



PRESS RELEASE

Magneti Marelli supplies electric engines for the LaFerrari, Maranello's first hybrid car

Thanks to its technological know-how in races, the company will contribute to the HY-KERS system with two moto-generators and various components for the electronic control of electric powertrain. Lighting, Electronic Systems and Suspensions are the other technologies fitted on the special limited series previewed in Geneva.

A long-awaited world preview at the Geneva Motor Show 2013, the new **LaFerrari** is the first Maranello car to fit a hybrid-electric system, called HY-KERS, to which Magneti Marelli will contribute electric engines and various strategic components for management and control electronics.

For the more extreme Ferrari ever, Magneti Marelli has drawn upon consolidated know-how and from the racing world, adding his technology to the HY-KERS developed by Maranello.

The HY-KERS fitted on the LaFerrari generates a total power of 963 HP. It consists of a V12 6.3-l aspirated combustion engine running on gasoline, able of delivering 800 HP, and of an electric part developed with Magneti Marelli, consisting of two electric engines (one main motor and one for the auxiliary systems) capable of delivering together a peak power of 120 kW (163 HP).

The HY-KERS system is able to push the car to record performances and simultaneously to reduce emissions by about 40%.

The two Magneti Marelli electric engines incorporated in the HY-KERS system are controlled by two associated inverters which are compact in terms of weight and size.

The first engine provides drive to the vehicle and recovers kinetic energy during braking, storing such energy in the lithium batteries for the over-boost power managed in an intelligent manner by the vehicle dynamic control systems.

The second engine, driven by the combustion engine, generates electricity used to keep the charge level of lithium batteries constant, in addition to provide energy for standard vehicle systems (lights, etc.).

Below please find a detailed description of the main components and the operating diagram of the system.

Magneti Marelli supplies technology dedicated to the LaFerrari in the Lighting area too (high-intensity Bi-Xenon headlights, LED rear lights), Powertrain (throttled body) and Electronic Systems with 10 electronic control units dedicated to controlling the vehicle standard functions, such as headlights, Superlift system, body computer, electric actuator for the intake manifolds, electronic control unit for the Dual Clutch transmission, driver and passenger carrying modules. The LaFerrari uses the Superlift system designed by Magneti Marelli which, thanks to hydraulic actuators, lifts the

vehicle and helps it to easily overcome speed bumps and other irregularities in the road surface.

The development of strategic components for the electric engine system fitted on the LaFerrari symbolizes, at the utmost level, the **technological osmosis** between the **racing** world and the **mass-production** that characterizes Magneti Marelli.

Thanks to this dynamics, technologies and know-how tested in an environment featuring extreme conditions and performances are used and transferred over to mass-produced vehicles, thus ensuring great reliability, the maintenance of excellent technical characteristics in parallel with flexibility and excellent ability to adapt to the customer's needs.

In the specific case of the LaFerrari, this process has originated the development of electric moto-generators from a "racing" application already conceived from an **"automotive" standpoint** and not from generic industrial applications.

This **racers-mass production technological osmosis** contributes to the evolution towards new frontiers in terms of efficiency, yield, safety, lower fuel consumption and emissions, alternative engines and electronics at the service of intelligent mobility.

