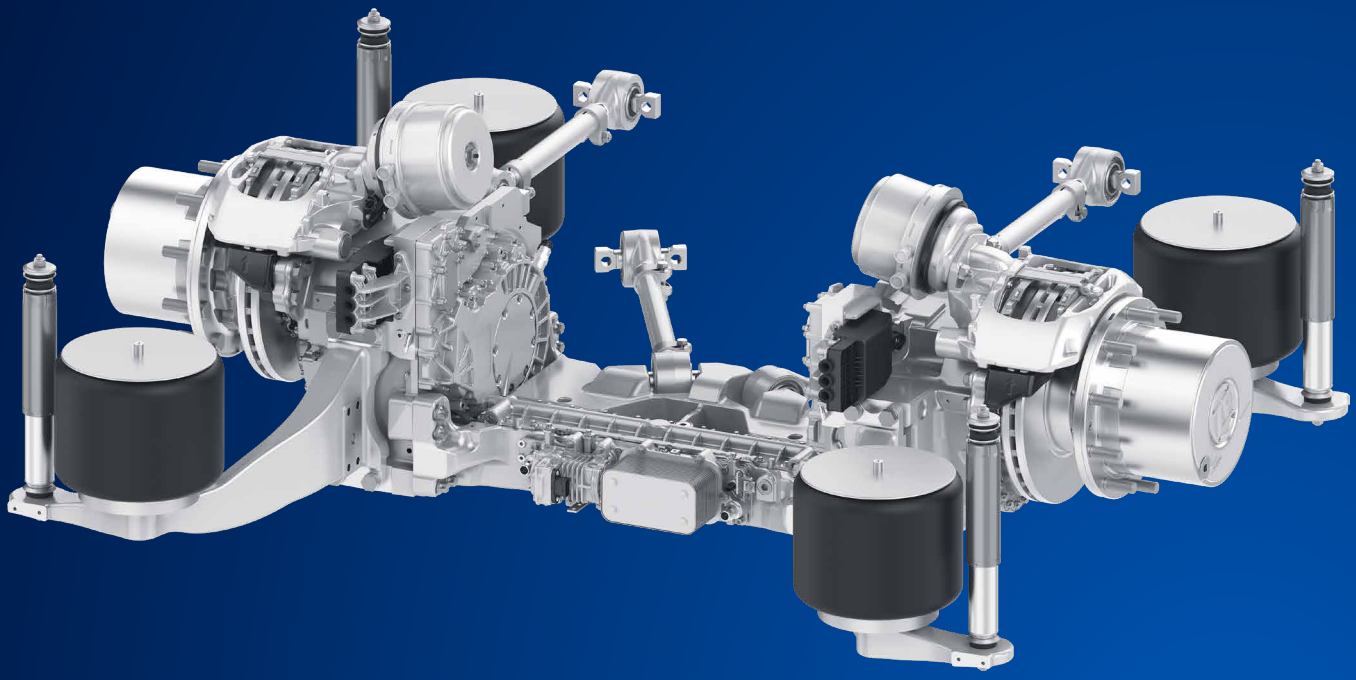
AxTrax 2 LF

Low-Floor Electric Axle

Next-generation advanced e-Drive specifically designed for city bus applications

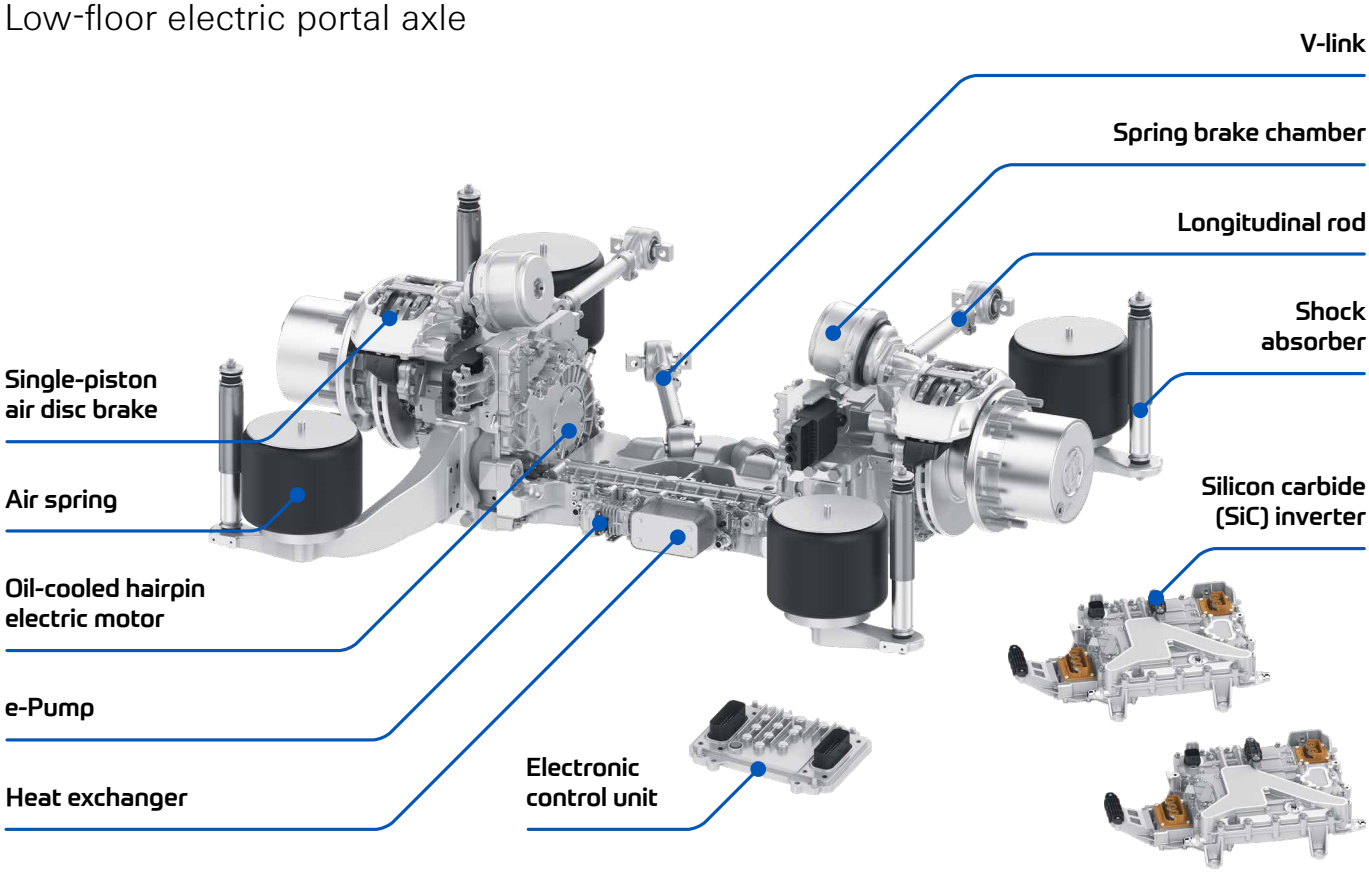


ZF's Next-Generation Low-Floor Electric Axle for City Buses

AxTrax 2 LF is ZF's latest addition to its in-house developed suite of e-drives specifically designed for city and intercity buses up to 30 tons. With a space-efficient design using similar installation space than the previous low-floor e-axle, it allows for simple interchangeability with existing electric vehicle setups. The innovative solution comprises two stand-alone silicon carbide (SiC) inverters and an ECU, creating a comprehensive e-axle system for electric, hybrid, and trolley buses.

