TRESU

Controlled ink logistics from bucket to substrate

Trends towards shorter production runs and the need to reduce downtime have made controlling the processes a matter of urgency. Christian Fogh, Product & Portfolio management, TRESU, explains that contra/led ink logistics offers the solution to predictable quality and an efficient workflow.

Explain the importance of process control.

In an age of shorter production runs, high running costs and stringent quality demands, packaging printers are driven to cut out waste of the workflow at every opportunity. That is only possible if one has full control of the processes. This is especially true in flexo printing situations, where performance depends on many components working harmoniously.

Efficient management of the ink supply is crucial to the profitability, not to mention reputation, of the business. Calibration of ink recipes requires the precision balancing of a tightrope act. Uniform, accurate, high-gloss and uncontaminated print results depend greatly on tightly regulating the ink or coating medium's flow, viscosity and pressure, from the bucket to the point at which it is applied to the substrate. The term for that regulation is 'fully controlled ink logistics'.

Why is manually controlling the ink unsuitable today?

The conventional method of ink regulation has been to manually top up the chambers with ink, but manual intervention and systems that expose the ink to the atmosphere have !imitations. It is an intensive, ongoing task that is prone to error. Furthermore, open trays induce evaporation, and without a supply system, it is impossible to efficiently feed unused ink back to the bucket after production. Manual chamber cleaning is an arduous task, severely impacting productivity when several colours on a press are needed. On central impression presses, the ability to control is limited because many areas of the press are inaccessible or invisible without aids such as ladders.
Moreover, general market trends make a more sophisticated ink supply a necessity:

- Achieving ink quality has become increasingly challenging: brand owners accept no visible deviation in quality of package presentation, which increasingly must include more colours and more complex formulations. For example, package printers report that an average job today will contain two spot colours.
- The trend towards shorter production runs in particular has made setup times and startup waste costlier. We hear from flexible packaging and corrugated board suppliers who have experienced a reduction in order sizes by 35% - from 70,000 m^2 to about 45,000 m^2 - in just three years, because retailers want to reduce stockholding costs by placing smaller orders more frequently. But whether one is producing ten thousand or ten million square metres, chambers need to be cleaned and recipes set with the same accuracy and dedication.
- Thirdly, the need for cost control is compounded by the running cost of a flexo press, which can be anything from 250 to 1,000 Euro per hour. Printers may be able to compensate for lost time by maximising speeds, in some cases to over S00m/min. But higher speeds can affect the ink rheology, and leverage the cost of scrapped material.

- Fourthly, brand-owners expect their suppliers to maintain safe, environmentally responsible practices, not least to protect their reputation as a 'sustainable' supplier.

It follows, therefore, that to meet productivity, quality and sustainability expectations, today's printer must have a professional, automated system in place to regulate the supply of ink from bucket to press, and maintain that delicate balance at all times.

What are the opportunities for improvement in the workflow?

lt's generally accepted that the key benchmarks for measuring the impact of the ink supply on overall performance are production time, consumption and man-power. By closely studying the workflows of Danish wide-web Flexo printers using the manual ink supply method, TRESU gained insight into where the opportunities for improvement existed. Over seven months in 2014, we measured performance at seven stages of the process from preparation to finishing, in terms production time and consumption.

Production time.

The average time spent at each stage of the workflow for each press studied was as follows:

The average time spent at each stage of the work-flow for each press studied was as follows:

Stage of workflow	Hours	Percent
Print preparation	31	1
Start-up of new job	200	6
Start-up of repeat job	520	15
Colour adjustment	475	13
Printing	1970	55
Finishing the job	389	11
Total	3585	100

The study showed plenty of room for improvement:

- Amid-to-wide web flexo press typically runs at about 55 percent efficiency, with the remaining 45 percent being lost to setup times.
- 27% of time was lost to adjusting viscosity, flow and pressure for repeat job start-ups and cleaning after production.

Time lost depends on the number, accessibility and weight of components that must be replaced or cleaned during or between jobs. It can take up to 45 minutes to clean each chamber, and several minutes to replace a doctor blade without a safe release and slot mechanism for example.

Consumption.

