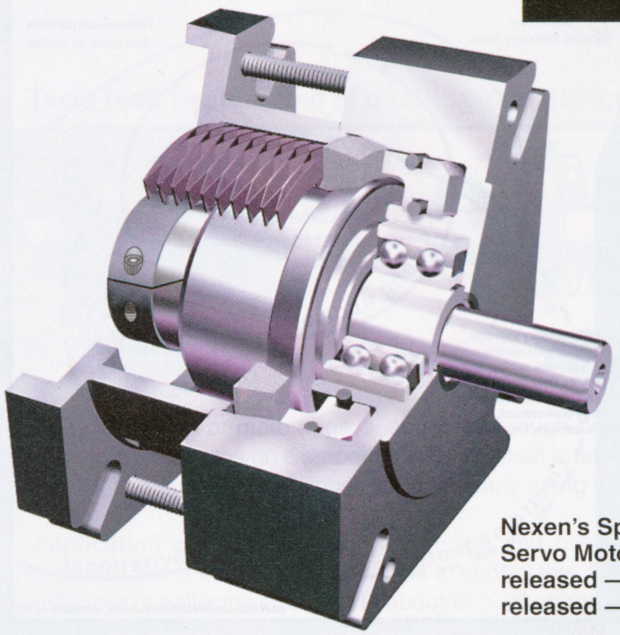
Trends in braking technology

Keeping up with ever changing braking technology and global safety standards requires due diligence on the part of savvy design engineers. Learn what a few of today's brake manufacturers are seeing as market trends and the most important safety standards.

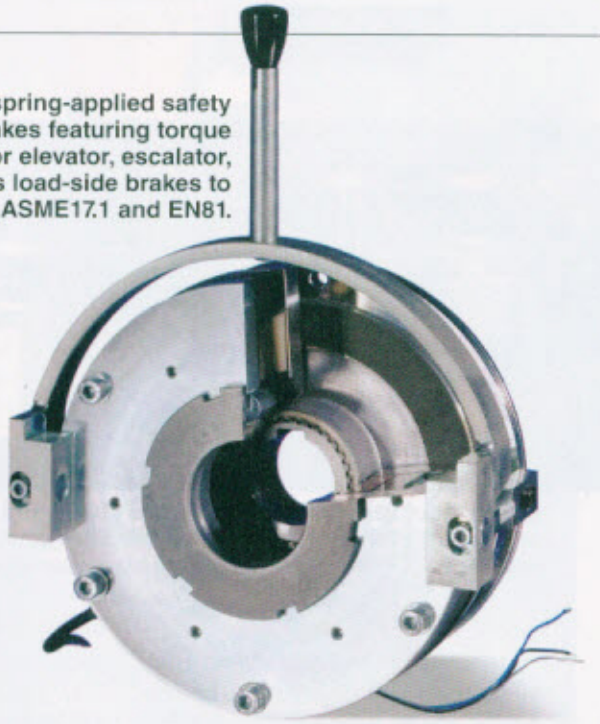
By Frances Richards, Senior Editor



Nexen's Spring-Engaged Eclipse Servo Motor Brake features an air-released — rather than electrically released — design.

In the world of motion control and power transmission, *control* is the key design objective. Put simply, stopping a load in a predictable and controlled manner is at least as important as the motion itself, especially when it comes to the health and safety of machinery and operators. To find out what's new in the world of brake design, we asked a few manufacturers what they are seeing as overall business trends and if they've developed any innovative products lately.

Hank Schilling of Nexen Group Inc., Vadnais Heights, Minn., notes that the company produces a line of motor brakes that mount directly onto servo and ac motor flanges. For example, the company's Ball Screw Brake with plug-in coupling mounts directly on the machined end of ball screws. Nexen's brakes are spring-engaged, air released devices. Here's how they work: Springs push against a wedge-shaped piece of friction material and force it between the tapered



BFK468 (pictured), BFK455, and BFK470 series spring-applied safety brakes from Lenze Americas are multi-coil dc brakes featuring torque ratings to 1,500 Nm. The brakes are designed for elevator, escalator, stage, and theater lift applications, and are used as load-side brakes to provide redundant safety braking required by ASME17.1 and EN81.

surfaces on the shaft and air chamber. The facing is split in one location and constricts around the shaft's tapered surface. Air pressure (80 psi) is applied to release the brake. The brake is normally on (engaged) until air pressure is applied to release it.

"The dual friction interface produces enough torque to stall the motors and is a true zero-backlash device, which is important in many applications for holding accurate position," says Schilling.

The company's *air released* motor brakes have an advantage over traditional spring-engaged, *electrically released* designs because no energy is consumed while the brake is engaged. In contrast, an electrically released brake consumes power continuously, thus creating heat inside the brake and detracting from its ability to produce full torque.

