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Best Practice



A GUIDE TO BEST PRACTICES

Fast work and turn on high speed presses



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Best Practice – Fast work and turn on high speed presses

Scope

This guide gives guidance in 'Best Practices' in fast work and turn offset printing on high-speed presses. Sun Chemical EOS™ can form part of this best practice.

Changes in market trends in the commercial and publication sheetfed printing market include the necessity to 'work' and 'turn' or 'work and tumble' sheetfed offset prints within a matter of minutes. In addition the work often demands print finishing very soon after printing both sides of the sheet. The demands on modern printing inks are therefore fast printing, fast work and turn and fast finishing or fast processing.

Let's have a look at some figures to gain a better appreciation of the speeds involved and therefore the constraints and challenges on ink and substrate.

A glossary of **terms and definitions** included at the end for clarity.

Fast running, fast setting, fast turning and fast finishing

Fast running – 14 000 to 18 000 cph

Fast setting – an ink formulated to be free of set-off and resistant to marking in the shortest possible time. Note that these inks may not normally be the first choice for perfecting on certain substrates due to the increased risk of back cylinder marking. We recommend a full test including the actual substrate before starting a perfecting print run.

Fast turning – printing the first side and then turning to print the other in straight printing in less than an hour.

Fast finishing – for double sided work moving to guillotine, die-cutter or bindery in less than an hour.

Printing press speeds can be up to 18 000 cph...this equates to about 5m/sec and is the state-of-the art in 2006. Future press speeds may reach 6m/sec in sheetfed printing...compare this with 15 m/sec in web offset printing.

If a substrate of 150g/m² is printed at 18 000 cph a stack height of 1 meter is reached after only 22 minutes. This represents a weight of nearly 700 kg on the sheets on the bottom of the delivery pallet. (Sheet size 70cm x 100 cm and this equates to 1 kg per square cm)

The same weight at a press speed of 12 000 cph arrives in 33 minutes. Taking into consideration that the normal setting time of offset inks is between 10 and 30 minutes one can imagine the high pressure on the sheets in the stack at 18 000 sheets/hour.

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taking up oxygen. The oxidative drying is responsible for the ultimate rub resistance, the scratch resistance and the slip properties of the final printing product.

Depending on the substrate to be printed, one or the other of these two drying mechanisms predominates. On satin coated and wood fibre containing uncoated papers the absorbing properties of the printing ink are most important. For coated papers the correct balance between both drying processes is important. Finally, for success on most non-absorbent substrates a purely oxidative drying process works best.

Work and tumble

The term work and tumble is used when the sheet is printed on both sides with only one set of plates to save plate costs. This is often done on smaller jobs when a double gate fold is applied. The sheets are placed face to face parallel to the cylinder axis. Before printing the reverse side the sheet is turned around the cylinder axis. Technically the side lay remains on the same side of the sheet but the front lay is changed to the opposite side of the paper. As there is a disadvantage with the higher costs of the paper (2 paper size additions for the gripper space instead of one) this is only done on smaller runs where the saving in make ready times and lower costs for plate making justify the higher costs.

Work and turn

The term work and turn is used when the sheet is printed on both sides with only one set of plates to save plate costs. This is often done when printing magazine covers for example. On a sheet in size 64cm x 45 cm there is one complete magazine cover printed. On the first side printed there are pages 1 and 4 side by side with pages 3 and 4. When turning the sheets and printing them again the page 2 backs page 1 and page 4 backs page 3. If the covers are to be coated off-line then a coating blanket of half the sheet size is used.

Technically the sheet is turned around the machine axis meaning that the front lays remain on the same side of the sheet but the used side lays are on the opposite side of the press after turning.

Set off

Set off is a transfer of ink or ink component in the delivery stack from the fresh ink layer to the reverse side of the sheet which is laying on top of the printed sheet. Ink set-off can be visible or in some cases (ghosting) it can be invisible. Visible set off can be measured using a densitometer or spectrometer fitted with the appropriate filter.

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- **Dampening**
Beside the fountain solution composition or choice noted above the actual amount of fount used plays an important role. Only with well adjusted and maintained inking and dampening systems it is possible to run the required minimum fountain solution. Even if industry trends today encourage the reduction in the level of IPA (Isopropyl Alcohol) used, some additional IPA could be favourable in order to get best results in fast processing as it may allow even lower levels of dampening to be used...less water = faster ink drying, in general terms.
- **Artwork**
In order to avoid drying problems due to too high ink coverage it is recommended to reduce the total tonal value to 280% which is the best compromise between colour reproduction and printability.

Press room management

Since fast running and fast processing challenge every part of the offset process the printing press must be well managed and regularly cleaned and adjusted. The main problems for fast work and turn are related to set-off and marking in the press. These can be both related to substrate but more often than not to less than optimum press settings both for fount and rollers.

Glossary of terms and definitions...

High Speed Press

As the average speed of a printing press today is above 12 000 cph a high speed press may be described as a press running faster than 14 000 cph.

Ink Drying

Ink drying can be separated into chemical and physical drying of the printing ink.

- **Physical drying of printing ink:**

The physical drying process of the printing ink is also known as penetration, i.e. the thin phase of the ink penetrates into the substrate. This process starts immediately after the ink has been printed and may take between 2 and 60 minutes depending on substrate and ink type. The drying by absorption setting is responsible for properties like fast work-and-turn, fast further processing and certain behaviour in perfecting print on 8 and 10 colour long perfecting presses.

- **Chemical drying of printing ink:**

The chemical drying process is known as oxidative drying. The oxidative drying only starts some time after the print and is finished ca. 24 hours after the print. The chemical drying consists in a polymerization of the vegetable oil components by

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As freedom from set-off or marking cannot be guaranteed under these conditions on all papers spray powder is applied to the fresh printed sheet as a means of creating a 'gap' between ink film and reverse side of the print/paper and so avoid set-off.

Printing fast 'work and turn' or 'work and tumble' jobs on fast running presses to get the full benefit of the increased productivity offered means no waiting time between finishing the front side of the print before turning the sheet and printing the reverse side.

Conventional printing inks 'dry' by first 'setting' and then by 'oxidation'. The first setting step is assisted by the thin phase in the ink moving into the paper coating and so leaving a solid matrix on the top. The oxidation process is much slower and can be many hours (or days) before final full hardness is achieved. (See more details in the Section Glossary and definitions)

Common problems

Set-off and marking in the stack

Assuming that a fast setting ink such as Sun Chemical EOS™ has been chosen and the press is properly set up then the following are the variables:

- Substrate
- Artwork
- Spray powder
- Fountain solution
- Press speed

Beside the inks the factor having the most influence on set off in the stack is the paper. As a guideline the papers can be separated into three classes.

- *Gloss coated papers*
Gloss coated papers show the fastest setting properties. Therefore fast work and turn is possible after the shortest delay.
- *Matt coated papers*
Matt-coated paper show a very long setting time. The delay before turning the sheet could be up to 10 times longer than with gloss coated paper. Testing is essential before printing the reverse side.
- *Uncoated papers*
The setting time of these papers is usually the longest of all. The delay before being able to turn the sheet can be significant and careful testing must be done before printing the second side.

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However, within the groups of paper mentioned above there are differences. Especially with uncoated papers there are substrates available which may have a similar performance to gloss coated papers. Prints must be checked carefully before the reverse side is printed.

While the L*a*b* values given in ISO 12647-2 or the density values as they are established in today's printing industry should not be changed, special attention must to be paid to the total tonal value. It is clear that a smaller total tonal value allows faster ink setting and consequently a faster work and turn. A total tonal value of 280% is recommended, as it is a good compromise between colour reproduction and ink drying.

Is the spray powder the correct type and dosage? Generally speaking a smaller amount of a larger particle size should help. Extensive high use of spray powder should be avoided as it will lead to a soiling of the blankets during reverse side printing and subsequently to more press stops for cleaning and reduced productivity. Spray powder suppliers suggest a non-coated starch powder with an appropriate size for this application.

If there are no obvious improvements that can be made in ink and anti-set-off powder choices then perhaps a review of the fountain solution is needed. Assuming the fountain system is clean and charged with the chosen solution then changes should be considered. Ink setting and drying are significantly affected by the amount and nature of the water taken up in the offset printing process. The fountain solution plays a vital role in many areas of offset printing. Therefore there are several best practice guides for fountain solutions available. Details on fountain solutions could be found in the following documents available from Sun Chemical:

- Best practice - Fountain solution auditing
- Best practice - Fountain solution trouble shooting
- Best practice - IPA free printing

Marking on the press

In much the same way as set off in the stack the problem of marking in the press can be related to several factors when they are not at the optimum:

- Press cleanliness
- Substrate
- Artwork
- Fountain solution

As for set-off each factor needs to be checked in sequence starting with the cleanliness of the various metal parts of the press such as paper guides.

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Marking in the press is usually caused by a build up of sticky residue from ink, and/or paper coating and occurs on the press usually when printing the second side. The reason for the formation of the residues on the paper guides is due to printing of the reverse side too soon. The printer can test this in advance by checking the stickiness of the first side print. This test should not be done with the sheet on top of the pile as these sheets are exposed to more air than the rest of the stack. This test needs to be done at least 10 sheets under the top sheet. Reasons for the formation of residues on the paper guide could be:

- **Poor paper choice**
In today's environment papers are often specified by the print buyer. As noted above the paper, together with the ink, has the biggest influence on fast work and turn properties and should therefore be chosen very carefully.
- **Total tonal value too high**
A maximum total tonal value of 280% is recommended. This is a good compromise between colour reproduction and ink drying.
- **Excessive water or fount in the ink or settings**

When printing the reverse side (2nd run) sheets should be taken out of the press for evaluation for reverse side scratches or marking. Always take out two sheets as there is the risk that metal parts in the delivery create scratches during take out. The lower sheet therefore should not be taken for evaluation.

The remedy of last resort is to reduce the press speed.

Problems with fast finishing

In former times long drying times were acceptable in printing. Long drying times and long delays before finishing are not acceptable today...either due to short lead time demand or the problem of storage of large amounts of work-in-progress. The lead time for the production of printed matter now is often below 24h, in some cases an order made before midday is processed and ready for pick up by courier at 18hrs00.

Optimisation of all the factors noted above is necessary to meet current demands in short lead time work. When it comes to fast processing the following factors have the biggest influence:

- **Ink selection**
For use on fast presses in straight printing Sun Chemical EOS™ will give an excellent result. On perfecting presses a test with EOS™ under full operating conditions is needed. Alternatively use Sun Chemical EXACT PSO™.
- **Paper selection**
The fastest finishing will be possible with gloss-coated papers, and slowest in many cases with uncoated paper. However, as there are big differences within these groups of substrates a careful selection of paper is absolutely necessary.

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