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Flywheel Hybrids – Fast Frugal and Affordable

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Overview



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Modern flywheel hybrid systems have been under development since the beginning of 2007

These systems store energy using a small flywheel weighing just 5 Kg and are distinguished from earlier technologies by a very high flywheel speed

Key attributes are high power, low weight, high efficiency and a low cost in mass production

Overview



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Flywheel hybrid technology has been proven in demonstrator cars by a number of different OEMs and is now ready for industrialisation

Several automotive Tier 1 companies are available to make these systems in mass production

The first cars fitted with this technology will go on sale to the public in 2013

Introduction



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Modern systems feature 60,000 RPM flywheels mounted inside a vacuum chamber in order to make the flywheel small, light and inexpensive

$$\text{Energy} = \frac{1}{2} J \omega^2$$

The systems are reliable and completely safe



Typical Characteristics



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- High efficiency of $\approx 70\%$ round trip
- Full performance over the whole system life
- Works over a wide temperature range
- Works with all types of prime mover
- 1/3 the size, 1/5 the weight and 1/3 the cost of an equivalent electric hybrid system
- The only hybrid system that can pay for its own weight in terms of performance

CVT Based Systems



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- The high-speed flywheel is connected to the vehicle via a CVT (Continuously Variable Transmission)
- Storage and recovery of energy is achieved by varying the torque transfer through the CVT using an electro-hydraulic control system
- Capable of 20% fuel and CO₂ savings on the NEDC when combined with a stop / start system
- 80 BHP power boost capability
- Under development by several OEMs for mass production cars



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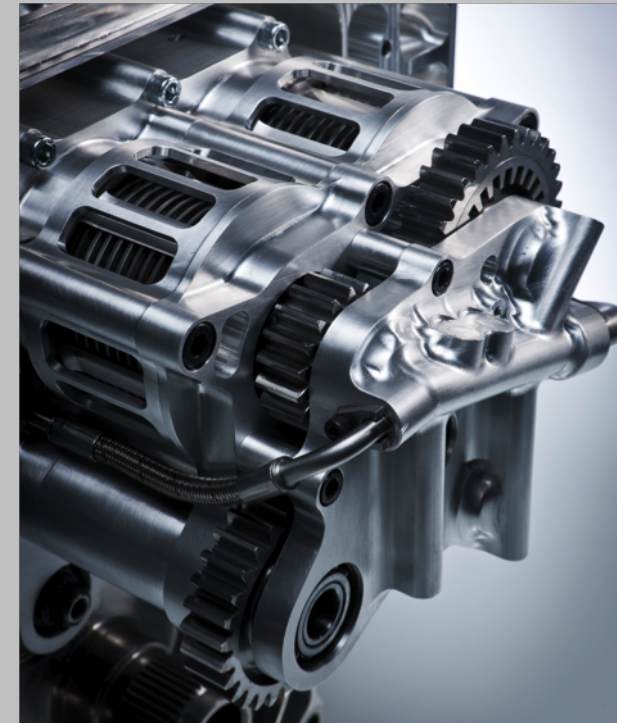
Clutch Based Systems



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The latest clutch based flywheel hybrid systems promise to be smaller, lighter and lower cost

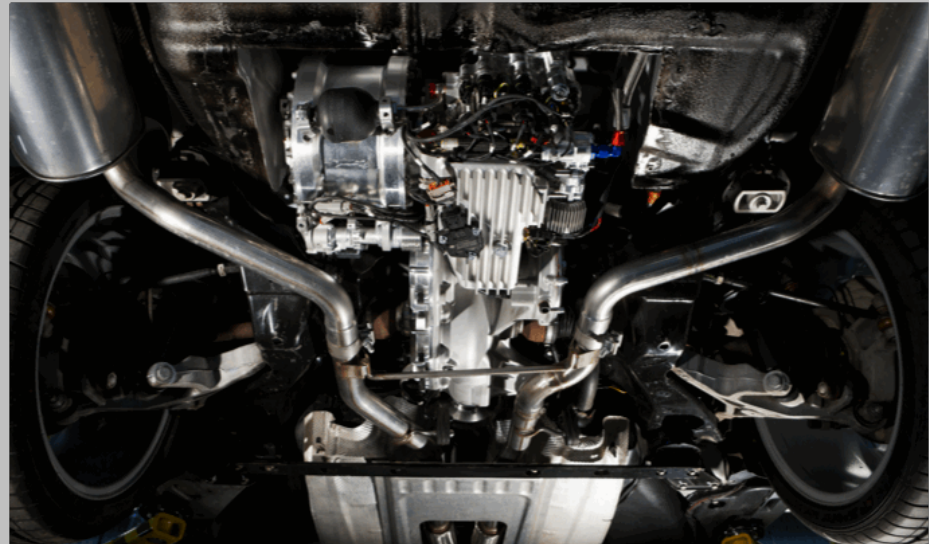
- The flywheel is connected to the vehicle via a set of gears and clutches
- Closing one of the clutches in a controlled slip transfers torque through the chosen gear ratio
- The clutches rotate at high speed so the torque is low and the parts are small and light



Jaguar Demo Car



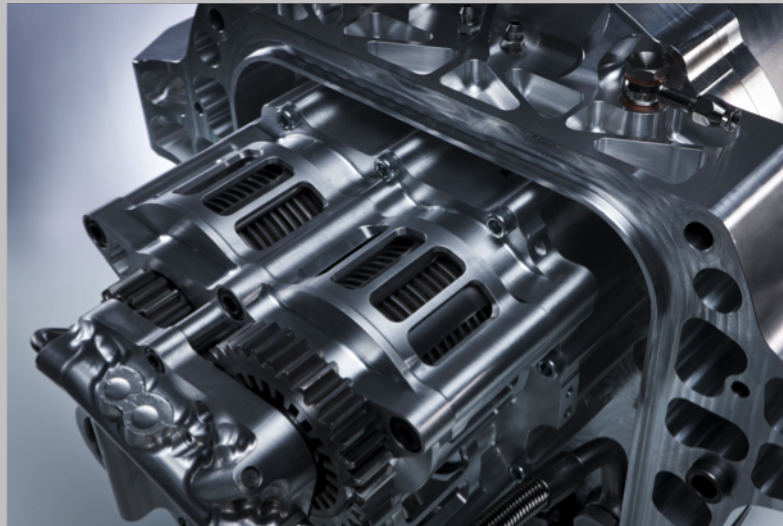
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LMP1 Le Mans Car



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Production



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Systems are available now in prototype quantities and in low volume production from 2013

For high volume applications Tier 1 automotive suppliers are available to manufacture the systems

The first cars should go on sale to the public in 2013 and new projects started now could be available for mass production in 2016

Potential Applications



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The key attributes of mechanical flywheel hybrid systems make them suitable for a wide range of applications

The systems are scalable from small 15 kW mild hybrid solutions to large 100 kW+ systems for buses and trucks

Great performance and low cost of the systems is expected to generate large sales volumes



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