

Printers' Guide

Gravure printing

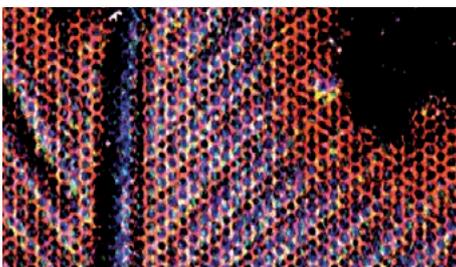
1. Gravure printing methods at a glance

2. Printing plate production
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The gravure printing process

Gravure printing is one of the four conventional major printing methods. Secondary processes are, on the one hand, the manual, artisanal techniques like copperplate engraving and dry point and/or etching and, on the other hand, the industrially used doctor blade systems, pad printing and intaglio printing. Within the industrially used methods, doctor blade based gravure printing plays a leading role. As far as the doctor blade based gravure printing process itself is concerned, a difference is often made between illustration gravure printing, gravure packaging printing, including gravure label printing and decorative gravure printing. All gravure printing processes originate in copperplate engraving. This technique was developed in Europe in the Middle Ages already and brought to perfection by real masters of their craft. Many of these works have survived for centuries and are now important sources of information for historians.

Copperplate engraving was later supplemented with etchings with a needle. With the start of industrialisation, gravure printing was first mechanised and then ripened into a full-fledged industrial printing method. An important stage in this development was the implementation of multi-colour gravure printing.



Typical gravure cell structure within an image area

In 1783, Thomas Bell received an English patent for multi-colour roller printing on textiles. In 1820, the American Jacob Perkins improved copperplate engraving and developed steel engraving thus creating the bases of modern banknote printing. Numerous experiments with the first gravure printing machines and the enormous demand of publishers to decorate their newspapers and magazines with multi-colour images advanced these developments.

In 1910, the Easter edition of Freiburger Zeitung was published with supplements in which multi-colour images produced in gravure printing could be seen. Doctor-blade based gravure printing rapidly established itself as the leading process for mass publications with a large number of images in the so-called illustrated magazines.

The basic principle of this printing method

The basic principle of copperplate engraving has been retained until today and is used in all different gravure printing processes. The motif that shall be printed is produced in the form of cells of different size on the surface of the printing plate. This can be achieved by means of engraving, etching or as is the case in pad printing by exposing and washing out a photopolymer printing plate. Between the cells, there are the walls. These very narrow, non-printing areas support the doctor blades during the printing process and prevent the printing form from being worn by the scraping process.

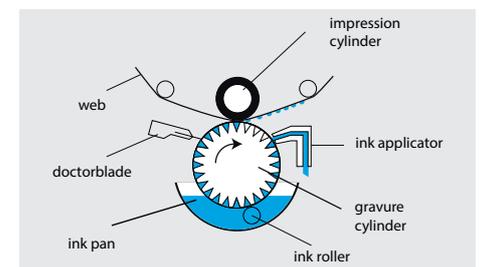
The printing process itself is an easily understandable process. The cells of the printing forme are flooded with ink, then the excess amount of ink is removed from the surface through the scraping process. The result is filled cells that contain different amounts of ink depending on the printing motif. The ink transfer to the substrate takes place through the short



Typical gravure cell structure within a text area

ink/substrate contact in the printing nip, i.e., the impression cylinder presses the substrate against the printing forme. The hard surface of the printing forme requires the impression cylinder to be soft. Therefore, the impression cylinder is coated with an elastic rubber layer. The hardness and elasticity of this rubber layer has an essential influence on the ink transfer during the printing process. A soft impression cylinder results in a wide printing nip and a correspondingly longer contact time between the substrate and the printing forme. As a result, the ink can be transferred optimally from the cells. The printed image looks soft and is rich in colour tones. A hard impression cylinder reduces the printing nip and results in a hard and contrast-rich printed image. In pad printing, the soft-elastic pad is an intermediate carrier and acts as the impression cylinder transferring the ink from the printing forme to the substrate, and/or the surface to be printed on. The low-viscous inking systems which are often used in doctor-blade systems require sufficient drying after the printing process before any further layer of ink may be applied.

Therefore, the printing units are equipped with an integrated dryer. The web-fed substrate runs through a drying section immediately after the printing unit where, e.g., the running web is heated by means of an impact jet drying unit and the solvent evaporates out of the humid ink film. A sufficient length of the web run and high dryer performance ensure rapid and sufficient drying of the fresh ink film. The combination of printing unit and dryer gives the doctor blade system a characteristic look which differs only with regard to its dimensions. Ink application in multi-colour printing takes place wet-on-dry. Therefore, the doctor-blade systems are constructed in unit-design. The long web path in the dryer of multi-colour machines adds up to a considerable length which quite often comprises a three-digit number of metres.



Scheme of the printing unit of a gravure printing machine

Fields of application and gravure printing products

Illustration gravure printing is still an important method for the production of periodically published illustrated papers and magazines with long runs despite the declining lengths of runs and profitability. Other products that add to the capacity utilisation of the printing companies are catalogues and advertising supplements. During recent years, web-fed offset printing improved to become a strong competitor of illustration gravure printing.

Gravure packaging printing is the second big domain of doctor-blade based gravure printing. Supplementing flexo printing, packaging made of film/foil, carton and composite materials as well as labels are produced, partly in a process combining both methods. A special niche are highly enhanced folding cartons for the cigarette and cosmetics industry.

In decoration gravure printing, special papers, films/ foils, composite materials as well as fibre fleece for the wallpaper and furniture industry are printed. Growing fields of application are special coatings and the transfer of functional layers onto a large diversity of substrates.

Intaglio printing is and remains one of the most important processes for the production of banknotes. Now, many hybrid techniques are used in banknote printing and different processes are combined to achieve higher forgery protection. Nevertheless, intaglio printing is the leading method for the production of aesthetic and sophisticated motifs with finest lines and elements, relief-type embossing and high colour intensity.

Since the 1960s, the industrial processes are supplemented with a direct gravure printing method, i.e., pad printing. Pad printing finds its domain in the

printing of three-dimensional objects, e.g., plastic moulded parts. In comparison with other printing methods, the printed area is rather limited to just a few centimetres. On the other hand, this method also enables to print one or multiple colours on irregular surfaces. Using a variety of pad shapes and hardness, nearly every surface structure can be achieved.

Pad printing is applied in the decoration of advertising materials, bottle caps or models. In the automobile and electrical industry, this process is used to produce, e.g. markings and decorations on switches, operating elements or housings.

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