A guide to UV PRINTING

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ULTRA VIOLET DRYING

Ultra violet (UV) reactive inks and coatings require a high intensity source of UV light to initiate a chemical reaction. This reaction dries the UK ink or coating in fractions of a second.

The electro-magnetic spectrum, of which UV forms a small part, is expressed in wavelengths. Longer wavelengths form radio and microwaves, and reducing wavelengths descend through infra-red, visible light to UV and beyond.
UV wavelengths are extremely short and are measured in nanometres, and the most suitable UV wavelengths for drying UV reactive inks and coatings lie between 200 and 400 nanometres.

The most proven and widely used source of high intensity UV light is the medium pressure mercury arc lamp. It gives a high output in the 200 – 400
nanometres range; medium pressure mercury lamps will perform efficiently over a long working life of 1,000 hours and more.

Premium quality quartz must form the body of the lamp and provide a 90% transparency to UV light. Low-grade quartz and glass filter out most UV wavelengths, allowing through only the longer, weaker wavelengths. The quartz body of the lamp must be capable of withstanding surface temperatures of 600 – 800 degrees centigrade, this being the range at which the UV output is at its peak, and thermal expansion must be minimal to avoid distortion of the lamp. UV output from the lamp declines gradually, as the UV transparency of the quartz body deteriorates. The quartz changes form optically clear to opaque, thus filtering out all the useful UV.

The rate of decline depends on the number of factors; lamp cooling efficiency; power rating; current rating of the electrodes; electrode cooling efficiency; cleanliness of quartz surface, and switching frequency.

ENSURE THAT THE ROLLER COVERINGS AND BLANKETS ARE COMPATIBLE FOR USING WITH ULTRA-VIOLET INKS

UV ink vehicles are classified among the unsaturated acrylic polyesters. That is to say, they are different from the binders used in conventional inks, because of their different solubility characteristics.
UV ink binders can cause swelling of the elastomers in the rollers and blankets. The present state of technology and the experience gained have enabled ink and roller manufacturers to recommend to their customers the appropriate quality for this purpose.

NITRIL (Perbunan):
Minimum swelling (about 5%) suitable for BOTH UV AND conventional inks wherever inter-changing is required.

BUTYL:
Behaviour very similar to NITRIL type elastomers.

POLYURETHANE:
Very large swelling.

EDPM or EPT: (Ethylene-Propylene-Terpolymer)
This type of elastomers originally recommended for UV inks, has given rise in practice to several problems regarding the distribution of inks, caused by a shrinkage towards the middle of rollers. The substitution of EDPM by NITRIL (without polyurethane) has been carried out satisfactorily.

WASH-UP SOLUTIONS CAN ALSO PRODUCE SWELLING OF ROLLERS AND BLANKETS
Wash-up solvents for UV inks are different to those used for conventional inks. As a general rule they are more aggressive towards certain materials such as rollers, blankets and photopolymer plates.
Unwisely chosen UV ink cleaning solvents are very often the cause of physiological disorder among printers, e.g. skin irritation, abdominal troubles and headaches. These drawbacks originally blamed on UV inks have been overcome, thanks to some commercially available wash-up solvents being made to ensure:
* Good dissolving action on UV inks
* Minimum aggression on rollers, blankets, plates etc
* Physiological behavior satisfying health and safety regulations
* Less volatile

UV CURABLE INKS

Without going into details regarding UV ink formulation, it is important to make a comparison between their composition and those of conventional inks.

Conventional Ink	**Ultra Violet Ink**
Pigments	Pigments
Resins	Acrylic Prepolymers
Vegetable Oils	or Oligomers
Mineral Oils	Acrylic Monomers
Drying Agents	Photo-Initiators
Additives	Additives

Although UV ink looks very similar to conventional inks by the principle of their formation and their final appearance, their composition demands a choice of raw materials satisfying UV curing requirements.

Pigments

Following their chemical composition and their surface treatment, pigment may affect:-

THE PENETRATION OF UV RAYS AND CONSEQUENTLY UV INK CURING

The graph (fig. 1 page 6) shows the UV transmission spectra (200 –400 mm) of the four pigments of the process inks (European scale). The figures show that each colour pigment leave “open windows” in well-defined zones of the Ultra Violet spectrum. The only exception to this rule is the carbon black pigment which covers almost the whole of the UV spectrum.
For the requirements of this experiment these spectra were measured through aqueous dispersions of each pigment and at a thickness averaging one centimetre. In practice, in offset printing, where the ink layer measures from 2 to 3 microns, the penetration of the UV rays is better and the inks cure perfectly at industrial production speeds.

