

Guardian Couplings

Huco

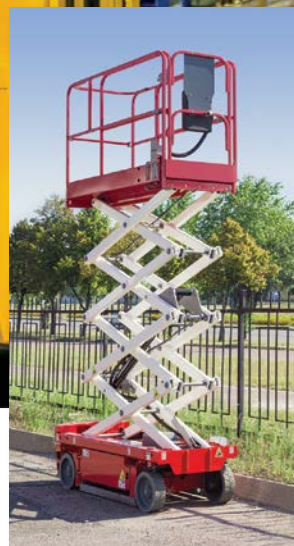
Matrix

Stromag

Warner Electric

Warner Linear

Power Transmission Solutions for the Forklift Truck & Electric Vehicle Market



ALTRA INDUSTRIAL MOTION PROVIDES ADVANCED POWER TRANSMISSION SOLUTIONS FOR THE FORKLIFT TRUCK AND ELECTRICAL VEHICLE MARKET

Warner Electric, Stromag and Matrix, three Altra Industrial Motion companies, are world leaders in the design and manufacture of hydraulic, pneumatic and electromagnetic brakes and clutches for battery powered vehicles. Combined, they offer a full range of traction motor and load wheel brakes and specialize in customized solutions to meet specific performance and installation requirements. Altra's braking solutions are designed with the industry's toughest challenges in mind, utilizing proprietary technology to analyze magnetic properties of the brake, brake interfaces and surroundings.



Altra Brands Deliver Value Throughout the Drivetrain

With industry-leading brand names, including Warner Electric, Matrix, Stromag, Warner Linear, Guardian Couplings, and Huco, Altra Industrial Motion is positioned to provide OEMs with exceptional drivetrain value by ensuring component compatibility and optimized performance combined with time-saving, single-source convenience.

Extensive Technical Experience in Forklift Applications

Altra brands work with more than 30 customers in the forklift truck and aerial lift market on three continents. These customers are comprised of OEMs and Tier 1 manufacturers (motor/gear boxes), including all of the top OEMs around the world.

Altra's customers routinely rely on the vast forklift truck application knowledge of Altra's engineering teams that collaborate to thoroughly analyze specific customer applications and then apply the latest technologies in design, materials and manufacturing. Whether a modified standard product or a custom solution is required, Altra provides complete sales and engineering support to customers around the world from the very first concept to the detailed planning, design variation phase and commissioning.

For more information about power transmission solutions for forklift truck applications from Altra Industrial Motion including case studies, literature, and service manuals, visit

www.AltraForklifts.com

ALTRA PRODUCTS HELP KEEP FORKLIFT TRUCKS AND OTHER ELECTRIC VEHICLES RUNNING SMOOTHLY



Brakes and Clutches

Warner Electric's ERD brakes, low-profile PK (Pan-Cake) brakes are utilized to lock the traction motor shaft when the vehicle is parked. Matrix LWB 4EB and 4PMB brakes are installed inside the front load wheel to function as a servicing and parking brake. Hydraulic brakes from Warner Electric are used to hold rotating fork attachments in place. Warner's E220 clutch is used on hybrid drive vehicles and its fan drive clutches are often used on larger vehicles.

Matrix • Stromag • Warner Electric

NEW Advanced Non-Stick Friction Material

For cold room and outdoor environments

Altra engineers have developed a proprietary friction material specifically designed for cold room and outdoor environments with high moisture levels and wide temperature differentials. Most standard friction materials tend to get sticky and lose their effectiveness in these cold, harsh conditions.

Altra's new friction material has proven to retain stable torque in between static parking and high energy service and emergency stopping during rigorous climate chamber testing, endurance testing, and field testing. The new material is available on all PK Series motor brakes.



Couplings

Guardian offers a variety of flywheel couplings that are ideally suited for motor/pump and motor/generator hybrid drive connections on forklift trucks and aerial lifts. Guardian's curved jaw couplings are also used on these vehicles. Huco's Oldham style couplings are utilized on forklift steering columns.

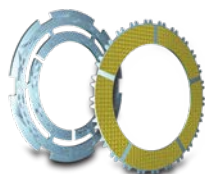
Guardian Couplings • Huco



Linear Actuators

Rugged-duty Warner Linear actuators are used for a broad range of forklift and electric vehicle applications, including main mast and fork positioning, seat adjustment, fork attachment release, and reach extenders. B-Track and H-Track actuators provide years of dependable service in these challenging applications.

