

HRB Hydrostatic Regenerative Braking system from Rexroth for commercial vehicles:

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Hydraulic hybrid from Rexroth reduces fuel consumption by up to 25 percent

The HRB hydraulic hybrid drive from Rexroth reduces fuel consumption and CO₂ emissions from heavy commercial vehicles by up to 25 percent. Brake wear is also reduced by up to 50 percent. After successful field testing in Berlin and New York HRB is now going into series production.

Efficient reuse of braking energy

The basic idea of the HRB Hydrostatic Regenerative Braking system is to convert kinetic energy generated during braking into hydraulic energy and storing it instead of letting it go to waste. When the vehicle then accelerates again the stored energy is fed to the travel drive, thereby unburdening the combustion engine.

The hydraulic hybrid drive from Rexroth realizes its full savings potential especially in heavy vehicles that brake often and intensively. The harder the braking, the greater the possible reduction in fuel consumption provided by HRB.

HRB facts at a glance

- ▶ Fuel savings up to 25 percent
- ▶ Reduced harmful emissions
- ▶ Brake wear reduced by up to 50 percent
- ▶ Less brake dust
- ▶ Storage of large amounts of energy in a short time for nearly complete recovery of the braking energy
- ▶ Rugged, low-maintenance accumulator
- ▶ Rapid release of the stored energy to the drive train for effective load reduction on the drive engine
- ▶ More economical total cost of ownership

HRB unburdens the existing combustion engine

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The hydraulic hybrid drive is ideal for vehicles having conventional mechanical drive trains and a combustion engine, including refuse trucks and heavy delivery vehicles.

A gearbox links a hydraulic variable axial piston unit to the mechanical drive train (drive shaft) to convert kinetic into hydraulic energy when braking. The axial variable piston unit acts here like a pump and converts the released braking energy into hydraulic energy by loading a hydraulic bladder accumulator with hydraulic fluid. This process is controlled by an electronic controller from Rexroth together with a hydraulic valve manifold.

During acceleration the entire process is reversed: The pressurized fluid is discharged in a controlled manner from the accumulator and flows back through the variable axial piston unit. The latter is driven by the fluid flow and, acting like a motor, gives up its energy to the mechanical drive train. A pressure relief valve in the system ensures the highest level of safety for both processes.

A positive added benefit for man and the environment is the reduction in diesel emission particles due to the fact that the diesel engine does not have to work so hard during acceleration.

HRB system components

- ▶ A4VSO variable axial piston unit with gearbox for pump/motor operation
- ▶ High-pressure bladder accumulator
- ▶ Valve control block
- ▶ Electronic controller
- ▶ Sensors

Key data for the installed HRB

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Data assumes an HRB used in a three-axle refuse truck with an empty weight of 17 t. (including refuse container), with a permissible gross weight of 25 t. and a diesel engine output of 235 kW:

- ▶ HRB output/torque: approx. 233 kW/1,113 Nm (max. output/torque of the hydraulic power unit)
- ▶ Accumulator size: two bladder-type accumulators with 32 l rated gas volume each
- ▶ Maximum accumulator pressure: 325 bar (accumulator initial pressure 120 bar)
- ▶ Maximum accumulator capacity: 0.15 kWh (corresponds roughly to the kinetic energy of the fully loaded vehicle at 30 km/h)
- ▶ Weight of HRB: approx. 500 kg
- ▶ No retarder function, but can be structured

HRB costs

HRB is based on proven production and close-to-production components. Nevertheless, these are not catalog products, so that no general selling price can be published. The actual added value lies in the combination of these components into a system, i.e., in the Rexroth know-how for configuring the hydraulic hybrid for the respective vehicle class and the driving strategy. The (added) price for the HRB as part of the respective project situation is derived based on these and other vehicle-specific requirements. Vehicle operators demand amortization times of less than four years.