THE INK/WATER BALANCE IN OFFSET

Due to the fact that UV ink vehicles are more popular than those of conventional inks, it has been noted that, for a given UK ink vehicle a simple change of pigment can raise difficulties of the ink/water balance on the offset plate.

HYDROPHOBIC PIGMENTS
Some pigments can produce hydrophobic (water reliance) problems. In this case, the dampening solution is not properly emulsified and has tendency to remain on the ink surface. Water loses no time in climbing up the inking train and forms a slippery aqueous film, thus causing a poor ink transfer (from the printing plate to the blanket and the substrate).
This is less of a problem with Dahlgren-type dampening system.

HYDROPHILIC PIGMENTS
Mineral pigments such as titanium dioxide, chrome yellow or molybdate orange are very hydrophilic pigments by nature. The problem noted with UV inks containing this type of pigment is exactly the reverse of the hydrophilic; the pigment is extracted by the dampening solution and the print “scums” very quickly.

SELECTION OF PIGMENTS
It is therefore important for UV inks to choose the pigments according to their:-
- Optical properties in the UV light radiation
- Lithographic properties for offset printing
- Storage stability in relation with the composition of the UV ink vehicle

THE INK VEHICLE
It is in this part of the ink that the fundamental difference between a conventional ink and a UV ink lies.
The vehicle of the ink is composed of:-
- Acrylic Prepolymers Or Oligomers
- Acrylic Monomers Or Oligomers
- Photo Initiators
- Additives

All these products, compounded in clearly defined proportions, are responsible for the photo-polymerisation reaction (UV curing) and the final properties of the printed matter (gloss, chemical and physical resistances).

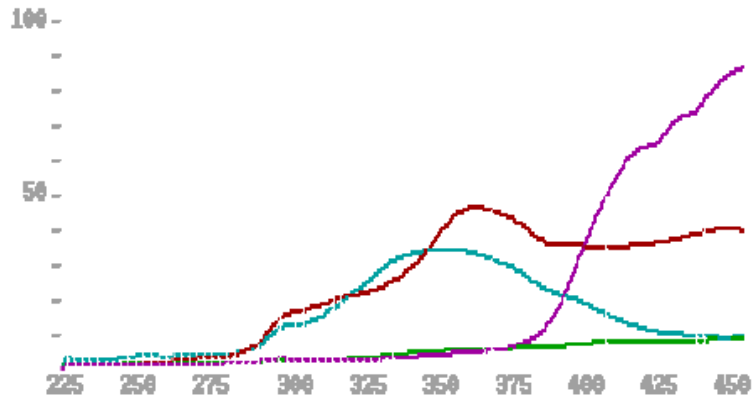
This instantaneous reaction resulting in the complete drying of the ink takes place in a period of time estimated at a tenth of a second via the following stages:-

1. **Initiation:** Activation of the photo-initiator (specific to the wavelength of UV radiation emitted by the source) resulting in the formation of free radicals. The photo-initiation contained in the ink stays in its fundamental state (stable), until it is exposed to the UV radiation. From this moment on and passing through different stages of excitation it is decomposed and forms the free radicals for the polymerisation reaction.
2. **Energy Transfer:** Stage of reaction of the free radical with the double bonds present in the monomers and prepolymers composing the ink binder.
3. **Propagation:** Increase in the crosslinking network of the ink vehicle. Transition from the liquid to the solid state of the ink. This stage takes place before the pile delivery.
4. **Termination:** Ending stage also called “post curing” having the effect of improving the mechanical properties of the film up to twenty four house after drying.

Summary:

An ink containing a light-sensitive vehicle (composed of prepolymers, monomers and photo-initiators) pigmented with suitable pigment can polymerise (cure become solid) in a fraction of a second after exposure to Ultra-violet radiation.

UV-Light Transmission Spectra of Process Inks



PLATES
Due to the high ink film weights usually carried when printing with UV inks, plates should be printed down as sharp as possible to minimise dot gain on press.

