



## **Up to 15 percent increase in efficiency with MAN HydroHybrid**

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### **Fully-integrated hydraulic hybrid system in MAN TGM refuse collection truck**

The inclusion of the hydraulic hybrid drive, or hydrostatic regenerative braking system, in the three-axle chassis of the TGM series, lets MAN Truck & Bus offer a highly environmentally-friendly product for the waste disposal sector. Refuse collection vehicles are ideally suited for the recovery of braking energy as the stop-start nature of emptying bins involves frequent braking and subsequent driving away over short distances.

In field trials in France, operators measured an increase in efficiency of around 12% thanks to the system of energy recuperation during coasting and braking and the exploitation of this energy when pulling away. With a trained driver and an optimum collection route, this generates potential fuel savings of up to 15%. With the normal service life of a refuse collection vehicle amounting to eight to nine years, the latest estimates suggest that it would pay for itself after around two-thirds of its operating life. Other positive effects are the reduction in CO<sub>2</sub> emissions and particulate pollution in residential areas.

#### **How the HydroHybrid works**

At the core of the system is a hydraulic axial piston unit, which is integrated into the MAN TGM's driveline via a gearbox. In other words, the system is a parallel hybrid design. The gearbox is installed between the transmission output and the first rear axle. The kinetic energy that would normally be lost as heat during braking and coasting is transformed into hydraulic energy and stored. As the vehicle begins to coast, the kinetic energy is recuperated hydraulically and the vehicle decelerates without any brake friction. The axial piston unit functions as a pump, filling a hydraulic bladder accumulator with hydraulic fluid. The oil flowing into the pressure cylinder is consequently pressurised, causing it to compress a nitrogen-filled bladder. The system functions as a retarder during the brak-

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ing phase. The two pressure accumulators are housed on the rear side of the cab.

When pulling away, the procedure is reversed: the oil, which is under pressure, flows back from the accumulator to the axial piston unit. This functions as an additional drive, and feeds its power to the vehicle's drive-line. The transfer of energy between the hybrid system and the vehicle is coordinated by an electronic control system to match the driver's control of the vehicle's acceleration. The vehicle's acceleration is supported by energy from the pressure accumulator regardless of the charging state of the vehicle, which constantly changes during the collection round. As a result, the diesel engine uses less power and fuel to accelerate the vehicle.

### **Straightforward operation**

The system is active at speeds of between 0 and 40 km/h. A toggle switch in the instrument panel is the only indication that the energy-saving function is installed. The driver uses this switch to activate the function. If the vehicle exceeds a speed of 40 km/h on its way to and from the collection area or during the round, the system is automatically deactivated; it is automatically reactivated when the speed drops below 40 km/h again.

The system weighs in at approximately 500 kg, which is very suitable for the weight-optimised MAN chassis of the TGM, with its high payload capacity. The heavy lifting mechanisms of refuse collection vehicles mean that they are, by design, subjected to heavy rear axle loads and a lighter front axle load. The position of the accumulator, weighing approximately 200 kg, on the rear cab wall contributes to optimising the weight balance and also has a positive effect on steering characteristics and handling as well as the distribution of weight.

### **Fully integrated system**

The system is fully integrated into the MAN vehicle concept and the body-mounting characteristics are especially good. No components protrude above the upper edge of the frame and thus regular refuse containers can be fitted without restrictions on size, capacity or installation points. One significant factor is the integration of the system into the vehicle's electronic and brake systems. This means control is achieved simply by means of the accelerator pedal position, allowing automated braking functions such as ABS, ESP and load-dependent braking torque to be fully



maintained. By integrating the axial piston unit into the driveline propshaft, the PTO on the flywheel side continues to provide unrestricted functionality. The hydraulic pump is flange-mounted to it by the body manufacturer for the operation of the refuse collection body.

MAN is the exclusive contact partner for purchasing the MAN TGM with hydraulic hybrid drive, which means there is no need to worry about coordinating specifications between chassis manufacturers and system suppliers.

### **Active contribution to environmental protection**

The great potential of the system when used in heavy-duty refuse collection vehicles lies in the recuperation of energy during frequent braking and the supply of gained energy when pulling away again. The more braking and driving away manoeuvres the vehicle completes and the heavier it becomes during the collection round, the more efficiently energy is stored through the hydraulic charging of the pressure accumulator.

When pulling away, the hydraulic drive system reduces the load on the engine. This reduces diesel consumption and with it CO<sub>2</sub> emissions by around 15% (field test results are 12%). With less active braking using the service brake, brake wear is reduced, as are particulate pollution and noise. This has a positive impact on the service life of the brake system and on operating costs.

### **No additional maintenance costs**

The hydraulic components are series production parts from Bosch Rexroth. Servicing is carried out in collaboration with them. The maintenance tasks are no greater than those for conventional hydraulic systems. Oil quality and the service life of the hydraulic hoses are covered by the same regulations that normally apply to the hydraulic systems for the refuse collection body with lifting mechanism and compactor.

### **The MAN TGM as a base vehicle**

The three-axle MAN TGM chassis is eminently suitable for use as a base for refuse collection vehicles. Factors in its favour include the low-entry cab which has only two steps, excellent manoeuvrability with steerable trailing axle, and the high payload.

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The HydroHybrid is available as the MAN 26-tonne 6x2-4 with C cab and MAN TipMatic gearbox with special refuse collection software for low clutch wear and user-friendly operation.