FLEXO 101

What is Flexography?

Flexography, also known as Flexographic Printing or 'Flexo', is a method of printing using resilient but flexible raised image printing plates to print on a wide range of flexible substrates including plastic, metallic films, cellophane, paper or cardboard. These presses and the substrate webs they carry can vary in width from narrow to wide web as required by the nature of the work the printer produces.

Each station on a Flexo press will carry one raised image printing plate to transfer one colour to the substrate which moves through the press at high speed.By the time the substrate travels through all colour stations, the individual colours from each station are overlayed and the image is complete.

Flexo printing is most commonly used for printing on the non-porous substrates required for food and beverage packaging.

In Flexo printing, raised image printing plates are affixed to plate cylinders of various repeat lengths, and then in the printing process are inked by a roll or in many cases a doctor blade wiped metering roll, carrying liquid low viscosity inks (both water and solvent) onto the substrate.

Flexo printing most often utilizes continuous rolls (webs) of substrate for uninterrupted printing at high speeds. In this case the printed web of substrate will later require finishing which could include cutting, and slitting and then converting into the ultimate packaging product. Some Flexo printers are strictly printers who later send the web of printed substrate to a converter, while Flexo printing is also done as one part of the larger manufacturing process by converters such as bag makers.

Advantages

Flexo has an advantage over lithography in that it can use a wider range of inks, water based rather than oil based inks, and is good at printing on a variety of different substrate materials like plastic, foil, acetate film, brown paper, and other materials used in packaging. Typical products printed using flexography include brown corrugated boxes, flexible packaging including retail and shopping bags, food and hygiene bags and sacks, large paper and plastic bags such as used in fertilizers, and pet foods, milk and beverage cartons, flexible plastics, self-adhesive labels, disposable cups and containers, envelopes and wallpaper. Flexographic inks generally have a low viscosity, enabling faster drying and, as a result, faster production, which results in lower costs.

A Brief History

While Lithography has been in use since the 1890's, Flexographic printing began in the 1920's when It was known as Anilin printing.

The aniline printing process was introduced in the United States on a fairly broad scale in the early 1920's. Practically all the early aniline presses were imported from Germany, where the process is still termed gummidruck or rubber plate printing.

In America the process was called aniline printing because at the time coal tar dyestuffs - their parent substance being aniline oil - were used as the colouring ingredient in the inks.

With the war period over shortly after 1946, aniline as a printing method experienced a surge of rapid growth and acceptance in an ever increasing number of industries and substrate materials. The process was found adaptable to printing materials ranging from news stock to vinyl shower curtains. Aniline printing now established its own position. The number of converters, usually staffed by skilled craftsmen, multiplied rapidly. A new era had begun for an industry that was to grow by leaps and bounds.

Once aniline dyes were deemed unsuitable for food packaging, and new safe inks were developed and approved by the FDA, the term aniline was dropped and in 1951 the process was renamed Flexographic printing, and Williamson Printing Materials was born in 1952.

While quality was originally rudimentary, it has improved dramatically over decades and is now growing globally due to high quality, economic, and environmental factors.

Flexography Today

Today Flexographic printing is the fastest growing segment of printing, including wide web flexible packaging and narrow web label printing. It has evolved into a highly efficient and high quality process and able to produce more elaborate lavel and package decoration to capture consumers attention. As manufacturers of consumer goods strive to differentiate their products, labels and packaging are driving the growth of flexographic printing worldwide.

How does it work?
Flexographic Printing Process

Platemaking

Platemaking is a pre-press step that transfers the image to be printed into a number of printing plates each plate representing a specific colour. Platemaking has evolved significantly over years from being primarily rubber molded to today where the vast majority of Flexo printing plates are made of photopolymer. In the hotopolymer platemaking process a film negative of the artwork is created and placed over the raw photopolymer plate which is then exposed to ultra-violet light for a specific period of time. The polymer that was exposed to the light hardens and remains (the image area) while the unexposed polymer (non image areas) remains with a soft consistency which through a washout process is then removed and discarded, leaving a resilient raised image.

Photopolymer plates may be made using a variety of technologies, using liquid photopolymer or sheets of photopolymer that utilizes either Solvent, a Thermal process, and now environmentally friendly Waterwash photopolymer. Regardless of process selected by the platemaker, the result is a raised image plate, one for each colour in the printing job.

