Special Effects & Doctor Blades

Meter Higher Viscosity Inks & Coatings More Effectively

Bill Warner

Everyone enjoys special effects, whether they are found in the latest sci-fi thriller, a video game, or on a printed package or label. As competition between products gets more intense, brand owners are always looking for a way to use special effects.

What are they trying to do? Three things:

- Stand out on the store shelf
- Trigger impulse purchasing
- Increase product security

To accomplish the intended special effect, various forms of specialty inks and pigments are available that include metallic, pearlescent and textured coatings, to name a few. The flexo process is fully capable of printing most specialty inks on various substrates but, as with any component used in the process, the doctor blade needs to be chosen wisely to get the best results.

DEFLECTION & ABRASIVITY

All specialty ink applications typically have two things in common: They generally have a higher viscosity and are more abrasive to the doctor blade than standard inks. Higher viscosity leads to blade deflection issues and increased abrasivity results in more doctor blade wear. Both of these factors can contribute to unsatisfactory and inconsistent results if the doctor blade material, thickness and edge shape are not adjusted to deal with the issues.

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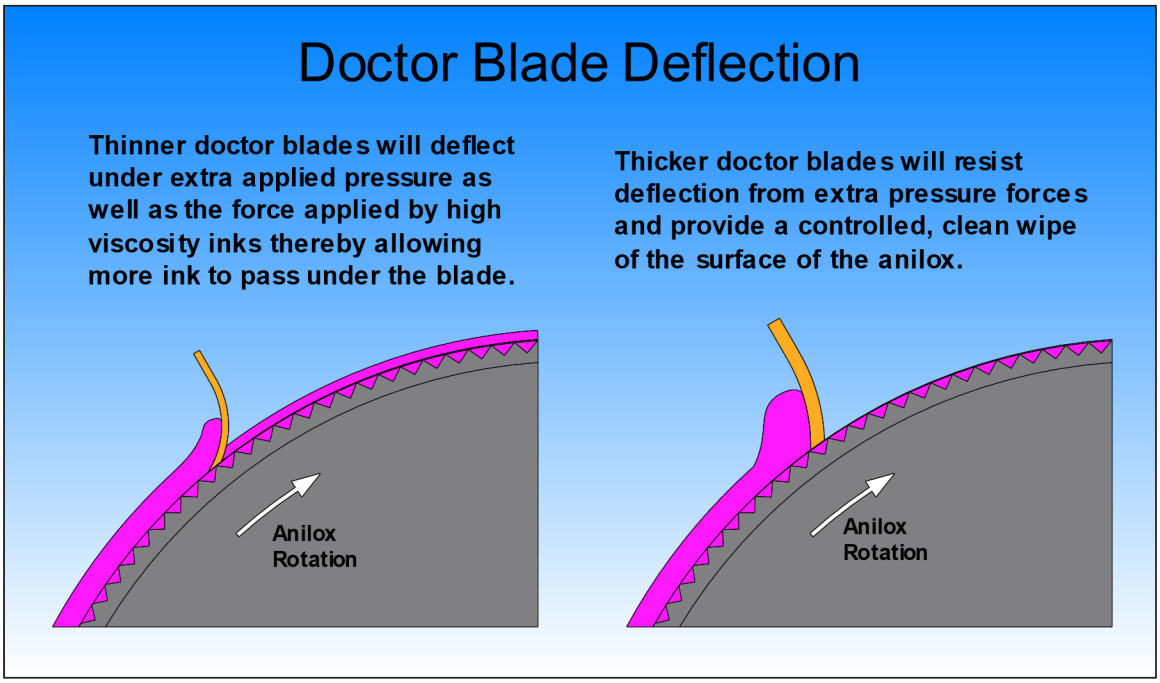
Historically, a basic carbon steel doctor blade has been, and still is, the most common material used across all types of printing whether it is narrow, mid or wide web applications. The carbon steel doctor blade performs well when used on shorter runs and for inks that are not known to be abrasive in nature. However, whenever specialty inks are considered, a blade material that offers longer life and consistent performance throughout that life is required.



All photos courtesy of Allison Systems Corp

When working with specialty inks, abrasive behavior and its resulting wear on the doctor blade comes from two sources: the ink and the anilox roll. The pigment used to produce shades of gold- and copper-colored metallic inks are ratios of copper and zinc alloys. Similarly, silver shades of metallic inks use highly pure aluminum for the pigment. Pearlescent pigments are made from glass-based platelets with mixtures of titanium dioxide and other iron oxides.

I am not an expert in ink composition and the previous description is an over simplification of the pigment structure. However, the point that I want to make is that all these metallic- or glass-based pigments are larger, harder and more abrasive when compared to common inks. Additionally, the specialty pigments generally are used in a higher concentration percentage (more abrasive particles) to achieve the desired result.

Most printers know that white inks, with their titanium dioxide pigment, are more abrasive to the doctor blade. The same holds true for the pigments used in metallic and pearlescent inks. Since the pigment size is generally considered large and the pigments need to freely flow from the anilox roll to the plate and substrate, the anilox engravings used for these specialty inks are typically well below 500 lpi and can have volumes as high as 70 bcm. Anilox rolls with these specifications are by nature abrasive to the doctor blade.

To illustrate this, an analogy could be made between anilox roll line count and sandpaper grit. When comparing the effect of running a piece of steel continuously over coarse or fine grit sandpaper, you would expect the coarse sandpaper to wear the steel at a faster rate than the fine sandpaper. All the abrasiveness described here, from both the ink pigment and anilox roll, will quickly wear a carbon steel doctor blade and necessitate the use of "long life" doctor blade materials. While some plastic doctor blade materials may provide acceptable results in these applications, particularly with high volumes, long-life steel doctor blades are known to provide more consistent and repeatable results across most applications.

