

Press News

Brushless DC motors increase reliability:

Wear-free Direct Drives for Strapping Machine Systems

Electronically commutated DC motors offer many practical advantages. They avoid the short-comings found with mechanical commutators, such as wear of the commutating device, brush wear, carbon dust contamination due to abrasion, starting difficulties because of commutator corrosion or spark formation. Modern drives also have the advantage of small physical dimensions. Even with conventional DC technology, development has not stood still. Here, new generations of motors are setting new standards for economic efficiency and long service life. Very often totally new approaches to solutions arise from this, as the following example from the packaging industry shows. Here, thanks to modern DC drives, "mechatronics" has found its way in. It avoids the need for mechanical parts that wear, reduces the number of components and thus lowers the follow-up costs of the machine.

Good shipping protection - tailored perfectly and efficiently to the product in question - is today mandatory in all lines of business. Here strapping system technology has proven itself in many cases to be the most convenient and often quickest method, with the lowest material and energy usage (Fig 1). The mail order trade provides clear examples of this, as for years it has been using the sturdy non-metallic straps for protecting carton packs. Strapping technology has also been long established in many other industrial and commercial fields, such as newspapers, building materials, wood etc. Short cycle times and the user's desire for higher machine availability demand that strapping machines have the latest technology and high-quality production. Good examples of this can be found from the Gerd Mosca AG engineering company, with its wide-ranging selection of strapping machines, where great emphasis is placed on functionality, ease of maintenance and high reliability. It is no great surprise then that DC drives have found their way into these machines. With their help, completely new types of sealing units can be manufactured that work with practically no maintenance.

DC sealing units increase economic efficiency

At the “heart” of the compact designs of the latest generation lie the integrated alignment and strapping devices, which work almost exclusively with distributed brushless DC direct drives. In contrast to older sealing units, where all the axes were driven via a line shaft, one can now avoid many mechanical components that are prone to wear, such as clutches, belts or chains; moreover the brushless drives are not sensitive to dirt build-up, as the critical brush contacts are eliminated. Compared to previous solutions, tests have demonstrated a service life of almost twenty times longer for these sealing units.

In total three brushless DC motors are used today in the latest Standard 3 units. The drives come from the specialist drives company ebm-papst St.Georgen, Germany, and work one as the propulsion motor driving the main shaft, one as a reversing drive motor for the infeed/retraction and the third as a strap tensioning motor. There were several good reasons for choosing the series-wound motor, ECI 24.42 (Fig 3), which is used in the same construction on all three axes:

Small physical dimensions, high torque and good dynamics

The benefit of electronically commutated motors lies in the high output from small physical dimensions. For a length of 103 mm and a diameter of just 56 mm, power ranges of up to 150W, nominal speeds of up to 6000 rpm and nominal torque of up to 170 mNm can be achieved. These motors, in the top range for their class yet still relatively inexpensive, are ideal for applications that demand such dynamic capabilities, low mass inertia and high torque levels. Even at high speeds temperature build-up is low, this being especially noticeable with fast cycle times. Even at forty straps per minute, critical temperatures in the sealing units are not reached.

The electronic commutation, together with the manufacturer’s proven bearing technology, also bring with them the guarantee of quiet operation. The noise level of the strapping machines is thus also relatively low. The signals from the integrated Hall effect sensors can be fed to control electronics in the shape of a 1-quadrant controller with plug braking, for further problem-free processing. There are also special flat units, where the motors and the electronics are just laid out differently to the standard version.

Easily integrated into the application

All three drives could easily be integrated into the application. The main drive was combined with a special two-stage flat drive that works with a reduction ratio of 36:1. Using a cam disk the drive initiates the other axes of the

sealing unit. When driving the strap tensioner pulley a single-stage planetary gear with a reduction ratio of 7.4:1 provides the appropriate torque. For tensile forces over 12 kp or strap widths over 12 mm then a two-stage gear is used in order to achieve a greater reduction ratio (20:1) and in turn higher torque. For infeed/retraction the motor works without gearing.

A special engaging piece was shrink-fitted onto the shaft of the infeed/retraction motor, to guarantee a friction-locked connection between the drive and the subsequent mechanics. The electrical connection was also customised to fit the application. For the connection between the motor and the controller, the drives are equipped with a cable harness of between 500 and 700mm and with an eight-pin Phoenix connector.

Mechanically commutated DC motors with a long service life.

