

Successful finish: F-CELL World Drive reaches Stuttgart after circling the globe

Press Information

- **Three B-Class F-CELL drive more than 30,000 km around the world**
- **Impressive proof of everyday usability of fuel-cell technology**
- **Reliable operation even under tough conditions**
- **Initial impetus for establishing hydrogen infrastructure**
- **90,000 km covered with zero emissions**

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The “Mercedes-Benz F-CELL World Drive” – the first round-the-world drive with fuel-cell vehicles - successfully concluded on schedule today in Stuttgart. After more than 30,000 kilometers, three Mercedes-Benz B-Class F-CELL vehicles with zero local emissions drivelines crossed the finish line in front of the Mercedes-Benz Museum in Stuttgart. The hydrogen-powered B-Classes and their support vehicles set off from Stuttgart at the end of January on the occasion of the official 125th birthday of the automobile, and on their way have crossed through 14 countries on four continents.

“With the F-CELL World Drive we have shown, that the time for electric vehicles with fuel cell has come. Now the development of the infrastructure has to pick up speed,” said Dr. Dieter Zetsche, Chairman of the Board of Management and Head of Mercedes-Benz Cars. “For only an adequate number of hydrogen fueling stations enables car drivers to benefit from the advantages of this technology: high range, short refueling times, zero emissions.

Hydrogen infrastructure challenge

Within the scope of the F-CELL World Drive, the Mercedes-Benz B-Class F- Seite 2 CELL was functioning as an ambassador for a new, zero-emissions auto-mobility of the future. At the same time, Mercedes-Benz was lobbying extensively for the establishment of a comprehensive network of hydrogen fueling stations – a crucial factor for the market success of this technology. So far, there are only approximately 200 fuel stations worldwide at which fuel cell vehicles can be refueled. According to expert calculations, a network of around 1,000 fixed fuel stations would be sufficient for basic nationwide coverage in Germany. A central aim of Mercedes-Benz is to see to it that, in future, drivers all over the world will be able to refuel with hydrogen – just as they do today with gasoline and diesel fuel.

The exclusive partner for hydrogen supply on the F-CELL World Drive was the Linde Group. Thanks to its hydrogen expertise and global presence, it was able to guarantee fuel supply throughout the entire world trip. A jointly developed mobile refueling unit based on a Mercedes-Benz Sprinter accompanied the tour – the only way to ensure fuel supply even on the most remote stretches.

Proof of the everyday usability of fuel-cell drive

During the F-CELL World Drive, Mercedes-Benz was able to provide an impressive demonstration of the qualities of its fuel cell vehicles in terms of performance and robustness. The World Drive vehicles drove not only in downtown areas, on country roads and lengthy stretches of highway, but also proved their capabilities driving on unfinished surfaces, for example on stages in Australia and China.

Even a no-fault accident in Kazakhstan was unable to stop the B-Class F-CELL. On the route from Almaty to Balkhash, the number-three B-Class F-CELL was rammed on its rear left fender. The rear axle and bumper of the fuel-cell car both sustained damage. However, the fuel cell vehicle was repaired in a nearby workshop and continued its way around the world. Only a small dent in the bodywork bears testament to this single incident.

Round the world with hydrogen – the tour in figures

Over a total of 70 driving days, participants in the F-CELL World Drive collected an abundance of travel notes documenting the multi-faceted aspects of the tour and, at the same time, underscoring the everyday usability of the fuel cell technology on board the B-Class F-CELL. The record distance of 648 kilometers, split between two stretches of more than 300 kilometers

each, was covered on the drive from Almaty to Balkhash in Kazakhstan. Seite 3

Another likely record is the number of inhabitants in the places visited by the tour, ranging from no more than twenty in Balladonia, Australia, to an impressive 19 million in Shanghai, China. Due to the still insufficient hydrogen infrastructure, the mobile unit, which has been developed in cooperation with the Linde AG, was used around 130 times to refuel the B-Classes. Along the route, the B-Class F-CELL vehicles were also refueled in just a few minutes at two hydrogen fueling stations.

Mercedes-Benz long-distance drives – in the tracks of Bertha Benz

With the now historic F-CELL World Drive, the first round-the-world drive with fuel cell vehicles, Mercedes-Benz is adding to a long history of legendary long-distance drives. Examples include the first crossing of Africa in a car in 1909 and the longest diesel marathon - the “E-Class Experience” - run in 2006 over 14,000 kilometers from Paris to Beijing.

As far as its objective was concerned, the F-CELL World Drive has a direct connection to the world’s very first long-distance drive – the pioneering endeavor of Bertha Benz, who, in 1888, completed the first cross-country drive with the Benz Patent-Motorwagen from Mannheim to Pforzheim. She faced in principle the same challenge as her successors with the B-Class F-CELL – she, too, could not exactly roll into the next fuel station and top up.