Warner Linear

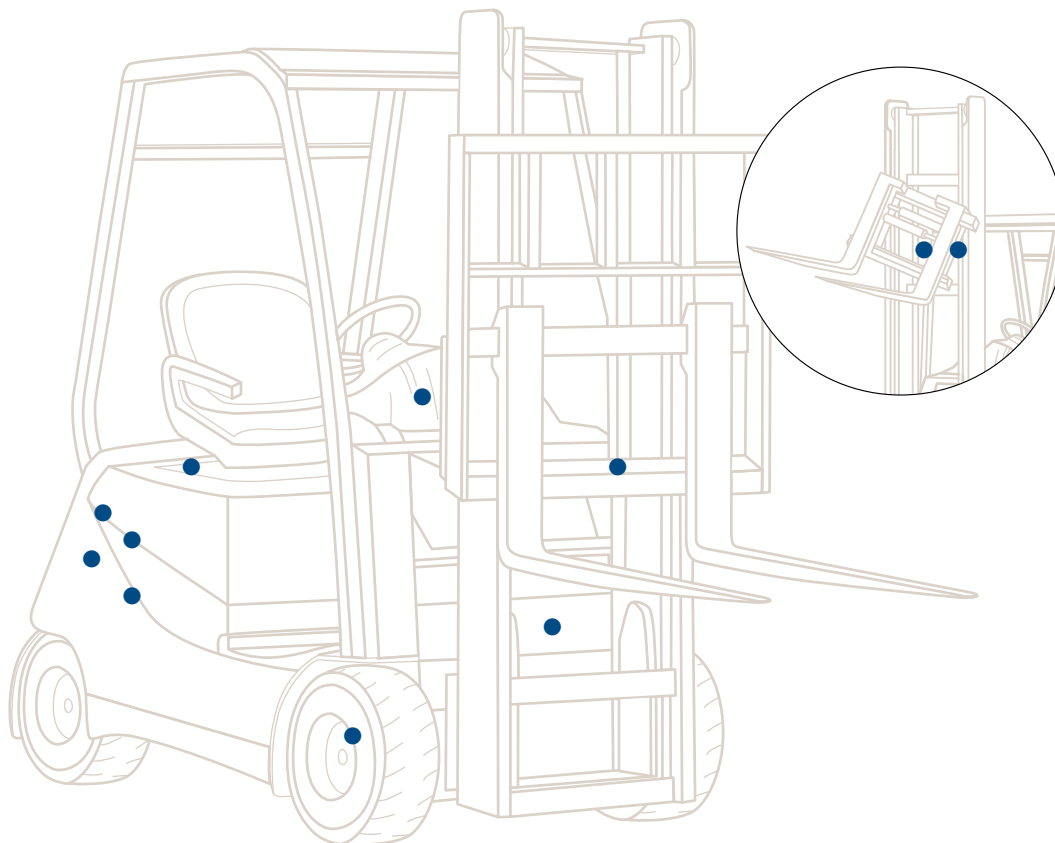


Discs

High-performance, precision steel discs along with mated paper/sintered friction discs from Stromag are widely used on forklift and electric vehicle drives.

Stromag

Forklift Trucks



Counter Balance Trucks

A range of braking solutions from Altra including Stromag's very flat SLA Series brakes and PK35 captive design brakes for back-to-back mounting configurations, can be used on all types of counter balance forklift trucks.

Warner Linear's rugged-duty B-Track and H-Track electric actuators can be used for seat height and fork position adjustment. Actuators are also used for optional attachment release mechanisms. Units provide high load capability, efficient power use, compact package size, and excellent corrosion and washdown protection.

Matrix SAE Series brakes are fitted into the wheel to be used as a hub brake on larger trucks. Diesel powered trucks use a variety of flywheel couplings from Guardian as well as fan clutches from Warner Electric. Hybrid trucks incorporate Warner's E220 clutch that allows the diesel engine drive to engage when the electric drive's battery power is low.