Longer life can be achieved by adding a wear resistant coating to a carbon steel doctor blade or more wear resistant grades of steel can be used. Our experience has shown that doctor blades made from enhanced, high-quality tool steel perform well in specialty applications without requiring additional wear-resistant coatings to the steel.

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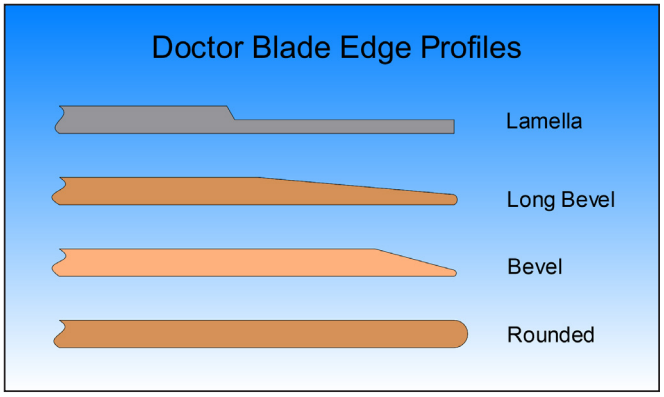
THICK IS IN

Years ago, when I first started in this industry, typical doctor blade thicknesses for most applications varied from 0.004-in. to 0.008-in., with 0.008-in. only being used on difficult applications. Today, with higher press speeds, ceramic anilox rolls and abrasive inks, typical doctor blade thicknesses vary from 0.008-in. to 0.012-in. The



0.004-in. thickness is almost never used anymore and is even difficult to obtain; the once common 0.006-in. is often being replaced with thicker options.

Most applications are using the 0.008-in. as a starting point and then moving to 0.010-in. and 0.012-in. thicknesses to help meter higher viscosity inks and coatings more effectively. Higher viscosity inks, such as those typically seen with specialty inks, apply more hydraulic forces on the doctor blade during the printrun. If you were to use a thinner doctor blade, the blade tends to over deflect, resulting in a flat contact angle that would deliver a poor wipe.

Poor wipe conditions can lead to print defects, print density variations, and, in the case of chambered ink system applications, back doctoring. Most specialty ink applications will require doctor blades that have a minimum thickness of 0.010-in., but 0.012-in. is often used, especially when the ink system is UV based. Increased doctor blade thickness is also necessary to effectively wipe the large particle sizes found in metallic and pearlescent inks. The thicker doctor blade will be able to better control the particles, so they flow in the cell structure of the anilox roll in a manner that will provide uniform pigment distribution to the plate and ultimately the substrate.

SHAPE MATTERS

So far, we have covered material selection and thickness. The final piece of the puzzle to consider when choosing a doctor blade for specialty inks is the edge shape. There are four common edge shapes being provided by doctor blade suppliers with variations found within the four groups. They are:

- Lamella (reduced thickness or stepped edge shape)
- Beveled (typically a 15-degree bevel angle or greater)
- Long bevel (typically a 10-degree bevel angle or less)
- Rounded (polished and rounded edge only without any additional edge shape)

All of these shapes have a place in flexo printing, but two of them are not recommended for specialty inks. The two edge shapes not recommended are the lamella and long beveled. When used with specialty inks, they will be more likely to over deflect when subjected to the high forces required. Conversely, the beveled and rounded edge shapes provide a very robust working edge that will resist high applied loading and over deflection.

- Use the beveled blade for more detailed print jobs that typically are run with higher linescreen, lower volume anilox rolls
- The rounded edge is best used for less detailed, higher ink coverage jobs that typically are run with lower line count, higher volume anilox rolls

SET FOR SUCCESS

Although the focus of this article is on choosing doctor blades, I would be remiss if I did not at least touch on the topic of setting the doctor blade. The best blade for the application will not perform well if it is not set up and used correctly. This is even more important when discussing difficult applications such as specialty inks. Doctor blades are intended to run at approximately a 30-degree contact angle for flexo printing applications. Equipment manufacturers design blade-holding components to be able to achieve good contact angles that cannot be adjusted. However, improper blade installation or increased application pressure will quickly reduce the doctor blade contact angle and create print issues.

Before installing the doctor blade in the holding device, be sure all components are clean and in good working condition. Anything in the holding device that creates blade wrinkles or bowing will require additional application pressure to achieve a clean wipe. Always use the least amount of pressure that is needed to apply the blade to the anilox roll and achieve a clean wipe. This will allow the blade to perform as it is intended and it will also reduce doctor blade and anilox roll wear. If using a blade with a beveled edge shape, keep in mind that the bevel is not intended to run on the anilox roll. Always be sure to install the bevel away from the anilox roll.

To summarize, our experience has shown that the best blade choices for specialty ink applications will likely be a 0.010-in. or 0.012-in. thick, long-life enhanced tool steel blade, with a beveled or rounded edge shape. Be sure the blade is installed in clean, well-maintained holding devices and applied to the anilox correctly and with minimal pressure. If you follow these general guidelines, your doctor blade will be able to deliver the special effects your customer is expecting with minimal issues. Always work with your doctor blade supplier to help with recommendations for blade selection and application. ■

About the Author: *Bill Warner is the vice president of Allison Systems Corp. Throughout his 31-year career with Allison, he has been involved in the application of doctor blades and doctor blade-related components for various printing processes. Specific areas of experience include doctor blade sales, tech support, training and R&D, as well as the design of custom retrofit doctor blade holders and systems. He has a Bachelor of Science in mechanical engineering from Drexel University. For more information, visit www.allisonblades.com or contact Bill directly at bwarner@allisonblades.com.*