Through management reports it was possible to identify how a lack of control of ink supply resulted in overconsumption of substrates, inks, cleaning fluids and energy:
Substrates, the costliest form of consumption, especially for mid- and wide-web printers, account for between 60 and 90 percent of total waste. Without satisfactory ink control, paper or film can be lost because of:

- Start-up waste, due to excessive 'trial-and-error' recipe calibration
- Splashing
- Costliest of all: material rejects resulting from blistering or shadow printing.

Ink and additives account for up to 20 percent of waste costs.
In situations where the ink or coating medium is exposed to the atmosphere, waste results from:

- Foaming
- Inability to return inks to the bucket at the end of the production run. This can result in up to 20 litres of waste per chamber / unit
- The need to constantly top up ink trays with ink or extenders due to evaporation, which is also a serious health and fire hazard.

Cleaning fluids, comprising water, solvents and detergents, account for 5 percent of costs. Energy, accounting for 1 - 2 percent of all costs, becomes more expensive in solvent ink situations, where air-driven pumps are necessary because cheaper, electrically powered pumps are prohibited because they pose a risk of explosion.

What does this experiment teach about optimising ink supply?

The experiences of our sample of Danish packaging manufacturers clearly show that careful consideration has to be given to a design of the supply system. That design should offer:

- An enclosed system that allows no interaction between the ink and atmosphere at any time
- Automation of controls and ink recipe setups
- Reduced maintenance
- Easy, safe access

For this, and because of their reliability, speed and accuracy, automated ink controls, featuring ink supply systems that pump ink or coating into the press, and chambered doctor blades that deliver the medium directly to the anilox roll cells, are essential on today's presses.

How does the system work?

The key to control is enclosure of the ink system: this allows the harmonious, precise regulation of flow, pressure and viscosity, which in turn determines ink density, uniformity of coverage and dot gain.

The solution for that regulation comprises an ink supply system, connected by hoses to a sealed chamber doctor blade. These components must be seen as a whole due to their interdependency: the supply system automatically replenishes the chamber at finely calibrated rates, as the rotating anilox roll sucks the ink into the cells.

Ink supply systems.

The software-powered supply system is the measurement and control device. Its functions illustrate the interrelationship between flow, pressure and viscosity.
Flow is measured by counting the pump strokes, multiplied by a stroke volume that can be estimated to an accuracy of 2.5 percent. An ink supply system typically has a variable flow range, from 5 to 30 litres per minute. Stroke counting ensures that the supply system pumps precise amounts of fresh ink into the chamber at the right time.

Optimum pressure ensures ink or coating is free of air bubbles, both in the chamber and when it flows into the anilox cells. The supply system regulates pressure based on measurements at the chamber inlet and compensations for variations in chamber lengths and ink viscosity. Pressure is maintained by maintaining the chamber depth. The operator raises the pressure so a wall of ink forms at the point where the rotating cells meet the blade. This stops air bubbles from entering, thus preventing the foaming that can result in blistered print effects.

When the flow has been stabilized, the air regulation valve locks the air pressure to the pump. Since both the pressure inside the chamber and the air pressure to the pump are stable, only a change in ink resistance can change pumping frequency. Ink resistance, measured in viscosity, is determined by the supply system's software and is based on a known pumping frequency. Thus, the supply of ink is maintained without human intervention.

Specially developed software not only controls flow but stores viscosity, flow-rate and pressure data for each job for easy recall. According to our survey, the savings potential from this is significant, as more than one-seventh of down-time resulted from manually preparing repeat jobs.

The supply system also assures an accurate way of returning inks to the bucket and fast, thorough chamber cleaning, without manual intervention.

A cleaning system ensures the chamber is clear of residue, so ink is removed from the system. Cleaning cycles for solvent inks, e.g. on an eight colour press, takes up to ten minutes; for aqueous inks, 10 - 15 minutes are needed. Solvent consumption during cleaning amounts to 10-15 litres over two cycles. lf water is used consumption of 20-30 litres less than one litre of detergent is usually needed. Also, because of its flow measurement assures accuracy to one litre, the supply system can safely return up to 90 percent of the ink or coating medium to the bucket after production.