Oldham style steering column couplings from Guardian are often installed. Stromag high-performance, precision steel discs along with mated paper/sintered friction discs are also widely used on these forklift drives.

Warner Electric

- PK35 & 60 Brakes (Standard & Enclosed)
- PK100 & 170 Brakes
- FC550 Fan Clutch
- E220 Clutch (Hybrid drive)

Matrix

- SAE Series Brakes

Stromag

- SLA Series Brakes
- Discs

Guardian Couplings

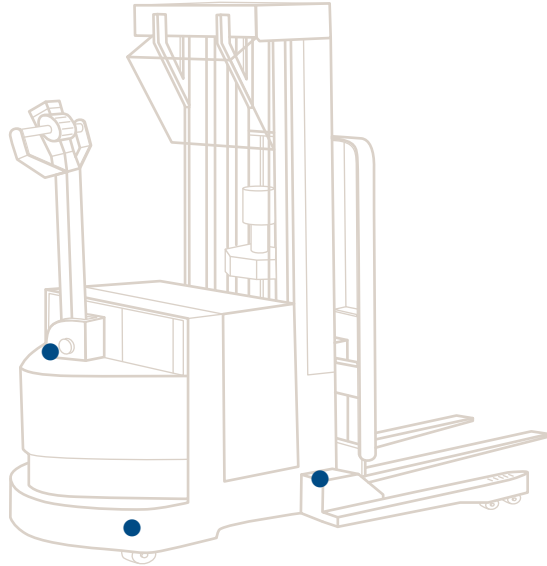
- Curved Jaw Couplings
- FL Series Flywheel Couplings
- Delta Series Flywheel Couplings
- FBA Series Flywheel Couplings
- FLD Series Pulley Couplings

Warner Linear

- B-Track Electric Actuators
- H-Track Electric Actuators

Huco

- Oldham Couplings



Stackers & Pallet Trucks

Spring-applied PK brakes from Warner Electric provide emergency stopping and parking brake functionality on these types of forklifts. Captive (enclosed) models are available for outdoor truck use. Matrix LWB 4EB load wheel brakes are used for service braking only, where as the LWB 4PMB range provides both service and parking options.

Warner's Electrically Released Dynamic (ERD) brakes are a popular choice for braking and stopping functionality. These on/off dry failsafe brakes are designed for dynamic applications. Torque value is defined for the trucks running at full speed and at full load.

Heavy-duty B-Track and H-Track electric actuators from Warner Linear provide lifting functionality on stackers. Huco's Oldham style couplings are used on steering mechanisms.

Warner Electric

- PK5, 10, 20, 35 & 60 Brakes
- PK35 & 60 Brakes (Captive/Enclosed)
- ERD20 & 35 Brakes

Matrix

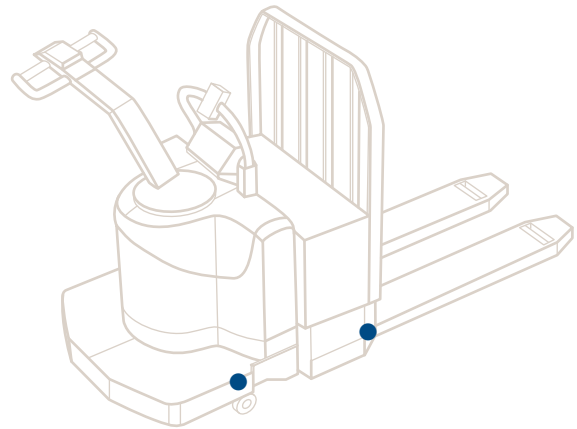
- LWB 4EB Brakes (Single face)
- LWB 4PMB Brakes

Huco

- Oldham Couplings

Warner Linear

- B-Track Electric Actuators
- H-Track Electric Actuators



Ride-On Pallet Trucks

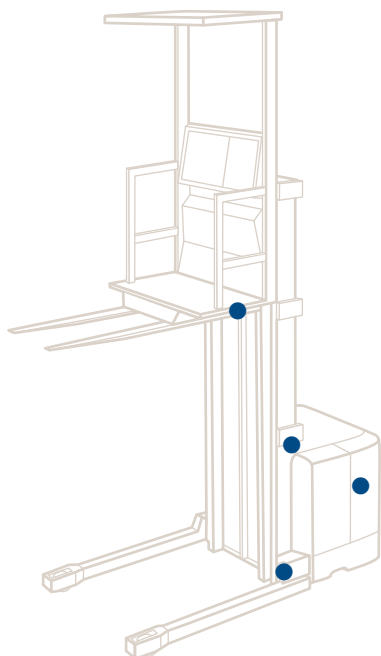
Warner Electrically Released Dynamic PK brakes are widely used for braking, stopping and emergency functionality on ride-on trucks.