With regard to overall trends in braking, Schilling points to harmonization of international safety standards allowing machine builders to develop and use globally acceptable safety solutions. He also sees more intelligent and safe machine control networks and formal risk assessment and risk reduction programs adopted by U.S. standards associations having an impact. Schilling cites various standards that are having an impact on product design, including the ANSI B11 Series and OSHA rules in the U.S., and in Europe, EN 954-1 (Categories B, 1, 2, 3,4), Machinery directive 98/37/EC, and DIN EN 1050/ISO 12100-1.

As far as sizing, the following specifications are critical when applying spring-engaged devices: Categorize the application (horizontal or vertical), and then determine mass (weight) of the load, kinetic energy per stop, load velocity, brake force, engagement time, allowable travel distance during brake engagement, ballscrew driving torque and back drive torque, and motor flange specifications if applicable.

"What we're seeing lately is an increase in static or holding brake applications and a decrease in dynamic or service brake applications," says Alex Himmelberg of Lenze Americas Corp., Uxbridge, Mass. "Most dynamic braking is now done by the variable frequency drive or using servo control. Load-side safety brakes (holding, parking, static) are required to ensure that the load remains at rest until the drive restarts, in case of power failure or any failure in the drive train between the motor brake and the final

Ogura Industrial Corp.'s Thin Profile MCNB Brake employs a higher coefficient of friction material and more efficient coil flux path to reduce brake size. ***Opening article image also courtesy of Ogura.***

load shaft."

As far as specification advice, Himmelberg says it's important to first determine the braking requirement: Is a dynamic (service) brake required to stop the load or is a static or *holding brake* needed to hold the load at rest and provide E-stop operation? For dynamic applications, first determine the load type (horizontal or vertical), then calculate required braking torque, and finally determine cycles per hour and perform a thermal load check if cycles exceed published values.

Spring-applied brakes continue to be one of the most diverse and constantly changing product categories, according to Frank Flemming of Ogura Industrial Corp., Somerset, N.J. Several trends have emerged over the past couple of years across different markets.

"For consumer and robotics applications, low cost is always a factor, but we're also being pushed to decrease the physical size of our brakes," says Flemming. "In our new Thin Profile MCNB Brake, we're able to physically reduce the brake's dimensions by using a higher coefficient of friction material and more efficient coil flux path. For high volume servomotor manufacturers, we're able to make the brake part of the end bell of the motor so that our Motor End Brakes are extremely thin, reducing previous axial length by as much as 60%."

For industrial customers, Flemming cites requests from customers for more value-added brake components to better meet certain specifications — with custom coatings and limit switches or with epoxy-coated housings and stainless-steel release levers, for example. Further, Flemming notes that when motor manufacturers add brakes, they don't want to change the motor performance, so any added inertia from the brake must be minimized. Industrial customers also want the brake to be delivered to them with customized torque specifications. Many times, this requires burnishing, so Ogura has implemented a number of burnishing stands to pre-burnish brakes. Internationally, Flemming has seen a change in specifications for elevator brakes in Europe, Japan, and other countries, which led to the development of the company's new Double Elevator Brake.

"Over the past couple of years, we've also seen a resurgence in requirements for spring-applied clutches. This clutch style is typically engaged all the time when no power is supplied, but when electrical power is applied to the clutch, it releases. In any application where it's critical that the unit drive all the time, even with the loss of electrical power, a spring-applied clutch could be used," says Flemming.

Regarding sizing and selection, holding brakes are relatively easy. Besides dimensional and voltage requirements, the only pieces of information needed are the holding torque required and speed when the brake is not engaged. Stopping applications are more complicated: Manufacturers must know the running speed, inertia, and time required to stop. From those values, one can determine the torque required to the brake — and when that is factored in with the cycle rate, the brake manufacturer can determine the temperature rise and overall cycle life estimate.

Coming soon: Standards update

ISO 13849 is a globally recognized standard originally released in 2006 and adopted by the European Union as a required standard in 2009 as EN ISO 13849. The standard categorizes safety levels, helping designers identify the level of safety necessary to effectively mitigate risk. As of December 31, 2011, two safety standards – EN ISO 13849 and EN IEC 62061 – officially superseded EN 954-1, requiring machines shipped into or out of Europe to comply with one of the two standards. Machine builders who migrated to the international standards before the deadline stand to gain a competitive edge when serving global or multinational customers. However, even machine builders that currently serve only North American manufacturers are positioned to gain competitive edge and are better prepared to expand in pursuit of global customers in the future. We will explore this topic further in our April issue. Stay tuned.

Information courtesy of Mike Miller, Rockwell Automation

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