Recommended Step Wedge Reading
On Positive Plates - Clear 4/5 on stouffer wedge
On Negative Plates - Clear 9 breaking 10 on stouffer wedge
All positive plates should be baked to protect the image from attack from UV solvents. Positive plates are advisable to use when tone/screen work is to be reproduced as dot reproduction size can be controlled at the plate making stage, as opposed to negative working where the dot can only be adjusted for sharpness at the film making stage. If, however, negative plates are used, post exposure of the finished plate will increase resistance to solvents. Care and good housekeeping methods must be utilised when plates are in operation on press.

1. UV inks are polymer based, as are some plate coatings, and plates will sensitise very quickly if left unprotected with gum for a short length of time.

2. UV solvents should never be applied directly to a plate that is not protected with:
(a) Gum or
(b) Water

UV solvents evaporate extremely quickly and key to the plate, causing sensitivity which can only be removed by vigorous etching.

3. The plate should be completely rinsed with water before recommencement of printing (roller and damper contact).

4. It is imperative that a system is adopted and utilised during press stops, to avoid any unnecessary problems with plates.

Would suggest (at Blanket Wash Stage):
1. Dampers are lifted off all plates.
2. Plates are fully gummed.
3. Blankets are washed. By this time, the gum of the plates will have dried off.
4. Wash plates out with UV solvents or methylated spirits.
5. Rinse over all the plates surface with water.

Full machine wash-up, at completion of printed job

1. Dampers are lifted off plates' surfaces. (If heavy solids are being printed, it may be beneficial to lift the inking rollers off the plate, when the last twenty sheets are being printed to strip some of the ink film off the plate).

2. All plates are gummed.

3. Dampers are lifted from machine, for off-press washing recovering etc.

4. Rollers are washed with automatic wash-up system.

5. Blankets/impression/transfer cylinders are washed.

6. Plates are washed over with UV solvents and excess solvent smoothed down.

IF PLATES ARE TO BE STORED:

1. On removal from press, break the film of dried ink residue and gum with a thorough application of water.

2. Re-wash plate with UV solvent.

3. Rinse with water.

4. At this stage, it may be beneficial to etch the plate with a mild plate cleaner, re-rinse with water.

5. Thoroughly gum and buff down the plate and dry.

6. Cover plates with paper/board to prevent scratching during storage.

BLANKETS
Both compressible and conventional blankets can be used for UV printing.
It is worth considering that all UV inks and solvents tend to swell the blankets, and slight embossing of the printed image appears on the blanket.
Compressible blankets with finer profile and higher filler loadings present less base polymers to ink and solvents and embossing and tackiness is minimised.
The usual benefits of greater dot definition, smash recovery and increased packing latitude associated with the compressible blanket still apply.
Always use blankets that have sealed edges that offer protection from solvent ingression.

BLANKET WASHING (Manual Application)
Wipe over blanket surface with a wet rag/sponge to remove any accumulation of gum/paper dust etc. Wash over the blanket with a rag saturated with UV wash to break the ink film down. Wipe over and dry with a damp cloth.

N.B:
UV solvent will dry off and evaporate quickly, and cause tackiness if allowed to dry into the blanket. In order to minimise this, on presses with large cylinders, it is advisable to wash with solvent and wipe immediately with a damp cloth, before inching the machine into the next position.

AUTOMATIC BLANKET (Washing Systems)
1. Allow a short cycle of water/rinse to dissolve gum and paper dust.
2. Normal cycle with UV Wash.
3. Ensure drying rollers are well maintained and fabric covers are in good condition.
4. Thoroughly clean and rinse all systems when changing from conventional to UV solvents (and vice versa).

DAMPENING
Behaviour of UV inks with the Dampening Solution: Ink – Water balance.
Early UV inks had a pronounced tendency to Hydrophilic (Emulsification-Scum). The development of new UV curable vehicles has contributed to the creation of a new generation of UV inks whose “Ink-Water” characteristics are very close to those of conventional inks. The composition of the dampening solution varies according to the pressman’s habits and may range from ordinary running tap water to water which contains Acid additives and isopropylic alcohol (PH varying from 2 to 6).

Example: The following formula of dampening solution gives in practice very satisfactory results:
WATER 88%
FRONT SOLUTION 2%
ISOPROPYLIC ALCOHOL 10%
P.H. 4-5%

DAMPENING ROLLERS (CONVENTIONAL)

1. UV inks will tend to shorten the life of fabric covers. Ink stains and breaks down the fabric pile.
2. Wash thoroughly with UV solvents, thoroughly rinse and scrub dry.
3. 3M damping covers offer an alternative to fabric covers. They offer a considerable working life, can easily be cleaned, and offer a quick change around between colour changes. They also offer a fine controlled even damp. Ink/water balance is critical in UV printing.

