

# INNOVATIONS OF GREAT VALUE

ZF-EFFICIENCY PACKAGE



**LESS CONSUMPTION** Full utilization of the EFFICIENCY PACKAGE options for transmissions and axles allow fuel savings of up to 15 %.

**-15 %**

## Increased efficiency for your driveline

**During hard, practical application the driver and the construction machine form one unit. It is only when each is perfectly matched to the other that the heaviest work can be carried out.**

ZF is a renowned specialist for driveline technology and recognized worldwide as an innovative systems supplier for off-road machinery. For many years already, ZF driveline and chassis systems have proven themselves in meeting the challenges of the market. The optimally matched system components – ZF transmissions and axles – already provide a high level of efficiency and ease of handling which is brought to perfection with new additional features and functions: The ZF EFFICIENCY PACKAGE.

The options of the package provide increased productivity and enhanced operating and driving comfort for the operator associated with a reduction of the operating

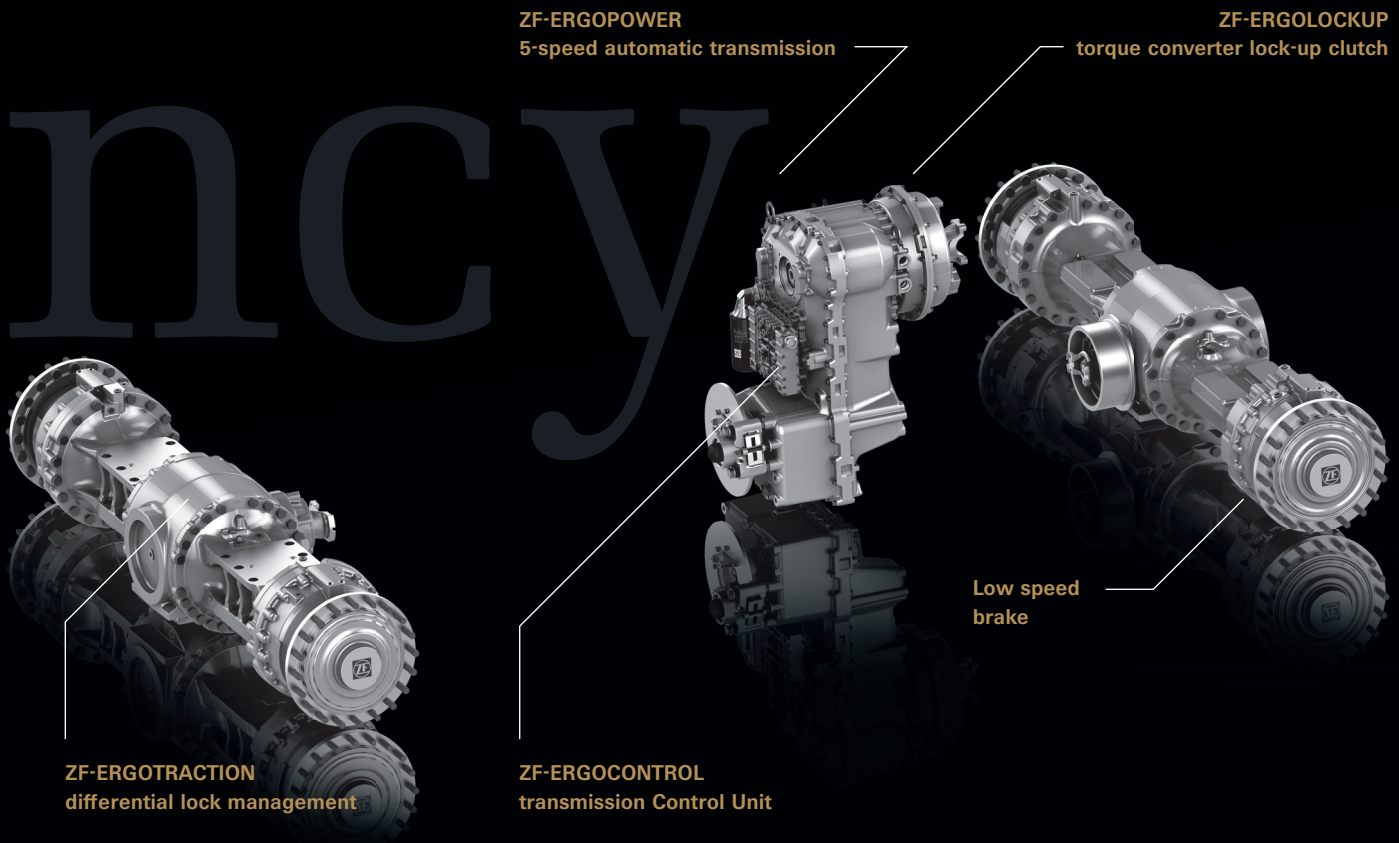
and maintenance costs for the vehicle owner. This approach makes it possible to reconcile the frequently conflicting demands for:

- less fuel and oil consumption
- reduced component wear
- increased productivity
- enhanced comfort
- extended service intervals
- noise reduction
- higher levels of automation
- improved shift quality
- easier operation

With the EFFICIENCY PACKAGE ZF consolidates its competence in the transmission, axle and functions development, thus offering more than the sum of individual advantages.

## THE COMPONENTS OF THE EFFICIENCY PACKAGE

The core element of the Efficiency Package is a 5-speed transmission and ERGOLOCKUP, a lock-up converter which enables direct drive already at low speeds. Further features are the automated differential lock (ERGOTRACTION) and the new clutch cut-off function POWERINCH. Additional functions are improved tractive and power management via engine de-rate and operating mode selection.



ZF underlines its system competence with the EFFICIENCY PACKAGE which includes many benefits due to perfectly matched components:

### **15% less fuel consumption**

The fuel consumption of a vehicle gets more and more important as the costs for fuel will increase due to shortage of resources. The features of the EFFICIENCY PACKAGE lead to fuel savings of up to 15%.

### **40% higher productivity**

The productivity of man and machine is the most important factor for the costs per ton of moved dirt. The perfect interplay between all relevant ZF components help reducing production costs.

### **15% less service costs**

A machine in the work shop costs money and is not productive. ZF product quality, intelligent driveline management options, and many

more protective features reduce down time and service costs.

### **60% more fuel efficiency**

The amount of material the machine can move per liter fuel indicates the fuel efficiency. With ZF this efficiency is increasing extremely due to high performance, comfort for the driver and high flexibility. As a result you will save transit and material handling time.

# ZF EFFICIENCY PACKAGE. BOOST YOUR PRODUCTIVITY.



The modules of the EFFICIENCY PACKAGE not only reduce consumption and emissions, they also increase the service life of the components. The simple operation supports the driver in all working situations.

A five-speed transmission is at the heart of the Efficiency Package, meaning fuel savings can be guaranteed due to engine speed reduction, higher productivity through better driving performance and higher shift quality, noise reduction and, last but not least, a higher number of gears which is the future standard.

The ZF-ERGOPOWER provides additional possibilities for connecting an electronic driveline management, thus enabling vehicle-specific controls.

## **Optimized power transfer with ZF-ERGOLOCKUP**

ZF-ERGOLOCKUP ensures that at low speeds already the converter lock-up clutch is applied. The optimum effect of this function is of particular benefit to transmissions with 5 gears, since in this case the converter lock-up clutch can be kept closed when shifting gears. 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.

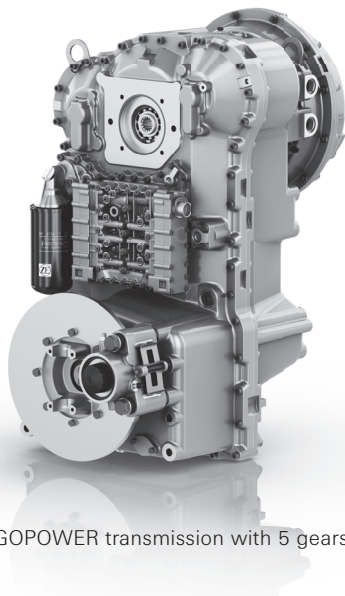
**Advantage:** Depending on the application conditions, the fuel consumption can be reduced by 10 % to 15 %. A realistic fuel consumption reduction of 5 liters per operating hour would mean a saving of 100,000 liters for a fleet of 10 wheel loaders with an average of just 2000 h per year.

## **More savings and comfort with ZF-ERGOTRACTION**

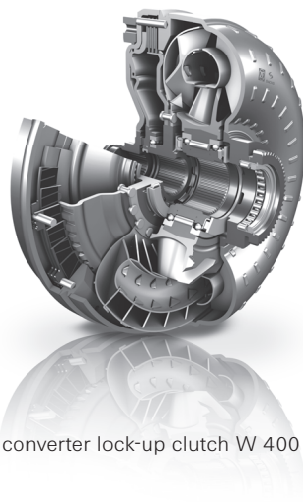
Standard self-locking differentials are purely torque dependent and interfere in many drive conditions. Manual operated diff-locks are fully operator dependent hence misused in many cases. ZF-ERGOTRACTION, the automatic diff-lock control and ZF hydraulic power-shift differentials, is the state of the art solution for wheel loaders.

**Advantages:** This innovation protects the drive system components and the tires whilst offering 100 % tractive effort. It also contributes to a significant fuel saving.

