Appendix: Flexographic printing technology

Flexographic printing has some unique properties and requirements for setting up curves and profiles. ColorFlow software has a variety of capabilities for setting up flexographic devices and device conditions, and for accurately simulating their color response on proofing devices.

Flexographic printing technology uses a flexible relief plate that transfers ink from a roller, called the *anilox* roller, to a substrate with a rubber-stamp-type mechanism. Ink-carrying surfaces protrude above a recessed base. Total plate thicknesses range from about 0.05 to 0.25 in. or 1.2 to 6.4 mm, with the base comprising about two-thirds of the thickness.

Like offset printing, flexographic printing (or *flexography*) uses halftone screens to render tints, but the protrusion of flexographic halftone dots above the base of the plate produces some physical effects that uniquely affect the color response of this technology. The two primary effects to control and proof flexography are:

- Highlight gain
- Minimum printable dot

Highlight gain

Small halftone dots form rubber pillars on the flexographic plate. Under compression, these pillars expand in diameter, transferring more ink to the substrate than expected from the intended halftone dot area. This results in large physical dot gain in the highlight region. Accurate color control and proofing require special treatment of this large highlight gain.

Minimum printable dot

Some flexographic plate technologies cannot reliably image and print a halftone dot smaller than about 5%. For lighter tints, halftone dot pillars may form on the plate, but they collapse under compression. This collapse causes excessive physical gain, smearing, and color instability—an effect called scum dots.

The smallest tint value that can be reliably imaged and printed is called the minimum printable dot. This dot varies according to screen ruling, plate thickness, web width, and other physical factors. To avoid scum dots, it is essential that dots smaller than the minimum printable dot are never imaged on the plate. Two approaches to curve shape are used to ensure that dots smaller than the minimum printable dot are not imaged on a flexographic plates:

- Bump curves
- Cutoff curves.

Bump curves

Bump curves map a low input tint value, typically between 0.3% and 1.0%, to the minimum printable dot. Lower input tint values are mapped to zero output, ensuring that no dots smaller than the minimum printable dot appear on the plate. The curve has a discontinuity, where the selected input tint value is “bumped” to the minimum printable dot. Above this discontinuity, the curve generally increases smoothly to 100%. The curve often becomes linear (output = input) at some intermediate point.

It is common practice to select 0.39% as the input tint value that is bumped up to the minimum printable dot. This value represents the first tint level above zero in 8-bit image files. This ensures, for example, that a gradient that extends down to 0% produces non-zero output on the plate over the maximum possible extent of the gradient. However, the bump causes the gradient to be darker than expected in the highlight region.

Cutoff curves

Cutoff curves are typically linear from 100% down to the point where input and output equal the minimum printable dot. Below this point, input tint values are mapped to zero output, ensuring that no dots smaller than the minimum printable dot appear on the plate. Cutoff curves, like bump curves, are discontinuous. They differ only in the input tint value that is chosen to reproduce the minimum printable dot on the plate.

Reproducing a gradient with a cutoff curve ensures that the gradient has the correct tonality down to the minimum-printable-dot cutoff point. The disadvantage is that a substantial portion of the gradient will be reproduced with zero output. For example, if a cutoff curve is used with a 10% minimum printable dot, then one-tenth the length of a gradient from 0% to 100% will have zero output.

ColorFlow can generate both bump and cutoff curves.