stitcher with vertical delivery.

After each processing test, the test brochures were inspected visually for abrasion residues and evaluated.

One is very good, two is good, three is critical, four is unacceptable.

The evaluations are presented graphically on the next two pages.

Fig. B2 *Test form first and last page*

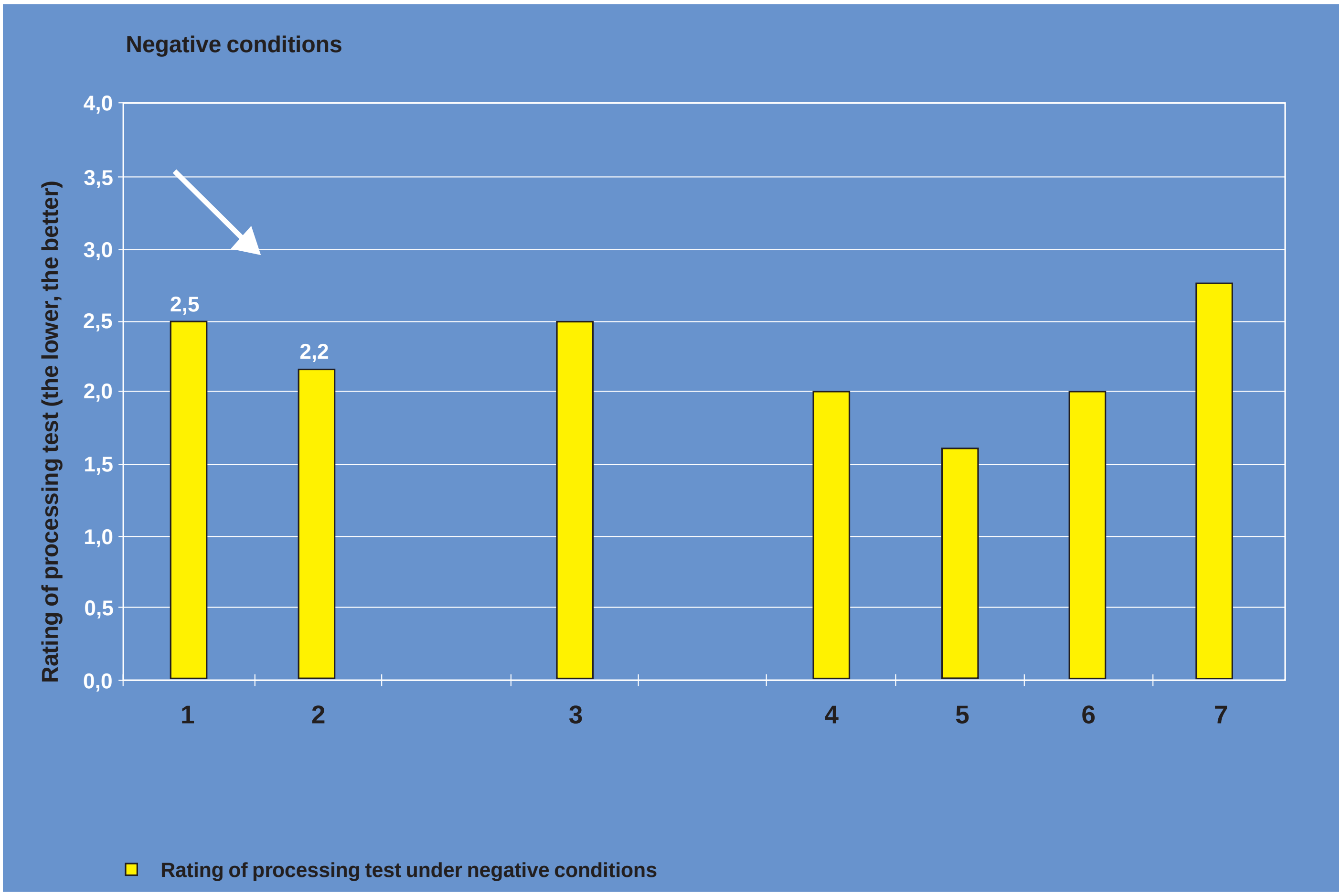


Fig. B3 *Results – negative conditions*

The results of the tests were marked in accordance with a ranking system as follows:

