



Driveline Technology for
Heavy Material Handling Vehicles



Innovations
of Great Value.



High precision with heavy loads and fully automatic gear shift

Material handling vehicles with internal combustion engines (ICE) are real “all rounders”. In outdoor applications, for example, they must not only be able to quickly transport extremely heavy loads over long distances, but they must also be able to precisely maneuver their load and set it down in the tightest of spaces.

ZF transmissions meet all demands

The widely varying functions of material handling equipment create the highest demands on the driveline, in particular on the transmission which must be designed to cope with high torque engines and allow smooth gear shifts under full load, without interruption to the tractive effort.

Important for the manufacturer and the end user

Due to manufacturer's requirements to keep their machines as small and manoeuvrable as possible, transmissions need to be designed for installation into limited spaces, this has been achieved with the ZF-ERGOPOWER transmissions.

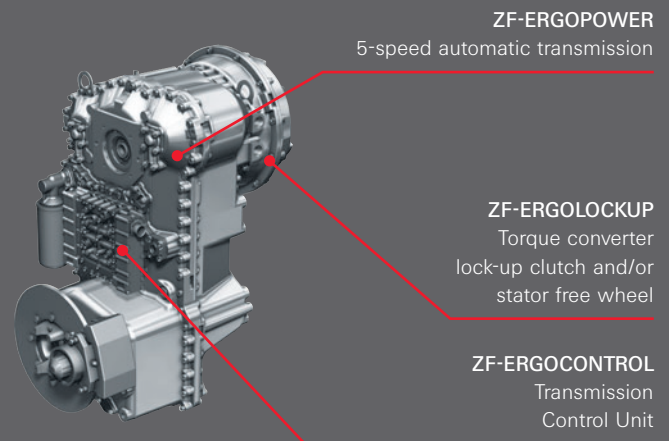
Specially designed for Material Handling

With Ergopower ZF is offering a complete range of transmissions which feature this variety of functions: Apart from high flexibility and compact design, the transmissions from this range, which were specially designed for material handling vehicles with combustion engines, also have a highly developed electro-hydraulic control for fully automatic soft shifting.

Conclusion

ZF-ERGOPOWER offers important benefits to the OEM and the end user alike; offering low operating costs and ease of maintenance.

The ZF EFFICIENCY PACKAGE can be offered for different applications in material handling equipment, for example: lift-trucks, Ro-Ro-/terminal trucks, straddle carriers, reach stackers, airplane tow tractors and baggage handling equipment.



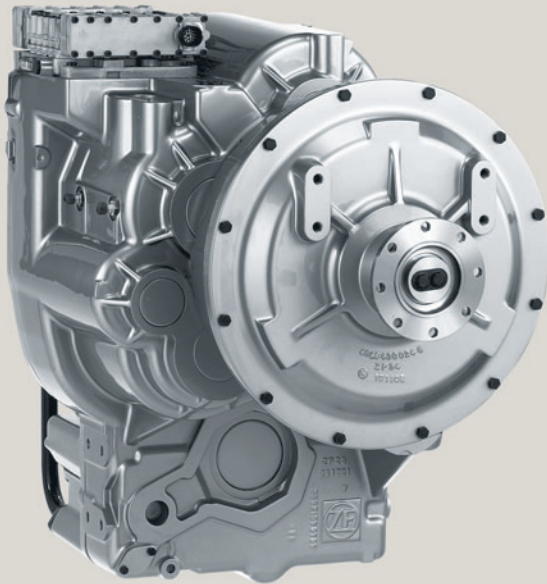
ZF EFFICIENCY PACKAGE

For improved efficiency and productivity ZF offers 5- or even 6-speed transmissions in addition to the standard 3- and 4-speed versions. ZF focuses on Direct Drive in order to improve fuel consumption, tractive effort, speed and productivity. Direct Drive is engaged in most driving conditions. The lock-up clutch is opened automatically only when really needed and therefore operator abuse is avoided.

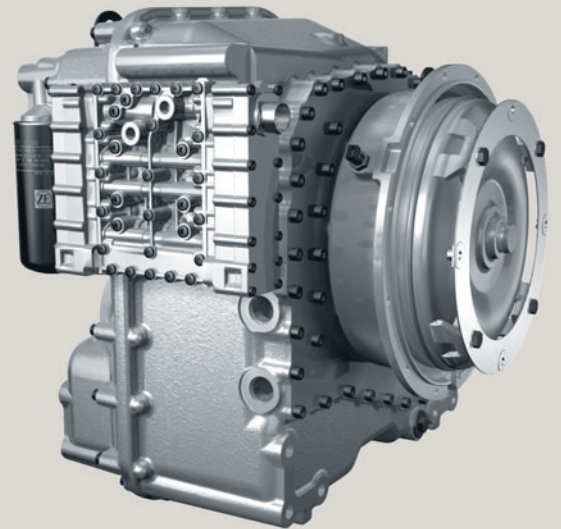
ZF is a partner to manufacturers of material handling vehicles throughout the world.