When printing with UV inks, keep conventional inks and wash up solvents away from the press to avoid any possibility of cross contamination.
Do not make the press ready using conventionally printed waste material which may still be wet, and will therefore contaminate the blankets.
Keep a regular check on the lamp hour counters, since the UV emittance from a lamp will reduce by 1-2% approximately, for every 100 hours that a lamp is used. Special attention should be paid to curing, once the lamps have completed 1000 working hours. Change the lamps at the first sign of any deterioration in cure after this time.
Once a week, check that the lamp units are clean, if necessary using a mirror held in front of the lamps if direct access cannot be gained from the press delivery. Any dust or ink deposits should be removed using a lint-free rag lightly soaked in alcohol.
When linking up with UV inks for the first time, refer to the section in this manual marked `Changing form conventional to UV inks'.

SMELL OF UV CURED PRINTS

Very often the odour of ozone, although very characteristic, is confused with the surface odour given off by certain substrates (such as paper and cardboard) when exposed to UV radiation. A more detailed study of the problem has shown that odours can be attributed to the casein-based glues used in paper and cardboard coatings. A preliminary test with blank substrate is recommended.

GUIDELINE NOTES FOR INTERCHANGING BETWEEN THE USE OF UV AND CONVENTIONAL INKS

GENERAL

1. Ensure that the roller covering, plates and blankets are compatible with both ink systems.
2. Always keep tins of UV and conventional ink separate, and ensure that they are clearly labelled.
3. Clearly label and keep separate bottles containing roller and blanket wash-up solvents.
4. Always use clean pallet knives, sponges and rags.
5. Never mix UV and conventional inks together, and similarly do not use reducers from one ink system in another.

CHANGING UV TO CONVENTIONAL INKS

1. Wash the rollers, plates and blankets using UV wash-up solvents. Ensure that the ink ducts are clean, allow solvent residue to evaporate before applying conventional inks to the ducts or rollers.
2. Fit the spray powder shield covers on to the UV lamps.
3. Ink, plate-up and make-ready as normal.

CHANGING FROM CONVENTIONAL TO UV INKS

1. Wash the rollers, plates and blankets using conventional wash-up solvents. Ensure the ink ducts are clean and allow any solvent residue to evaporate.
2. Remove the back cover from the press delivery and vacuum out any excess spray powder. Also brush off any loose spray powder from the gripper bars.
3. Remove the covers from the front of the UV lamps and check that the cooling tubes are clean. If necessary wipe the cooling tubes clean with a lint-free cloth lightly moistened with alcohol. Never use an air-line to blow away spray powder with the lamp covers removed.
4. Wash the rollers, plates and blankets using the UV wash-up solvents and allow any residue to evaporate.
5. Apply a stiff UV tinting medium to the rollers and allow the press to run on crawl for about 20 minutes.

6. Again, wash the rollers, plates and blankets using UV wash-up solvents and allow any residue to evaporate.
7. Ink up with UV inks and make ready as normal.
8. If the printed ink fails to cure or is still soft after printing between 200-500 sheets, pull up and repeat points 4 to 7 above.
9. If after a further 200-500 sheets, the printed ink is still failing to cure fully, pull up and apply some ink (from the tin, not the duct) on to a blank sheet using a hand roller or some similar means, and press this through the press and past the lamps, ensuring that the lamps are on full power when the sheet passes.
10. If this ink cures, remove the ink from the ducts and throw this away and thoroughly clean the ducts. Re-ink the press and repeat points 4 to 8 until satisfactory curing is achieved.
11. If the test as in point 9 fails to cure, repeat with a fresh tin of UV ink, preferably an ink that has been used before and cured satisfactorily.
12. If the test in point 11 gives a good cure, consult the ink manufacturer with regard to the original ink.
13. If the test in point 11 fails to give a good cure, inspect the UV system for either a fault or lack of UV emission.

SOME COMMON CAUSES OF LACK OF CURING

1. Effective lamp life expired.

2. Lamps not reaching full power.

3. Cross-contamination of UV inks by conventional inks and solvents.

4. Wrongly formulated ink.

5. Ink shelf life expired.

6. Dirt or deposits on the cooling tubes (IR filtration systems).

7. Dirty or annealed reflectors.

8. Lamps overheating.

PROBLEMS ASSOCIATED WITH UV VARNISH OVER CONVENTIONAL INKS WET-ON-DRY

Although problems associated with UV varnishing have become less frequent in recent years, there are occasions when they do occur. In the interest of our customers we have listed problem areas and the precautions to be taken to help a void unnecessary waste and reprints.

