



Smaller, lighter, more powerful: ZF presents new e-drives for passenger cars and commercial vehicles

- **Excellent power density and efficiency in overall system comprising e-motor, power electronics, transmission and software**
- **Maximum flexibility thanks to optimized modular concept with three basic configurations**
- **Compact design enables resource-saving use of materials**
- **ZF demonstrates technological leadership through product innovations**
- **Industry's highest order backlog for e-drives with a volume of €25 billion**

Friedrichshafen. ZF presents the latest generation of electric drives for passenger cars and light commercial vehicles. It sets standards through outstanding power density and energy efficiency. ZF achieves this thanks to numerous innovations at both the component and system level. These include the compact design of the drives, the "discrete approach" in power electronics, and a resource-saving use of materials, which also makes the production of the drives more sustainable. With their modular concept, the new ZF e-drives support automotive manufacturers in customizing the further electrification of their entire model range. For end customers, the new technologies offer higher efficiency, more power, and shorter charging times.

ZF develops and produces technologies for the mobility of the future. Two million e-motors produced and the high-voltage vehicle electric system with 800-volt technology, which will go into series production this year, show: ZF is setting the pace in the dynamic electromobility market and is now further expanding its role as a technology and innovation leader. Proof of the company's successful transformation are the latest developments that ZF presented to international media in Friedrichshafen on November 21, 2022.



System approach anticipates market requirements

ZF is already developing its comprehensive product range for pure e-drives with a view to the functions desired by customers and end users. In order to better and faster meet the highly diversified market demand, the technology Group is now presenting a new generation of electric drives based on a modular overall concept with electric motor, inverter, transmission, and software. "We are focusing on three basic systems that meet our customers' main requirements, namely efficiency, performance and cost, even in the standard version," explains Markus Schwabe, Product Line Manager Electrified Powertrain Systems. "On this basis, we can optimally implement further individual customer requirements in e-vehicles of all segments."

"The great interest of manufacturers in our products in both the passenger car and commercial vehicle sectors is confirmed by our high order backlog in the high-voltage business. With the next generation of electric drives, we are consistently continuing our strategy of developing sustainable and efficient mobility for the future," explains ZF Board of Management member Stephan von Schuckmann, who is responsible for e-mobility within the Group.

Innovative strength in the system as well as in the components

With the new generation of e-drives, ZF provides fully integrated electric drive systems. With its high level of interface expertise and unique know-how for driving strategies, ZF application engineers can meet customer requirements fully in the best possible way. However, the Group will also offer the innovative components individually, on which its own system solution is based. "Thanks to sophisticated internal interfaces, the new, extremely compact design allows system or component adaptations to be made with little effort. In addition, the design has very high structural rigidity, which enables superior noise behavior," explains Dr. Otmar Scharrer, Head of Development for Electric Drive Technologies.



The new generation of ZF e-drives will be available on the market as a complete system starting in 2025; ZF will bring individual components into series production earlier. The following innovations at component level make their contribution to the advanced overall system:

With "discrete package technology", **power electronics** manage the balancing act between a high degree of component uniformity and high adaptability. The individualization takes place at the chip level: A discretely structured ZF inverter is built with individual power semiconductor switches. This modularity offers better performance scalability than is possible with complex power modules. In addition, ZF's "discrete package technology" requires fewer types of components than using conventional power modules. "With our new approach to power electronics, we can serve different market requirements faster and more precisely," explains Scharrer.

With a new, highly integrated **e-motor**, ZF once again increases the power density compared to the technology currently available in the market. A new cooling concept and a new winding technology play the decisive role here. Thanks to the new cooling concept, ZF allows oil to flow directly around the copper rods - exactly at the point where most heat is generated during operation. Such highly efficient cooling significantly increases performance with the same weight and installation space. The continuous power of the electric motor is increased to up to 85 percent of the peak power. In addition, the use of heavy rare earths can be largely dispensed with, and the e-motor can thus be produced more sustainably. The braided winding technology developed by ZF, a further development of the "hairpin" winding, enables a total of 10 percent less installation space. The winding head alone is around 50 percent smaller than with conventional approaches. This means that around 10 percent less raw material is processed.

With its new coaxial reduction **gearbox**, ZF transfers its world-leading know-how in planetary gearboxes to the next generation of electric drives. Two integrated planetary gears not only generate the desired axle ratio, but also include the fully integrated differential function.



Compared to common offset concepts, the new solution reduces weight and installation space requirements without compromising efficiency, noise, and vibration.

High-voltage converters (DC-DC converters) play a central role in fuel cell-powered electric drives. They compensate for the low output voltage and the strong voltage drop at high load of the fuel cells. The new high-voltage converter from the ZF power electronics platform, which was developed for passenger car and commercial vehicle applications, has a top value of 99.6 percent in terms of efficiency.

Captions:

1. *[e-Drive Platform – General view]*
Innovative components combine to form a flexible platform for e-drives: Overall system comprising e-motor, power electronics, transmission and software.
2. *[Product image of the new e-drive].*
Sophisticated interface technology ensures optimum scalability in the new design of the electric drive.
3. *[Product image E-motor]*
Innovation in components: ZF develops e-motors with new cooling concepts and new winding technology. The picture shows the stator with the new braided winding.
4. *[Product image high-voltage converter].*
ZF's new high-voltage converter achieves an efficiency of 99.6 percent.
5. *[Product image Integrated differential gear]*
Planetary gear sets in e-mobility: ZF uses its immense know-how to make e-drives with reduction gears more efficient and more powerful.

Images: ZF



PRESSE-INFORMATION
PRESS RELEASE

Page 5/5, November 21, 2022

Press contact:

Karin Markenstein, Head of Communication, Electrified Powertrain
Technology Division,
phone: +49 681 920-2563, e-mail: karin.markenstein@zf.com

Johannes Jerg, Electromobility and Chassis Technology,
phone: +49 7541 77-963 246, e-mail: johannes.jerg@zf.com

About ZF

ZF is a global technology company supplying systems for passenger cars, commercial vehicles and industrial technology, enabling the next generation of mobility. ZF allows vehicles to see, think and act. In the four technology domains of Vehicle Motion Control, Integrated Safety, Automated Driving, and Electric Mobility, ZF offers comprehensive product and software solutions for established vehicle manufacturers and newly emerging transport and mobility service providers. ZF electrifies a wide range of vehicle types. With its products, the company contributes to reducing emissions, protecting the climate and enhancing safe mobility.

With some 157,500 employees worldwide, ZF reported sales of €38.3 billion in fiscal 2021. The company operates 188 production locations in 31 countries.

For further press information and photos, please visit: www.zf.com

ZF Group
Global Corporate &
Marketing Communications
88038 Friedrichshafen
Deutschland · Germany
press.zf.com