AxTrax 2 LF

Low-floor electric portal axle



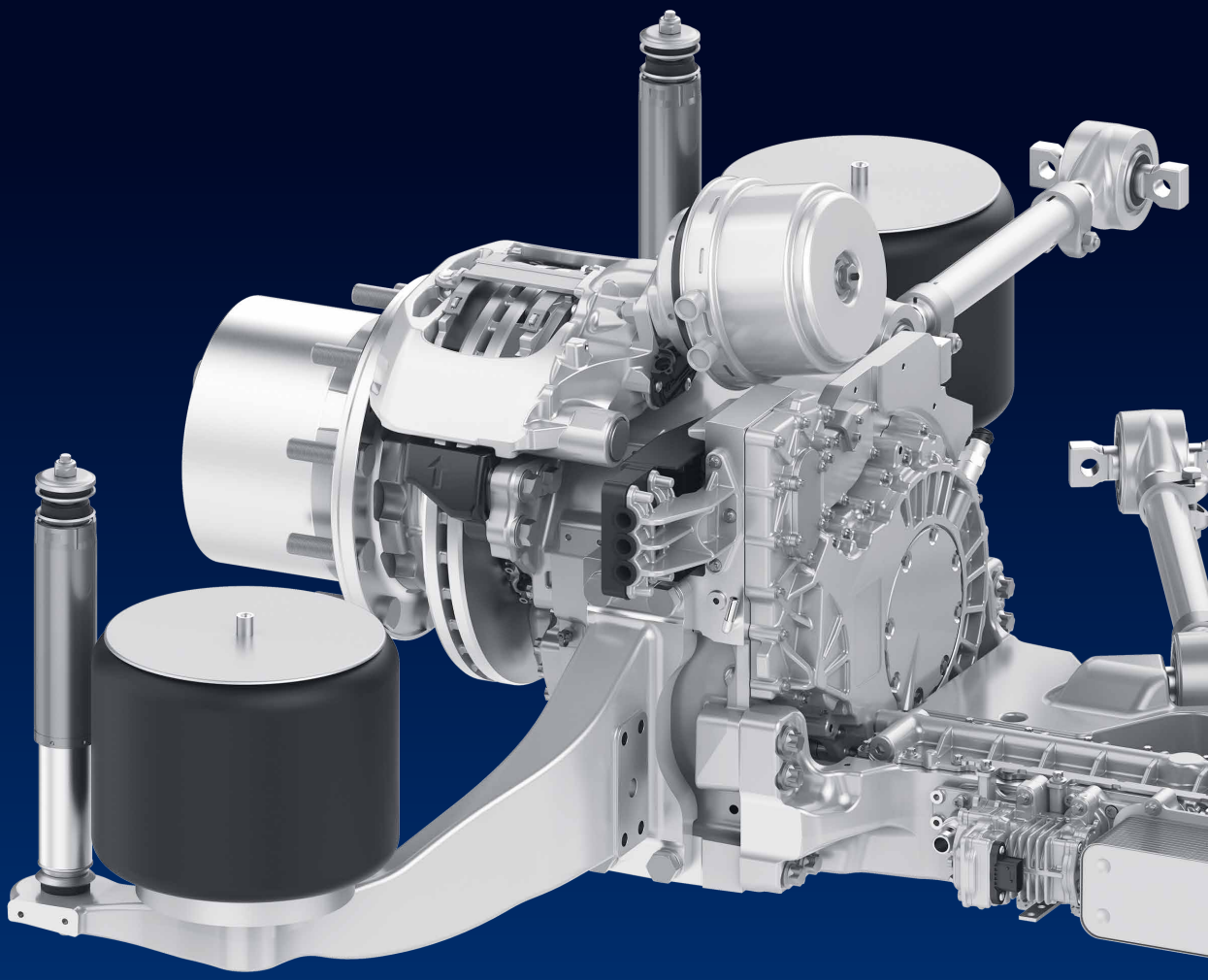
Value to Customers

- Advanced next-generation e-axle system provides premium, reliable performance, and optimized energy efficiency tailored to demanding bus applications
- Flexible, streamlined approach enables powerful operation of a solo or articulated bus with only one driven axle as pusher or puller, with an overall lighter system
- Offers more space for powerful batteries, passengers, or innovative bus interior designs
- Helps to extend battery duration and vehicle operational range
- Offers high-speed processing for advanced software functionality, while fulfilling regulatory cyber security requirements and functional safety
- Maximizes uptime and delivers intelligent, data-driven maintenance powered by ZF expertise enabling OEMs and fleets to significantly reduce repair costs and boost operational efficiency
- Enables local zero emissions for battery electric, fuel cell and trolley buses
- Supports to optimize ride experience for drivers and passengers with quiet and smooth electric powertrain operation
- Able to be delivered as full e-axle system with harmonized in-house air suspension and wheel-end solutions for ease of integration of AxTrax 2 LF into vehicle applications
- Single driveline solution enabling OEMs to flexibly design and deploy vehicles for diverse operational environments

The ZF Difference

- Provides optimized system performance and efficiency achieved through the exclusive utilization of in-house developed key components and software as part of a seamless platform approach
- Simplifies vehicle system integration, interoperability and therefore enables faster time-to-market, helping to accelerate the public transit conversion towards electrification and zero emission
- Provides a one-stop-shop for aftermarket partners and vehicle maintainers with a worldwide trained network of 3,800 ZF Service Partners
- Benefits from ZF's expertise in developing e-mobility, axle, and transmission solutions for a broad range of vehicles spanning from passenger cars up to heavy-duty trucks and buses

AxTrax 2 LF Low-Floor Electric Axle
Next-generation advanced e-Drive specifically designed for city bus applications



Modular Platform Approach

Leverages only ZF in-house developed key components and software

Powerful Operation

Integrates two PSM hairpin electric motors delivering up to 360 kW continuous power

