

Hybrid drive

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Function

The hybrid drive combines the combustion engine with an electric motor. Readiness for start of production of the first vehicles with hybrid drive is the result of the perfect combination of the very latest technologies. Thanks to the interplay of the very latest system components, it has been possible to integrate the hybrid drive into production vehicles for everyday use with impressive distance coverage and high efficiency.

Components of the hybrid drive

A hybrid vehicle usually comprises the following components:

- Electric machine
- Inverter
- Cooperative regenerative braking system
- High-voltage battery

The electric machine

The electric machine is the linchpin of a modern vehicle with hybrid drive. It has two functions. As a motor, it provides the electric drive for the vehicle. As a generator, it helps to convert kinetic energy from the braking process into electrical energy.

Inverter

The power electronics, also known as the inverter, provides the link between the battery and the electric machine. It converts the direct voltage from the high-voltage battery into an alternating voltage needed to run the electric machine.

Cooperative regenerative braking system

With conventional brakes, the kinetic energy from the vehicle generated from the fuel upstream is converted into heat and lost. The cooperative regenerative braking system ensures that as much braking energy as possible is recovered and stored as electrical energy. The generator is used to decelerate the vehicle. The conventional wheel brakes are only applied if the braking requirement exceeds the deceleration potential of the generator. As such the cooperative regenerative braking system meets the same safety requirements as conventional braking systems.

High-voltage battery

The high-voltage battery supplies electrical energy to the electric machine during electric driving. When driving with the combustion engine and during regenerative braking, the battery is charged by the electric machine. Safe, powerful and high-quality lithium-ion batteries with a battery management system are used.

Types of system of hybrid drive

Hybrid drives are often designated as follows based on performance dimensions:

- Mild hybrid: uses the combined power of combustion engine and electric drive as a "boost function". In other words, the electric machine assists the combustion engine when accelerating, for example. Pure electric driving is not possible with this hybrid variant.
- Strong hybrid: Pure electric driving is possible for short distances.
- Plug-in hybrid: Electric driving is possible even for long distances.

Types of drive of hybrid drive

Several drive type options are available for hybrid drive vehicles. The possible drive types at a glance:

Serial drive

The combustion engine drives a generator. The electric motor uses the electrical energy from the generator to drive the vehicle. The power flows in series (combustion engine, generator, engine).

Parallel drive

Both the combustion engine and the electric motor drive the drive wheels. Power addition of the drive units takes place. Power flows in parallel from combustion engine and/or electric motor.

Split-power drive

A split-power drive combines serial and parallel concepts. The drive can either be provided solely by an electric motor (serial energy conversion by means of combustion engine and generator) or by the electric motor with a combustion engine in parallel.

The range extender as a valuable option

The use of a range extender is another option supported by hybrid technology. In vehicles with range extender, the electric drive is even more powerful and supports pure electric driving. The range is big enough to cover the average daily need for mobility. If necessary, electrical energy can be generated on-board by the range extender (small combustion engine). The range covered by pure electric driving is approximately 80 km. Over longer distances, the range extender increases the range by recharging the battery.

The components for electric vehicles with range extender are:

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- Electric axle drive
 - Inverter
 - Charger
 - Cooperative regenerative braking system
 - High-voltage battery
 - Range extender (combustion engine – often dimensioned as a rotary engine)

The range extender offers the following benefits to customers:

- Reduction in fuel consumption of up to 90%
- Reduction in CO2 emissions of up to 90%
- Mobility guarantee from the range extender
- More driving pleasure thanks to the boost effect of the electric motor
- Braking energy recovery
- No noise emissions

Safety

The high-voltage system in vehicles with hybrid drive is designed to ensure that the driver cannot come into contact with it during normal operation. For safety reasons, work on vehicles with hybrid drive must only be carried out by specialists with the requisite system knowledge and specific supplementary qualifications such as high-voltage training.

Aid organisations such as rescue services, the fire service, THW (the German government agency for disaster relief) and vehicle recovery services are also undertaking further training with a view to working with the new systems. This is in order to ensure that during recovery work after accidents involving hybrid drive vehicles, possible hazards which these vehicle may pose in addition to those usually encountered are minimised for rescue workers. Similarly, the high-voltage battery is housed inside a sealed container so that it cannot pose an additional hazard in the event of an accident.

Environmental protection

The electric drive relieves the load on the combustion engine in particular in situations where fuel consumption is above average levels (when starting off and accelerating, for example). In so doing, it helps to lower CO2 emissions and reduce harmful substance emissions in urban traffic in particular. When the vehicle is powered solely by means of the electric drive, noise emissions are reduced to an absolute minimum. Compared with a conventional drive, the hybrid can achieve fuel savings of up to 25%. This significantly relieves the load placed on the environment.



Delphi_EN



MAHLE



ZF

BORGWARNER

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Bosch

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