Warner Electric Hydraulic-Amplified, Electrically Released (ERD H) brakes provide parking and stopping brake functionality on reach trucks. These performance-enhanced ERD failsafe brakes feature a hydraulic piston that connects to the mast cylinder hydraulic circuit. The hydraulic force applied is proportional to the load on the fork.

Warner Electric

- PK20 & 35 Brakes
- ERD35H Brakes

Forklift Trucks



High Level Order Pickers

Warner Electric spring-applied PK 60 motor brakes are a popular choice to provide emergency stopping and parking brake functionality on high level order pickers.

Single-face Varistop brakes from Matrix are typically mounted vertically to the top of the vehicle's traction motor. They also provide parking brake functionality with zero drag torque.

Guardian and Huco elastomeric couplings can also be installed on these trucks.

Warner Electric

- PK20, 35 & 60 Brakes
- ERD35 & 35H Brakes

Matrix

- Varistop Traction Motor Brakes

Warner Linear

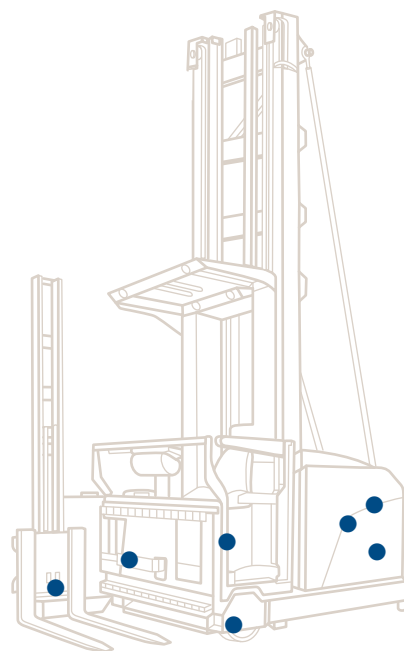
- B-Track Electric Actuators
- H-Track Electric Actuators

Guardian Couplings

- Curved Jaw Couplings

Huco

- Oldham Couplings



Very Narrow Aisle Trucks

Warner Electric PK (Pancake) motor brakes provide parking brake and emergency stopping brake functionality.

Rugged duty Warner Linear B-Track and H-Track electric actuators are used to position the smaller front mast and forks as well as the main mast on very narrow aisle trucks.

Elastomeric couplings from Guardian and Huco are often incorporated on these vehicles.

Warner Electric

- PK35 & 60 Brakes
- (Captive/Enclosed)

Matrix

- LWB 4EB Brakes
- LWB 4PMB Brakes

Warner Linear

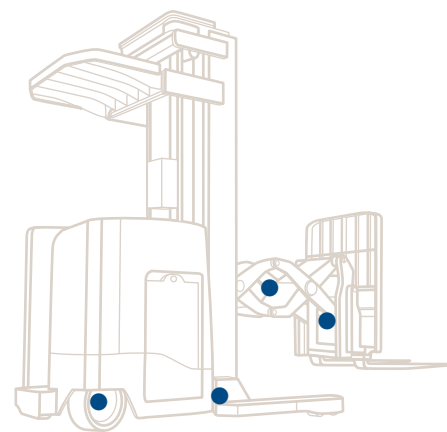
- B-Track Electric Actuators
- H-Track Electric Actuators

Guardian Couplings

- Curved Jaw Couplings

Huco

- Oldham Couplings



Reach Trucks

Traction motor Varistop and LWB 4EB & 4PMB brakes from Matrix are stationary single-face brakes designed for dry use. PK motor brakes also provide emergency stopping and parking brake functionality.

Warner Linear B-Track and H-Track electric actuators are used for mast position adjustment and to extend and retract the forks on reach trucks.