SUBSTRATE

The substrate to be UV varnished must be (Clay) coated/roller calendered. Un-coated substrates act like sponges and absorb the varnish. Cast-coated substrates are also not suitable of UV varnishing as the thickness of the clay coating is two or three times more than roller coated stock. This amount of clay acts as an absorber and gives the same result as an un-coated substrate. It is always advisable to check with the paper supplier if there is the slightest doubt as to the substrate's suitability.

The substrate must not be scored prior to UV varnishing. The amount of varnish deposited in the score can be as much as three times the thickness compared to the overall flat sheet, and will crack when folded. Please advise your supplier of any subsequent process to be carried out on the substrate, ie, foil blocking, die stamping and gluing etc.

PANTONE INKS

Not all pantone inks are suitable to be used when the job has to be UV varnished. The following colours: RHODAMINE RED, PURPLE, REFLEX BLUE and BLUE 072 may alter or fade dramatically when processed, especially when used at low concentrations, eg, Tints.

FOUR COLOUR PROCESS INK

Many printers continue to use their normal four-colour ink when work has to be UV varnished. Although problems soldem occur, they can. Successful UV varnishing can only be guaranteed if the correct links are used. Standard Four Colour inks normally contain additives that could cause poor wetting and the reticulation of UV varnish. This is not a frequent problem; however, under certain circumstances this can happen. Consult your ink supplier, as there are special Four Colour sets available for UV varnishing. The inks must be completely dry prior to UV varnishing or adhesion failure may occur. It may not be visible immediately but within two or three days, the coating may dull and flake off.

ADDITIVES AND SPRAY POWDER

It is also important that additives are not used with the ink as these can cause the same problems. Keep spray powder to a minimum or the finished result will look more like sandpaper than the smooth, even finish required.

SET-OFF AND STICKING IN THE STACK AFTER UV VARNISHING OF SHEETS PRINTED BOTH SIDES

The incidence of this type of problem has increased with the use of `STAY OPEN', `DUCT FRESH', or `PRESS STABLE' inks. Such inks are easier to run on modern presses and frequently minimise set-off in the printed stack. Since they set quickly on the surface, the sheets can be safely handled after a short period, although the whole ink layer is not fully hardened. After the application of UV Varnish to the front of the sheets, volatile products trapped in the ink are unable to disperse, the inks softens on the back of the sheet and sticks to the adjacent varnish surface. Many factors contribute to the risk but the problems most usually occur in heavily inked areas of smooth, heavy, un-absorbent substrates when only a relatively short time has been allowed between printing and further processing. Any situation which delays ink drying and solvent dispersion will increase the risk.

UV VARNISH OVER CONVENTIONAL INKS WET-ON-WET IN LINE

The basic problem to overcome is the degrees of dry back and subsequent reduction in gloss over heavily inked areas (three or four colour build). The other common fault is weak intercoat adhesion causing flaking or candling.

INK AND VARNISH

Inks for printing in line should have high pigment strength, controlled setting and water balance with specific surface tension characteristics. The varnish must have the correct cure rate, flexibility and flow out to maximise gloss and adhesion. In this selection of the primary materials the printer will rely on the skill and knowledge of his chosen supplier.

MACHINERY

UV varnish may be applied wet-on-wet by dry offset or Coater application. Cut blankets, dedicated relief plates or direct coating can be employed. Best results to date are achieved using a multi-unit press with extended delivery to Coater and employing IR/Warm Air after the inks to assist in setting and removal of water. End of Press UV lamps should be matched to press speed to avoid either embrittlement or undercure.

Some re-circulation pumping systems can entrap tiny air bubbles in the varnish, which impedes the flow-out properties.

SUBSTRATE

Board or paper previously designed to assist oil inks to set rapidly is not always the best choice for in-line printing. Many good quality substrates are heavily coated and very absorbent, leading to excessive dry back. The ideal properties to be sought are smooth surface, even absorbency, and good hold out.

PRINTING CONTROLS

Having carefully selected the raw materials and bought them together on press, the printer must continue to exercise control in order to optimise results. Inks must be run at minimum film weights to enhance trapping and reduce dry-back. The use of under colour removal in repro for process work can make substantial improvements. Fount settings should be kept at minimum and use made of alcohol to reduce the overall water content of the inks.