HRB in practice

Following a successful testing phase, the HRB system has now become available in series production, with installations in many refuse trucks at waste disposal companies in Europe and North America. The high savings potential and everyday suitability of the hydraulic hybrid has been confirmed in practice: in a study by the German Automobile Association ADAC at their Driving Safety Center in Berlin-Brandenburg fuel savings of at least 20% in pure drive operation were demonstrated. End customers are reporting savings of 15 to 18 percent for a complete daily route. In addition, brake wear has been reduced to the point where, compared with vehicles not having HRB, only every third scheduled brake service needs to be performed.

Feedback from end users

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The hydraulic hybrid from Rexroth is already in use in more than ten cities as of October 2010. Here is what end users have to say about HRB:

Carsten Mielke, Head of Transport Department for Waste Disposal, District of Kassel:

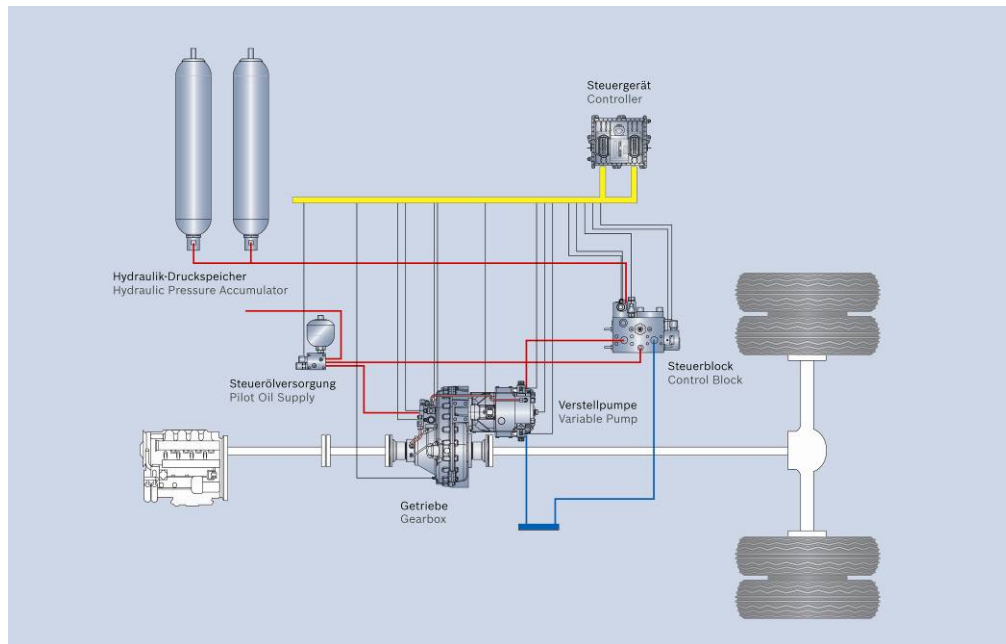
“Our expectations with respect to lowered diesel consumption using HRB have been met. According to initial findings we are seeing a savings in the range of 15 to 18 percent for a complete daily route. This trend is sufficient to warrant procurement of the next vehicle with hydraulic hybrid.”

Rocco DiRico, Deputy Commissioner of Support Services, New York City Department of Sanitation:

“In New York City our waste collection routes lead through various neighborhoods with differing building densities. This makes a hydraulic hybrid with its functionality and mode of operation the perfect solution. In terms of maintenance for our trucks from brake wear and replacement parts, we hope to reduce these costs as well through regenerative braking.”