Platemounting

Once created, the plates are then mounted to cylinders which are then placed in the printing press. Specially engineered two-sided platemounting tapes (also called stickyback) is used to mount each plate to its respective cylinder. Crucially, to make a complete and clear image, each plate has to 'register' exactly with the other plates in the print job. To do this specialized plate mounting machines utilizing mounting marks (microdots or crosses) are used.

Printing

Once the cylinders are loaded into the printing press, and each colour station has ink of that colour and a correct viscosity, and the web of substrate material is threaded through the press, the Flexo printing process can begin.

In simple terms, as substrate material is 'unwound' from the web or spool at the starting end of the press, it travels through the press, and the multiple cylinders or rolls (except fountain rolls) at each colour station rotate at the same speed. At each station, there is an inking roll which is partially submerged in the ink tank. It picks up ink and transfers this to an anilox roll which then transfers the ink to the raised image plate which in turn transfers this ink to the substrate as it moves through the press. This is repeated with each revolution of the cylinders for the length of the print run. At the finish end of the press the substrate is 'rewound' into another spool or web.

During the printing process, once the substrate leaves one colour station it continues to feed along the length of the press through the remaining colour stations until the 'painting' of the complete image is complete. Between each colour station, the substrate passes through a dryer to dry that colour in a fraction of a second. If a UV-curing ink is being used, there is no dryer, but a UV light source instead which instantly cures the ink on the substrate. All of this occurs in a very fast process requiring great accuracy. Print quality is affected not only by the press, the ink and the printing process itself, but all the way back upstream from initial artwork creation and plate-making to platemounting. All steps and consumable materials used are critical in producing the desired and optimal print result. Skilled Flexo practitioners can diagnose quality issues on the end-product and identify where along the process a quality issue may exist.

To be slightly more detailed; the anilox roll is a knurled roll with thousands of tiny engraved ceramic cups (or cells) on its surface. It uses these cells to pick up a fixed volume of ink. On most Flexo presses that ink is then metered by a device called a doctor blade. The purpose of the doctor blade is to act as a scraper against the anilox roll to further ensure that just the right amount of ink is applied to the raised image plate. Proper metering or 'doctoring' ensures print will be crisp and clean without lumps or smudges from an excess of ink.

The finer the work, the tinier the ceramic cups or 'cells' on the anilox roll. The number of cells per linear inch is referred to as the 'line count' of the anilox roll, and will vary according to the type of print job and the quality required by the end customer. A course anilox roll may have 120 cells per inch where a fine roll may have 500.

Inside the Colour Station

In its simplest and most common form, the flexographic printing system consists of four basic parts at each colour station:

Fountain Roll

The fountain roll is generally a rubber-covered roll of either natural or synthetic rubber. It is positioned to rotate in a reservoir of thin ink. Its main purpose is to pick up and deliver a relatively heavy flow from the reservoir or fountain to the metering roll. The fountain roll is usually driven much slower than the metering in order to effect a wiping action with the metering roll it presses against.

Doctor Blade (Optional)

The doctor blade scrapes the anilox roll to ensure that a smooth thin laeyr of ink as predetermined in press trials is delivered to the raised image plate without lumps or excess quantities of ink. Doctor blades are primarily made of steel withy several different types of edges as determined for the specific press, anilox roll and print job.

Impression Cylinder

The impression cylinder is a smooth polished metal cylinder which services to back up and support the substrate as it comes in contact with the printing plate. The surface speed of the impression cylinder must be identical to that of the plate surface, anilox roll, and substrate. Otherwise, slurring, halos, smeared printing and reduced plate life will result.

Also, for quality printing, the accuracy of cylinder diameters, concentricity, gearing and bearing fit cannot be over stressed

Ink Metering Roll (Anilox)

The ink metering roll, generally called the anilox roll, is usually a metal or ceramic coated roll, engraved over its entire surface with tiny cells numbering from 80 to over 500 per lineal inch. The purpose of the metering roll is to supply a controlled, metered, fine film of ink to the printing plates affixed to the next roller in the train which is the plate cylinder.

