

ZF IS EFFICIENCY

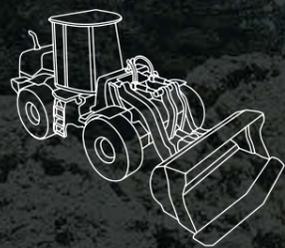
ZF DRIVELINE TECHNOLOGY AND AXLE SYSTEMS FOR
CONSTRUCTION MACHINERY AND CONSTRUCTION SITE VEHICLES





ZF IS EFFICIENCY! ZF offers advantages for driver, owner and manufacturer in equal measure. The industry of construction machinery and construction site vehicles is more and more focused on topics like reduced fuel consumption, driver comfort or environmental compatibility. ZF driveline and chassis technology provides solutions with products and functions to satisfy this development. Less fuel consumption, reduced wear and emission, increased efficiency, extended service intervals, easier and better handling, and more automation are all topics in the focus of ZF engineers.

Content



ZF IS EFFICIENCY.	page 3
MAKE VISIONS COME TRUE. WITH ZF TECHNOLOGY.	page 4
OFF-HIGHWAY SYSTEMS GLOBAL PRESENCE	page 6
ZF TECHNOLOGY: TOGETHER WE MOVE THE EARTH.	page 8
BEST PERFORMANCE ON ALL GROUNDS	page 12
INCREASED EFFICIENCY FOR YOUR DRIVELINE	page 14
TREND-SETTING PREMIUM DRIVELINE TECHNOLOGY	page 16
HIGHLY EFFICIENT FUTURE DRIVELINE TECHNOLOGY	page 18
ZF – THE SYSTEM SUPPLIER	page 20
TECHNICAL GLOSSARY	page 21
MORE SAFETY AND COMFORT	page 34
AFTER-SALES SERVICES FOR OFF-HIGHWAY SYSTEMS	page 38
DIAGNOSE AND TESTMAN	page 40
OPENMATICS – THE OPEN TELEMATIC PLATFORM	page 41
RESEARCH AND DEVELOPMENT TO SECURE MOBILITY	page 42
THE ZF GROUP	page 43

MAKE VISIONS COME TRUE. WITH ZF TECHNOLOGY.



ZF offers new products which allow maintaining its market position as a technology leader in the long term and to stand out against competitors.

Larger, faster, more impressive. Rapid progress and the process of globalization have triggered a global building boom whose sophisticated construction projects demand maximum performance from people and machines. More productivity, more efficiency, and increased driving comfort – these are the requirements construction machinery has to meet today. ZF Friedrichshafen AG has developed and manufactured transmission and axles for construction machinery for half a century now. It has always been the objective of ZF engineers to develop and enhance components and functions in a purposeful manner to meet the increasing requirements of the market. In this process, they rely on the

Group's enormous know-how, proven in millions of cases, in the field of driveline and chassis systems. Starting with the 2-speed reversing transmission used for wheel loaders in the past, ZF today equips a wide range of construction vehicles with state-of-the-art axle and driveline technology. In the field of construction machinery, ZF is one of the technology and innovation leaders worldwide. The developers' focus in this field is on reducing consumption and emissions, increasing productivity, driving comfort and safety as well as increasing the ease of operation and reducing noise. As a systems supplier, ZF concentrates on the driveline as a whole and combines axles and transmissions with advanced software functions.

Numerous milestones in the development of construction machinery are attributable to ZF. With the cPOWER transmission, ZF presented the first CVT for off-highway machinery to the world. By advancing the CVT powersplit technology known from agricultural machinery, the cPOWER provides significant consumption benefits and productivity increases with a level of efficiency previously inconceivable.

ZF is also committed to the advancement of alternative drives – not only on the road, but also for off-road applications. The company is a pioneer in this field and developed the first hybrid drive for construction machinery. An electric motor with a capacity of up to 120 kW supports the conventional drive and prevents high power peaks. This significantly lowers fuel consumption and reduces the load on the drive. By integrating a hybrid module with the proven ERGOPOWER transmission, ZF takes the logical step toward the future. And, by doing so, continues to develop innovations of great value.