In the early days of the automobile, drivers had to buy their fuel from the pharmacy, which is why Bertha Benz stopped at the town pharmacy in Wiesloch. That was the only place she could acquire the light gasoline “ligroin” – which was actually intended for domestic use as a stain remover, but also worked as fuel. First gradually, then with increasing speed, the fuel station network expanded into the worldwide infrastructure we know today. That was a defining factor in the triumphant procession of the combustion-engine-powered automobile invented in 1886 by Daimler and Benz. With new drive systems the motto is: alternative drives need alternative infrastructures. In the case of the B-Class F-CELL, this means hydrogen fueling stations. It is for this reason that Mercedes-Benz, as the inventor of the automobile, together with partners from commerce and politics, is lobbying heavily for the establishment of a comprehensive infrastructure – both for electric cars with fuel cells and for those with battery-electric drive.

Contact:

Seite 4

Eva Wiese, Tel.: +49 (0)711-17-92311, eva.wiese@daimler.com
Matthias Brock, Tel.: +49 (0)711 17-91404, matthias.brock@daimler.com

Further information about Mercedes-Benz is available online at: www.media.daimler.com
and www.mercedes-benz.com

Mercedes-Benz B-Class F-CELL

First electric car fully suited for everyday driving and with the driving dynamics of a two-litre petrol car

Mercedes-Benz is launching its first series-produced electric car with a fuel cell on the road: the new B-Class F-CELL. The small-scale production of the environmentally friendly electric car is already underway. In 2010, the first of around 200 vehicles have been delivered to customers in Europe and the USA. The technology for the B-Class F-CELL drive system is based on the optimised latest-generation fuel cell system. It is some 40 percent smaller than the system in the A-Class F-CELL from 2004, but develops 30 percent more power while consuming 30 percent less fuel. The main drive system components include a compact fuel cell stack, a powerful lithium-ion battery, three 700-bar tanks for the hydrogen and a compact, lightweight drive motor at the front axle.

Cold-start capability down to minus 25 degrees Celsius

The fuel cell module in the B-Class F-CELL, the stack, boasts outstanding cold-start capability down to minus 25 degrees Celsius. The system features a new humidification system consisting of hollow fibres that ensures, unlike with the first-generation fuel cell, that water no longer freezes in the stack, a characteristic that used to impair cold-start capability. Even at minus 15 degrees Celsius the B-Class F-CELL starts just as quickly as the very latest diesel engine. A dedicated operating strategy helps ensure the fuel cell stack reaches its optimum operating temperature of around 80 degrees Celsius as quickly as possible each time the vehicle is started. Thanks to the powerful cooling system and intelligent temperature management, this 'pleasant temperature' is maintained constant under all operating

conditions.

Seite 5

Range of around 400 kilometres with the tanks full

The hydrogen used to run the fuel cell is stored in three tanks at a pressure of 700 bar. Each tank holds just under 4 kilograms of the gaseous fuel. The tanks are hermetically sealed from the outside world, preventing the loss of hydrogen into the atmosphere even if the vehicle is left to stand for long periods. Thanks to the high compression ratio, the B-Class F-CELL can cover long ranges of up to 400 kilometres with the tanks full, over twice as far as the A-Class F-CELL. If the tanks are empty, they can be filled simply and quickly in less than three minutes, thanks to a standardised refuelling system.

Equivalent of just 3.3 litres of diesel per 100 kilometres

The electric motor – a permanently excited synchronous motor – develops a peak output of 100 kW/136 hp and a maximum torque of 290 Nm – typical of the high torque generated by an electric motor –, which is available from the instant the engine starts to turn. It ensures that the B-Class F-CELL, whose impressive dynamic handling properties are in some cases far better than those of a two-litre petrol car, gets off to an excellent start. Nonetheless, the local zero-emission electric drive with fuel cells consumes the equivalent of just 3.3 litres of diesel per 100 kilometres (NEDC).

Compact lithium-ion battery with high power density

A powerful high-voltage lithium-ion battery is used to store the power. It boasts an energy capacity of 1.4 kWh and is cooled via the air-conditioning system circuit. When it came to the battery for the B-Class F-CELL, Mercedes-Benz drew on the experience garnered during the development of the lithium-ion technology for the S 400 HYBRID. Advantages of the lithium-ion battery include its compact dimensions and much superior performance compared with nickel metal hydride batteries (NiMH). The energy density is 30 percent higher than with NiMH technology; the power density 50 percent higher by comparison. Furthermore, high recharge efficiency and a long service life make the technology even more compelling.