**MORE EFFICIENCY** With the ZF-ERGOPOWER 5-speed transmission and ZF-ERGOLCKUP fuel consumption can be reduced by 10 % to 15 %.



ZF-ERGOPOWER transmission with 5 gears

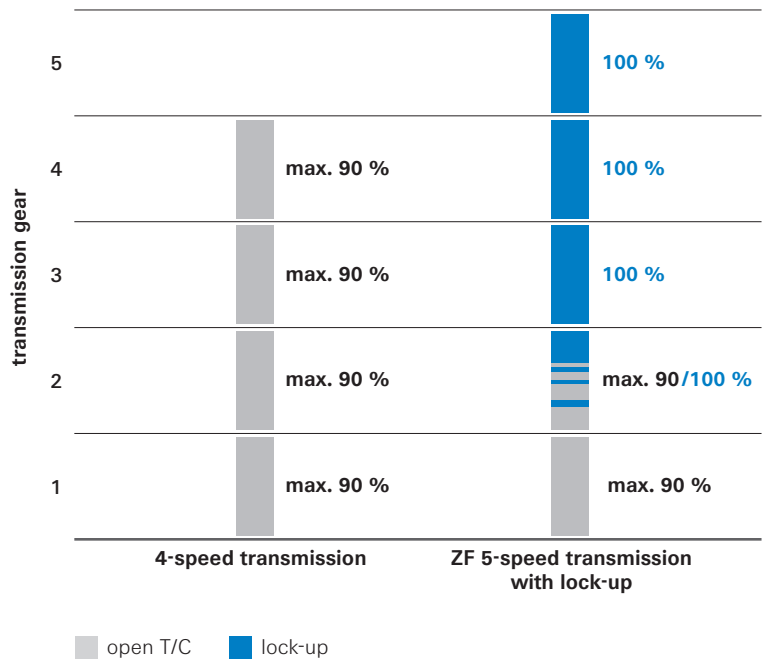


Torque converter lock-up clutch W 400 WK TD

EFFICIENCY WITH TORQUE CONVERTER

**ZF 5-speed with lock-up:  
100% torque already in 2nd gear,  
no losses**

Since any kind of hydraulic power transfer generates high levels of fuel consumption, it must only be used where explicitly required. Therefore, after the setting off process, a torque converter lock-up clutch ensures that the torque flow between the engine and the transmission can be designed in a loss-free and thus, completely direct way (Direct Drive).

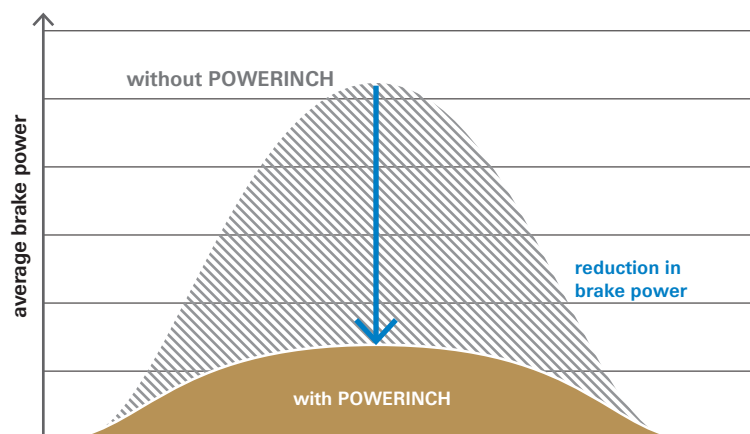


Learn more about the ZF Efficiency Package. Watch the animation on your smartphone.

**TRANSMISSION OPTIONS** Additional functions to the Efficiency Package core functions make construction machinery and construction site vehicles even more efficient and powerful.

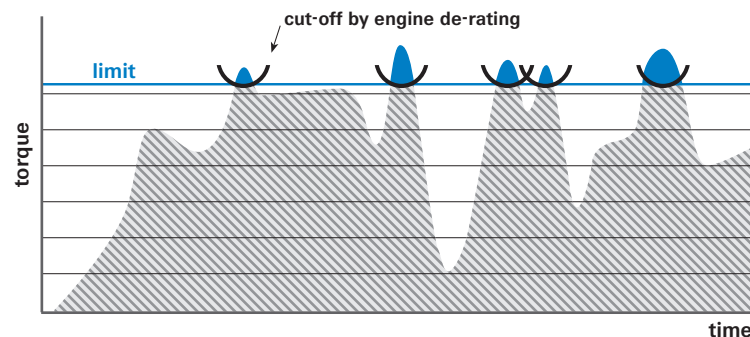
#### ZF POWERINCH

The 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. The POWERINCH dynamically adjusts the clutch cut-off point depending on transmission output torque and brake pressure. It enables the control of 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 brakes.



