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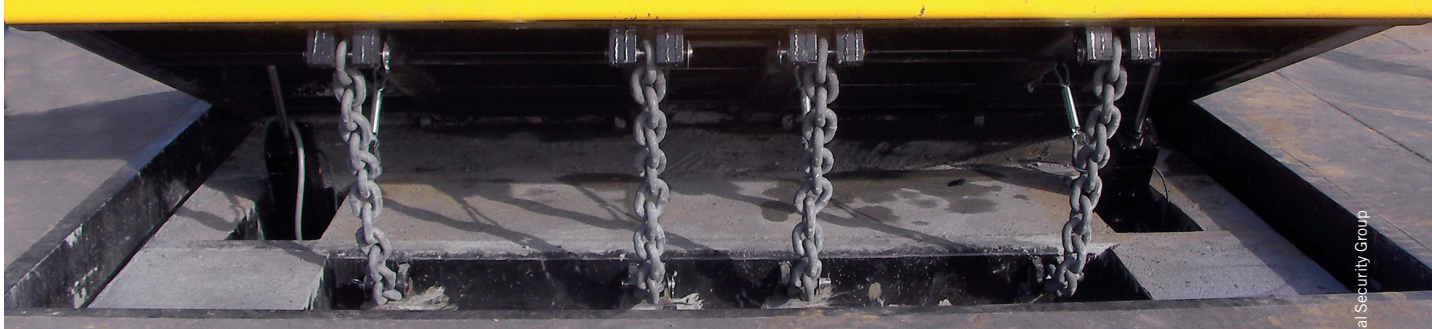
Roadway BARRIERS Go Electric

DC servo motor and ball screw replace hydraulics in barrier applications.



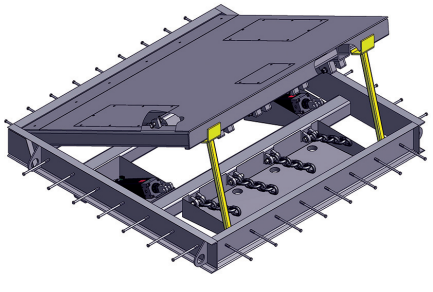
Source: American Physical Security Group

Roadway barriers, which can measure 16 ft wide and weigh 6,000 lb, can stop a big truck traveling at 50 mph.

By Charles J. Murray, Senior Technical Editor, Electronics & Test

Roadway barriers, the last line of defense for hundreds of military installations and utility plants, are undergoing a transformation. Once powered exclusively by hydraulics, the giant barriers are now moving to simpler, greener electric actuators.

For roadway barriers, that's a big change. Designed to stop a 15,000-lb truck traveling at 50 mph, the beefy barriers have traditionally employed hydraulics as a means of quickly raising 6,000 lb of steel into the path of a truck.



Source: Moog Industrial Controls

Servo actuators lie in a pit beneath the concrete roadway.

"The idea was always to be able to stop the biggest, baddest truck you could find," says Paul Roland, director of engineering at the American Physical Security Group (American PSG), a maker of roadway barriers. "They have to stop the truck with zero penetration and still be operable afterward."

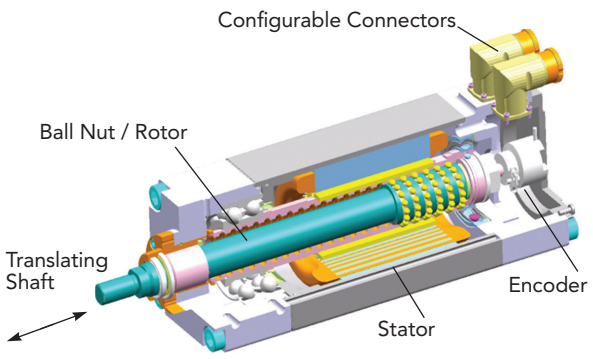
Doing so with a servo motor and a ball screw, however, is a comparatively new idea. For more than a quarter-century, makers of the steel barriers have employed hydraulic actuators, largely because they offered — and still offer — tremendous power density.

But barrier makers are teaming with electric actuator manufacturers to change that.

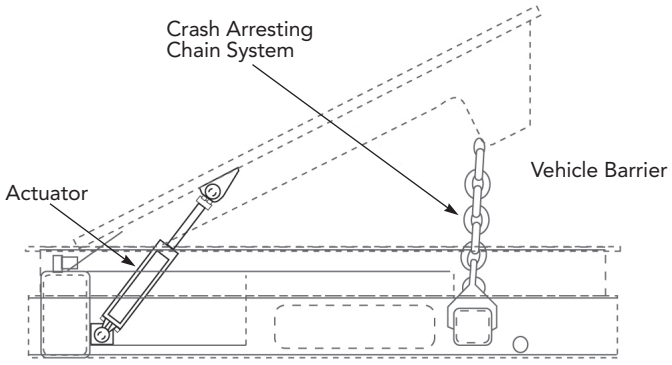
"The servo is the only electric motor that can give you the power density you need for this application," says, Don Bockhahn, product application manager for electromechanical actuators for Moog Industrial Controls, a maker of motion control products (including both electric and hydraulic products). "The power density is very similar to that of a hydraulic system, and that allows us to quickly raise the plates."

