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TDS 7\001

## **A PRINTERS GUIDE TO RUNNING WATERBASED COATINGS**

Water based coatings were introduced with the intention to increase flexibility in terms of press speeds, ink weights and gloss finishes and turn around times. Since that time technology has progressed rapidly giving printers a far wider choice of finishes, drying speeds and specialist products.

As their name suggests water-based emulsions generally consist of 58-60% water, with an average solids content of 40-42%. Emulsions work by the evaporation of volatiles when contact is made with the substrate leaving a blend of polymers, waxes and modifying additives to cross link providing a touch dry finish on delivery.

The cost effectiveness of water based coatings makes the purchase of a coating unit a wise investment. It is possible to supply clients with a range of finishes starting from matts and satins up to water white high glosses. Printing speeds can be greatly increased without the occurrence of set-off and with the minimal use of spray powder. Once the job is coated any intermediate storage of material requiring further processing is eliminated.

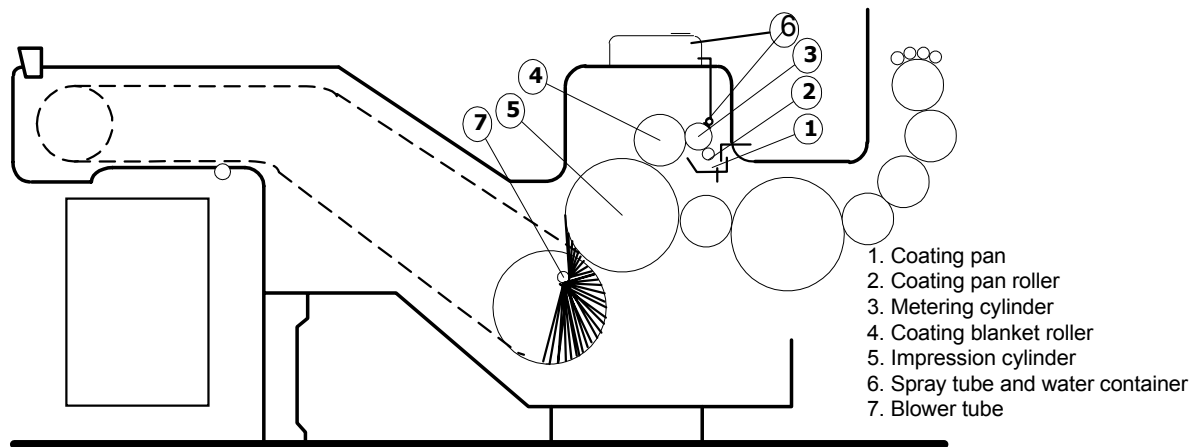
Coating units are located at the end of the press after the inking units. This allows the coating to be applied in-line over relatively dry ink therefore increasing gloss. These units are described as 'dedicated' however off-line versions are also available. The diagram below illustrates roller configurations on a Heidelberg coating unit.

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To ensure smooth consistent finishes and economical running it is important that the correct pressures and settings are maintained between the various rollers. It is recommended that the 'stripe' or 'nip' between the pan roller and applicator should be between 4 and 6 mm. This can be set by running the rollers slowly in application mode, and then stopping and measuring the width of the resulting coating line. If this is too small the system will be starved of coating and the sweep will need to be increased.

The sweep is the speed at which the pan roller runs, effectively metering the film weight of coating on the sheet. Ideally the sweep can be run at between 10 and 20%, although this is a guide and settings can be higher. The greater the sweep the greater the film weight as the pan roller moves faster collecting more coating. Increasing the pan roller speed to excessive levels in order to achieve higher gloss is not recommended, as the gloss will increase only very slightly whilst the coating usage becomes highly inefficient. *(Example – Heidelberg 102 set with sweep at 20% whilst coating with Stehlin Hostag highest gloss emulsion gave a gloss figure of 78% when measured with a Sheen gloss meter set at 60° Increasing the sweep to 40% resulted in a mere 2% gloss increase)*

The distance from the coating pan to the paper is extremely short. This prevents drying of the coating film before it reaches the paper. The continued running of pan and applicator roller also reduces the risk of drying on the rollers during printing interruptions. Emulsion in the pan is kept fresh with the use of a pump, which continuously keeps the coating in circulation.