1 - very good
2 - good
3 - borderline
4 - unacceptable

Papergrades:	basis weight	Gloss Tappi 75°
1. Magno Satin old	135 g/m²	32
2. Magno Satin new from PM 11	135 g/m²	32
3. Magno Matt Classic very matt	135 g/m²	12
4. Competitor's paper 1	135 g/m²	29
5. Competitor's paper 2 silk matt	135 g/m²	47
6. Competitor's paper 3	135 g/m²	28
7. Competitor's paper 4	135 g/m²	10

The test shows that the results of the development to improve this paper grade was not as significant as the results that printers can achieve through proper operating conditions.

The results also show a relation between the abrasion tendency and the paper gloss values. The really matt qualities (numbers 3 and 7) show, as could be expected, poorer results than for instance a satin paper (number 5), which shows a gloss value close to that of a glossy coated paper.

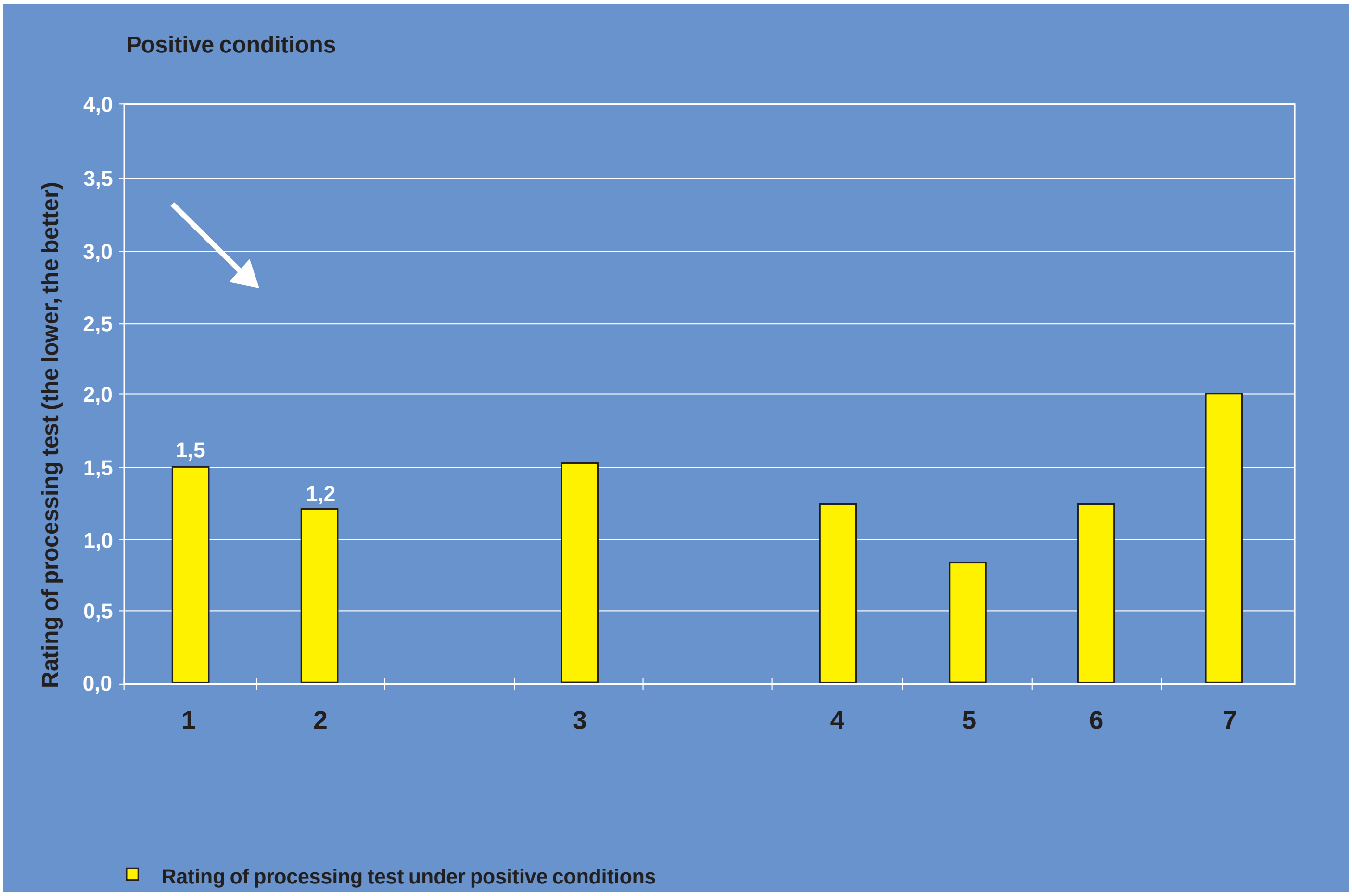


Fig. B4 *Results – positive conditions*

The results of the tests were marked in accordance with a ranking system as follows:

1 - very good
2 - good
3 - borderline
4 - unacceptable

Papergrades:	**basis weight**	**Gloss Tappi 75°**
1. Magno Satin old	135 g/m²	32
2. Magno Satin new from PM 11	135 g/m²	32
3. Magno Matt Classic very matt	135 g/m²	12
4. Competitor's paper 1	135 g/m²	29
5. Competitor's paper 2 silk matt	135 g/m²	47
6. Competitor's paper 3	135 g/m²	28
7. Competitor's paper 4	135 g/m²	10

