## To dry or not to dry?



hp home digital photo studio

the distant cousin in today's graphic arts marketplace; direct print technology combined with infrared drying and UV curing have now become a viable competitor to litho and pre-print — so says Warren Bird, Vice President of US based JB Machinery Inc in the following report.

Flexo printing on corrugated is no longer

Just six short years ago, we wrote about how 'The Rules Have Changed', where by a fundamental shift had begun in flexography beginning in the late 1990s. That renaissance shall we say, saw the refinement of vacuum transfer, the introduction of servo drive technology, more accurate ink metering, improved doctor blade systems, variable ink formulations and far superior substrate surfaces, just to name a few contributing factors. Since that time, it has become evident that the technology movement and direct print flexography have been gaining market share in unison and at break neck speed.

Mega stores and supermarkets are now fertile ground for direct print with retail or shelf-ready packaging, POS/POP displays and pallet wraps all falling perfectly into the direct print quiver, where in the past folding carton, screen print and plastic containers commanded a far greater share. Vastly improved registration, print reproduction, more colours and gloss approaching film lamination are all factors that, when combined and offered in a single pass operation, can make for a very compelling value proposition. Now factor in the massive width format advantages while having the option for die-cutting, slotting, folding and gluing in-line and it becomes a relatively simple argument to bear assuming the run lengths and plate costs compute.

Further evidence of this continued movement can be derived from two very important industry commodities in the direct print formula for success, namely paper and ink. According to one of the leading coated liner mills in the world, the demand for coated linerboards started increasing rapidly in the mid 1990s. Since then, the

Decorative graphics... practical, not black magic!

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annual growth in this sector has been higher than the general growth for the corrugated industry, in some years clearly exceeding 10 per cent growth rates, but

typically showing no less than 5-7 per

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cent growth demand per annum. In conjunction, a recent study by the Freedonia Group concluded that although digital inks represent the fastest-growing product segment in the US printing ink industry, flexo sat in second place with the largest percentage annual growth from 2003-2008 at 5.4 per cent. A staggering growth rate when compared against all other print disciplines. One glance at the It is a simple fact today that the question most readily asked while purchasing or renewing a multi-colour printing machine is not; "Do we add infrared drying?"

table above (US Printing Ink Demand) embellishes the notion that packaging represents both the largest and the fastest growing market for printing inks.

Yet, direct print flexo is still in it's infancy. While the top 10 to 15 per cent of converters have invested in five, six, seven, eight and even nine color flexo printing machines, (with in-line drying, curing and finishing), the masses are still

fulfilling the traditional market demand for two, three, and four colour work on Kraft (brown) and White-top liner. However, in this global period of economic stagnation, it is those that continue to innovate, strive for litho-like quality, increased shelf velocity and amplification for their customers products, that are weathering the storm most effectively. In fact, recent interviews in the US market have revealed that some of the leading high graphics converters have actually achieved record monthly sales results from the 4th quarter of 2008 to the first quarter of 2009.

It is a simple fact today that the question most readily asked while purchasing or renewing a multi-colour



printing machine is not; "Do we add infrared drying?" Instead, boxmakers are asking "How many do we install, where and do we

install UV at inception?" For many, it has been a daunting

task to reach a decision on a relatively new technology while at the same time building a sales force, revised market approach and new scope to enter unchartered waters.

So how can this process and change in print practices be simplified? Simply by understanding how drying and curing systems simplify and expand the printing process. We should start by emphasising that a majority of the infrared users in today's corrugated arena are retrofit applications on older machines. The initial goal was to double or triple production speeds on basic two to four colour bleach and White-top applications, minimise marking/smearing, while at the same time eliminate two and three passes on high holdout clay-coated substrates. Many of these converters are able to take a claycoated substrate and print, varnish and die-cut inline at speeds ranging from 3,500 to 10,000 sheets per hour, depending upon the drying configuration, ink coverage and trapping requirements.

Infrared dryers deliver a radiated heat energy in either the short or medium wavelength in the electromagnetic spectrum or a combination of both. Radiated heat energy and supplementary forced hot air impingement penetrate the laminar layer of air that envelopes the moving sheet, exciting the ink vehicle

> (water and amines) which immediately permeate and evaporate from the ink or varnish film at the point of print. This accelerated evaportation process arrests the ink (resin/pigment) at the surface, increasing colour strength, and provides a more receptive surface for subsequent colours, traps and overprint varnish applications.

As with the lithographic

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has become the preferred drying method in flexography over all forced hot air applications. It is possible to expose flexo ink or varnish to a significantly higher level of focused heat energy for a shorter given dwell time while the majority of the moisture-laden air is extracted through the vacuum transfer systems. Needless to say, this has proven critical to overall print quality, as the ink film is not prematurely dried on the plate or anilox cell, therefore avoiding the bridging and plugging issues that are commonly cited with hot air.

industry 30 years ago, short wave infrared

Moreover, unlike any other drying methods, infrared provides instantaneous on/off response, extremely accurate and variable heat output adjustment, which when combined with automatic width control confines the infrared radiation area to the target image area only. This provides valuable energy conservation and ensures that the printing machine components' longevity, such as transfer plates, rollers, belts and the like, are not in any way degradated.

Typically, a minimum dryer configuration on two to four colour machines consists of one Interstation Flexo Dryer between the last two print units and a Final Flexo Dryer after the last print unit, prior to the die-cutter in a dwell or transfer section.