Anilox rolls are carefully selected for specific types of printing, substrates, and customer requirements. Often the flexographic printer will perform test runs to determine the ideal anilox for producing the desired ink distribution for halftones, spot color, and solids.

Plate Cylinder

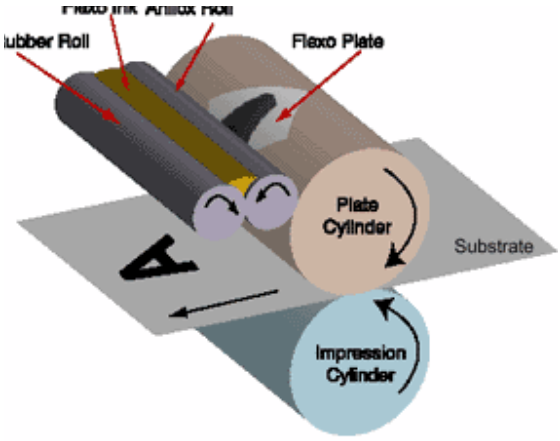
The plate cylinder is generally a steel cylinder placed between the ink transfer (anilox) roll and the impression cylinder. Printing plates are adhered to it through the use of a double-sided adhesive tape called stickyback. Other methods include metal-backed plates magnetically held to the plate cylinder.

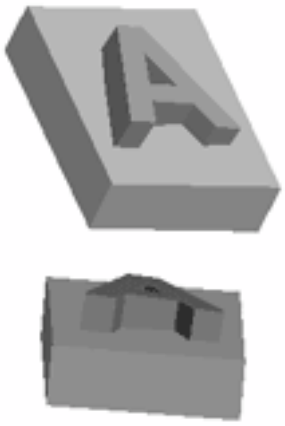
The ink transfer roll then transfers a finely metered film of ink to the raised surface of the plate, which in turn transfers the ink to the surface of the substrate.

As previously stated presses can be categorized in web widths. Traditionally Narrow Web is under 18” with Mid Web being 20-40” wide and Wide Web anything over 40” wide. Certainly these numbers are not cast in stone but serve as a good rule of thumb.

Interestingly though there are other critical differences besides physical web size that help define ‘narrow web’ vs. ‘wide web’. One of these differences is the speed at which the printing press runs. Where a wide web printing application can run at speeds exceeding 1-2000 feet per minute, narrow web flexo presses are often in the range of a few hundred feet per minute. This difference in press speed has a major impact on ink formulation. Wide web inks must have lower viscosity so that they will be faster drying. Having said this, in recent years, the development of UV inks has allowed for higher speeds and quality within Narrow Web helping fuel a major growth spurt at the expense of litho and gravure.

Wide web presses typically use a more closed chambered doctor blade ink metering system wheras narrow web presses often use a more open ink fountain and trailing doctor blade mounted on the anilox roll. As a result narrow web presses can be more vulnerable to solvent loss and pH variation in the ink fountain due to evaporation.





Configurations of Presses

Flexographic printing units in use today consist of three basic types: the two roll unit, the two roll unit with a doctor blade, and the dual doctor ink chamber system.

Two roll units are usually found on older flexographic presses, and on narrow web presses. Narrow web presses equipped for process colors often use the two roll unit with a doctor blade, and more modern wide web presses use the dual doctor ink chamber system.

The design of the flexographic printing unit enables press manufacturers to build presses in any one of three configurations:

The stack press.

Colour stations stack up vertically which eases access. This press is able to print on both sides of the substrate.

The inline press (including corrugated presses).

Colour stations are placed horizontally. This press can print on both sides via a turnbar and can print on heavier substrates such as corrugated cardboard.

Central impression cylinder press.

Colour stations are located in a circle around a single impression cylinder. This press can only print on one side but offers excellent registry.

Each configuration can be equipped with any of the basic printing units, depending upon the needs of the flexographic printer.

Wide web printing is dominated by a central impression (CI) drum flexo configuration to maintain good register whereas most narrow web presses have an in-line configuration. The CI drum is at a constant temperature of about 98 degrees F and in-between dryers are used as well as a post-dryer. Narrow web presses commonly utilize only in-between dryers or UV curing stations without post drying.