Fig. B5 *Magno Satin 150 g/m² processed under negative conditions.*

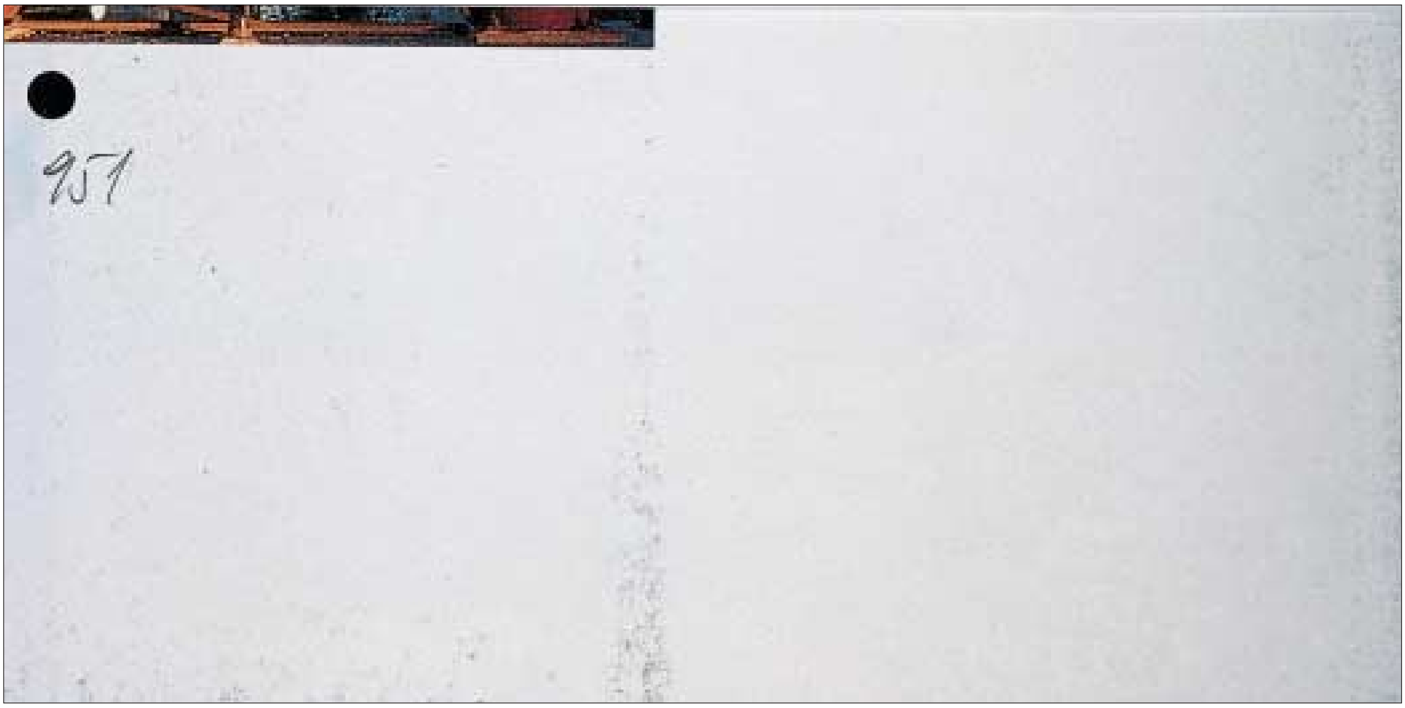
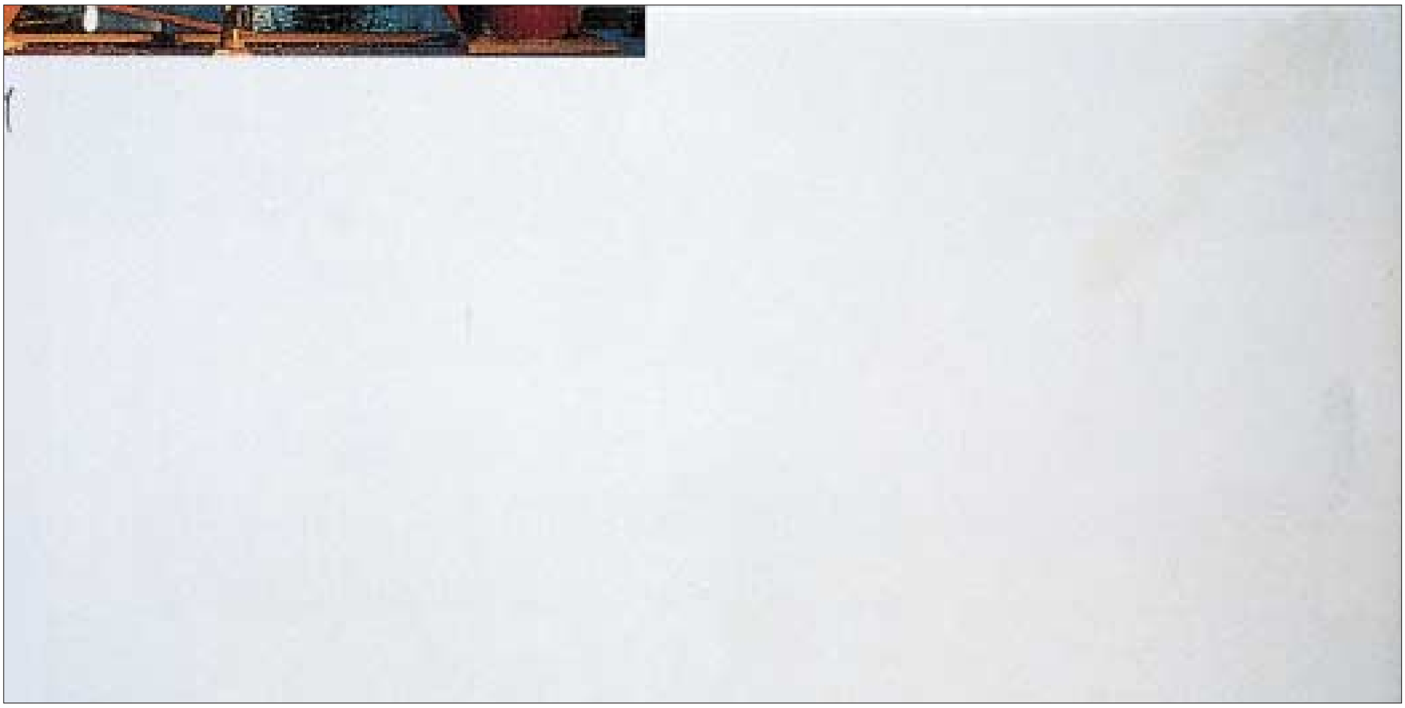


