Ameridrives
Bauer Gear Motor
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Boston Gear
Delroyd Worm Gear
Formsprag Clutch
Guardian Couplings
Huco
Industrial Clutch
Inertia Dynamics
Kilian
Lamiflex Couplings
Marland Clutch
Matrix
Nuttall Gear
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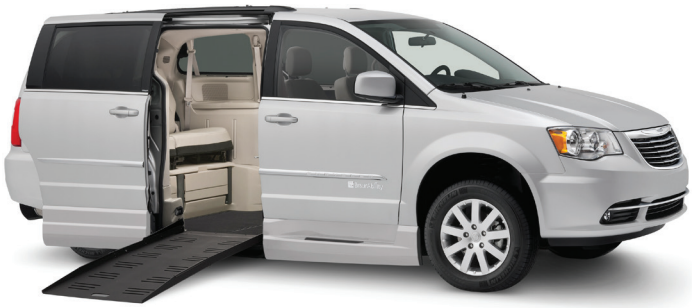
Svendborg Brakes
TB Wood's
Twiflex
Warner Electric
Warner Linear
Wichita Clutch

A New Angle On Wheelchair Vehicle Accessibility



As seen in
Design World
November, 2017

As seen on
LinearMotionTips.com
November, 2017

Warner Linear®
Altra Industrial Motion

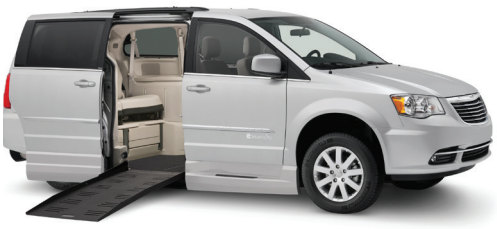
A New Angle On Wheelchair Vehicle Accessibility

Warner Linear actuators help provide easier wheelchair access on BraunAbility® vehicles equipped with optional “kneeling” feature

Kneeling systems have become a popular option on custom wheelchair-accessible vehicles available from BraunAbility® and other accessible-vehicle converters. Linear actuators are used in these systems to lower the rear suspension of the vehicle, reducing the incline angle of the wheelchair ramp when deployed, which allows for easier access. Since the actuators are typically mounted under the vehicle chassis, a rugged solution is required to withstand road salt and dirt build up that can cause failures.

Mike Laird, BraunAbility Senior Engineer/Commercial SE Vehicle Manager, explains, “Our vehicles typically kneel 2-1/2 to 3". We add a mount near the shock absorber or at the lower outboard A-Arm pivot and attach a chain that typically runs up into the body and attaches to an actuator.”

Laird continues, “A single inch of kneel reduces the ramp angle by roughly one degree, so kneeling gives us 2-1/2 to 3 degrees. This seemingly small angle change significantly reduces the effort a wheelchair user needs to exert to get up the ramp, and that’s a critical feature for someone who has limited mobility and strength, especially someone using a manual wheelchair.”



BraunAbility utilizes Warner Linear K2x electric actuators for the kneeling option on its side-entry Chrysler Town and Country, Toyota Sienna, and Honda Odyssey conversion vans.

Growing Demand

According to the Centers for Disease Control and Prevention (CDC), 20% of US adults have a disability, with the most common being mobility-related. One of the significant factors behind this alarming statistic is the aging of Baby Boomers. With aging comes related mobility loss and other physical conditions or illnesses.

Many aging adults with mobility-related disabilities are determined to keep a high quality of life, and having a wheelchair-accessible vehicle gives them the freedom and ease of use that keeps them independent.

While the Americans with Disabilities Act (ADA), enacted in 1990, did not directly impact the market for personal use vehicles, it did make society more accessible for wheelchair users, and just as importantly, made these people more accessible to the rest of society. With improved access came the need for more personal transportation solutions, which contributed to the overall growth of the accessible vehicle industry.

In response to this growing trend, BraunAbility and other vehicle converters have expanded their product offerings and continue to add more user-friendly features to their vehicles. In North America, sales of wheelchair accessible vehicles (WAVs) are projected to reach $1.9 Billion by 2024, with full-size vehicles (vans and SUVs accounting for 73% of the market.

The Birth of an Industry

As a young boy, Ralph Braun was diagnosed with spinal muscular atrophy and was unable to walk by the age of 15. He used a scooter for mobility from a young age – a scooter that he built. In 1966, he pioneered the accessible vehicle industry when he installed a wheelchair lift on the back of an old postal Jeep® so he could drive it back and forth to work every day. Having an accessible vehicle made him blend in with the rest of society and gave him independence and freedom. He realized other people could benefit from that same mobility, and that's how BraunAbility and the industry were born.

"Aside from founding the category, other BraunAbility innovations revolve around engineering for ease-of-use, for example, key fob integration – ensuring the vehicle and the conversion's electronics speak to each other so they can be operated from the same key fob." said Megan Wegner, Brand Manager at BraunAbility.