Warner Electric

- PK35, 60 & 100 Brakes

Matrix

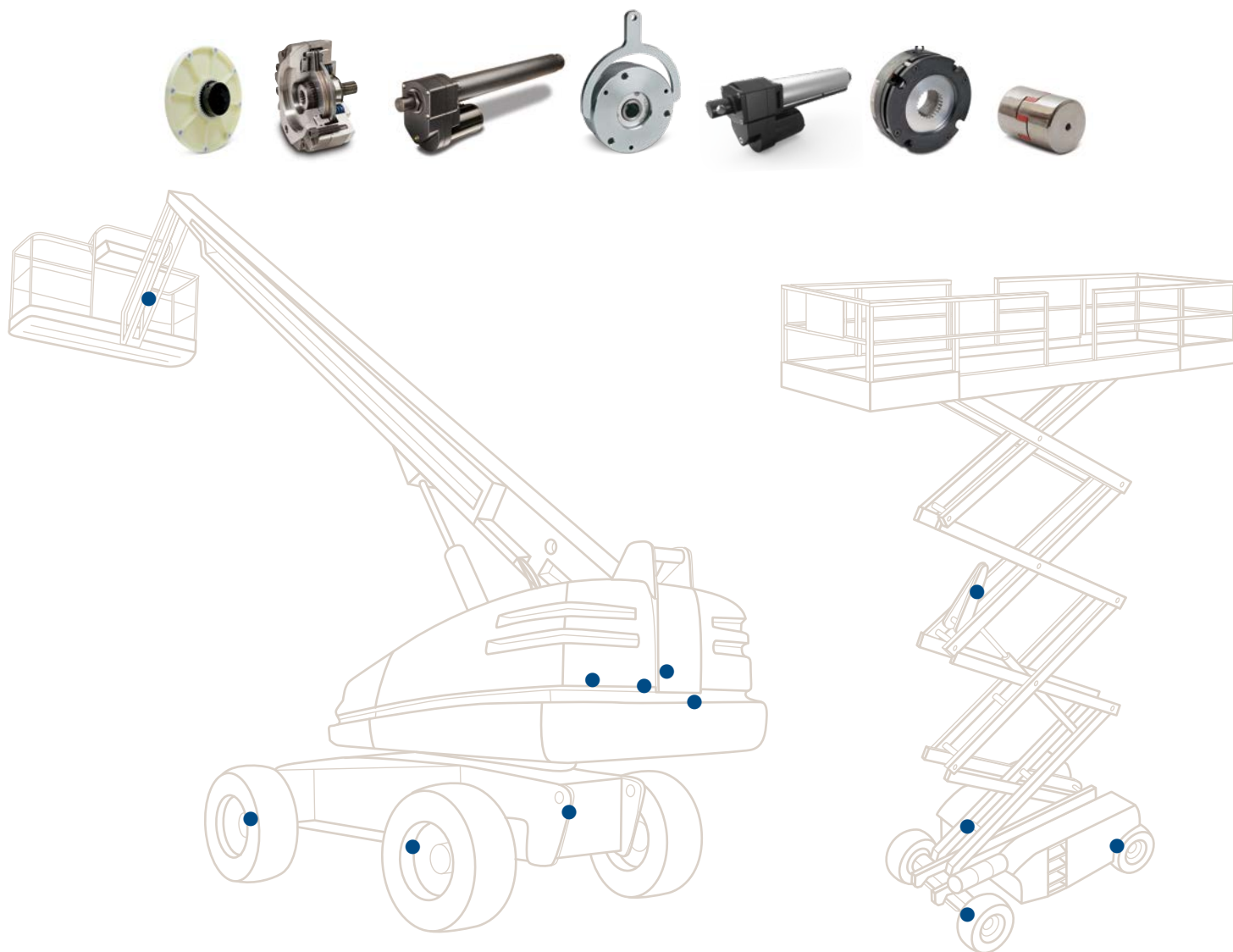
- LWB 4EB Brakes
- LWB 4PMB Brakes
- Varistop Traction Motor Brakes

Huco

- Oldham Couplings

Warner Linear

- B-Track Electric Actuators
- H-Track Electric Actuators



Scissor and Boom Lifts

Warner Electric PK captive design brakes are often incorporated into these vehicles. These units are enclosed to withstand harsh outdoor environments. IP67-Rated Models are available to meet challenging washdown application requirements.