In the last ten years, it has become evident that a dryer positioned after each print unit renders optimal performance from inks and varnish on all substrates, particularly on multi-colour machines with four or more units or on lines where UV overprint varnish is being applied on the last print unit.

Converters can achieve the following benefits by drying each flexo colour before the next colour or varnish is applied:

- Increased productivity (converters report increases of as much as two and three times);
- Inline multi-colour printing, varnishing and finishing on clay coated stock;
- Improved colour brilliance and quality through dry trapping;
- Elimination of tinting and/or repeating when over-varnishing;
- Improved ink stability;
- Minimised (or eliminated) tracking, marking and smearing through unit transfers and stacker belts;
- Minimised (or eliminated) ink transfer to anvil covers increasing uptime and increasing anvil cover life;
- Considerable reduction of waste;
  Maximised gloss levels of ink and
- varnish;
- Thermal flow assist when UV overvarnishing inline.

Further developments and inroads have continued to be made by a number of the more progressive converters who have successfully gained new business by replacing pre-print and folding carton with equally acceptable results, eliminating costly process elements and handling.

Unlike the accelerated evaporation process with infrared, UV curing is a photomechanical process where the UV lamps produce ultraviolet energy, initiating an instantaneous chain reaction or polymerisation, commonly referred to as curing. Simply put, this means transforming a 100 per cent liquid to a 100 per cent solid upon exposure whereas only 45 to 55 per cent of a water-based varnish is captured as a solid due to the evaporation of the vehicle.

POS display by inspirepac Ltd

In the corrugated converting industry, UV curing is normally employed to cure UV overprint varnishes applied in-line over infrared dried flexo inks and then finished at high speed. Since UV varnishes are 100 per cent solids and there is little to no penetration, they offer gloss levels and a tactile experience near comparable to film lamination and abrasion, scuff and rub resistance at a much higher level than that of water-based varnish. They also provide functional properties designed for non-skid, writeable or moisture resistance.

For the corrugated converter, UV inline offers an opportunity to provide high value-added product at a low incremental cost. By drying inks with infrared, curing UV overprint varnishes and die-cutting in-line, converters achieve the following additional benefits to those previously listed:

- Instant drying for inline finishing;
- Maximised gloss levels approaching film lamination;
- Significant reduction of waste;
- Zero VOC emissions;
- Rapid startup and makeready, due to the capacity of UV overprint varnishes to remain open on press indefinitely;



Eliminated wash-ups and sheet wraps;Superior scuff and rub resistance.

Installation of infrared dryers after each flexo colour station (with infrared and UV after the last flexo station) enables the converter to print multiple colours; overprint varnish water-based or UV; and die-cut in-line at maximum designed machine speeds on high hold-out clay coated board stock. Of course, it must be recognised that the ink and varnish supplier is absolutely critical to the converters level of success.

## Success with one common goal

Now, let us share the following case study, a recent modest investment that has translated into significant returns during somewhat troubled times.

Even with a fragile economic climate, the management team at inspirepac Ltd in Chesterfield, England, elected to invest in some key upgrades from MarquipWardUnited, while adding a full complement of infrared dryers from JB Machinery. In brief, the decision was made to take their existing Ward 16000 (1676mm x 3200mm) printer/diecutter/slotter and convert it into a four colour 'High Graphics' rotary die-cutter by removing the slotting section, relocating the die-cutting section and installing a vacuum transfer section (1422mm) between the last down print unit and diecut section. In addition, one Interstation Flexo Dryer was installed after print units one, two and three, while a Final Flexo Dryer was installed after print unit four.

Within 30 days, inspirepac reported running a half pallet display for Walkers on the Ward using two colours plus varnish, with 90 per cent solid ink coverage on coated board, with dimensions of 2253mm x 1035mm, all while die-cutting in a single pass. Effectively taking a 10 year old gear driven machine that was running Kraft (brown) and White-top and creating a high graphics machine with vastly improved registration. Not only has this become an impressive value proposition at a total investment of \$450,000 versus a new machine at \$1+ million, but it also provides overflow wide format capacity, while freeing up further printing time for the six colour Bobst Masterflex-L in their Wetherby factory. Further advantages and benefits include:

- Quality better than screen print;
- Size a massive machine with a maximum blank of 1600mm x 3016mm;
- Speed faster than any screen press. It prints up to four colours and die-cuts inline at up to 6,000 sheets per hour;
- Cost a faster process, so on average a less expensive process on medium to large run lengths (1,000+ sheets);

Environmental – all water-based inks and varnish with no solvents. All waste inks are recycled. All water used in the wash down process is recycled on site.

In short, with the superior print quality, size, speed and inline die-cutting capability, savings are reported on average between 20 and 35 per cent factoring in initial and repeat runs versus screen print.



POS display by inspirepac Ltd The results speek for themselves NTERNATIONAL PAPER BOARD INDUSTRY MAY 2009

Winning one Corrbie is certainly a fine achievement... But sweeping the awards and winning "Best of Show" speaks for itself.

1<sup>st</sup> place 2<sup>nd</sup> place 3<sup>rd</sup> place

& Best of Show

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## Congratulations

to one of our great industry friends and partners Chief Container

2008 Winners in the category: Flexo Direct Print on Combined Liner Board

Because

Chief's award winning entries were each 6 color on clay-coated substrates and all were printed, UV varnished and die-cut in a single pass using a full complement of Infrared and end-of-press UV from JB Machinery.

