

PRINTERS' GUIDE

Training Information & News in Printing and Paper Converting Technology

Flexographic printing

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4. Print quality

Print quality is only looked at when competing products or technologies are compared and all other criteria could not secure a points win for one side or another. Offset printing, e.g., is habitually assessed as a high-quality method, and flexographic printing as an inferior one. In reality, however, the required quality which also includes the characteristics is dependent on the purpose for which a print product is used. The requirements on a cement sack, for instance, are different from those set on a bag of washing powder. A napkin must

comply with other criteria than an adhesive label. They can all be produced with flexo printing presses, but the combination of motif, substrate, printing ink, forme and machines is matched with the individual product. Hence, a quality assessment can only be made with defined parameters. One key parameter is the printable line width in lines/cm (l/cm). For offset printing, line widths of 60 l/cm and 80 l/cm are used as standard. In special cases, the line width is higher. Flexographic printing, however, uses a wide range of line widths.

The choice of line width is orientated towards the product and the materials and/or their surface characteristics. In corrugated board printing (postprint) on coarse flutes and rough substrates, e.g., a line width between 20 and 35 l/cm is preferred. The printable line width in the high-quality print segment, however, can be up to 48 l/cm. This requires printing forme production and the printing machine to be efficient and the use of adequately smooth surfaces. Napkin printing, on the other hand, is generally on very rough and absorbent tissue and pulp surfaces. Despite the maximum demands on the printed motif, the printable line widths are between 30 and 40 l/cm. Totally different standards apply to printing on films and foils where now line widths of between 54 and 60 l/cm or even higher are achieved on smooth films and composite materials.

Another significant quality characteristic is the printable tonal value range. In flexographic printing, this criterion is dependent on two parameters. The first one is printing forme production. The letterpress printing method reaches its limits in printing forme production insofar that the 3% and increasingly finer screen elements on the printing forme are only similar to the tip of a needle. The reproduction process must ensure that these finest elements can be fully exposed and washed out or engraved. The second parameter is governed by printability in the machine. The printing forme, ink transfer and tonal value must remain stable during the print-



Figure 1: A comparison of different print products: a) simple corrugated board printing, b) napkin printing, c) beverage package



Figure 2: Visible banding in the printed image

Figure 3: A comparison of offset printing and flexographic printing



Figure 4: Halo effect at the edges in the form of a light outline around the printed area

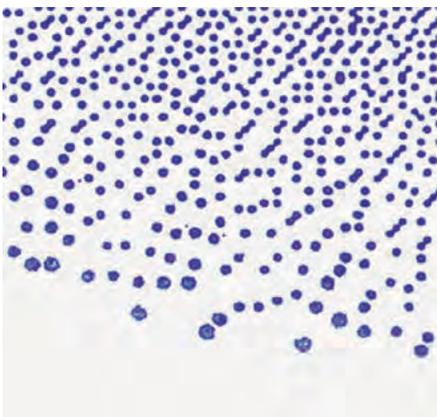


Figure 5: Dots at the end of a pass

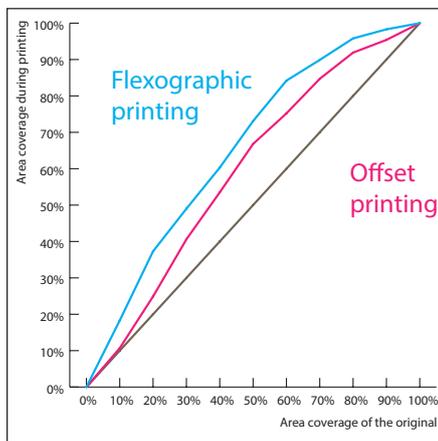


Figure 6: Characteristic print curves for offset printing and flexographic printing