Fig. B6 *Magno Satin 150 g/m² processed under positive conditions.*



Figs. B5, B6, B7 and B8 are from the lower half of the last page. Obvious deterioration under negative conditions, especially for 150 g/m², ink traces left during delivery, and colour abrasion to the binding margin, are clearly recognisable (Fig. B5).

Fig. B7 *Magno Satin 115 g/m² processed under negative conditions.*

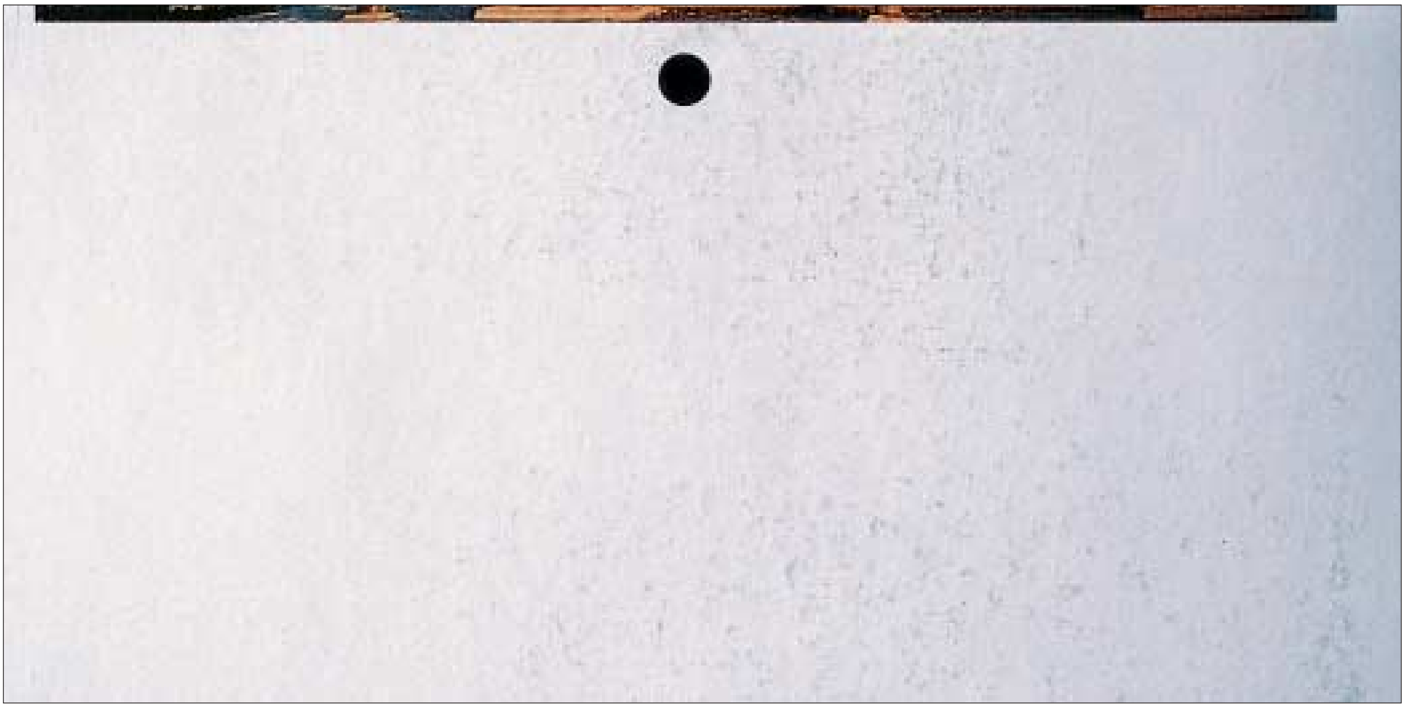
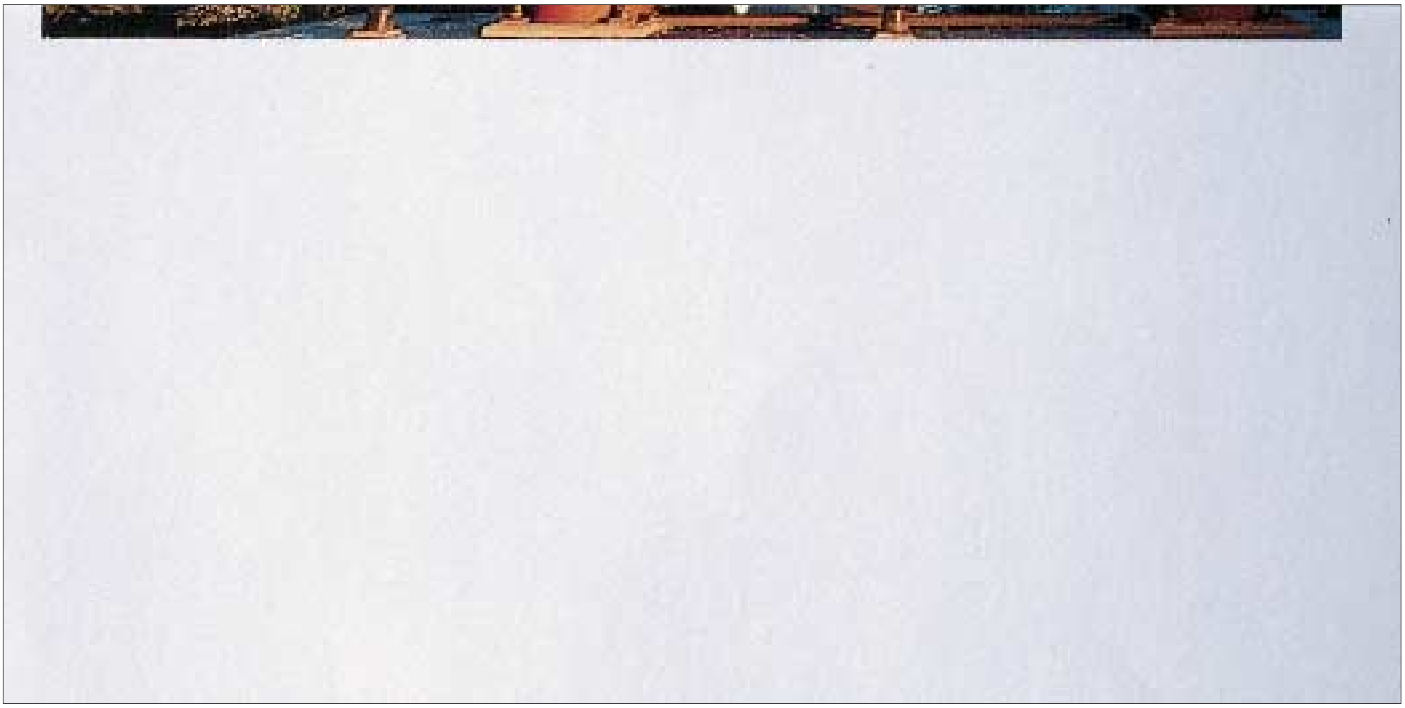


