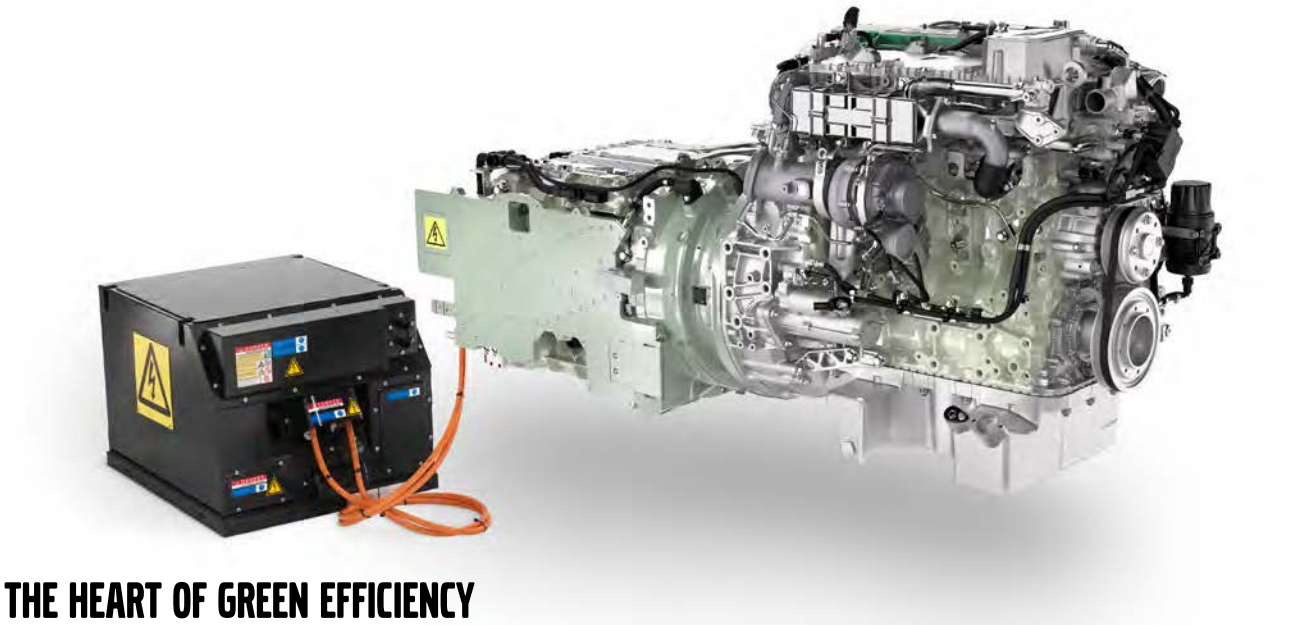
VOLVO HYBRID DRIVELINE

Euro 6



THE HEART OF GREEN EFFICIENCY

The Volvo Hybrid Driveline is world-leading in both fuel efficiency and uptime. Thanks to the concept of parallel hybrid propulsion both the diesel engine and the electric drive can be utilized to their full potential. Hybrid technology is widely applicable not only in all types of city traffic but also in shorter commuter and intercity applications. The driveline is available in two versions, one with increased capacity for articulated buses.

Configuration

The Volvo Hybrid Driveline consists of four building blocks:

- The Volvo D5K Euro 6 diesel engine
- Electric motor/generator
- Volvo I-Shift automated gearbox
- Energy Storage System (ESS)

The hybrid driveline makes it possible to downsize the diesel engine and in that way contribute to fuel savings compared with conventional vehicles. For further details on the D5K engine please refer to its fact sheet.

Energy Storage System (ESS)

The energy storage system contains a battery with Lithium Ion cells. It weighs approximately 220 kg. The battery's peak power is 120 kW and energy storage capacity is 1.2 kWh (double capacity for articulated buses). To operate the battery in cold conditions it is equipped with a heater. The heater can be used both when the bus is standing at the ramp and when driving.

Hybrid drive

The most common mode is hybrid drive, where the diesel engine and the electric motor together propel the vehicle. Torque is distributed between the two units depending on the ESS charge status, speed and other conditions.