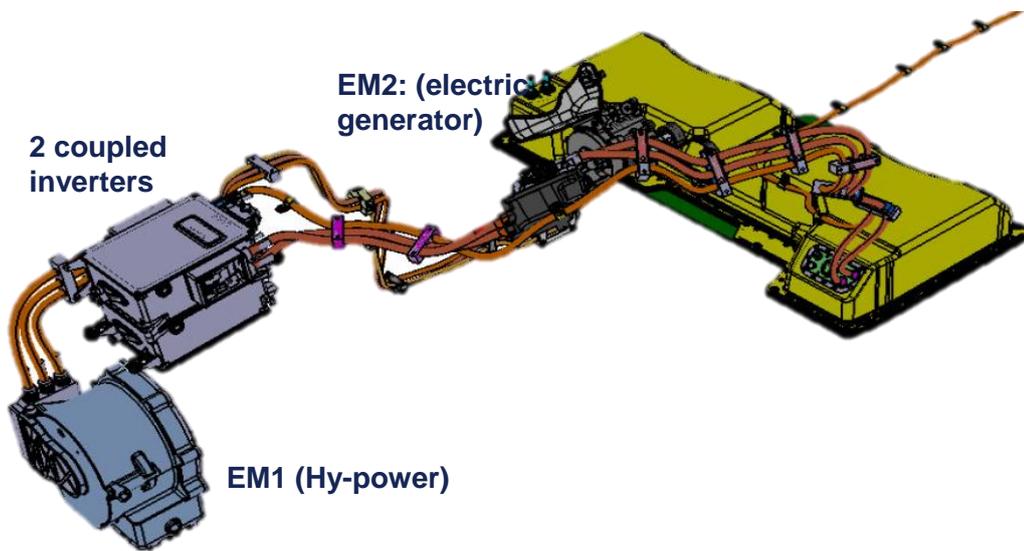
Illuminating examples of such an exchange, with applications in both areas, can be found in both the recent past (the evolution of engine control electronics, the AMT **robotized gearbox**) but most importantly in a future perspective: **GDI direct injection** from the factory to the races, the hybrid engine systems based on **KERS** technologies and the possible transfers of know-how between **advanced telemetry** solutions for the racing world and **info-telematic** communication technologies between mass-produced vehicles and infrastructures.

The operating system of the electric engine developed by Magneti Marelli for the LaFerrari

Main components:

- EM1: Hy-Power electric engine used for the drive or as a generator, coupled to the dual-clutch transmission (DCT). This engine recovers kinetic energy under braking (the KERS principle), converting it into electricity which is stored in the batteries, and generates additional power (over-boost) of 120 KW (about 200 torque) during the acceleration phase. The engine also ensures the deactivation of the combustion engine once the vehicle has stopped, keeping the in-vehicle electronic systems active. The Hy-Power electric engine comes from F1, and features a stator with revolutionary bar windings.
- EM2: Auxiliary electric engine operated by the combustion engine which is used to keep the charge level of the KERS lithium ion batteries constant as well as to convert - thanks to the dedicated inverter - electricity from high to low voltage (12v), which can then be used for standard vehicle functions (lighting, air-conditioning, etc.)
- Double inverter used to control the two electric engines. There are two compact-size DCDC converters inside the same box: one with voltage of 12 V, and another one that controls the battery cooling system.

- Battery control system consisting of a BSM (Battery Management System) and 8 BMCs (Battery Module Controllers), connected one to the other by means of two CAN lines. The control units constantly monitor the 120 battery cells. Each BMC monitors 15 cells, their balancing and temperatures. The BSM handles the control strategies of the entire package, including safety checks, such as, for example, any insulation losses.



Technical characteristics of the individual components

EM1 (Hy-Power) electric/generator motor:

- Length 251 mm
- Width 346 mm
- Weight 47.5 kg
- Cooling liquid Oil (Tmax 90°)
- Max torque > 200 Nm
- Max power 120 kw

EM2 electric generator:

- Length 280 mm
- Width 218 mm
- Weight 14.95 kg
- Cooling liquid Water (Tmax 90°)
- Max torque 20 Nm
- Max power 6 kw

Inverter:

- Power control module for both electric motors
- Length 371 mm
- Width 218 mm

- Weight 14.5 kg
- Cooling liquid Water (Tmax 80°)
- DCDC LV (12V) Up to 3.3 kw
- DCDC HV (380V) Up to 7 kw

Magneti Marelli designs and produces advanced systems and components for the automotive industry. With its 83 production units, 12 R&D centres and 26 application centres in 19 countries, about 36,900 employees and a turnover of 5.8 billion Euros in 2012, the group supplies all leading carmakers in Europe, North and South America and the Far East.. Its business areas include: Electronic Systems, Lighting; Powertrain, Suspension Systems and Shock Absorbers, Exhaust Systems, Aftermarket Parts & Services, Plastic Components and Modules, Motorsport. Magneti Marelli is part of Fiat Spa.

Milan – Geneva, 8th March 2013