Sleeve adaptors – a technical challenge?

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Adaptors and sleeves are both innovative technologies offering the user a whole range of benefits. However, this requires precise adaptation as well as faultless running of both technologies. In recent years, the combined use of adaptors and sleeves on flexo printing presses has often caused detractions or even interruptions of the production run.

Sleeve technology has a 25 year history of development, growing alongside the steadly altering technical requirements of state-of-the-art flexo printing. Therefore, the flexo sleeve is a technically mature product. In contrast, the flexo sleeve adaptor is still in its early stages of development.

Almost all manufacturers of flexo presses offer machines with lateral loading and unloading and two different solutions for repeat bridging are available. The first comprises the use of sleeves with the appropriate wall thickness. The printing forme consists of an air mandrel with a sliding forme sleeve and operators refer to the sound overall tolerances. The second solution uses adaptors for the bridging of certain repeat lengths, allowing the use of thin sleeves and utilizes the high production speed of state-of-the-art flexo presses.

The print forme consist of an air mandrel, adaptor and forme sleeve.

The basics of the system

Sleeve adaptors have to meet the highest and sometimes even contrary demands. Accurate concentric running characteristics, static discharging capabilities for the problem-free use of solvent-based printing inks as well as reproducible air guiding conditions are some of the essential properties of adaptor systems. Moreover, they should have a damping effect on the resonances caused by the printing process.

They are considerably lighter than air mandrels, which facilitates handling and at the same time ensures the necessary fastness and rigidity of the sleeve adaptor.

Composite and specifications

To meet demanding criteria, high-strength synthetics with embedded carbon fibres (CFK) are used. Due to the high demand on part of the aircraft construction industry, there are delivery bottlenecks for these quite expensive materials. Therefore carbon fibres for adaptor manufacturing are only used if it is technically as well as physically inevitable. This means, the amount of carbon fibre for a CFK sleeve adaptor is proportional to its required fastness and rigidity. The remaining space is filled with other kinds of fibre, this combination is called fibre composite or hybrid.

The particular combination of carbon and glass fibre is determined by the needs for static, dynamic and rigidity as well as by the »Finite-Elements-Calculation«. In this context, the fibre module as well as its alignment is of particular importance. Further parameters are the diameter of the air mandrel, the external diameter, the face length as well as the maximum weight. If the manufacturer knows all these specifications, he will be able to produce a lightweight, yet fast and rigid adaptor.

Print quality and productivity

The aim of using an adaptor is the vibration-free transfer of the print image via the forme sleeve onto the substrate. Therefore firm fixing of the sleeve on the adaptor is a basic requirement, demanding high balance of the sleeve and adaptor. Moreover, the adaptor has to compensate streaking caused by the sleeve. It must be provided with a robust surface to avoid damage during sleeve changes. For mounting and demounting of the sleeve an air cushion is necessary, which requires an air pressure of about 6 - 8 Bar and an amount of air of 12 l/s.

Increased demands

The increased demands on quality and reproducibility require strict compliance to the aforementioned specifications. This excludes sleeve constructions to mount/demount with any amount of air and pressure. Concerning the internal deformability, state-of-the-art sleeves are provided with compressible layers of very close tolerances. For a long time, the tightrope walk between vibration-free performance at high press speeds and the claim for easy mounting caused huge problems for the manufacturers of printing presses and sleeves. Economic efficiency as well as increased quality demands forced all parties involved to take up the challenge.

Today, most of the printing presses provide an optimum air supply. Older presses are upgraded accordingly by passing a parallel air conduction to the sleeve station, supplying the mandrel. However, as with the sleeve, the air has to be transferred onto the surface of the adaptor with minimum loss. Due to the efforts for standardisation in flexo, it is desirable to achieve uniform mandrels on different printing presses. This is a necessary prerequisite for the introduction of standardized air guiding for adaptors.

The principle of hybrid sleeve adaptors

The hybrid sleeve adaptor (HSA) consists of a combination of two different fibre composite materials. The inner tube is constructed to facilitate mounting/dismounting of the adaptor using an air cushion. Depending on face length and special requirements, the adaptor consists of two outer circular blanks

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and one inner circular blank at least. The outer tube consists of two different composite materials, mostly carbon and glass fibre. A functional layer of different hardness is applied onto its surface (*figure 1*).

To avoid risks when using solvent-based inks, it is recommended to supply sleeve adaptors with the ability to discharge electrostatic energy. This is of particular importance to provide the package printer with a universal tool to process all commercially available inks and varnishes. The wall thickness ranges from 17 to 150 mm, whereas also thinner thickness can be achieved with special constructions.

Different methods of air supply

In the following, the focus is not so much on the fibre composite parts but the dependencies on the given press parameters.

With the HSA-Version 1, the air supply is performed with an inlet on the drive side (*figure 2*). From there, the air is conducted to the operator side via an inside supply pipe, providing the radial air hole. The supply of the axial air outlet is carried out via the middle circular blanks. The HSA Version 2 is identical in construction but with an air inlet on the operator side (figure 2).

Another solution is feeding the air via a radial groove on the air mandrel (HSA-Version 3). From the groove, the air travels through grub screws with air holes on the adaptor (serving as radial drilling) via a peripheral pipe back to the middle circular blank (*figure 3*).

With the HSA-Version 4 the air mandrel may also be used for the mounting/dismounting of conventional sleeves, with an air supply via the radial drillings of the mandrel. The adaptor is provided with a radial groove, supplying air to the radial drillings as well as the peripheral pipe (*figure 4*).