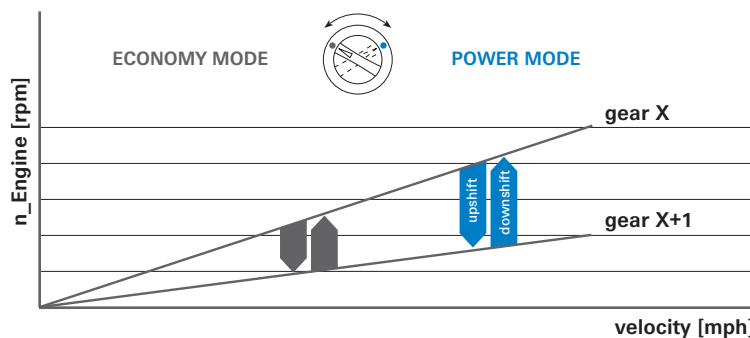
#### ZF ENGINE DE-RATING

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.



#### OPERATING MODE SELECTION

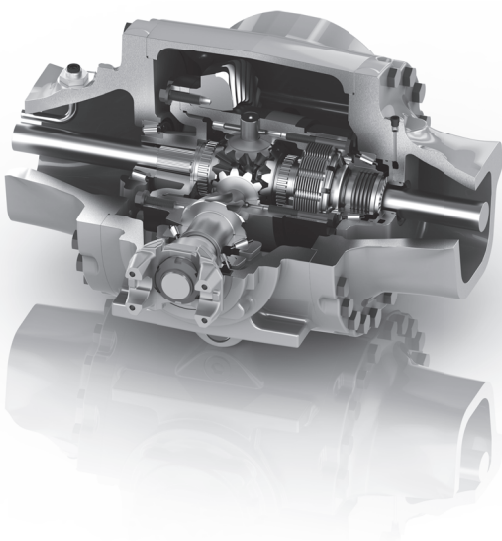
This additional function provides a selection of shift-point curves to accommodate various operating conditions or multiple engine curves. Its advantages include reduced fuel consumption and noise emissions, as well as optimised travelling performance.



**AXLE OPTIONS** The differential lock management ZF-ERGOTRACTION provides traction in all situations and on all surfaces, which is decisive to reduce component wear and increase productivity.

#### ZF-ERGOTRACTION

This feature for axle control offers a differential lock management which governs the interwheel 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 t with the optional hydraulic power-shift differential. ERGOTRACTION improves the cross-country mobility and increases the performance. Vehicle handling is comfortable and easy. Protection against misuse is also guaranteed.



## 100 % TRACTION ON ALL GROUNDS

ZF-ERGOTRACTION ensures that the diff-lock is always engaged when needed and automatically switches off when it is not necessary. Therefore optimal traction is guaranteed under all driving conditions.

#### CUSTOMER BENEFITS

##### Less tire wear

- no slipping tires esp. with unskilled operator
- no tire slippage on solid ground due to open differentials

##### Fuel savings

- no internal wind-up
- no internal friction losses

##### Higher productivity

- 100% traction due to diff-lock

##### Reduced load on driveline components

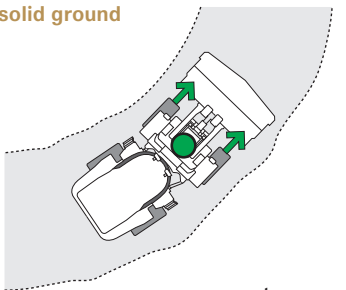
- no wind-up
- over-speeding

##### Higher operator comfort

- automated diff-lock actuation
- prevention of tire rut holes due to slipping tires

#### WITH ZF-ERGOTRACTION

##### solid ground



**no engagement  
(open differential)**  
- no losses in differential

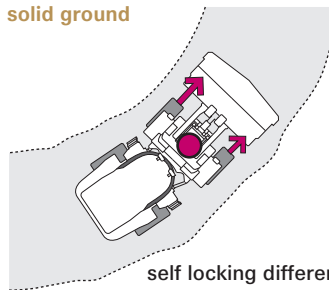
##### soft ground



- high traction  
- automatic engagement

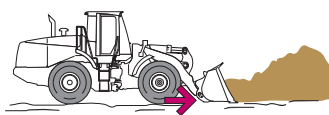
#### WITHOUT ZF-ERGOTRACTION

##### solid ground

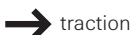


**self locking differential**  
- internal losses  
- internal wind-up  
- increased tire wear

##### soft ground



- low traction  
- wheel slip



**ZF Friedrichshafen AG**

Division Industrial Technology  
Construction Machinery Systems  
94030 Passau  
Germany  
Phone +49 851 494-2732  
Fax +49 851 494-2191  
sales.iac@zf.com  
www.zf.com



**MOTION AND MOBILITY**