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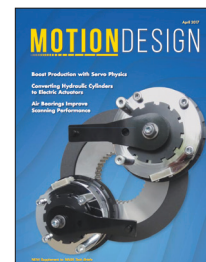
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Custom Brakes Meet the Challenges of Gearless Motor Elevators



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Custom Brakes Meet the Challenges of Gearless Motor Elevators

Standard braking systems could not meet the difficult speed, energy, and dynamic torque constraints.

by Lisa Maliniak

Production Editor, NASA Tech Briefs



Figure 1: Warner Electric developed this custom brake because standard braking systems could not meet the elevator's difficult speed, energy, and dynamic torque constraints.

A manufacturer of low- and high-rise elevators faced a challenge when customers began calling for a flexible elevator to meet the needs of the growing mid-rise, mixed-use building market. The global construction boom of mid-rise buildings can be attributed to several factors.

Developers are more apt to build “short” because it requires less capital and the time to get permits approved is reduced considerably, especially in developing countries.

In response to this growing demand, the elevator OEM began developing a new elevator design that was adaptable for a variety of mid-rise buildings including apartments, hotels, offices, and shopping centers. To ensure global acceptance, the new flexible elevator was designed to meet building codes around the world.

Increased Constraints

The technology of elevator manufacturing is changing as OEMs migrate from using standard steel ropes to using innovative belts. One consequence of the change is increased constraints for the braking system, resulting in a difficult specification for this design. The company called on Warner Electric, part of Altra Industrial Motion, to develop a braking system for the challenging gearless motor elevator application that required dynamic torque less than 160% of nominal torque, noise lower than 54 dB, and very high energy up to 57 kJ (Figure 1).

The braking system had to provide the following three functions:

- Parking brake: maintain elevator car in position when not used (at a floor or during night).
- Ascending car overspeed protection: stop the car or reduce the speed of the counterweight if falling.
- Protection against unintended car movement: stop the car if there is abnormal movement with open doors.

The elevator design process spanned several years, and Warner Electric engineers worked closely with the customer's engineering team as the elevator design evolved. Initially, the request was for a standard elevator brake, but the specifications became more challenging over time. The leading constraints were increased speed (x3), increased energy (x10), and the previously mentioned maximum torque limitation.

Warner Engineers developed a solution that had low wear but high energy, noise dampening with low torque impact, and torque stability and precision. To meet the criteria, two modified ERS VAR15 spring set/electrically released brakes with fixed magnets and a floating disc were designed. The floating disc is connected to the shaft that rotates to move the elevator up or down, and a set of springs inside

the brake module can press a plate against the disc. With power, the magnetism pulls the plate away from the disc, compressing the springs and allowing the disc to rotate. This allows the elevator to move. When power is cut, the springs compress the plate against the rotating disc to stop or hold the elevator in place.

The disc is splined and mounts to a mated splined hub so that it can move slightly along the hub. When the brake engages the disc, it does so on both sides. Since the plate floats, it can receive equal compression from both sides of the brake.

Tight Footprint

The modular, compact units allowed the configured system to fit within the customer's tight footprint. Units are microswitch equipped and conform to European Lift Directive 2014/33/EU (EN 81-20 and EN 81-50 certified). To meet the tight footprint, the design team needed to choose the best compromise between maximum energy versus wear, maximum torque limit versus noise, and 100% adjusted brake (6 sigma oriented) versus production cost.

Thermal control was a key issue due to the system's high-energy braking. Heat is not dissipated, but must instead be absorbed by the system. This was a major criterion that impacted the overall brake design and friction material selection.

The OEM team was in regular contact with Warner Electric's engineering team during all the development phases of the project, including many meetings in person. Various performance curves, statistical analysis, and test reports were provided to the customer to validate the brake design and performance.

The brakes were subjected to a full array of lengthy testing including energy, life cycle, climatic, aging and destruction tests. Pre-packaged brake assemblies were delivered to the customer with ready-to-mount paired magnets and burnished discs.

Manufacturing Technology

Warner Electric has recently invested in new manufacturing technology while optimizing their elevator brake manufacturing workflow for improved quality and efficiency (Figure 2). Manufacturing upgrades include a new production line divided into two new work cells. The primary work cell allows for semi-automatized assembly utilizing conveyors. Components and brakes are traceable via bar codes. Visio software is used for component presence and profile detection. A slaved system has also been incorporated for screwdrivers, di-electrical tests, etc.

A new, multi-station robotized cell is also incorporated into the production process to provide friction disc burnishing, static torque adjustment, electrical adjustment, dynamic torque measuring, and component crimping to secure the adjustment. All production parameters are stored in a custom software program developed exclusively for Warner Electric. The program provides traceability for future analysis and continuous improvement.

The new production enhancements to the Warner Electric plant in Angers, France will allow Warner to more effectively meet the anticipated demand for the new elevator brake from Europe, Asia Pacific, and Latin America.

For more information about the Warner Electric products used in this application, visit www.warnerelectric.com.

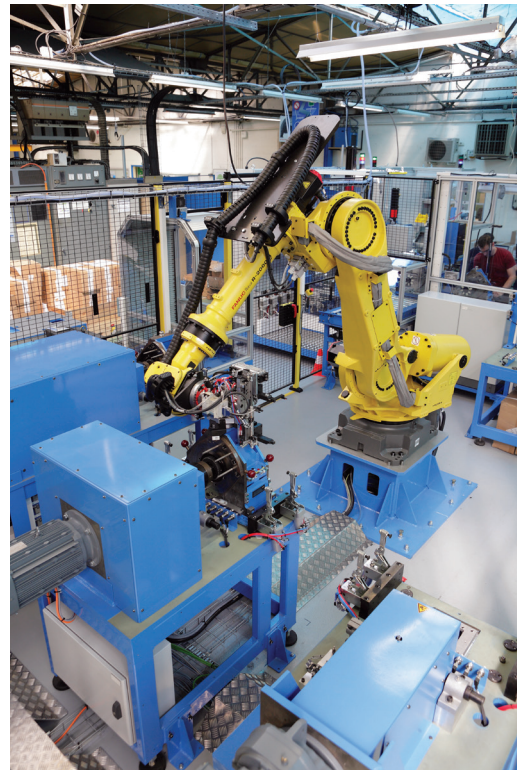


Figure 2: A new, multi-station robotized cell is also incorporated into the production process to provide friction disc burnishing, static torque adjustment, electrical adjustment, dynamic torque measuring, and component crimping to secure the adjustment.

About Altra Industrial Motion

Altra is a leading global designer and manufacturer of quality power transmission and motion control products utilized on a wide variety of industrial drivetrain applications. Altra clutches and brakes, couplings, gearing and PT component product lines are marketed under the industries most well known manufacturing brands. Each brand is committed to the guiding principles of operational excellence, continuous improvement and customer satisfaction. Highly-engineered Altra solutions are sold in over 70 countries and utilized in a variety of major industrial markets, including food processing, material handling, packaging machinery, mining, energy, automotive, primary metals, turf and garden and many others.

Altra's leading brands include Ameridrives, Bauer Gear Motor, Bibby Turboflex, Boston Gear, Delroyd Worm Gear, Formsprag Clutch, Guardian Couplings, Huco, Industrial Clutch, Inertia Dynamics, Kilian, Lamiflex Couplings, Marland Clutch, Matrix, Nuttall Gear, Stieber Clutch, Stromag, Svendborg Brakes, TB Wood's, Twiflex, Warner Electric, Warner Linear and Wichita Clutch.



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