Obstacles to standardisation

Often air mandrels are used with air holes positioned far ahead. Due to the physical law that air (as well as water) always flows the most direct way, this construction is problematic. The air escapes forward and therefore is not available for the mounting/demounting of adaptors and sleeves. The HSA-Version 5 solves these problems with an ahead positioned metallic ring with an included O-ring, which avoids air escaping by sealing (*figure 5*).

Due to the aforementioned, the standardized construction of a hybrid sleeve adaptor is strictly speaking, possible. However, the every day production practice has its own rules, as the construction is limited by the different air guiding systems on the mandrels and the air mandrels of the respective printing presses.

Outlook

A main disadvantage of the adaptor technology is the high number of needless variations of air supply systems. Moreover, the overall tolerance of the printing plate may generate a negative affect. As the printing forme consists of several cylindrical bodies fixed one upon the other (e.g. base cylinder, adaptor for repeat bridging, sleeve as image carrier) with each cylinder having its own concentric running tolerances, these tolerances may add up.

However, the reasonable use of this technology offers significant advantages. The very low mass volume and therefore very low moment of inertia of a printing forme composition using adaptors allows significantly faster production speed with high quality results. Therefore, the use of adaptors increases the productivity of printing presses as well as the added value for the user. Moreover, the adaptor technology has paved the way for the broad use of thin walled sleeves.

For high quality flexo printing, adaptors must show a certain number of characteristics including accurate concentric running, the ability to discharge electrostatic energy, low weight, good damping characteristics as well as high fastness and rigidity. To push standardization ahead, the manufacturers of adaptors are challenged not only to even out such contrary characteristics but also to further optimize them. ■

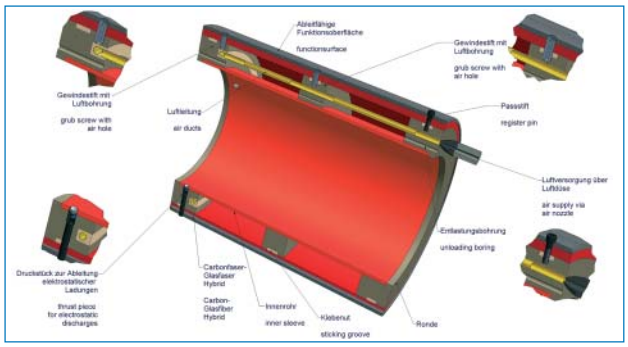

Figure 1: Hybrid sleeve adaptor, Version 1.

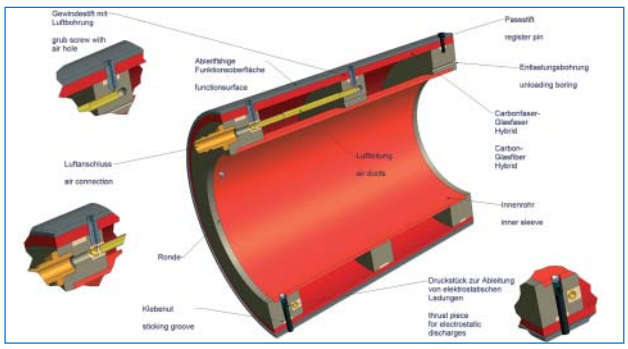

Figure 2: Hybrid sleeve adaptor, Version 2.

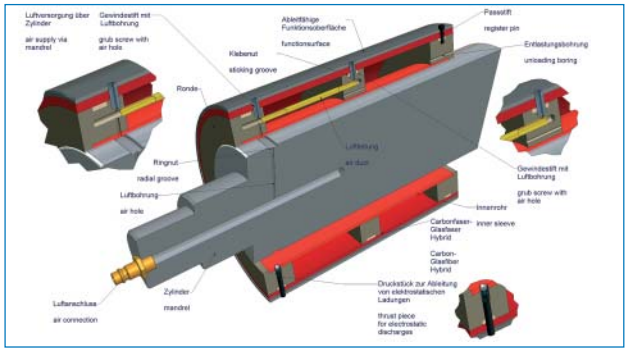

Figure 3: Hybrid sleeve adaptor, Version 3.

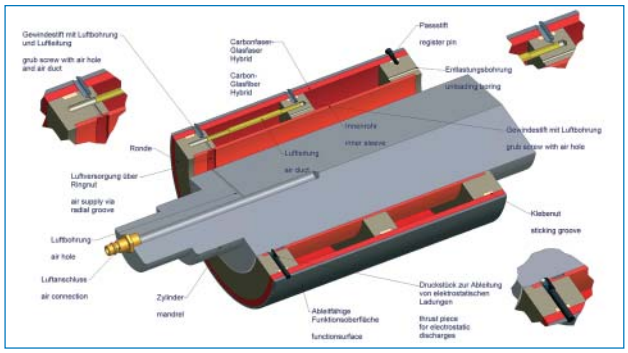

Figure 4: Hybrid sleeve adaptor, Version 4.

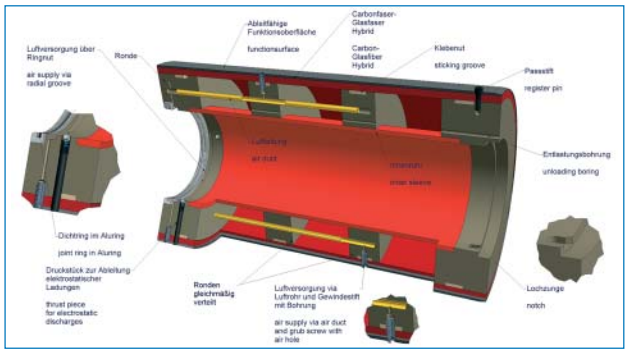

Figure 5: Hybrid sleeve adaptor, Version 5.