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When starting up it is highly advisable to allow the first 2-3kgs to run through the system and be pumped off into a waste container. This action will ensure that any water, which may be retained in the pipe work is flushed out and not allowed to significantly reduce the viscosity of the new emulsion. (Note – depending on press size the pipes can retain as much as 6kgs of water after cleaning).

Once a sheet has been coated it should be almost touch dry on delivery with the use of a drying system, the most common of which being IR and hot air knives. The use of IR lamps and air knives allow the printer to control drying speeds and stack temperature. The ideal stack temperature for single sided work would fall between 30-35°C, dropping to 28-32°C when coating on the second side. A stack temperature probe is highly recommended on presses, which do not come with such equipment as standard.

When all of the afore-mentioned machine specifications are met, problems are rare, however they can occur and knowledge of problem solving can save costly down time. Described below are a list of the more common problems and steps, which need to be taken in order to overcome them.

### **Drying**

Slow drying of coatings causes the obvious problem of set-off and sticking in the stack, as well as slower press speeds and inefficient print runs.

Slow drying can be caused by the following criteria:-

- Film weight
- Heavy ink coverage
- Impervious/difficult substrates
- Fault with drying system

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Film weight is metered by the sweep and is ideally set at between 10 and 20%. A sudden increase in film weight will result in inhibited drying and can be recognized by a significant increase in gloss as well as the appearance of the coating giving a rippled finish. Viscosity changes (caused by volatiles within the coating evaporating and leaving a more viscous product) can often be the cause. Viscosity should be monitored throughout the run and if required water can be added at a rate of approximately 1½% for every 10 second reduction. If very large additions are required it is best to premix a solution of water and IPA in the ratio 1:1 and add, as you would water.

Heat during the summer months is often the cause of volatile evaporation although this can be reduced by keeping open top drums with their lids in place. Care should also be taken to avoid close contact of feed pipes with heated areas of the press as this can also cause bodying within the pipes and therefore slower drying.

Ink coverage plays an important role in drying with the basic rule being to keep ink film weight at a minimum. Over very heavy ink coverage, emulsions will have impaired drying speeds this could result in set-off or blocking unless handled with care. If heavy coverage is anticipated, Stehlin Hostag have formulated an intense ink system with extra strength which may be used in order to reduce film weight. A light application of a spray powder would also be advisable.

Specially formulated coatings are required if drying is to be successfully achieved on impervious substrates such as foils and polyethylene papers. These are particularly fast drying coatings, which require no absorption into the stock to set.

Occasionally faults with drying systems can result in unacceptable drying times. Stack temperatures can be monitored using a long temperature probe, and should not fall below 28°C or above 36°C.

Imperfections in the printed film can sometimes be observed if coating has dried in the pipework and then been forced through the filters into the pan. These particles normally only appear on the rollers but in extreme cases they can be transferred onto the printed sheet. Checking the filter in the pipework will confirm this problem and once it has occurred a thorough wash-up (using the Delta Emulsion Cleaner D1024) should be actioned.

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### **Crazing**

Crazing, also known as the 'egg shell' effect, is the result of a coating drying too fast often over heavy ink coverage's, therefore creating a cracked appearance. Crazing can be reduced with the addition of a retarder, but this will impair the drying speed of the coating in the delivery. If this is going to cause a problem then the coating will need to be reformulated to allow the coating to film form more easily.

### **Gloss**

Problems concerning gloss are generally rare and are often related to unrealistic views on the kind of gloss levels, which can be achieved. Requests are often made for levels similar to that of UV, however it is important to note that whereas UV has a solids level of 100%, water based averages at around 45% solids. This means that 55% of the original formulation is lost to the atmosphere, therefore making comparative matches to UV very unlikely.

Coatings, which do exhibit high gloss, are generally slow drying giving reflection readings of between 70 and 80% depending on the stock used. Either slowing the speed of the press or increasing the sweep can increase the gloss level. If the decision is made to increase film weight, work should be monitored for blocking, as the drying speed will be reduced.

### **Viscosity**

Viscosities are generally dictated by the type of coating unit and the level at which the printer feels happy to run. Most waterbased coatings applied via a dedicated coating unit will have a viscosity of between 30 and 60 seconds DIN 4 @ 20°C.

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### **Rub**

Rub problems are rare but are usually caused by heavy ink coverage's or by substrates where drying is inhibited. If heavy ink coverage is anticipated it may be beneficial to use an intense ink series in order to keep the film weight low.