■ ■ ■ Cargotec ■ CMHA (ROK) ■ CVS (I) ■ Doosan (ROK)
■ Douglas (GB) ■ Fantuzzi (I) ■ Fresia (I) ■ JBTC (USA) ■
Godrej (IND) ■ Heli (CN) ■ Hyundai (ROK) ■ Kamag (D)
■ Kion ■ Konecranes (FIN) ■ Mafi (D) ■ Meclift (FIN) ■
Milan (BR) ■ MOL (B) ■ Noell (D) ■ Sahand (IR) ■
Schopf (D) ■ Svetruck (S) ■ Taylor (USA) ■ Terberg (NL)
■ TIL (IND) ■ TLD (F) ■ TREPEL (D) ■ TUG (USA) ■
Zhejiang Hangcha (CN) ■ ■ ■

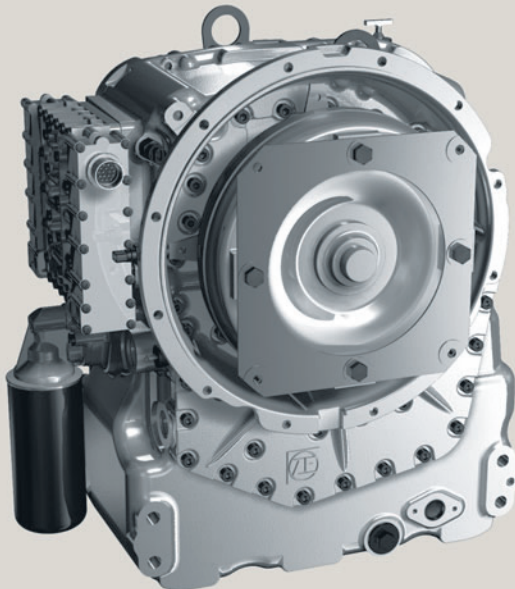
WG 311



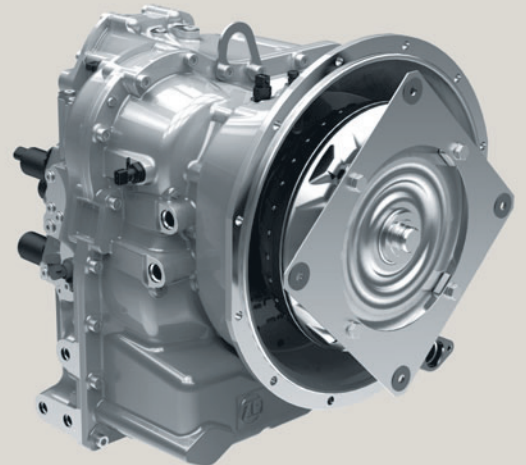
WG 211



WG 161



WG 94



Power packs for material handling

The products of the fully automatic ZF-ERGOPOWER family are applicable for engine power up to 330 kW and thus match many different vehicle applications. Shifting is fully automatic with no interruption of the tractive effort.

Special design for material handling

The ZF-ERGOPOWER transmissions have been specially designed for the most versatile applications in combustion engine powered material handling equipment. By optimum matching of transmission hardware and electronic control, the ZF-ERGOPOWER units assure soft shift transitions, decisive criteria for practical applications.

User-friendly with electronic assistance

A new particularly user friendly feature of the latest compact ZF transmissions is the electronic inching feature. This offers a "creep function" which makes it easier to position loads with highest levels of accuracy.



Easy handling, short cycling time, exact positioning of the material are just some requirements for modern material handling vehicles.

With ZF driveline technology for material handling, moving heavy loads could not be easier.

Main product advantages

- Fully automatic powershift transmission
- Special and compact design for material handling applications (ratios, center-drop, installation dimensions)
- No tractive effort interruption during shifting by using proportional valves and highly intelligent software
- High sophisticated shift quality (soft and smooth shifting), developed with the know-how from ZF passenger car automatic transmissions
- High flexibility (different options)
- Various torque converters for different engines available
- Short- and long-drop gearboxes available
- Low noise level (high contact helical ground gears)
- Electronical inching possibility available
- Stiff and short rotating shafts – less deflexion
- Durable clutch packs with increased oil flow (optimized cooling)
- For WG 94 - WG 211 one PTO is standard
- For WG 131/ WG 161/ WG 171/ WG 191/ WG 211 a second PTO as an option available
- For WG 261 - WG 311 up to three PTOs possible
- Low weights
- Maintenance advantages because of standard parts between the different ranges
- Electronic system with self-diagnosis for easy maintenance
- Easy maintenance and repair (set right bearings, no shimming)