To obtain maximum gloss uniformly over the complete sheet, the choice must be UV inks with interdeck curing before the UV varnish station. If, however, the cost of such a set-up is prohibitive but you still require a UV finish, following these guidelines can produce a result perfectly acceptable for a wide range of packaging and commercial printing.

RECOMMENDED GUIDELINES FOR HANDLING UV RPINTING INKS, COATINGS AND SOLVENTS

HEALTH

Since the chemistry of Ultra Violet curable materials is different from that of conventional printing materials, the hazards associated with handling them will also be different. These differences must be emphasised to those more familiar with handling conventional products, so that minimum exposure will occur.

Compared to conventional printing ink, the raw materials have a higher intrinsic toxicity associated with them. These materials are classified to the eye, as a potential danger of irritation, and are much higher than in a skin contact situation.

They are rated as low to moderate potential skin irritants by standard testing procedures. This rating is not of a severe enough nature to require labelling, as do “primary” skin irritants.

The type of irritation most generally produced by long skin exposure is characterised by redness, soreness and, if left unattended with daily exposure by a severe rash. The effect is similar to dermatitis or to an allergy which follows the same general pattern. The extent of reaction will also be highly individual in nature.

These products are not corrosive. This complicates the effect of exposure since the worker is not apt to recognise the presence of the material on the hands and by normal activity will tend to spread it to other parts of the body.

The chief concern here is accidental entry into the eye, as by rubbing the eyes or lids with contaminated fingers.

Another source of exposure which goes unrecognised in practice is soiled clothing or shoes. The uncured ink on clothing becomes a source of exposure, both at the soiled position, and also by secondary transfer to other parts of the body as mentioned above.
Finally, with regard to ingestion, tests conducted on these materials in the uncured state show that they have low oral toxicity. However, accidental or deliberate ingestion should always be avoided.

PRECAUTIONS FOR HANDLING

The following programmed is recommended for pressrooms using UV formulations. It should be followed by all those involved in ink handling or fixing and especially those workers involved with plate, roller or blankets wash-up. The necessary items should be readily available in the press area.

1. The use of standard barrier creams for the hands for those workers in all short-term exposure situations.
2. The use of vinyl or latex glove protection is recommended for personnel where continuous or long-term exposure is expected and cannot be avoided. This is especially useful in wash-up situations where solvents will be used. Disposable examination type gloves have been useful in practice being their snug fit is an added safety feature around roller nips.
3. It is recommended that goggles be supplied to pressroom personnel and be used at all times during wash-up. Goggles are a first line of defence against introducing materials directly into the eyes. They also reduce the chance of rubbing the eyes with contaminated hands. Should ink be accidentally introduced into the eyes, flush with water for at least five minutes and follow in-plant first aid procedures.
4. It is recommended that all personnel adopt the practice of cleaning ink from the skin with soap and water and not solvent. The use of solvent removes the natural oils from the skin and may actually aid the penetration of the offensive materials into the lower layers of the sink. This intensifies the irritation problem rather than helping it.
5. It is recommended that all personnel cleaning large spills of UV ink or varnish use gloves. In addition, any used wipers from a clean-up or wash-up operation should be placed in a container so that the wiper does not become a source of additional contamination to anyone in the work area. Solvents may be used with care in cleaning spills on the floors or equipment, provided gloves are used.
6. In the event that a spill accident occurs using UV inks, it is recommended that soiled clothing be changed immediately so as to prevent long term skin contact during the remainder of a shift.
7. Adequate ventilation is recommended throughout the press area. Localised ventilation has been found to be particularly effective around open roller train.
8. It is recommended that the practice of eating while working or in the immediate work place be discouraged and that good personal hygiene practices be encouraged at all times. Press personnel working with UV inks should be urged to wash thoroughly before eating or using sanitary facilities.

CONCLUSION

As can be seen, most of the above recommendations are little more than good common sense. They simply involve a re-education programme towards good work habits at the plant and pressroom level.

Experience gained from successful users of UV inks are applied and enforced by managerial supervision, health and production problems are minimised.

STORAGE

All UV curable products are reactive and must be stored under conditions which will avoid excessive heat and direct sunlight. All containers should be kept closed. It is recommended to store containers at temperatures between 50^0 and 80^0 Fahrenheit.