Substrates such as foils, polyethylene papers and recycled stocks may require a special coating to give optimum protection. If this is the case please contact the technical department at Stehlin Hostag Head Office

### **Foaming**

Water based coatings are designed to minimise the formation of foam with the use of a defoamer, however on large presses where diaphragm pumps are used to circulate coatings (sometimes from containers as large as 200kg) the generation of foam can become a problem.

In severe cases the formation of foam can create increases in viscosity and the problems associated with viscosity appear. If foaming is anticipated it may be beneficial to make an addition of defoamer.

If this is the case please contact the laboratory at Stehlin Hostag for further information and reference number.

### **Slip**

Slip is an important factor in the carton printing industry and depending on the packaging line requirements, low slip or high slip may be required. Slip is controlled by a blend of waxes and silicones and can be specified by using slip angles or static and dynamic measurements.

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Film weights and ink coverage can dictate slip, with low coverage work generally giving higher slip results (i.e. more slippy) than work with heavy coverage. In order to compensate for these differences, Stehlin Hostag has a number of additives

Caution is required when increasing slip with either wax or silicone. Wax will reduce gloss levels and silicone will inhibit glueability, foil blockability and subsequent UV varnishing or lamination.

### **Wetting**

Poor wetting can be the result of the following factors:-

Pressure between blanket and impression cylinders

High ink filmweight

Excessive pressure between blanket and impression cylinder of the coating unit may result in inadequate wetting of the blanket cylinder, leading to a build-up of ink on this cylinder. This results in patches on the coated sheet where the ink build up is restricting the coverage. The obvious remedy in such cases is to reduce pressures to the bare minimum.

Heavy film weights of oil-based inks may lead to unacceptable wetting of the waterbased emulsion. If heavy film weights are anticipated an intense ink system should be considered, and if not available the addition of a wetting additive may be necessary.

Please contact the laboratory at Stehlin Hostag for further information and reference number.

NOTE : Additions of wetting additive may result in an increase in viscosity.

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### **Curl**

Substrate curl is heat related, and is caused by the evaporation of moisture from the board. Some low grammage stocks (i.e. under 100gsm) can also be affected by the evaporation of volatiles in the drying process of waterbased coatings.

In the case of substrate curl on stocks above 100 gsm, it can be beneficial to reduce I.R lamps and air knives to the bare minimum monitoring closely for blocking. This reduction in heat allows a much slower release of moisture from the board, promoting lower curl. Substrates under 100gsm may require a specialist low curl formulation, if this is the case please contact the Coatings Laboratory at Stehlin Hostag Head Office in Nottingham.

### **Blocking**

Blocking and 'set off' can be initiated by a number of factors, which include:

- Extremes of heat
- Insufficient spray powder
- Incorrect coating
- Film weight

Stack temperatures should never fall below 28°C or above 36°C. Cold stacks will have meant that insufficient heat was applied as the sheet passed through the swan neck thus resulting in slow drying. Stacks with a temperature of over 36°C will keep the coating soft and ink wet and will increase the possibility of re-wetting and therefore blocking.

Heavy boards, rapid press speeds, very high gloss coatings and immediate back-ups are all scenarios where extra spray powder would be required. A medium size particle would be sufficient with a medium to high spray coverage.

**NOTE** : A larger size spray at a reduced coverage is more efficient than a small size with high coverage.

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Work which is to be backed-up and coated on the second side will require a special emulsion suitable for double sided printing. Regular, single sided emulsions (normally with high gloss characteristics) are not suitable for this application, and will re-wet when backed up resulting in serious blocking. Double-sided emulsions are generally faster drying and consequently slightly lower in gloss.

Extremes of coating film weight, may cause blocking, and should therefore be avoided.

**Colour Bleed.**

Pigment bleed when in-line coating with waterbased emulsions is extremely rare, however amines present in the formulation of all aqueous coatings have the potential to effect certain colours. These colours are reflex blue, 072 blue, warm red, rhodamine, violet and purple.

As previously stated, problems such as those in this report are rare and if adequate research is invested, every job will run trouble free. However if advice is required or it is felt necessary that a member of Stehlin Hostag technical service team should attend press runs please contact the Laboratory at our Head Office in Nottingham.