SAE Series brakes from Matrix can be fitted into the wheel to be used as a hub brake on large boom and scissor lifts. Diesel powered lifts use a variety of flywheel couplings from Guardian as well as fan clutches from Warner Electric. Hybrid vehicles incorporate Warner's E220 clutch that allows the diesel engine drive to engage when the electric drive's battery power is low.

Stromag precision steel discs and mated paper/sintered friction discs are also widely used on these lift drives. B-Track rugged duty actuators from Warner Linear are also utilized on these vehicles. The B-Track K4x model provides the highest load rating in its class with a ball nut screw for a 4,000 lb. (17760 N) load capability in a compact package size.

Warner Electric

- PK35 & 60 Brakes (Captive/Enclosed)

Matrix

- 1EB Series Brakes
- SAE Series Brakes

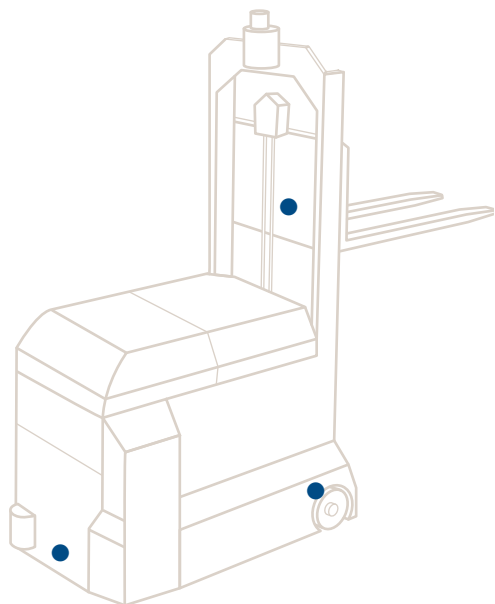
Guardian Couplings

- Curved Jaw Couplings
- FL Series Flywheel Couplings
- Delta Series Flywheel Couplings
- FBA Series Flywheel Couplings
- FLD Series Pulley Couplings

Warner Linear

- B-Track Electric Actuators
- H-Track Electric Actuators

Electric Vehicles



Autonomous Guided Vehicles (AGVs)

Warner Electric PK (Pancake) motor brakes provide parking brake and emergency stopping brake functionality on various types of AGVs. Matrix Varistop traction motor brakes are also used. Varying the brakes power supply will vary the torque. Once de-energized, the brake will return to parking function.

M-Track electric actuators from Warner Linear are used to align AGV tow tractor and cart hitches. These light-duty units are compact, completely self-contained and sealed to allow for use in small spaces without sacrificing power or capability.

Warner Electric

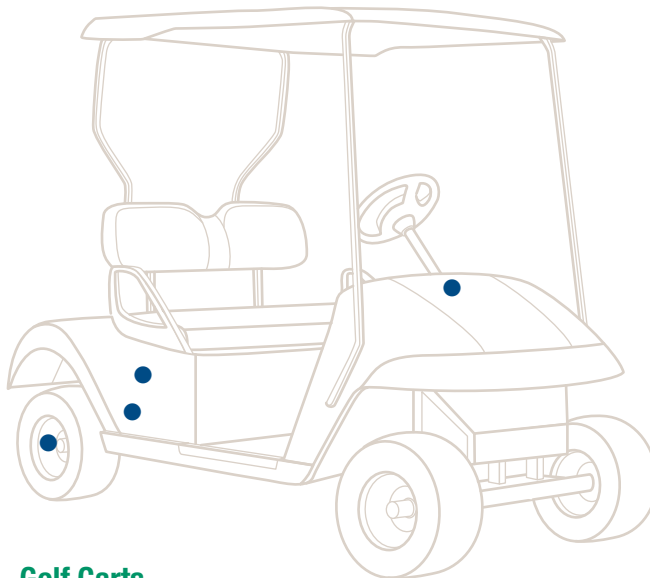
- PK5, 10, 20, 35 & 60 Brakes

Matrix

- Varistop Traction Motor Brakes

Warner Linear

- M-Track Electric Actuators



Golf Carts

Guardian curved jaw elastomeric couplings provide smooth operation on golf cart steering columns.