UV CURING SYSTEMS AND THE ENVIRONEMENT
We can summarise various positive aspects in the use of ultra violet curing which show clear advantages over conventional inks with or without in-line water based coatings.

VOLATIES
UV curing systems are 100% solids and as such are totally free of volatile solvents.

ODOUR/TAINT
Faster, safer low odour and taint are achieved since there are no oxidation byproducts. When conventional inks dry the inevitable vegetable oil content can cause decayed odour/taint problems.

CHEMICAL CONDITION OF FIILM
Printed films in their cured state are inert and also free of hydrocarbon distillate residuals, ie, less migratory than conventional.

SPRAY POWDER
Airborne dust is an undesirable condition in pressrooms and finishing and filling operations. UV eliminates the need for spray.

BIODEGRADABILITY
With long-term land fill, UV systems will degrade into carbon dioxide and water, whereas conventional ink will contain residual hydrocarbon distillate. In conclusion, we can state that UV has been used very successfully for 20 years in the UK with an excellent record of safe handling both in printing ink manufacture and during printing. The recommendations in hygiene and handling as given by SBPIM have been observed, practised and respected.

PRINT FAULT RECOGNITION
SLUR AND DOUBLING

Slur is caused by a difference in surface speed of two cylinders (Plate-Blanket or Blanket – Impression Cylinder) and results in a spreading of lines running perpendicular to the printing direction while lines running parallel with it are not affected. The visual effect is that the perpendicular lines become darker.

Doubling can be caused by register problems between different units on a multicolour press and results in a slightly mis-registered overprint of the same image. The visual effect is again that lines of a particular direction become darker. However, contrary to slur, doubling can occur in any direction.

Therefore, slur and doubling can visually be distinguished by two criteria:

a) Doubling shows two mis-registered images – one usually lighter than the other. Slur, however, makes the lines simply broader.

The two lines of doubling can be observed at the highlight dots.

b) Doubling can occur in any direction while slur happens only in the printing direction.

SLURRING

CAUSE	**REMEDY**
* Too much Ink	- Adjust Water
* Excessive back cylinder pressure	- Reduce pressure
* Excessive plate/blanket squeeze Pressure -	- Remove packing until image breaks at transfer then add 0.05 mm (0.002”) packing.
* Loose blanket	- Tighten blanket
* Blanket not square	- Replace blanket
* Wavy or Tight edged paper	- Use flat paper stock

DOUBLING

CAUSE	REMEDY
* Poorly tensioned blanket	* Retention blanket
* Poorly tensioned plate	* Retention plate
* Sheet slipping in grippers	* Adjust grippers

DOT GAIN

Dot gain is the enlargement in all directions which takes place in the dot area during the transfer stages from film to the printed sheet.

CAUSE	REMEDY
* Too much pressure	* Reduce blanket packing 0.025 mm (0.001”) at a time
* Blanket too soft	* Replace with hard blanket
* Ink too thin	* Increase ink tack
* Piling on blanket	* Wash blanket
* Over exposure (negative plates)	* Check exposure time (see manufacturer’s recommended time)
* Bad film/plate contact (negative plates)	* Improve stripping methods. Matt type film helps contact over large areas
* Soft dot negatives	* Use contact negative
* Veiled positives	* Check clear film for opacity and also dot shape
* Under development	* Use active developer and at 68^0 F – 20^0 C

DOT LOSS

Dot loss is a decrease in all directions which take place in the dot area during the transfer stages from film to the printed sheet.

CAUSE	REMEDY
* Abrasive paper dust	* Clean blanket regularly
* Wrong or too much anti-set off powder	* Use correct amount and grade of Powder on first pass through press
* Ink and water rollers set too hard	* Reset roller
* Over exposure (positive plate)	* Check exposure time (use Manufacturers recommended time)
* Bad film/plate contact (positive plate)	*improve stripping methods etc
* Too much White Light in Plate room	* Reduce to a minimum the stray white light in plate room when working with positive plates

TINTING AND SCUMMING

We will deal with both faults at the same time, because they may be confused both in appearance and meaning, when in fact they are caused by quite different factors.
Tinting and scumming both manifest themselves when non-image areas of the plate “appear” to print.

a) **Tinting** is an ink condition and takes place when particles of the ink pigment or colour leave the vehicle and are distributed across the entire area of the plate by the damping rollers. Easily identifiable on the sheet as an overall tint of the colour being printed – except on the paper grip margin. Easily sponged off the plate.

b) **Scumming** is plate condition and is recognised by non-image areas of the plate printing tiny spots in one or more areas or even over the total area of the plate. These ill register from sheet to sheet, since they are taking ink because the plate has become sensitised and accepts ink in these tiny areas. Easily identified on the plate and cannot be sponged off.