Full electric drive

When the bus is standing still the diesel engine is shut off during certain conditions. The bus will therefore take off from the bus stop in full electric mode. During this time the bus is silent and emits zero emissions. The diesel engine starts up at the first gearshift. When pulling away with the accelerator pedal partly pressed, for instance when driving in slow traffic queues, full electric drive can continue longer, until the ESS charge status is too low or if other circumstances requiring diesel engine start-up occur. To enable full electric drive, the bus is equipped with electric power steering, an electrical air compressor and a DC/DC unit that converts 600 V power to 24 V power. The DC/DC unit replaces the conventional alternator.

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Engine stopped when bus is at a standsill
When the bus is standing still the diesel engine is shut down. There are several conditions that influence the shut down of the engine, e.g. the battery charge level, coolant temperature and road gradient.

If the engine does not shut down it still meets the relevant noise emission requirements. The crankshaft and camshaft feature rubber vibration dampers, which minimize noise and vibrations. Fuel pre-injection is used to further dampen noise when idling.

Brake energy regeneration
During braking or retardation the kinetic energy is regenerated to charge the ESS. The regenerated energy is later used for propulsion or for auxiliary consumers such as the air compressor, DC/DC or air conditioning system.

Fuel-efficient with good drivability
The Volvo Hybrid Driveline is one of the world's most fuel-efficient drivelines for heavy duty vehicles commercially available and proven in operation. The Volvo D5K features common-rail injectors and air intake designed for optimum combustion, which provides high power and torque within a wide rev range. In addition, the electric motor adds full torque from low revs, delivering a peak of more than 1200 Nm in an articulated bus. As a result, the Volvo Hybrid Driveline offers extremely good drivability with supreme fuel efficiency.

Euro 6-compliant through advanced after-treatment
The Volvo D5K is a low-emission engine, in terms of exhaust gases as well as noise. The low emissions are achieved by after-treatment of the exhaust gases using:
- SCR (Selective Catalytic Reduction)
- EGR (Exhaust Gas Recirculation)
- DPF (Diesel Particulate Filter)

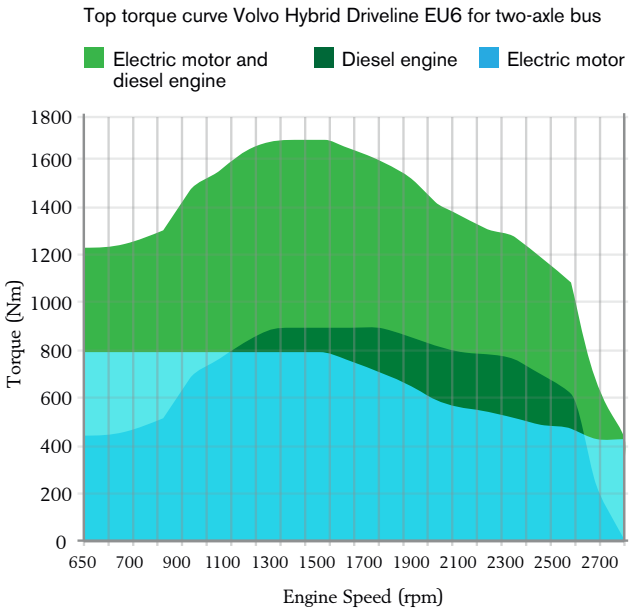
Thanks to the very high efficiency levels of the engine after-treatment system, emissions are below the legal requirements. The after-treatment modules are integrated in the one box silencer unit.

Volvo I-Shift
The Volvo I-Shift is a twelve-speed gearbox. Gear changing is automatic and software-controlled. I-Shift is used for many different Volvo applications, but there is a special program for hybrid drivelines. At takeoff the transmission program fully controls the driveline to optimize usage of the diesel engine and the electric motor in parallel.

During gear shifting the transmission program uses the electric motor to synchronize input and output shafts to speed up and optimize the comfort of the gear shift. The electric motor and the ESS are also used to ensure that the torque interruptions during gear shifting are minimized.

Volvo I-SAM electric motor	
Max. output	120/150 kW
Max. torque	800/1200 Nm

Volvo D5K240 EU6	
Max. output	240 hp (177 kW)
Max. power at	2200 rpm
Max. torque between 1200–1600 rpm	918 Nm
No. of cylinders	4
Bore	110 mm
Stroke	135 mm
Displacement	5.1 dm^3
Compression ratio	17.5:1
Oil-change volume, including oil filters	approx. 18.7 L



Volvo Bus Corporation
Göteborg, Sweden
www.volvobuses.com