Intelligent drive system management for superb efficiency

Mercedes-Benz has further enhanced the operating strategy of the electric drive with fuel cells for the B-Class F-CELL. As the outside temperature plummets, the electric motor

receives its electrical energy during a cold start both from the lithium-ion battery and from the fuel cell system as it "powers up". Battery power is sufficient as the outside temperature warms up; the fuel cell then comes on line later – depending on the power requirements. In drive mode, the energy management system constantly maintains the F-CELL system in the optimum operating range. The lithium-ion battery dynamically smoothes out variations with regard to the electrical power required in the current driving situation.

Seite 6

Whenever the driver brakes or as soon as they take their foot off the accelerator, the electric motor converts kinetic energy into electrical energy, which is then stored in the battery, using a process known as recuperation. While manoeuvring or on short journeys, the electric drive motor uses battery power. If the battery capacity is not sufficient, the fuel cell automatically kicks in. In a bid to ensure optimum efficiency and customer benefits, the intelligent drive management system decides whether the electrical energy is used from the lithium-ion battery, the fuel cell, or a combination of the two systems.

Full everyday practicality

Five seats and a boot capacity of 416 litres make the B-Class F-CELL fully suitable for day-to-day and family use. The key components for the electric drive with fuel cell are optimally protected in the vehicle underbody, thanks to a space-saving design that also promotes a low centre of gravity. Advantages of the design include:

- The generous interior space in the B-Class is fully retained. As the entire fuel cell system is integrated into the spacious sandwich floor, no compromises are necessary with respect to passenger and luggage space as well as variability
- The drive technology built into the sandwich floor ensures a low centre of gravity and, consequently, extremely reliable, agile handling
- Crash safety meets the extremely high standards associated with Mercedes, as the key drive components as well as the hydrogen tanks are placed between the axles.

The B-Class F-CELL offers consummate driving pleasure and full day-to-day suitability – without local emissions. The innovative electric car also has a great deal to offer when it comes to equipment and appointments, including the bonamite silver special paint finish and exclusive 10-spoke light-alloy wheels. In the interior, leather upholstery, heated seats,

automatic climate control and the COMAND system, as well as other features, ensure a high level of comfort. The dynamic energy flow display in the COMAND system display keeps the driver constantly abreast of the battery charge status, operating mode of the fuel cell system, as well as providing information on nearby hydrogen filling stations. Seite 7

Safety first: uncompromising safety standards

Mercedes-Benz applies the same high safety standards to the B-Class F-CELL as to any of its other series-production models. The starting point is the outstanding crash safety of the Mercedes-Benz B-Class, which received the highest five-star rating in the European NCAP (New Car Assessment Programme). The integrated safety concept of the B-Class F-CELL takes the specific characteristics of the innovative drive system into account. The experience garnered over many years by Mercedes-Benz with the electric drive powered by fuel cells from the A-Class F-CELL and the high-voltage technology involving the lithium-ion battery from the S 400 HYBRID went into honing the concept.

Mercedes engineers have tested the safety of the drive-specific components including the hydrogen tanks in the B-Class F-CELL in more than 30 crash tests. The hydrogen tanks are installed in the sandwich floor and therefore well protected in the event of an impact. They hold the hydrogen which is pressurised to 700 bar and have been designed to withstand all conceivable loads. In the event of a crash, safety valves close the hydrogen supply lines to the fuel cell and decouple the tanks from the other system components. Even after a serious accident, the hydrogen poses no risk whatsoever. If a fire leads to excessive heat, a temperature-controlled valve vents the tank contents in a controlled manner.

The lithium-ion battery and the high-voltage system in the B-Class F-CELL feature – based on the experience garnered with hybrid technology in the S 400 HYBRID – an extensive, seven-stage safety concept.

- All the wiring is colour-coded to avoid confusion, and marked with safety instructions. This prevents assembly errors in production or in repairs, and makes the quality checks easier to carry out
- Comprehensive contact protection for the entire system by means of generous insulation and dedicated connectors

- The lithium-ion battery is accommodated in a high-strength steel housing. Further safety features: blow-off vent with a rupture disc and Seite 8 a separate cooling circuit. An internal electronic controller continuously monitors the safety requirements and immediately signals any malfunctions
- All high-voltage components are connected by an electric loop. In the event of a malfunction the high-voltage system is automatically switched off
- As soon as the ignition is switched to "Off", or in the event of a possible malfunction, the high-voltage system is actively discharged
- During an accident, the high-voltage system is completely switched off within fractions of a second
- The system is continuously monitored for short circuits

The high level of safety means Mercedes-Benz fuel cell vehicles can use underground car parks, multi-storey car parks or tunnels with no restrictions whatsoever.