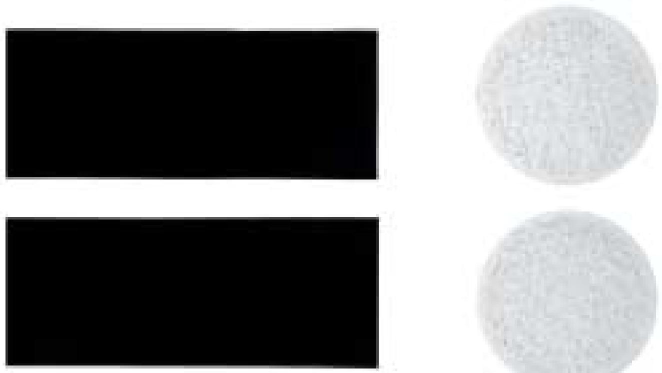
Fig. B8 *Magno Satin 115 g/m² processed under positive conditions.*



Important:
The lower the basic weight, the smaller the difference between the results of processing. Laboratory ink scuff tests are only useful to evaluate the paper surface and do not take into account the basis weight of the sheet, which strongly influences the scuffing behaviour in finishing in practice (Fig. B5 and B6).

Concluding remarks

As demonstrated by the tests in practice described in this brochure, a combination of unsuitable ink and processing conditions can lead to poor results.
Unfortunately, because so many factors exert an influence on the final result, we as paper manufacturers can not always determine the reasons for a poor printing result after the job is finished. As a reminder, the technical advices sometimes perhaps forgotten – for optimal processing of matt papers are listed again on page 19.


Magno Satin/fresh ink

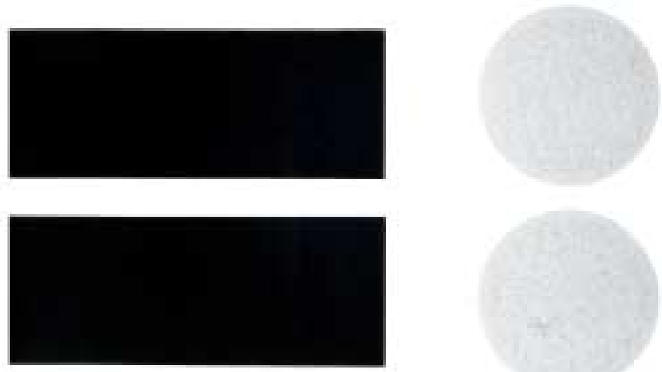
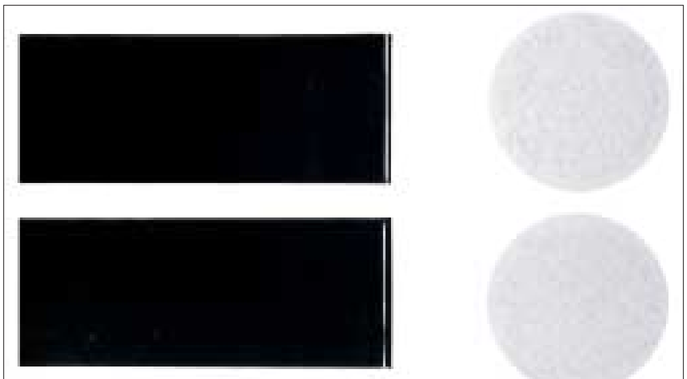

Magno Satin/optimised ink for matt paper

Fig. B9 (left) and Fig. B10 (right) *The comparison of different types of ink, i.e. fresh ink with matt paper ink, confirms the test of printing in practice and shows clearly better results for the matt paper ink originally used*


Competitor's paper 2/fresh ink


Competitor's paper 2/optimised ink for matt paper

Fig. B11 (left) and Fig. B12 (right) *Matt paper inks printed and scuffed on semi-matt paper demonstrate reduced effectiveness when the paper to be printed is not as rough.*

Matt papers are difficult to process and the following factors should therefore receive special attention:

- **Use abrasion resistant inks**
  Try not to use ductfresh inks or so-called stay open inks; if this is unavoidable, add lubricant and drying agent if necessary after consulting the ink manufacturer.

