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Kinetic Energy Recovery System

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KERS (Kinetic Energy Recovery System, Eng. Recovery system for kinetic energy) is a mostly electrical system for braking energy recovery, which was released in Formula 1 from 2009 to 2013 for use, and was in 2014 replaced by ERS. With the recovery of energy - in vehicle is also spoken of recuperation - and hybrid drive to the race car, according to the FIA and the car manufacturers become more environmentally friendly. KERS is used in electrical, electromechanical and mechanical variant [1].

KERS consists of four major components: 1. Motor / generator - electric motor that can run as a generator (i.e., to produce energy, select the kinetic energy from the engine shaft and convert it into electrical), as well as in motor mode (to convert electrical energy into rotational and transmit it to the motor shaft). **2. CPU (Electronic Control Unit)** - the central processing unit or control unit KERS system. This unit deals with charging and discharging the battery, switching on and off of the motor. In fact it is the brain of the whole system, it monitors the status of the battery (due to their charge) and the motor state (prevents overload). As it is this block monitors the temperature of all elements. **3. Battery Pack** - A set of lithium-ion batteries. They are often located under the pilot's seat (in the center of the body), for proper weight distribution of the car. There is no proven "insider" information that the set of batteries provides 400 V and 700 - 800 A, in this case weighs about 25 to 30 kg. This weight is added to the minimum set by

the car's weight (605 kg) on the rules of racing**. 4. Kers Button** - KERS control button. It is located on the difficult steering wheel of the Formula 1 pilot. The pilot clicks on it when it is necessary to use more energy during the race. Often, this happens at the start, but do not forget that the system starts to work only with overcoming the speed limit of 100 km / h [2].

Energy accumulation (charge cycle) - when braking on the rear drive wheels through a motor kinetic energy is transmitted to the motor / generator shaft. That, in its turn, transfers the power to the main control unit of KERS, which distributes electricity for the batteries.

Using the stored energy (discharge cycle) - during acceleration, when the pilot must use the extra energy he clicks on the button. Button in its turn sends a signal to the control unit, which connects battery directly to the motor / generator. The motor converts electrical energy into torque and transfers force to the motor shaft.

Disadvantages of improving this system: Scientists have repeatedly pointed some of shortcomings of regenerative braking systems. First of all, it is the low level of efficiency, which makes the cost of equipping a vehicle with system virtually unrecoverable. Indeed, the car can travel hundreds of kilometers per day and almost did not slow down at the same time. In the best case, the braking distance will amount to several hundred meters, for which a negligible amount of energy to be produced. In addition to the cost of creating a regenerative braking system the car must be equipped with a conventional brake system, as soon as it guarantees the safety of the driver. For several reasons, regenerative braking may not be effective in all driving situations and serves as a supplement to the service brake.

Advantages of improving this system: A mechanical kinetic energy recovery system (or KERS) is smaller and lighter than a petrol-electric hybrid system, and in real-world

conditions it hacks back fuel consumption by a similar percentage to a hybrid. And without troubling the engineers too much, you can add an F1-style boost function, which gives you a big lump of torque on tap if you need to overtake. Or do big, smoky burnouts. All of this, plainly, is a Good Thing. The sort of Good Thing that's attracted big, globo-corp manufacturers like Volvo, which has just built a KERS-equipped S60 T5 development mule. At the fore, there's the company's older 254hp five-cylinder petrol engine, powering the front wheels, and astern there's a Flybrid KERS system powering the back axle [2].

So, how does it work? Kinetic energy that you'd ordinarily lose to heat while braking is sent to a flywheel, which can capture 150 watt hours in around eight seconds of gentle braking. That's the same amount of energy you'd need to charge 25 new iPhones captured in a third of the time it'd take a Toyota Prius.

Once it's been recovered, it can be stored for about half an hour or used immediately, either as a supplement to the engine, or in one great big lump. Chose the former and it'll cut consumption by up to 25 per cent. Chose the latter and you get 80hp added instantly. Obviously, we tried the latter [2].

And all this thrust comes from a little box of gears and clutches that weighs 60kg, requires virtually no maintenance, and will last for what the company claim is the realistic life of the car. The batteries in Volvo's current petrol/electric hybrid weigh 300kg alone, and will have to be replaced after about a decade.

References:

1. Mode of access: http://pop-hi-tech.ru/texnologii/kers-sistema-rekuperacii-kineticheskoj-energii.html. – Date of access: 20.02.2016.
2. Mode of access: http://www.ijser.org/paper/Kinetic-Energy-Recovery-System.html. – Date of access: 18.02.2016.