



## **ZF EFFICIENCY PACKAGE**

- **Up to 20% less fuel**
- **Up to 40% more productivity**
- **Efficiency Package offers more than the sum of individual advantages**

**ZF is a renowned specialist for driveline technology and recognized worldwide as an innovative systems supplier for off-road machinery. The demands on these vehicle types are high: fast work with millimeter accuracy and highest productivity combined with reduced operating costs. ZF underlines its systems competence with the EFFICIENCY PACKAGE which includes many benefits due to perfectly matched components. The options of the EFFICIENCY PACKAGE provide increased productivity and enhanced operating and riding comfort for the driver associated with a reduction of the operating and maintenance costs for the vehicle owner. Full utilization of the EFFICIENCY PACKAGE allows fuel savings of up to 20%. (fig. 9)**

ZF Converter Lock-Up clutch and other components of the ZF-Efficiency Package increase fuel savings reduce emissions and extend lifetime. The easy handling of ZF fully automatic transmissions and high tech axle systems support the driver in all working situations, which means a significant increase of productivity and that is what pays off at the end.

For many years already, ZF driveline and chassis systems have proven themselves in meeting the challenges of the market. With the EFFICIENCY PACKAGE ZF consolidates its competence in the transmission, axle and functions development, thus offering more than the sum of individual advantages. This approach makes it possible to reconcile the frequently conflicting demands for:

- less consumption
- reduced component wear
- increased productivity
- enhanced comfort



- less oil consumption
- extended service intervals
- noise reduction
- higher levels of automation
- improved shift quality
- easier operation

**Following are the modules of the EFFICIENCY PACKAGE in detail:**

- The **MULTITRAC** and **MULTISTEER** axles featuring lightness, stability and high transmission power
- The **ERGOPOWER** transmission with 5 instead of standard 4 gears
- The **ERGOLOCKUP** which engages the torque converter lock-up clutch by modulation in low gears already
- The **ERGOTRACTION** which optimizes the engagement and disengagement of the powershift differentials in the axle
- **POWERINCH:** Operating condition dependent clutch cut-off with fully automated adjustment.
- **ENGINE DERATING:** Overload protection and tractive effort control
- **OPERATING MODE SELECTION:** Shift point selection depending on operating mode and selected engine rating

**ZF ERGOPOWER**

This proven fully automatic powershift transmission system has been optimized for different construction machinery types and offers the innovative feature of 5 instead of 4 gears. Therefore, the noise-optimized transmission allows even more comfortable and



easier handling, high shifting quality and flexibility. Moreover, the operating costs can be further reduced. The ZF ERGOPOWER provides additional possibilities for connecting an electronic driveline management, thus enabling vehicle-specific controls.

### **ZF ERGOLOCKUP**

ZF ERGOLOCKUP features Direct Drive whenever possible. The torque converter is only in operation when really needed through automatic t/c-mode selection and proportional pressure modulation. Hence the ZF ERGOPOWER 5-speed transmission with lock-up can be operated in 100% Direct Drive mode at almost all driving conditions which means no losses in the torque converter. In first gear work mode t/c is applied automatically.

**Advantage:** Depending on the application conditions, the fuel consumption can be reduced by 10% to 20%.

A realistic fuel consumption reduction of 5 liters per operating hour would mean a saving of 100.000 liters for a fleet of 10 wheel loaders with an average of just 2000 hours per year.

### **ZF ERGOTRACTION**

This feature for axle control offers a differential lock management which governs the axle differential locks in wheel loaders. The ERGOPOWER transmission control provides automatic engagement and disengagement of the powershift differentials. ZF offers the full range of MT-L 3000 axles for wheel loaders up to 35 tons with the optional hydraulic power-shift differential.

**Advantages:** This innovation protects the drive system components and the tires whilst offering 100% tractive effort. It also contributes to a significant fuel saving. Moreover, ERGOTRACTION improves the cross-country mobility and increases the performance. Vehicle handling is more comfortable and easy. Protection against maloperation is also guaranteed.

### **ZF POWERINCH – Intelligent Clutch Cut-Off Function**

POWERINCH is an advanced driveline management feature to improve loader application such as truck loading and tight corner operation by limiting vehicle tractive effort in hydraulic stall conditions to the minimum required to hold the vehicle and not to the maximum available. POWERINCH dynamically adjusts the clutch cut-off point depending on transmission output torque and brake pressure. It enables the vehicle drawbar pull via the brake pedal, independent of engine speed. The result is improved productivity and reduced fuel consumption as well as reduced loading of the service brake.

#### **Reduced fuel consumption**

- Reduced power loss in the torque converter
- Reduced energy dissipation in the axle service brake

#### **Improved productivity:**

- Provides more power to the vehicle hydraulics
- Ensures smooth control at high engine rpm and low vehicle speed
- Allows better handling of the vehicle

### **ZF ENGINE DE-RATING**

Prevention of torque spikes through active engine control via CAN. Torque reduction in first gear (particularly in stall conditions) can be provided, so that the maximum desired drawbar pull is not exceeded. The engine de-rating during shuttle shift reduces the energy dissipation in the clutches and contributes to lower fuel consumption. Engine de-rating leads to reduced fuel consumption, overload protection, better controlled drawbar pull and improved service life of the driveline.

### **ZF OPERATING MODE SELECTION**

This additional function provides a selection of shift-point curves to accommodate various operating conditions or multiple engine curves. Its advantages include reduced fuel consumption and noise emissions, as well as optimized traveling performance.



Picture caption:

9.) ZF EFFICIENCY PACKAGE

Picture: ZF

Press contact:

**Gernot Hein**, Head of Marketing and Communications

Tel.: +49 (8 51) 4 94-24 80, Fax: +49 (8 51) 4 94-90 24 80

E-mail: [gernot.hein@zf.com](mailto:gernot.hein@zf.com)

**Wolfgang Wohlgemuth**, Team Manager Market Communications

Tel.: +49 (8 51) 4 94-27 03, Fax: +49 (8 51) 4 94-90 27 03

E-mail: [wolfgang.wohlgemuth@zf.com](mailto:wolfgang.wohlgemuth@zf.com)

The ZF Division Off-Road Driveline Technology and Axle Systems specializes in the development and production of transmissions and axles for agricultural and construction machines as well as axle systems for buses and trucks. With 7,000 employees the division generated a preliminary turnover of 1.1 billion euros in 2009.

ZF is one of the world's leading automotive industry suppliers specializing in driveline and chassis technologies. With a workforce of 59,900 employees, the company operates 125 plants in 26 countries. ZF Group revenues in 2009 a preliminary turnover of €9.3 billion. ZF ranks as one of the top-10 automotive industry suppliers worldwide.

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