BraunAbility also introduced the MXV, the first wheelchair accessible SUV. It's built on the Ford Explorer platform and represents much-appreciated variety in mobility vehicle selection. While the minivan is a very convenient and spacious vehicle for mobility purposes, not everyone aspires to drive one. "The MXV provides a great alternative for many of our customers." said Wegner.

Vehicle Engineering Challenges

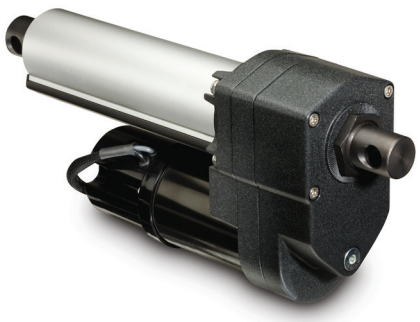
Converting a standard factory model van or SUV into a fully functional wheelchair accessible vehicle is a challenging endeavor. The process typically includes re-engineering the factory vehicle by lowering the floor, moving fluid lines, installing new seats, and integrating retractable ramps with their electric or hydraulic systems.

"One significant trend is mobility manufacturers continue to engineer for space", said Wegner. "Wheelchairs are getting larger and more complicated, and every inch of space on our ramps and inside the vehicle makes a big difference for customers. At BraunAbility our focus is on creating space in the vehicle without compromising the ride and handling."

Integrated Limit Switches Save Assembly and Installation Time

As BraunAbility began incorporating the kneeling feature on their vehicles, they tried some hydraulic units, but there were not many compact actuators available when some of its vehicle model lines began production.

Based on previous successful collaborations, BraunAbility worked closely with Warner Linear to provide an electric actuator solution for the kneeling function. According to Laird, "During development of a new vehicle platform, there is very little space to mount an actuator inside the cabin. Thus, requiring us to position the actuator under the chassis, below the third row of seats or on the top of the vehicle's rear suspension subframe. These tight envelope spaces minimize space for limit switch mounting brackets. In most cases, limited available space led to external switches being added directly to the actuator."



Ideal for use in tight spaces, Warner Linear B-Track K2x actuators, with adjustable limit switches mounted in a low-profile channel on the cover tube, save assembly and installation time.

To meet the challenging space requirements, Warner Linear engineers developed a modified B-Track K2x model actuator that incorporated adjustable limit switches mounted in a low-profile channel on the cover tube. Adjustable channel caps allow the flexibility of setting the stroke length at any position within the actuator's full stroke range.

"For us, having the limit switches integrated into the actuator meant we didn't have to assemble, mount and service a switch bracket tucked away in a small cavity under the vehicle." said Laird.

Rugged K2x electric actuators have a rated load capacity up to 2,800 lbs. (12,455 N) and travel speeds up to 2.1 in. (53.35 mm)/sec. Units are available with stroke lengths 2 to 24 inches (50 to 600mm). All models incorporate a patented in-line load transfer design which provides high load capability for rugged-duty use, an integral holding brake, and a ball detent overload clutch.

Models feature a compact package size and an efficient ball nut screw system yielding high-impact capability and long screw life. Double ball bearing motors with thermal overload, heat treated gears, heavy wall construction, O-ring seals and rugged extension rod bearing support provide best-in-class capabilities.

The Emphasis on Quiet Operation and Long Life

Actuator sound during the kneeling operation was also a concern. Ideally, no noise is best. Realistically, a linear motor sound is acceptable. As load increases, so does the sound pressure level with no strong peaks. However, free impact sounds from engaging/disengaging transmission components can cause user anxiety because it sounds like a malfunction may be eminent.

Warner Linear K2x models are designed to operate smoothly. However, during development on one particular van model, the actuator seemed to shudder on extension. According to Jared Zammuto, New Product Development Team Manager of Engineering at Warner Linear, "After the vehicle arrived at our lab, we were able to determine that the vehicle's natural rebound rate and the actuator's extend rate matched closely depending on spring and shock packages."

"This caused the controlling brake on the actuator to intermittently engage and release. These engagements/disengagements were the source of the troubling sound. While the sound was actually normal, it was a cause for concern for the customer. Based on this, we made a simple, no-cost modification to the load control brake that eliminated the issue," Zammuto said.

Typically, the actuators are installed in a steel housing under the chassis. This provides some protection from the elements. However, in some vehicles the actuator is fully exposed to water, snow, salt and debris. Corrosion resistance was a major consideration for the exposed actuators. Fortunately, Warner Linear K2x models feature excellent corrosion protection to withstand the harsh, under-chassis environment.

BraunAbility is very pleased with the K2x actuators' field performance. The company utilizes the actuators for the kneeling option on its side-entry Toyota Sienna, Chrysler Town and Country, Dodge Caravan and Honda Odyssey conversion vans.

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