Protecting High-Value Targets

Indeed, the roadway barrier plates need to be raised fast. The barriers, which came into being after the Beirut truck bombing that took the lives of 241 American servicemen in 1983, are called upon to lift giant metal plates into position in less than two seconds. The concept, originally proposed by the U.S. State Dept. more than a quarter-century ago, is intended as a means of stopping bombings like those in Beirut in '83 and in Oklahoma City in 1995. The plates, which can measure up to 16 ft wide and weigh more than 6,000 lb, operate in a manner similar to that of a pre-hung door with an under-



The electric actuator uses a servo motor to turn a ball screw, which pushes the barrier into place.



The electric actuator uses a 12-inch stroke length to raise the barrier to a height of about 40 inches.

ground hinge. The actuators swing the "door's" free end upward, enabling it to stop a mammoth truck dead in its tracks. The U.S. military, along with utilities and private companies, use a surprising number of the barriers. They're said to be employed at numerous government buildings around Washington D.C., at nuclear power plants, in hundreds of military installations around the world, and even at banks and courthouses around the U.S.

"They're used to protect any high-value target that a terrorist could go after," Bockhahn says.

The barriers typically lie in a pit underneath a roadway. When a car or truck approaches, a guard can deploy the device's steel plate by hitting an EFO (emergency fast operation) button. When the button is pushed, the system sends a signal to a servo controller. The servo controller, in turn, operates a servo motor that turns a ball screw, which moves a rod in and out of the actuator.

American PSG employs a Moog Electric Linear Servo Actuator on its SW12 wedge barrier. During operation, the actuator is controlled by a Moog Servo Drive, which operates off standard three-phase, 230V or 460V ac current. The drive rectifies the ac current to a dc voltage, filters it, and modulates the pulsewidth to get the desired velocity. An encoder on the back end of the actuator "knows" the position and speed of the servo motor at all times. In essence, the servo drive closes the loop on the actuator by controlling current into the motor. As a result, it controls the torque of the motor and the force out of the actuator.

"When the servo system gets a command to move, it accelerates at a pre-programmed acceleration rate, then decelerates to a target position," Bockhahn says. "So we can make it accelerate smoothly up to pre-programmed speed, and then decelerate it to a position."

At high speeds, the actuator can travel a full 12-inch stroke length in about one second. It has a continuous force rating of about 6,200 lb and a peak capability of more than 16,000 lb.

Engineers say that the choice of a dc servo motor is critical to moving the barrier plate into position. "If you use an ac motor, it's not going to be able to move a barrier that big at that kind of speed," Bockhahn says.

Simplicity Is Key

Until the last three or four years, hydraulics have dominated such applications, largely because of the need for power density. Today, hydraulics are still sold into roadway barrier systems, but electric actuators are growing in popularity.

"It's partly due to people wanting to go green," says Roland of American PSG. "They feel there's a positive environmental impact to be gained by using electrics, as opposed to hydraulics."

In truth, the environmental differences aren't as great as they might seem. New vegetable-based oils don't pose the same environmental worries as conventional hydraulic oils once did. With the vegetable-based products, maintenance workers can reportedly spill gallons of oil without concern.

"The real environmental threat of hydraulics is probably not as great as people imagine," Roland says.

Still, engineers say there are other advantages to be gained by using electric actuators on roadway barriers. The simplicity of a dc actuator, for example, makes it easy for users to speed up the movement of the barrier, merely by boosting the voltage.

Moreover, Roland says that some users prefer the simplicity of maintenance that electric actuators offer. Unlike hydraulic systems, which incorporate pumps, cylinders, valves, accumulators and hoses, electric units have few parts and can be easily repaired and replaced. "Electric is much simpler," Roland says. "It's not nearly as intimidating to people as hydraulics."

To be sure, representatives at Moog aren't proposing a universal move to electrics over hydraulics, especially since they manufacture both types of systems. But they do point to the higher force that's now available from electric actuators, and they acknowledge that, as a result, the electrics are starting to move into applications such as the roadway barriers, which once were the exclusive province of hydraulics. DN

Watch a video of the roadway barriers stopping a truck at ***http://dn.hotims.com/34934-512***.

Source: Moog Industrial Controls