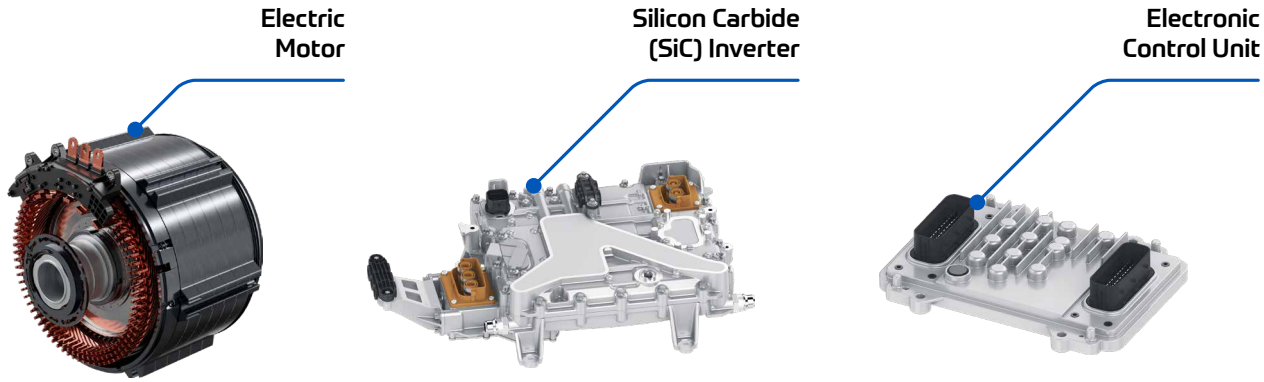
Enhanced e-Drive Efficiency

Controlled by two 800 Volt silicon carbide (SiC) inverters and a high-performance ECU

Optimized Uptime

Enables enhanced axle condition monitoring and over-the-air software updates

E-Drive Platform Components



Electric Motor

- Designed with hairpin windings to deliver high power and torque density in a compact lightweight package
- Provides high efficiency due to improved oil cooling
- Engineered in-house design delivers performance dedicated to commercial vehicle requirements
- Delivers quiet and smooth operation

Silicon Carbide (SiC) Inverter

- Delivers highly efficient power usage extending vehicle range
- Delivers high voltage (HV) range of 450 V – 770 V or 500 V – 850 V
- Offers a maximum high voltage (HV) DC current of up to 520 A
- Utilizes ZF control board and in-house developed software
- In-house developed key component as part of ZF's scalable and modular e-Drive platform

Electronic Control Unit

- Provides efficient powertrain control on electrified buses
- Enables advanced processing capability to match advanced customer requirements
- Complies with regulatory cyber security requirements
- Fulfills highest functional safety requirements for automotive regulations (ISO 26262)
- Provides optimized packaging design for limited installation space
- Builds on ZF experience in commercial vehicle electronics and intelligent transmission automation

Technical Features

- Leverages modular and scalable innovative platform approach with only in-house developed key components
- Integrates two permanent magnet synchronous hairpin electric motors delivering up to 360 kW continuous power and up to 36,800 Nm of peak system output torque
- Provides 25 % climbing ability in 30 t articulated buses with only one driven axle compared to the previous low-floor e-axle*
- Comes with an advanced motor oil-cooling system integrating e-pump and heat exchanger into the axle
- Enables up to 20% lower energy consumption compared to the previous low-floor e-axle through higher recuperation and improved efficiency**
- Controlled by two 800 Volt silicon carbide (SiC) inverters and a high-performance ECU for optimized e-drive efficiency
- Supports ZF Data Solutions analysis service providing vehicle driveline health data
- Ready for over-the-air software updates
- Offers optional integration of ZF air springs, shock absorbers, air disc brake and brake actuation solutions
- Provides compatibility with 6x2 or 6x4 drivetrains

* Based on performance assessment calculation; depending on specific combination of various factors, such as tire size, axle ratio, acceleration, starting speed

** based on various simulations

Technical Data

AxTrax 2 LF – AX426		
Continuous Power	260kW	
Axle ratio (integrated)	1st gear; i = 21.3	1st gear; i = 18.7
Peak output torque	22,400Nm	19,670Nm
Total vehicle weight (max.)	20t [1)]	
System weight	ca. 1,257kg [2)]	
Performance weight	0.26kW/kg	

AxTrax 2 LF – AX436		
Continuous Power	360kW	
Axle ratio (integrated)	1st gear; i = 21.3	1st gear; i = 18.7
Peak output torque	36,800Nm	32,310Nm
Total vehicle weight (max.)	30t [1)]	
System weight	ca. 1,257kg [2)]	
Performance weight	0.36kW/kg	

[1)] higher vehicle weights with multiple axles possible, max. axle load 13 t [2)] incl. spring carrier, ECU, inverter (2x), oil, air disc brakes

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