

Growing demand

Schaeffler expands its range of innovations for all-electric and hybrid vehicles

"The electrification of the drive train is making rapid progress. This means that engine start-stop systems, for example, are becoming standard, recovery of braking energy is gaining popularity on the roads, and the number of hybrid models is increasing," stated Prof. Peter Gutzmer, CTO at Schaeffler.

A supplier of bearings and automotive components and systems, Schaeffler has developed a series of innovations that are contributing to the further development of engine start-stop systems. These include the optimisation of components in order to accommodate the significant increase in the number of start procedures, as well as solutions for start-stop systems such as non-contact sensors, optimised bearings, specially-coated components, electro-mechanical camshaft phasing units, latching valves, and components for belt-driven starter generators and permanently-engaged starters.

Electrification of the drive train not only compensates for the intrinsic weaknesses of the internal combustion engine but also opens up additional potential for improving vehicle efficiencies. As well as requirement-based electromechanical ancillary devices, vehicle efficiencies can be improved by introducing high performance start-stop systems.

As the market for hybrid vehicles continues to grow, a new field is also emerging beneath this: 48-volt solutions. Vehicles with this second low-voltage on-board electrical system can already offer several driving characteristics that were previously

only possible with hybrid vehicles. These include moving off using only electric power, "boosting" during driving operation, and "crawling" in stop-and-go traffic, as well as energy recovery during deceleration. Compared to conventional 12-volt on-board electric systems, 48-volt products also offer a respectable output of up to 12kW.

The core element of the Schaeffler range is a compact 48-volt electric drive module that includes a clutch and



planetary transmission, which can be placed either on the front or the rear axle of the vehicle. The low-voltage design reduces costs compared to high-voltage solutions with their associated requirements. This economical hybridisation allows significant advances to be made in terms of increased drive efficiency, as the use of a 48-volt electric system opens up operational possibilities that were previously the exclusive domain of vehicles equipped

with high-voltage hybrid components, including "crawling" in traffic jams – electrically powered driving in dense inner-city traffic, i.e. moving off, driving at low speeds, and parking using electric power. In addition to electric 'boosting' during starting and electric 'sailing' – a driving mode in which the electric motor ensures constant speed while the internal combustion engine is switched off – the system also enables recovery and storage of energy during deceleration, which is key in terms of reducing fuel consumption.

With an output up to 12kW, the electric drive acts as the hybrid vehicle's sole source of power when "crawling" in stop-and-go traffic. The electrically generated propulsion of Schaeffler's 48-volt drive module is also sufficient for driving in residential areas, parking in garages and for other low speed driving situations. This is also true of the comfortable driving mode known as "sailing", in which the electric motor ensures virtually constant speed across a wide operating range while the internal combustion engine is switched off. The electric drive assists the internal combustion engine by providing additional torque, or "boosting", for example, when moving off from traffic lights.

The high performance of the 48-volt system also means that the drive element opens up new potential for energy recovery. Due to the higher recuperation capability, the kinetic energy released during deceleration is now no longer converted into heat that subsequently dissipates – as was

previously the norm – but is instead fed back into the onboard electric system in the form of electrical energy. Therefore, a hybrid solution with combustion engine and 48-volt system proves to be advantageous when generating electricity from braking energy.

"Using a 48-volt solution today makes it possible to achieve outputs of up to twelve kilowatts," summarises Prof. Peter Gutzmer. "This entry-level form of hybridisation already offers the essential advantages of a hybrid vehicle while simultaneously providing an economically attractive, low-cost option that allows CO₂ emissions to be reduced by up to 15 per cent."

Dr. Tomas Smetana, Vice President Product Group Electric Axle Systems at Schaeffler: "The fact that the drive unit is connected directly to the prop



With the modular electric axle, Schaeffler offers an interesting family of products for advanced and high-performance hybrid vehicles

shaft in rear-wheel drive vehicles prevents drag losses by the internal combustion engine. We can therefore achieve maximum efficiency and enable driving situations that were previously only offered by hybrid vehicles with significantly more complex designs."

"Our combination of an electric motor and transmission also allows the flow of force to be distributed selectively, drive torques can be superimposed, and even torque vectoring – the variable distribution of torque that serves to increase driving

safety – is possible," he continues.

In its current configuration, the cylindrical component of the drive module is 235mm in length with a diameter of 165mm. This compact design means that the module can easily be integrated into the drive train and overall design of the vehicle without any space having to be sacrificed by the boot space or fuel tank.

Vehicle manufacturers that decide to install a second low-voltage on-board electric system (48-volt in addition to the standard 12-volt system)



Schaeffler's latest all-electric vehicle, STEP2, competed in the E-Car Rally in Montafon, Austria in July 2014. The vehicle has a drive developed by Schaeffler subsidiary IDAM and a two-speed powershift transmission

Schaeffler's 48-volt electric drive module can be placed on the front or rear axle.

can also integrate other suitable high-performance innovations into the vehicle. These include high-performance, rapid-reaction actuators for the chassis. These allow the ground clearance to be regulated according to the driving conditions and terrain, which has a positive effect on the vehicle's aerodynamics and therefore on its fuel consumption. In addition to high performance due to the higher voltage range, a second on-board electric system also offers the advantage of smaller cable cross-sections. This reduces weight and facilitates the integration and installation of the cable harnesses in the vehicle.

A range of other functions that push today's standard 12-volt systems to their performance limit can now be practically integrated into the architecture of a 48-volt system. These range from mechanical tensioners for 48-volt belt-driven starter generators, to a number of electromechanical

adjusters for clutch, steering, roll stabilisation, self-levelling suspension, hybrid modules, axle drive solutions and electromechanical torque vectoring units.

Schaeffler also offers solutions for fully hybrid vehicles. These range from hydraulic clutches and corresponding actuators to hybrid modules and modular electric axles. This family of disc-shaped, compact hybrid modules is designed for use in vehicles of various performance classes. Depending on the vehicle's performance and torque class, these hybrid modules are installed between the engine and transmission and are customised in terms of their size and configuration. The range encompasses hybrid modules for passenger vehicles up to 280Nm to models with more than 780Nm. As well as reducing fuel consumption and emissions, these innovations also contribute to the increased safety and driving pleasure of

hybrid vehicles.

With the electric axle, Schaeffler offers another very interesting family of products for advanced and high-performance hybrid vehicles. The drive element also has a modular design and so can be adapted to suit the customer's specific requirements. Schaeffler's electric axle, for example, is ideal for all-wheel drive hybrid vehicles. This range covers electric drives, transmissions and differentials, which can be connected to Schaeffler's eDifferential, a multi-gear electric drive axle with two electric motors. The higher-performance electric motor supplies the drive power and energy recovery, while its lower-performance counterpart – which is mounted on the other side of the drive module – enables the selective distribution of torque to the wheels ('torque vectoring'), which improves driving dynamics and safety.

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