Precise positioning with electronic inching

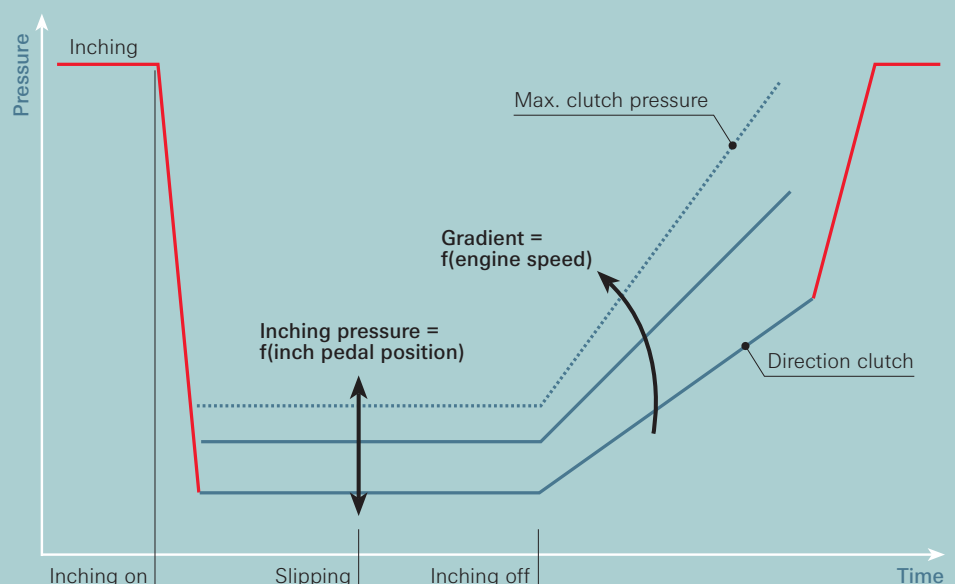
Also available in the ZF-ERGOPOWER series: Electronic inching.

By actuating a pedal the driver can reduce the speed during operation to maneuver in a "creeper mode" without himself having to declutch or shift gear. This enables loads to be positioned sensitively and accurately to the millimeter.

The system

The expansion of functions to include electronic inching has become possible by the electro-hydraulic ZF-ERGOCONTROL which is also supplied by ZF and which ideally matches the functions of engine, converter and transmission.

ZF-Ergocontrol works without mechanical linkage, but by a load sensor and the control unit. The CANbus-compatible transmission control unit has a diagnostic interface which simplifies service and maintenance. The controller software can be programmed not only specifically to the vehicle, but also according to the application, which makes the overall transmission package even more user-friendly.



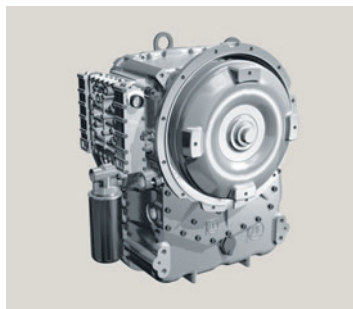
The inching pressure depends on the inch pedal position in the range between min. and max. inching pressure. When leaving the inching mode the closing pressure gradient is dependent on the engine speed.



ERGOPOWER "S"
2 WG 94 / 3 WG 94

Product features

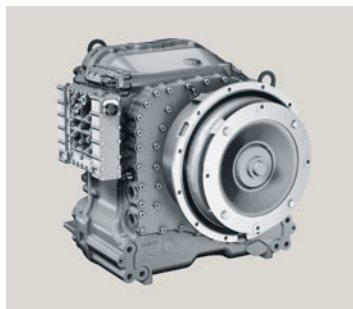
- For vehicles up to 23 t GVW (10 tons lifting capacity)
- 2 WG 94:
2 forward and 2 reverse gears
- 3 WG 94:
3 forward and 3 reverse gears
- Fully or semi-automatic gear shift control
- Powershiftable with proportional valves
- No tractive effort interruption
- Drop input / output 155 mm or 306 mm
- Standard engine dependent in-line PTO (only WG 94 long-drop); Standard short-drop version 155 mm, PTO offset upwards 105 mm
- Electronic inching only in combination with CAN or with engine speed sensor (integrated in the transmission) and angle sensor
- Electronic control unit EST 65 / 24 V
- Efficiency Package consisting of torque converter with free-wheel