- **pH 5.3**
  Set water supply slightly above the catching up. Stabilisation of the ink-water balance can be achieved through printing of additional colour bars in the case of printing forms with sparse ink coverage.

- **Use of starch powder**
  Mineral powders and sugar-based powders have a sharp-edged structure whereas starch grains are round. The particle size should be analogous to the basic weight of the paper; the less powder, the better the abrasion resistance.

- **Varnishing**
  Dispersion varnishing is better than oil-based varnishing.

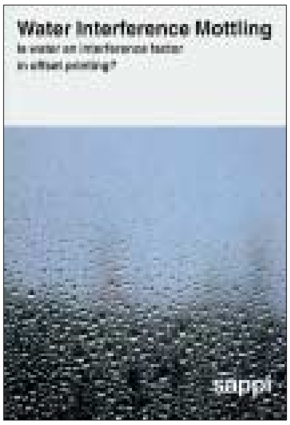
- **Gentle binding procedures**
  Because prevention is better than cure it is recommended, during printing, to keep an eye on the reverse side as well.
  This is even a necessity during binding where attention must be paid to possible marks produced by rollers or guide plates/rods. The drying time between printing and further processing must be at least 48 hours.

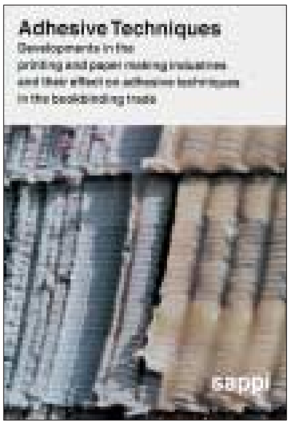
- **Prepress/Design**
  Pages with heavy ink coverage should not fall on unprinted pages. This is even more of a problem if pages are printed right to the edge. If possible, minimise the colour density by reducing the underlying colours.

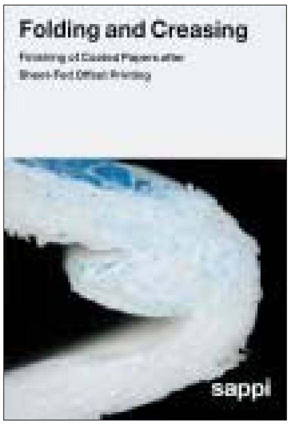
- **Metallic inks**
  Due to the microrough surface of matt papers, metallic inks can tend to loose their lustre and true colour value. If in doubt it is advisible to contact your ink supplier.

- **Film laminating**
  Generally matt coated substrates are not ideal for lamination. In some cases the roughness of the surface prevents the necessary close contact between the film and the inked image. Also depending on the amount of glue and the pressure, this uneven contact can result in a silver and hazy appearance particulary visible with darker colours.

The following brochures are also available in this series:







Imprint
Text and editing: Anton Albert, Hans Harms
Typography and title photo: Gerhard Wasshuber
Sappi Fine Paper Europe: Franz Frisch, Brigitte Spiegel, Monika Steyskal

Where information leads to inspiration

Printed on Magno Matt Classic 150 g/m² (content) and 250 g/m² (cover), September 2002, Sappi Europe SA

www.ideaexchange.sappi.com

www.sappi.com

Sappi Fine Paper Europe
154 Chausseé de la Hulpe
B-1170 Brussels
Tel. +32 2 676 97 51
Fax +32 2 676 96 65