ing process. The fine printing elements must not buckle or break off. More and more new technologies in printing forme production try to drive the tonal value limits towards 1%. Stability during the printing process is optimised by means of imposed supporting contours or printing elements with a shortened relief height (undercutting). The printable tonal value range in flexographic printing is often between 5% and 90% for simple jobs (e.g. simple corrugated board printing, tissue printing, papersacks). For jobs with higher requirements (e.g. label and flexible packaging printing), tonal value ranges between 3% and 95% are often achieved. In the so-called high-definition (HD) flexo segment, the manufacturers (DuPont and Flint Group) claim that tonal value ranges from 1% to 98% are already achieved on the printing forme. Production in practice, however, still pursues a different route. In order to avoid possible problems with finest halftones, the tonal value range is reduced. The limits normally are approximately 3% or 5%. All lower tonal values are cut-off during reproduction and are not produced in the printed image. The visible result is banding or striping in the printed image. This manipulation makes the printing process easier. The impression setting, e.g., can be somewhat higher in order to get a clean result for solids, too.

The comparison of the printed images produced using offset printing and flexo printing shows obvious differences. The shadow gradient in offset printing is more harmonious. Even finest tonal values are still reproduced. The flexo print was printed with a coarser printing resolution. The structure of the surfaces appears to be more unsteady and the tonal value distribution generates a lower image contrast. Due to the tonal value reduction in reproduction, the silhouette in flexographic printing is visibly interrupted, which produces a strong outline. Furthermore, an additional outline can be seen in the yellow patch at the right edge of the image. This outline is produced by stronger spreading in the yellow patch where the motif is. Spreads typically used in flexo printing are higher than those in offset printing in order to compensate for the larger register inaccuracies.

Besides the line width and the tonal value range, no doubt the tonal value increase (TVI) or dot gain is the most burning of all subjects in flexographic printing. The letterpress principle with flexible printing formes has disadvantages compared with, e.g., offset or gravure printing due to the printing process. The forces generated in the nip result in deformation and enlargement of the printing elements. In addition, the low-viscous printing ink may be squeezed out at the sides and, depending on the substrate, the absorptive capacity

of the substrate may cause further enlargement of the printing area. This results in the well-known squeezed edge or halo effect which is typical of flexographic printing. Particularly striking is the colour of the printed area. The key zone to which colour ink has been applied is surrounded by a lighter edge which in turn is enclosed by a darker outline. Figure 4 shows the typical structure of a halo effect at the edges.

Where the printed area is very small, e.g. screen dots, the key zone may be nearly free from ink so that the observer will only see a dark outline, which is the reason why this effect on the printed image is also called donut effect. The manifestation of the halo at the edge is especially increased if the impression setting is high. Compressible packings of the printing forme minimise this effect and ensure acceptable results and low tonal value increase in half-tone printing as well. Figure 5 shows strongly enlarged dots at the end of a 4c print run. Although the dots of the FM screen are consistent on the printing forme, some isolated dots are deformed more strongly at the end of the pass in the nip. Therefore, the halo created here enlarges the printed area substantially resulting in, as can be seen in this example, in a disproportionately high tonal value increase.

This fact is also obvious in the typical course of the characteristic print curve for flexo printing. Since it is to be expected that the tonal value increase is higher than in offset or gravure printing, a clear difference from the usually decreasing tonal values can be seen especially in the highlights. Due to the strong deformation of the smallest raster elements in the nip, the tonal value increase below the 20% level is significantly higher in flexographic printing than, e.g., in offset printing. Figure 6 shows a comparison of the characteristic print curves for offset printing and flexographic printing.

In conclusion it remains to be said that flexographic printing has experienced a very successful development the end of which certainly has not been reached. Compared with other printing methods, flexographic printing could improve in terms of productivity and quality to such an extent that it is now on equal footing with offset and gravure printing, apart from a few aspects for which the expectations must be scaled down. At the same time, flexo printing has established itself as the leading production method in packaging printing. The huge range of substrates as well as the variety of printing press solutions, printing formes and inks gives this printing method a degree of flexibility which can perhaps only be matched by screen printing. No doubt, the development will continue to be exciting and will bring numerous innovations.