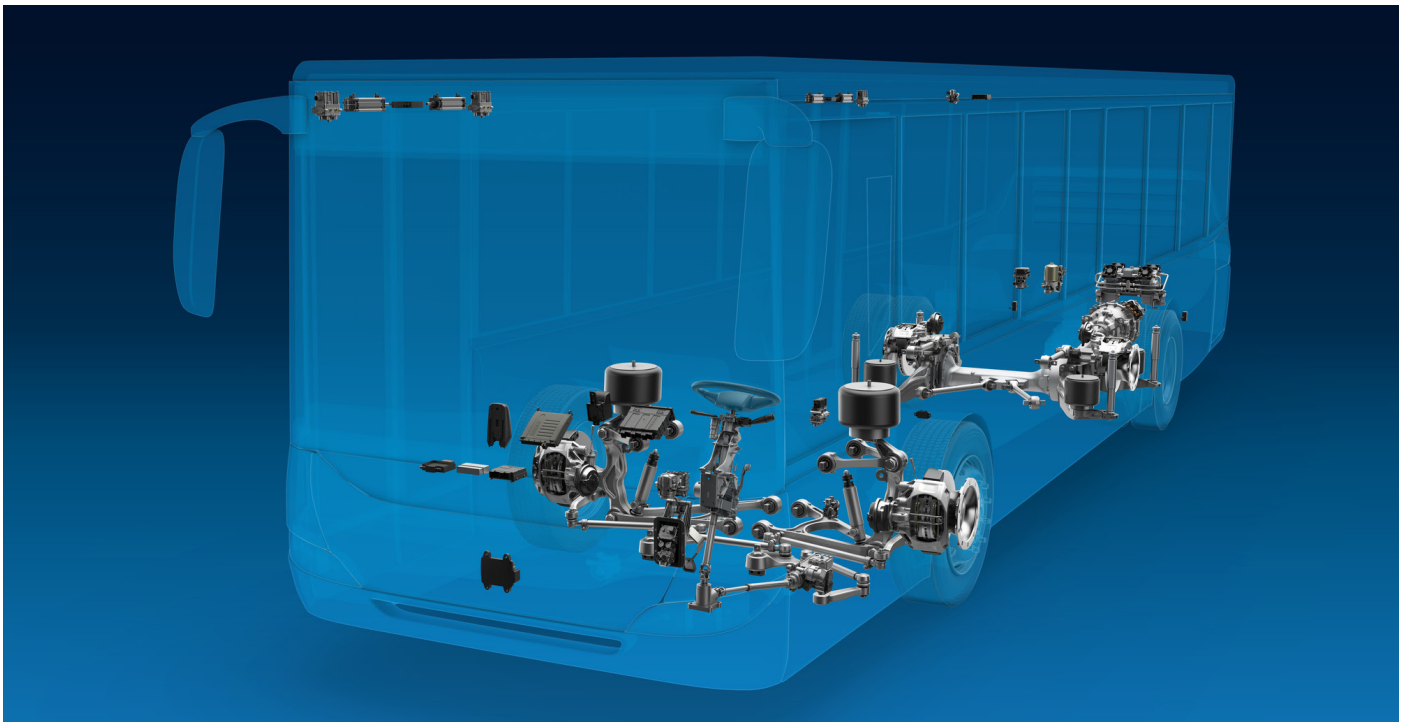
ZF

ZF Accelerates City Buses and Coaches Towards Next Generation Mobility



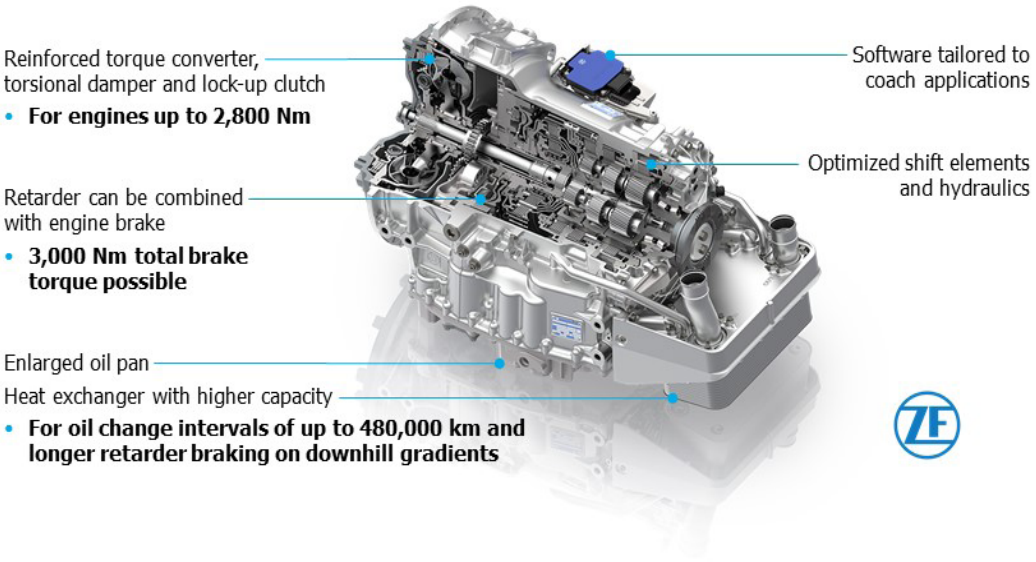
Underlining its support for city bus and coach manufacturers as well as fleet operators worldwide, ZF is taking its extensive portfolio of advanced systems and solutions to the next level.

Advancing the global technology leader's 'Next Generation Mobility' strategy, ZF's Commercial Vehicle Solutions (CVS) division is leveraging its unique capabilities to bring the sector's autonomous, connected and electric future ever closer.

Far from simply outlining the technologies of tomorrow, ZF is already bringing many of these innovations to our roads and highways. It also has a clear road map for the future advancement of cutting-edge bus and coach technologies. This includes raising and setting new industry benchmarks for the safety and efficiency of people transportation, thereby delivering significant advantages for all types of coach and city bus applications.

Setting a New Benchmark in Coach Efficiency

The second generation of ZF's proven six-speed automatic transmission, EcoLife CoachLine, is now available and has established an advanced new industry



benchmark in coach transmission system performance and efficiency. Suitable for all types of coach application, whether operating in a city, intercity or on steep mountain track, it offers significant advantages for customers. In addition to enabling outstanding passenger comfort, fuel savings of up to three percent over the previous-generation EcoLife are possible. This is thanks to EcoLife CoachLine's innovative start/stop function which saves fuel during the entire transmission service life. The powershift transmission also has an optimal gear ratio spread, from 3.36 to 0.59. This is powerfully combined with a high level of mechanical efficiency, ensuring that the vehicle always operates within the optimal range of engine speed.

"Environmentally and economically smart, EcoLife CoachLine sets a new standard of transmission performance, efficiency and driving comfort for even the most demanding coach applications, from city streets to mountain roads," said Dr Jochen Witzig who is responsible for transmission systems at ZF's Commercial Vehicle Solutions division.

"Given the continued predominance of traditionally internal combustion engine-powered buses in public transport and long-distance travel world-wide, it is vital that we focus on delivering ever-higher levels of fuel efficiency to help reduce emissions. EcoLife achieves this and so much more," added Dr Witzig.

Connecting Bus Fleets to the Power of Vehicle Data

Supporting public transport and private bus fleet operators, ZF Bus Connect is an advanced fleet management tool designed to improve fleet efficiency and performance. Leveraging vehicle data to enhance safety, efficiency and improve vehicle uptime, the digital fleet management solution was developed by ZF as part of its Data Venture Accelerator to create digital products and services.