Various parking and e-stopping braking solutions from Altra including, 1EB brakes, standard PK brakes, and enclosed PK brakes for longer-lasting performance in outdoor environments, are often installed on golf carts.

Warner Electric

- PK10, 35 & 60 Brakes
- PK35 & 60 Brakes (Captive/Enclosed)

Matrix

- 1EB Series Brakes

Guardian Couplings

- Curved Jaw Couplings

BRAKES AND CLUTCHES



Warner Electric **PK (Pancake) Brakes**

Spring-Applied Motor Brake
Parking and emergency stopping standard failsafe brake

Pre-assembled on/off dry failsafe electromagnetic brake. The AC motor is used in combination with the PK brake for regenerative braking of the truck.



Warner Electric **PK Enclosed Design Brakes**

Spring-Applied Motor Brake Captive Design

Parking and stopping standard brake for outdoor applications

IP67-Rated Models are available for wet, outdoor applications



Stromag **SLA Brakes**

Electromagnetic, Spring-Applied Brake

Parking and emergency stop brake

Very flat, low profile forklift truck brakes ideally suited for limited space applications including back-to-back mounting configurations.



Matrix **LWB 4PMB and Varistop Brakes**

Electrically Released, Variable Torque Load Wheel Brakes and Motor Brakes

LWB 4PMB parking and service brakes are positioned inside front load wheels, Varistop brakes are installed on the traction motor

Both models are stationary single-face brakes with zero backlash designed for dry use.



Matrix **LWB 4EB Brakes**

Electrically Applied, Load Wheel Brake

Service-only brake positioned inside front load wheel

Single face brake with zero backlash designed for dry use. Various configurations are available.



Matrix **SAE Hydraulic "Bolt On" Brakes**

SAE multi-disc brakes are widely used in mobile equipment parking brake applications, especially in the event of a power loss where failsafe brake operation is essential.



Warner Electric **ERD Brakes**

Electrically Released Dynamic Brake

Parking and stopping standard brake

Failsafe brake designed for dynamic applications. It is an on/off dry failsafe brake. Torque value is defined for the trucks running at full speed and at full load.



Warner Electric **ERD H Brakes**

Hydraulic Amplified, Electrically Released Brake

Parking and stopping brake-variable depending on load weight

The performance enhanced ERD failsafe brake features a hydraulic piston integrated in the shell of the mast cylinder. The hydraulic force applied is proportional to the load on the fork.



Warner Electric **E220 Clutch**

For Hybrid Drives

Electromagnetic clutch allows the diesel engine drive to engage when the electric drive's battery power is low.

Product Solutions

COUPLINGS



Guardian Couplings *Delta Series Flywheel Couplings*

The cost effective single-piece design incorporates a splined and hardened steel hub that is pre-assembled into the glass-fiber reinforced flange.

Attaches to the engine flywheel, taking advantage of elastomeric grommets that provide a steady dampening effect to normal engine vibrations.



Guardian Couplings *FL Series Flywheel Couplings*

Two-piece coupling used on off-highway construction equipment such as aerial lifts and many other mobile hydraulic applications.

The design consists of a glass reinforced nylon flywheel flange that fits both SAE and metric flywheels. The sintered steel mating hub can be used on both splined and straight shafts.



Guardian Couplings *FBA Series Flywheel Couplings*

One piece, all steel drive coupling attaches to the engine flywheel for easy installation. Utilizes elastomeric grommets that provide a steady dampening effect to normal engine vibrations, and helps minimize any side loading to the hydraulic pump shaft.



Guardian Couplings *FLD Series Flywheel Couplings*

Coupling enables the hydraulic pump to be driven from the pulley side of the engine. It features a retractable sleeve for easy belt replacement. This allows for servicing the equipment without removing the pump.



Huco *Oldham Style Couplings*

A reliable, cost-effective choice for forklift steering columns that are typically exposed to high loads and sudden changes of directional force. The Oldham style design transmits torque through a central disc that slides over the tenons on the hubs under controlled preload conditions.