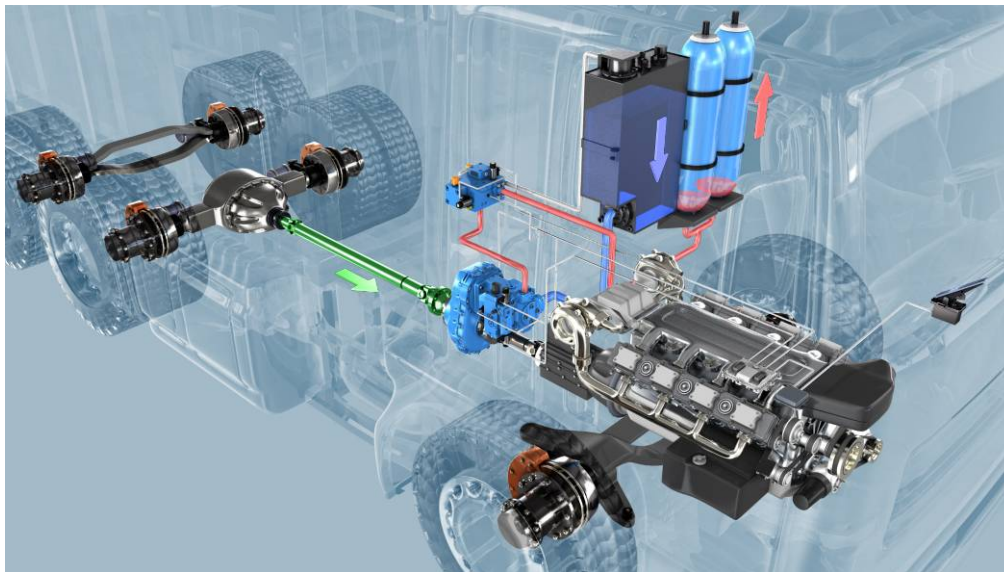
Illustrations

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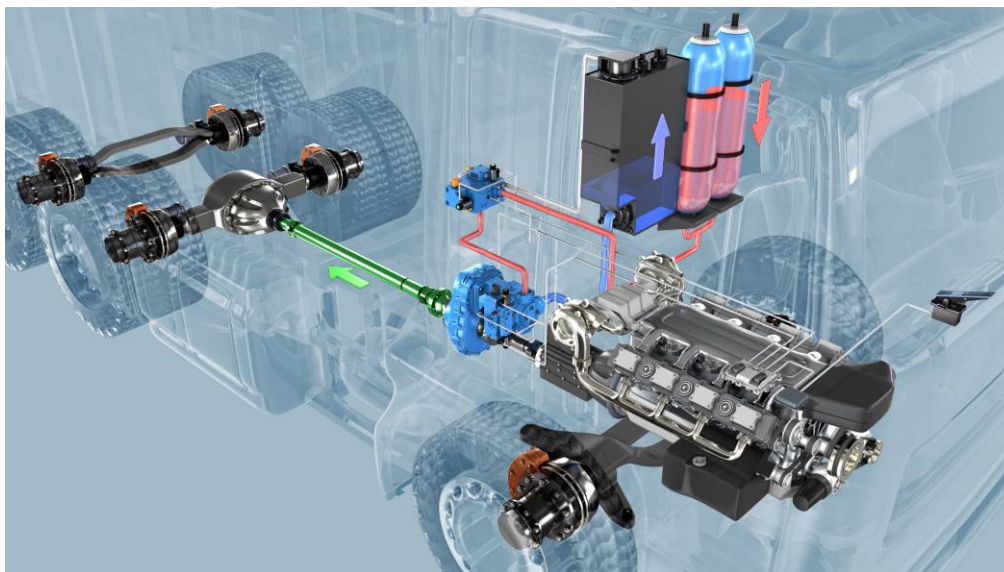


HRB system components: A4VSO axial piston unit with gearbox, accumulator, valve control block with accumulator safety valve, electronic controller

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When braking, the variable axial displacement unit converts kinetic into hydraulic energy and pumps hydraulic fluid into an accumulator



During acceleration the pressurized hydraulic fluid in the accumulator drives the variable axial displacement unit, which then works like a motor



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The HRB hydraulic hybrid from Rexroth is already in series use in over 10 cities

Bosch Rexroth AG is one of the world's leading specialists in the field of drive and control technologies. Under the brand name of Rexroth the company supplies more than 500,000 customers with tailored solutions for driving, controlling and moving. Bosch Rexroth is a partner for industrial applications and factory automation, mobile applications and using renewable energies. As The Drive & Control Company, Bosch Rexroth develops, produces and sells components and systems in more than 80 countries. In 2009 Bosch Rexroth part of the Bosch Group, achieved sales of around 4.1 billion Euro with 34,200 employees.

For more information and a downloadable version of this press release please visit: www.boschrexroth.com/hrb

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