Designed for scalability and ease of use, Bus Connect enables geofencing and driver behaviour monitoring to detect potentially dangerous bus driving situations, helping prevent accidents as well as offering theft protection. Enhancing efficiency, live data is evaluated on an individual bus basis, enabling the optimisation of driving and route plans while improving fuel consumption. ZF Bus Connect helps extend vehicle uptime by delivering predictive remote detection of damage or of wear and tear of consumable items that is compatible with real-world bus configurations; it also enables diagnosis and secure 'over the air' updates to reduce downtime.

ZF Bus Connect is developed for city buses and coaches with both electric and combustion engines or hybrid systems and it can be used in a mixed fleet. The user can check every aspect of the vehicle, including having a live view of vehicle locations in real-time, observing current energy or fuel consumption, and checking the status of battery charge or maintenance status of the vehicles' parts, brake wear and other system messages.

"With ZF Bus Connect we are helping the bus operators with their difficult change to all-electric fleets," explained Florian Freund, responsible for the ZF Bus Connect development. *"With the power of data-analytics of in-vehicle data, we are helping operators to manage their fleet efficiently by reducing the energy*

or fuel consumption whilst giving a clear CO2 fleet footprint overview."

Electrification Fast-Track for Buses and Coaches

ZF recently announced a fuel cell drive partnership with fuel cell and battery systems supplier, Freudenberg e-Power Systems. The partners will develop drive-train technologies for commercial vehicles, including buses and coaches. Supporting the industry's decarbonisation aims, ZF is advancing open technologies for the battery and fuel cell.

The joint development agreement brings together ZF's electric driveline leadership with Freudenberg's fuel cell expertise to develop clean e-Drive 'powerpack' solutions, consisting of a fuel cell and drivetrain system; the two partners will also share components for a variety of applications.

The pilot phase of the co-operation agreement is currently underway with prototypes of bus demonstration vehicles expected by 2023. This corresponds to ZF's already announced fuel cell partnership for the development of a coach prototype as part of the HyFleet project.

Pioneering City Bus Safety

ZF has developed its first collision-mitigation system (CMS) specifically designed for city buses taking its systems and components expertise to the next level. The pioneering system offers active braking to help avoid frontal collisions with other road users, including vehicles, bicycles and pedestrians. The system also helps counter the adverse impact of braking momentum on passengers. Helping reduce the risk of accidents and injuries both inside and outside of the bus, the solution is the industry's first manufacturer-independent CMS specifically engineered for city bus applications. The system is compatible with both electric and internal combustion engines. Having already secured business wins from leading bus OEMs, ZF will initially launch its City Bus CMS in Europe and, ultimately, plans to roll the system out worldwide.

"Leveraging ZF's wide-ranging competencies to develop a pioneering solution connecting radar and camera

with a central processing unit and braking system, City Bus CMS represents a clear proof point of the Group's Next Generation Mobility strategy," said Philipp Helmich, Head of Vehicle Dynamics Product Lines with ZF's Commercial Vehicle Solutions division. *"The system addresses the clear and pressing demand from manufacturers and their customers for ever higher levels of safety in city traffic.*

"In addition to providing advanced, integrated safety for road users as well as the driver and passengers of both electric and traditionally fuelled buses, we are extending ZF's advanced driver assistance systems leadership in trucks and coaches to the important city bus market segment. Utilising advanced braking system technology is fundamentally important for safety and autonomous driving, with complex city bus applications providing an interesting and valuable use case," added Helmich.

Enhancing City Bus Comfort and Safety

ZF's continuous damping control (CDC) is suitable for city buses and combines uncompromising comfort and driving safety. Providing enhanced stability even in critical driving situations, it supports safe handling during dynamic manoeuvres. With improved acoustics, reduced vibrations and controlled cab movements under the effects of shifting loads, the system improves cockpit ergonomics. Especially in electric driven buses with batteries on the roof, it helps prevent dangerous dynamic pitching while combining vehicle stability to deliver greater comfort and safety for the driver and passengers.

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