An electronically commutated DC motor is also fitted to the automatic tensioning unit. When the strap is being threaded onto the storage spool the torque-limited drive ensures gentle tensioning of the strap. However for cost reasons with certain strapping machines a mechanically commutated DC motor was chosen. The motor, model BCI 63.55, also comes from ebm-papst. The main benefit of this completely newly designed generation of motors is the excellent performance to cost ratio as well as its long service life:

In continuous operation the service life is given as more than 3000 hours run. When used on the tensioning unit of the strapping machines this would equate to at least 5 years operation, which would be more than adequate. The motor has a length of only 125 mm, with a diameter of 6 mm and delivers a nominal torque of 270 mNm. In addition to the 24 V version used in the strapping systems, this motor is also available for 12, 40 and 60 V power supplies.

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Fig. 1: Thanks to the latest DC drives, “mechatronics” has found its way into modern strapping machines. This avoids the need for mechanical parts that wear, reduces the number of components and thus lowers the follow-up costs of the machine.

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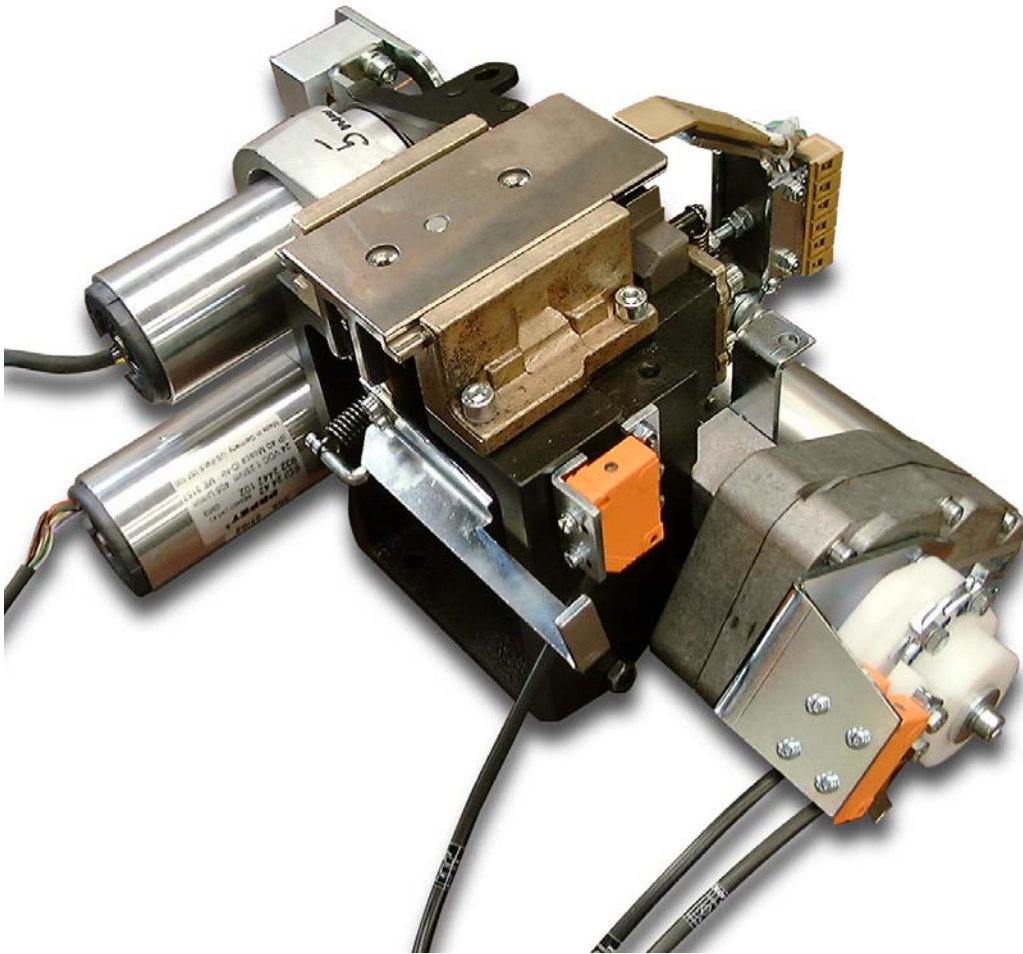


Fig. 2: At the “heart” of the compact designs of the latest generation lie the integrated alignment and strapping devices, which work almost exclusively with distributed brushless DC direct drives.

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Fig 3: The benefit of electronically commutated motors lies in the high output from small physical dimensions.

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Fig 4: The main benefit of this completely newly designed generation of motors is the excellent performance to cost ratio as well as its long service life.