Guardian Couplings *Curved Jaw Couplings*

Curved jaw design allows for a higher torque capacity in a compact size. Curved tooth reduces edge pressure. and accommodates axial, radial and angular shaft misalignments.

Aluminum, gray iron, steel, sintered steel, and stainless steel hubs are available. Spider elements are available in various durometer options in Urethane & Hytrel.

ACTUATORS



Warner Linear *B-Track K2 & K2x Electric Actuators*

K2 and K2x models are designed for severe duty applications. 115/230 volt AC or 12/24 volt DC motors. Load ratings to 2200 pounds. Stroke lengths to 24 inch standard.



Warner Linear *B-Track K4x Electric Actuators*

The K4x model provides the highest load rating in its class with a ball nut screw for a 4,000 lb. (17760 N) load capability in a compact package size. Well suited for the most demanding applications where an alternative to hydraulic or air cylinders is needed.



Warner Linear *H-Track Electric Actuators*

A robust electric actuator solution with a force up to 4800 lbs. and travel speeds near 4 in./sec. Units feature the smallest mounting envelope in their class with a patented valve and reservoir design that provides significant space savings.

ALTRA MARKET WEBSITES

See how the brands of Altra Industrial Motion are dedicated to providing better ways to solve power transmission applications.

Forklifts

www.AltraForklifts.com

Request P-7637-C at
www.AltraLiterature.com



Turf and Garden

www.AltraTurfandGarden.com

Request P-1698-WE at
www.AltraLiterature.com



Mobile Off-Highway

www.AltraMobileOffHighway.com

Request Literature at
www.AltraLiterature.com



Oil and Gas

www.AltraOilandGas.com

Request P-8453-C at
www.AltraLiterature.com



Mining and Aggregate

www.AltraMining.com

Request P-1763-C at
www.AltraLiterature.com



Aerospace and Defense

www.Altra-Aerospace-Defense.com

Request P-1717-C at
www.AltraLiterature.com



Wind

www.AltraWind.com

Request P-1960-C at
www.AltraLiterature.com



Food and Beverage

www.AltraFoodandBeverage.com

Request P-7665-BBG at
www.AltraLiterature.com



Tidal

www.AltraTidal.com

Request P-7013-C at
www.AltraLiterature.com



Elevators

www.AltraElevators.com

Request P-1733-C at
www.AltraLiterature.com



Packaging Machinery

www.Altra-Packaging.com

Request Literature at
www.AltraLiterature.com



Energy

www.AltraEnergyOilandGas.com

Request P-1908-C at
www.AltraLiterature.com



A Global Footprint to Support Customers Around the World

- ★ Altra Headquarters
- Altra Manufacturing Facilities
- Light Manufacturing, Assembly, Regional Warehouse
- ▲ Altra Shared Services and ECB Technology Center

The Brands of Altra Industrial Motion

Couplings

Ameridrives
www.ameridrives.com

Bibby Turboflex
www.bibbyturboflex.com

Guardian Couplings
www.guardiancouplings.com

Huco
www.huco.com

Lamiflex Couplings
www.lamiflexcouplings.com

Stromag
www.stromag.com

TB Wood's
www.tbwoods.com

Geared Cam Limit Switches

Stromag
www.stromag.com

Electric Clutches & Brakes

Inertia Dynamics
www.idicb.com

Matrix
www.matrix-international.com

Stromag
www.stromag.com

Warner Electric
www.warnerelectric.com

Linear Products

Warner Linear
www.warnerlinear.com

Engineered Bearing Assemblies

Kilian
www.kilianbearings.com

Heavy Duty Clutches & Brakes

Industrial Clutch
www.indclutch.com

Twiflex
www.twiflex.com

Stromag
www.stromag.com

Svendborg Brakes
www.svendborg-brakes.com

Wichita Clutch
www.wichitaclutch.com

Belted Drives

TB Wood's
www.tbwoods.com

Gearing

Bauer Gear Motor
www.bauergears.com

Boston Gear
www.bostongear.com

Delroyd Worm Gear
www.delroyd.com

Nuttall Gear
www.nuttallgear.com

Overrunning Clutches

Formsprag Clutch
www.formsprag.com

Marland Clutch
www.marland.com

Stieber
www.stieberclutch.com



www.altramotion.com