

High power density motors create new possibilities for rubber manufacturers

by Fausto Belotti, ABB Motion

From mixing to extrusion, calendering, cutting and more, electric motors are critical at almost every step of rubber manufacturing. As motor technology has advanced rapidly over the past decade, latest generation high power density electric motors overcome many of the limitations of older models. They offer advantages in terms of size, precision and other critical areas; and, as a result, give rubber manufacturers a competitive edge in productivity.

Longstanding challenges

Traditionally, motor driven equipment in a rubber manufacturing facility has used low powered DC motors. They are large, not very energy efficient and difficult to maintain. In particular, the carbon brushes used in these motors are prone to wear, which shortens the machinery's life span.

More modern machinery uses AC motors, which offer a range of advantages. However, standard AC motors also have limitations; most significantly, their high rotor inertia makes it difficult to control them precisely. This is especially challenging in extrusion applications, where precise control is required to achieve a consistent product.

For demanding applications within a rubber facility, specialized AC motors (sometimes called square frame induction motors, low inertia motors or vector motors) present a solution. These models, such as ABB's high dynamic performance

(HDP) motors, achieve a significantly greater power density than conventional AC motors.

Advantages of HDP motors

HDP motors offer a range of advantages for rubber manufacturing applications. They have low rotor inertia, high overload capacity and impressive dynamic response. Each of these features results in manufacturing benefits. The low rotor inertia of the motor enables a faster cycling time; so, for example, the machinery it controls can move back and forth more quickly and precisely. This can result in up to 15% higher productivity compared to regular AC motors.

The high power density of HDP motors, meanwhile, means they are more compact than other motors (figure 1). This enables a smaller installation footprint; or alternatively, more rubber lines in the same footprint. This can restrict access space for maintenance, which is why the high reliability of the design is important. Moreover, in regions where space comes at a high cost, HDP motors pose a great solution to fit more production into the same footprint.

Further advantages come from integrating HDP motors with variable speed drives (VSDs). HDP motors are designed for use with variable speed drives. A VSD enables the precise control of a motor by adjusting the voltage and frequency of the electricity supplied to it. Motor drive packages offer significant precision advantages and are ideal for applications such as mixing, extrusion, calendering, tire press curing, conveying, winding, and more. ABB VSDs are designed to perfectly fit HDP motors for the best possible performance solution.

VSDs also enable motors to achieve greater energy efficiency. Since a motor runs at full speed unless controlled by a VSD, using one saves power. Even small reductions in total speed, such as during extrusion, result in significant energy savings; slowing a motor just 20% using a drive cuts its energy use by 50%.

Specifying the same brand of motor and drive enables additional optimization, increasing the energy efficiency of the system, while reducing negative harmonics. This enables a lower cable cross section to be used alongside a smaller transformer.

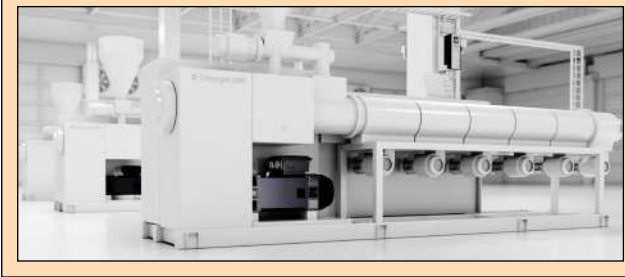
There are also significant maintenance benefits, since HDP motors are also designed for intensive work in rubber applications where lots of carbon dust is present. HDP motors are brushless, so they contain fewer moving parts than DC motors. They are, therefore, easier to maintain, and more reliable.

Water cooled solutions can also be specified. These guarantee a perfect seal, ensuring the motor's internals are not exposed to carbon dust that might cause wear or failure. They also cool down the motor much more efficiently than air, enabling a further increase in power density over regular air cooled HDP motors. The water jacket also reduces the noise coming from the motor to create a more pleasant work environment.

Figure 1 - a full range of machinery motors is optimized for high power density



Figure 2 - rubber manufacturers can access the benefits of HDP motors in both retrofits and new installations



HDP motors can provide power output of up to 2 megawatts (MW). They are available in a range of frame sizes, from 80 to 400, and designs, including square and cross section frames. This makes it easy to integrate HDP motors into a variety of machine types. High speed and water cooled models are available, and HDP motors are suitable for use with integrated mechanical brakes. HDP motors are also compatible with programmable encoders.

Suitability for new and existing installations

Rubber manufacturers can access the benefits of HDP motors in both retrofits and new installations. Due to their common frame sizes, HDP motors can act as drop-in replacements for existing motors (figure 2).

The replacement process typically takes under an hour, as the motors are designed with accessible connection points and flexible, adjustable mounting options for components such as the terminal box. Installing accessories, such as brakes, cooling fans and encoders, is similarly straightforward.

Matching the frame size of an existing motor with an HDP motor minimizes the engineering work required. Since the HDP motor of equivalent size is more powerful than the motor it replaces, operators have the option of running the machine at a faster rate. Even if they maintain the existing rate of operation, they benefit from the motor's improved inertial, overload and response properties.

In new installations, a facility can specify a low inertia HDP motor of a smaller size to achieve the same work as a larger, higher inertia model. At the same IP rating, a new HDP model is typically at least one frame size smaller than a standard induction motor. As a result, the machinery takes up less floor space and the facility can fit more in, increasing throughput.

More power, better products

In a competitive industry, rubber manufacturers face pressure to deliver high quality products at affordable prices. The best way to achieve this is investing in equipment that maximizes throughput and increases product consistency.

Due to the higher torque and smaller size versus conventional AC motors, and huge advantages over the DC motors still in use at some facilities, HDP motors are a clear choice for upgrading and specifying new equipment within rubber facilities.

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