Savings in material waste and downtime are enhanced when several colour stations are involved. For example, a Jutland-based corrugated preprint supplier estimates it will save 40,000 Euro annually as a result of retrofitting a six-colour Cl Flexo press with an enclosed chamber doctor blade with automated supply system. They are able to return 19 of the 20 remaining litres on each colour station of ink back to the bucket after every job.
Chamber doctor blade

The chamber doctor blade features a sealed, airtight chamber into which ink is pumped and circulated. Blades feature one at the top and bottom of the chamber wall. The wall formed by the two blades creates the closed environment, thus allowing controlled consistent ink metering, prevention against leakage and easier cleaning or job changes.

The two thin blades make contact with the surface of the anilox roll. One blade prevents the ink from escaping the chamber, the other metres the ink from the non-cell areas, so the exact desired ink/ coating volume is transferred, making the fountain roller redundant. Anilox cell volume determines ink or coating lay down, ensuring consistent results, without intervention. Carefully positioning the blade at the anilox roller minimises blade wear, reducing maintenance costs, and ensures a uniform transfer in the cross direction.

Together with correct angling of the doctor blade which prevents air from getting trapped, a rubber seal system forms a perfect airtight closure and stops ink leakage from between the anilox roll and the chamber.

A clamp allows the slotting of doctor blades into position, and easy release, keeping changeover times as low as one minute. Advanced systems include a fully automatic means of cleaning the chamber hoses and anilox roll on the press.

Doctor blade systems are adapted according to the print width and ink/ coating volume required. Variations range from closed-cassette chambers for label presses, to 3500mm-wide types for corrugated board printing and even wider.

What are the options?

Software-driven ancillary equipment plays a significant contribution to achieving uniform quality and driving waste out of the ink workflow, alongside dispensing and proofing equipment.
There are various degrees of control. Control of flow, pressure and viscosity should be considered a minimum requirement. Depending on budget and production volumes, additional control of ink consumption, temperature, pH levels, weight and cooling offer value.

What are the factors determining a retrofit?

Ink supply systems can be retrofitted into existing presses, by a supplier that is capable of sound project management. **Such modernisation exercises can bring presses aged in excess of 20 years to the latest standards of productivity.** A smoothly running modernisation programme depends on the supplier working closely with the customer's technical staff to know the specifications and understand its operation. These include the connections for waste, cleaning, water and solvents; the type of electrical power and air supply; the age of the

machine may also necessitate a bespoke design. Furthermore, extreme height may require additional ink pumping stations.

Quality benefits.

Controlled printing and coating results in significant quality benefits:

- The tolerance of the colour, ΔEis stable, because the ΔEis not effected by uncontrolled conditions in the chamber.
- No contamination of air in the chamber, meaning blister-free print results
- High gloss values, meaning better reflection

Productivity and waste benefits.

- Ability to achieve high quality-print at faster speeds
- Automatic recipe presets ensure quality is 'right first time,' avoiding 'trial-and-error' on-press calibrations that waste materials in startup phase
- Consistent coverage of the substrate with a uniform ink/ coating thickness, requiring less energy to dry and delivering higher ink yields

- Manual intervention eliminated, so operators can focus on high-value tasks
- Savings of up to 19 litres' ink/ coating medium per chamber, thanks to supply system's ability to return chamber contents after printing
- Elimination of evaporation improves ink yields, reduces emissions and reduces health and fire risks
- Setup times cut due to easy recall of ink recipe pre-sets, automatic chamber cleaning and fast, safe blade-change. Benefits are magnified on presses with several colour stations
- Cleaner and safer operating environment, with less spillage and equipment in the vicinity of the press

In conclusion, ink logistics is the control of the ink through the supply chain, from the ink manufacturer's container to the point when it is applied on to the packaging substrate.

An environment where the ink is closed from the atmosphere delivers predictable quality, better productivity with reduced setup times, assurance of a solvent-free working environment, higher ink yields, longer ink life and lower maintenance costs.

About TRESU

TRESU is a highly specialized company offering flexible, customized solutions of flexo printing machines and ancillary produets for flexo and offset printing. TRESU has over 30 years of experience and expertise in the development and production of engineered solutions for the package print converter. With more than 98% of the production being exported, TRESU is a strong player on the global market. TRESU has production facilities in Denmark, Lithuania and the USA, sales companies in Germany, Italy, Japan and China, and an international agency network providing round-the-clock, local support and know-how.

Visit the company's website at www.tresu.com