ERGOPOWER "M"
WG 115/130/131/160/161/171

Product features

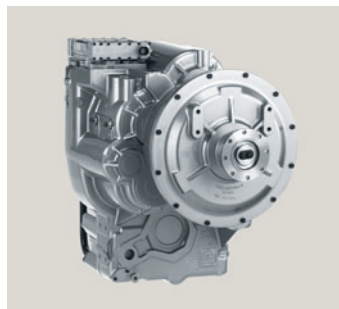
- For vehicles up to 72 t GVW (32 tons lifting capacity)
- 3 forward and 3 reverse gears for shortdrop version 3/4/5/6 gears for longdrop version forward, 3 gears for longdrop version reverse
- Fully or semi-automatic gear shift control
- Powershiftable with proportional valves
- No tractive effort interruption
- Drop input / output 300 mm (short-drop only WG 131/ WG 161/ WG 171); 500 mm (long-drop only WG 115/ WG 130/ WG 160)
- Standard engine dependent in-line PTO, second PTO optional
- Inching electronically controlled by EST-37 A, 24 V and angle sensor
- Efficiency Package available with converter lock-up



ERGOPOWER "M"
WG 190/191/210/211

Product features

- For vehicles up to 98 t GVW (42 tons lifting capacity)
- 3-6 forward and 3 reverse gears
- Fully or semi-automatic gear shift control
- Powershiftable with proportional valves
- No tractive effort interruption
- Various hydrodynamic torque converters, lock-up clutch with integrated stator free-wheel available
- Drop input / output 190 mm (short-drop) WG 191 / WG 211; 540 mm (long-drop) WG 190 / WG 210
- Standard engine dependent in-line PTO, second PTO optional
- Inching electronically controlled by EST-37 A, 24 V and angle sensor
- Efficiency Package available with converter lock-up



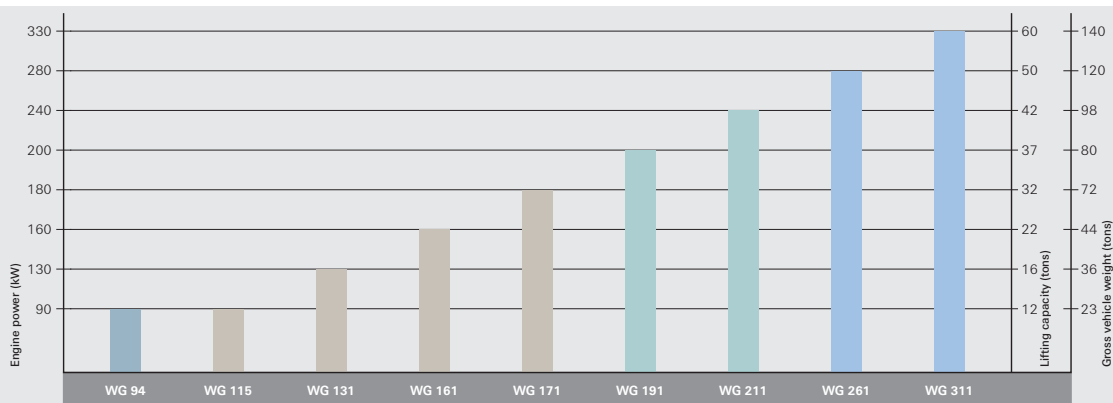
ERGOPOWER "L"
WG 260/261/310/311

Product features

- For vehicles up to 140 t GVW (60 tons lifting capacity)
- 3-6 forward and 3 reverse gears
- Fully or semi-automatic gear shift control
- Powershiftable with proportional valves
- No tractive effort interruption
- Drop input / output 380 mm (short-drop) WG 261 / WG 311; 575 mm (long-drop) WG 260 / WG 310
- Standard engine dependent in-line PTO, second and third PTO optional
- Inching electronically controlled by EST-37 A, 24 V and angle sensor
- Efficiency Package available with converter lock-up

For various requirements and numerous classes of material handling equipment, ZF offers a finely graded range of transmissions.

Applications: Lift-trucks, RoRo-, terminal- and yard-tractors, straddle carriers, airplane tow tractors, reachstackers



Technical data ZF-ERGOPOWER

Transmission	short-drop long-drop	WG 94 WG 94	– WG 115	WG 131 WG 130	WG 161 WG 160	WG 171 –	WG 191 WG 190	WG 211 WG 210	WG 261 WG 260	WG 311 WG 310
Engine power (kW)		90	90	130	160	180	200	240	280	330
Engine speed (rpm)		2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,500	2,500
PTO torque (Nm)		400	800	800	800	800	800	800	1,500	1,500
GVW (to)		23	23	36	44	72	80	98	120	140
Lifting capacity max. (to)		10	12	16	22	32	37	42	50	60
Center distance (mm)										
short-drop		155	–	300	300	300	190	190	380	380
long-drop		306	500	500	500	–	540	540	575	575

Engine Power Control via CAN possible (individual application process)

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Driveline and Chassis Technology

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IV / HEAVY MATERIAL HANDLING 11 / E