TINTING CAUSE

- Formation of oil in water emulsion due to colour/pigment leaving the ink
- vehicle and mixing instead with the water on the plate.
- The above condition can be caused by over reduction of the ink, which
- weakens the ability of the vehicle to contain the colour.
- The condition may also be caused by excessive additions of surface
- tension reducers to the fountain solution.
- Improperly washed dampers.

REMEDY

- Maintain sufficient “body” ink or correct by addition of extra strong varnish.
- Avoid additions to fountain solution whenever possible.
- Maintain accurate ink/damp balance with good ink and minimum damp.
- Ensure damping rollers thoroughly rinsed to remove all traces of
- cleaner/emulsifier.

SCUMMING CAUSE

- Badly processed plate.
- Improper plate treatment – eg, failing to gum and dry plate after
- corrections/etchings.
- Plate sensitised by reaction from substrate being printed.
- Stationary damp plate adjacent to wet damper rollers.

REMEDY

- Redevelop/etch/desensitise/gum and dry plate, according to type and
- manufacturer’s instructions.
- Check pH of substrate and neutralise with additions to fountain solution.
- When stationary, leave machine with dampers in plate cylinder gap.

TO DETERMINE BETWEEN SCUMMING AND TINTING
Delete in the non-image area where the problem occurs, wash with water and gum up. If the deleted area stays clean, it is scumming because the plate non-image area is sensitive. If deleted area continues to take ink, the problem is tinting caused by the press.

CATCH UP
This condition is identified as one or more areas of the plate which accept ink in what should be non-image areas, always extending between gripper to back edge, rarely from side to side.

CAUSE
* Insufficient damp is being applied to that area of the plate in order to prevent the ink adhering to the surface (other than the image areas).
* Badly set damping rollers.
* Dirty damping rollers.
* Badly set ink duct causing ink to be fed on one/more areas.
* Badly adjusted damp control rollers/squeegees.
* Water level in fountain too low.
* Badly worn damping rollers (no pile).

EMULSIFICATION
This is another problem which is peculiar to litho printing, and which can occur for a variety of reasons. First of all, we need to be clear about what this is and how we recognise it.
We said that “Tinting” was an “oil in water” emulsion. The condition we are now examining is a “water in oil” emulsion. In other words, a relatively small quantity of aqueous liquid has become completely integrated with our oily ink, and in its most advanced state the ink will perform physically rather like butter or margarine. The ink will no longer flow properly on the machine, it will not

transfer properly within the roller train nor will the image on the plate accept the ink, since it is no longer sufficiently “oily”. It will not transfer properly from plate to blanket, will probably “pile” on the blanket – in other words, it will accumulate there rather than transfer properly to the substrate – so that the impression, such as it is, will be weak, and at first sight appear to require more ink, which indeed it does, because though there may be more than enough ink on the roller train, it is no longer in any condition to transfer or print properly. The impression is “weak”, “washed out”, lacking strength, totally unacceptable. Look at the metal rollers in the inking train – there is no ink on them!

What has caused this dire state of affairs?

CAUSE

* Without doubt, the most frequent cause lies in feeding too much damp in the early stages of printing or make ready. This is invariably attributable to inexperience rather than any fault in materials.
* Formulation of ink – if incorrect – is the next most likely factor to blame, and this will probably be because the ink is too thin, so that there is a tendency to run excess water to keep the work clean, to prevent “greasing up”, thereby aggravating the problem.
* An excess of wetting agent in the paper coating can also contribute to this condition, but this is unlikely to take place before several thousand sheets have been printed and the reagents have had time to work back through the damping systems.
* Faulty formulation of fountain solution, eg, pH too low or wetting agent concentration too high.

REMEDY

Lithography is a chemical process of printing, not a physical one, and careful make ready is essential. Better to start with too little damp rather than too much. It is very much simpler and easier to add damp – just stop and sponge the plate – rather than be forced to take the damper rollers out to scrape some of the water out of them – or worse still – be obliged to wash up because the ink on the rollers is completely useless due to emulsification.

Few words from the author:
Would you like to get more information on uv curing and its application or similar data write to us or email.

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Notes: