Compact, Lightweight, Powerful: 
ZF’s Electric Axle Drive to Enter Volume Production in 2018

- First volume production application of a fully-integrated electric axle drive
- System for battery-powered, fuel-cell or hybrid electric vehicles
- Application for front and rear-wheel drive
- High power-to-weight ratio thanks to system integration of electric motor, transmission and power electronics

ZF has today announced that its new electric drive system, which is based on a modular approach, will start volume production with a European vehicle manufacturer in 2018. A drive system which is positioned at the centre of the axle is at the heart of the drive and can be used for various vehicle and performance categories. The system features an electric motor configured as an asynchronous motor (ASM). With up to 150 kW, the unit sets new standards in terms of power-to-weight ratio. An electric motor, a two-stage single-speed transmission complete with differential as well as power electronics form a highly-integrated and extremely compact unit. The technology is suitable as an all-electric drive for battery-powered, fuel-cell or hybrid electric vehicles and is suitable for both front and rear axle applications. Production will take place in Schweinfurt, the headquarters of ZF’s new E-Mobility Division; construction of the new production facility is already underway.

"ZF continues to proactively shape the future of electromobility. With the modular approach within our electric drive units, we are providing our customers with a tailored solution which at the same time is based on a high proportion of standard components," explains Jörg Grotendorst, Head of the new E-Mobility Division. "ZF’s efficient and compact drive system demonstrates that the system integration of the transmission, electric motor and power electronics can be highly successful."
electronics reflects a core competence that we can offer our customers from a single source." ZF already produces electric motors, axle drives and electronic control units individually in high volume. "Our first volume production award from 2018 reflects our capabilities and we will continue to consistently expand this systematic approach to solutions from the mild hybrid to the fully-electric drive" says Grotendorst.

**Modular approach**
ZF’s new modular approach for electric axle drives covers a range of performance categories and installation lengths and can therefore meet various customer and vehicle segment requirements – from compact cars to light commercial vehicles. The drive systems can be used in hybrid electric, fuel-cell and battery-powered vehicles.

**Highly-integrated drive system**
In an axially parallel electric drive module, ZF has integrated an electric ASM and a two-stage single-speed transmission with a differential, a housing and a cooling unit as well as power electronics including software. The motor and transmission share one housing, simplifying production and final assembly. The system generates up to 150 kW and the impressive maximum engine torque of 380 Nm is converted into a 3,500 Nm axle torque. Despite the integrated ASM, the compact drive system weighs a relatively light 113 kg. The entire unit has an axial length of around only 450 mm, a width of 380 mm and a height of 510 mm. Furthermore, the compact design naturally uses fewer materials and requires less installation space. This makes it easier for vehicle manufacturers to integrate the system into different vehicle architectures.

Unlike the permanent-field synchronous machine (PSM), the ASM does not require any magnetic materials and therefore does not need any rare earth elements such as neodymium or dysprosium.. The availability and price of such raw materials fluctuates vastly across the globe – which could entail a cost risk that is hard to
assess for vehicle manufacturers and suppliers. The ASM also requires only a simple concept to sense speed which offers advantages in terms of safety and reducing electric drag loss. In addition, the ASM allows a broader range between constant and peak performance which therefore lends itself particularly well to short-term, high performance requirements.

Speeds of around 13,000 rpm place exacting demands on the transmission with regard to noise emission. ZF has opted for an axially parallel single-speed transmission ratio of 9.6:1 which reduces the speed level in two subsequent spur gear stages. The optimized gearing and the low-loss mounting of rotating parts enable not only noise reduction but also very high efficiency across a wide operating range. The innovative design is rounded off by an integral overall cooling concept, which includes both power electronics and the electric motor and also cools the electric motor's rotor. This results in very good acoustic and dynamic characteristics of the electric drive in the vehicle.

**Low-loss conversion**
By integrating the power electronics into the electric drive ZF has been able to solve a problem that occurs in many all-electric vehicles regarding the interplay between the electric motor and power electronics. The power electronics convert the battery’s direct current into a three-phase alternating current required for the electric motor. As part of this process, notable losses occur in certain driving cycles. These losses are reduced with ZF’s electric drive axle system: as the actuation voltage is increased with the help of special modulation processes, the motor current can be reduced while performance remains unchanged. With normal driving cycles, this process significantly increases range.

**New E-Mobility Division**
With driveline electrification, ZF is able to significantly contribute to reducing CO2 emissions in road traffic. The technology company offers hybrid modules, plug-in hybrid transmissions as
well as electric drives for electric vehicles complete with power electronics and system integration.
With the foundation of a new E-Mobility division at the start of 2016 with headquarters in Schweinfurt, Germany, ZF has now merged all of its e-mobility activities under one roof. This is also where the E-Mobility system house was initiated, where all electromobility-related customer requests are processed and the competencies of the Group are bundled. More than 5,300 ZF employees work in this division at various locations around the world.

Customers of ZF’s electric drive systems can benefit from the Group’s overall expertise which offers valuable system know-how about the entire driveline, including its functional and structural integration into the complete vehicle.

The Group’s capabilities in the area of mechanics derived from its well-established driveline and chassis technology product portfolio is equally valuable to ZF’s customers. It includes topics as complex as the damping of torsional engine vibrations or efficient torque transmission.
Captions:
1.) Light, quiet, powerful: ZF’s fully-integrated electric axle drive system will enter volume production in 2018.
2.) The fully-integrated system for battery-powered, fuel-cell or hybrid electric vehicles is the first volume production application based on a new modular approach from ZF.
3.) The compact electric motor generates up to 150 kW.
4.) ZF’s electric drive system positioned centrally on the axle is also available as a unit fully integrated into a new modular rear axle concept.

Photos: ZF

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ZF is a global leader in driveline and chassis technology as well as active and passive safety technology. The company, which acquired TRW Automotive on May 15, 2015, is now represented at about 230 locations in some 40 countries. In 2015, ZF expects to achieve sales of EUR 29 billion to EUR 30 billion with approximately 138,000 employees (preliminary figures). ZF is one of the top three automotive suppliers worldwide.

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