Off-road specialists

Driveline technology for construction machinery, construction site vehicles and material handling vehicles is developed and produced by the business unit Off-Highway Systems, a part of the ZF division Industrial Technology. In this division, ZF bundles its activities for “Off-Road” applications. It comprises the development and production of transmissions and axles for agricultural- and construction machinery as well as driveline technology for material handling systems, rail and military vehicles. The division is also responsible for the worldwide business of marine propulsion systems, aviation technology as well as the development and production of wind power transmissions. Test systems and industrial drives for all kinds of applications are also included in the division's portfolio. The business units of the Industrial Technology division thus cover a very wide range of products and markets.

worldwide

Off-highway systems global presence

ZF offers you a comprehensive and attractive range of products and services to ensure mobility anywhere, at any time. Proximity to the customer is an essential element of the corporate performance.

Customer satisfaction with the services and products provided by ZF is the topmost objective in all company activities. All services integrated into the product cycle, ranging from development and consultancy to aftermarket service are derived from this. Thus, proximity to international customers is of great significance to ZF.

Worldwide, the ZF Group has 230 locations in 40 countries and 17 main development locations. In addition to that, ZF has 77 service locations as well as 650 service partners. This enables ZF to provide a dense network of highly qualified contacts close to international customers at all levels and in all regions.

The business unit “Off-Highway Systems” with its headquarters in Passau, Germany, offers its customers individual, tailor-made integrated solutions for construction machinery, agricultural machinery and material handling applications. Off-Highway Systems has nine production sites worldwide: Passau (Germany), Steyr (Austria), Stan-kov (Czech Republic), Gainesville (USA), Sorocaba (Brazil), Hangzhou (China), Liuzhou (China), Luoyang (China) and Coimbatore (India). With a global development network ZF is able to adapt its products to the local requirements as well as to the series production support. All over the world the service network and central sales teams are available.

- = ZF locations
- = Division Industrial Technology locations
- ★ = Off-Highway Systems locations
- ★ = Off-Highway Systems development locations

Tailor-made for the markets

This starts with engineering. Most ZF products, which are also produced outside Europe, have to be adapted to local market conditions. On the one hand, this involves meeting the prevalent cost structures in each country without compromising on functionality and the hallmark ZF quality. On the other, technical specifications have to be adjusted to market conditions: Commercial vehicle transmissions have to be tuned to actual engine torque and average transport weights; shock absorbers designed to meet typical load profiles. ZF has a well-oiled international development network to fulfill these tasks: The main development locations are in contact with several customization locations near to the large, in-country ZF plants. Corporate R&D also coordinates and supports the activities at the development center in Tokyo (Japan). Jointly, they devise specific solutions in product design. In the case of product development and customization, the divisions control the process; the Corporate R&D locations are called in whenever fundamental research questions are involved.

ZF TECHNOLOGY: TOGETHER WE MOVE THE EARTH.



As a system supplier ZF focuses on the entire driveline and combines advanced software features with transmissions and axles. The R+D Centers mainly focus on: Less fuel consumption, increased productivity, noise reduction, increased driving comfort.

ZF is a renowned specialist for driveline technology and recognized worldwide as innovative system supplier for off-road machinery. The demands on these vehicle types are high: fast work with accuracy to a millimeter and highest productivity combined with reduced operating costs.

ZF transmissions for construction and material handling machinery have been produced for more than 50 years with more than 200,000 transmissions, thereof more than 100,000 ERGOPOWER transmissions. ZF transmissions for the off-highway applications are used by worldwide customers based on a wide range of applications such as wheel loaders, dump trucks, graders, wheel excavators, backhoe loaders and many more. ZF transmissions are tailor-made for all kinds of different applications.

ZF-ERGOPOWER

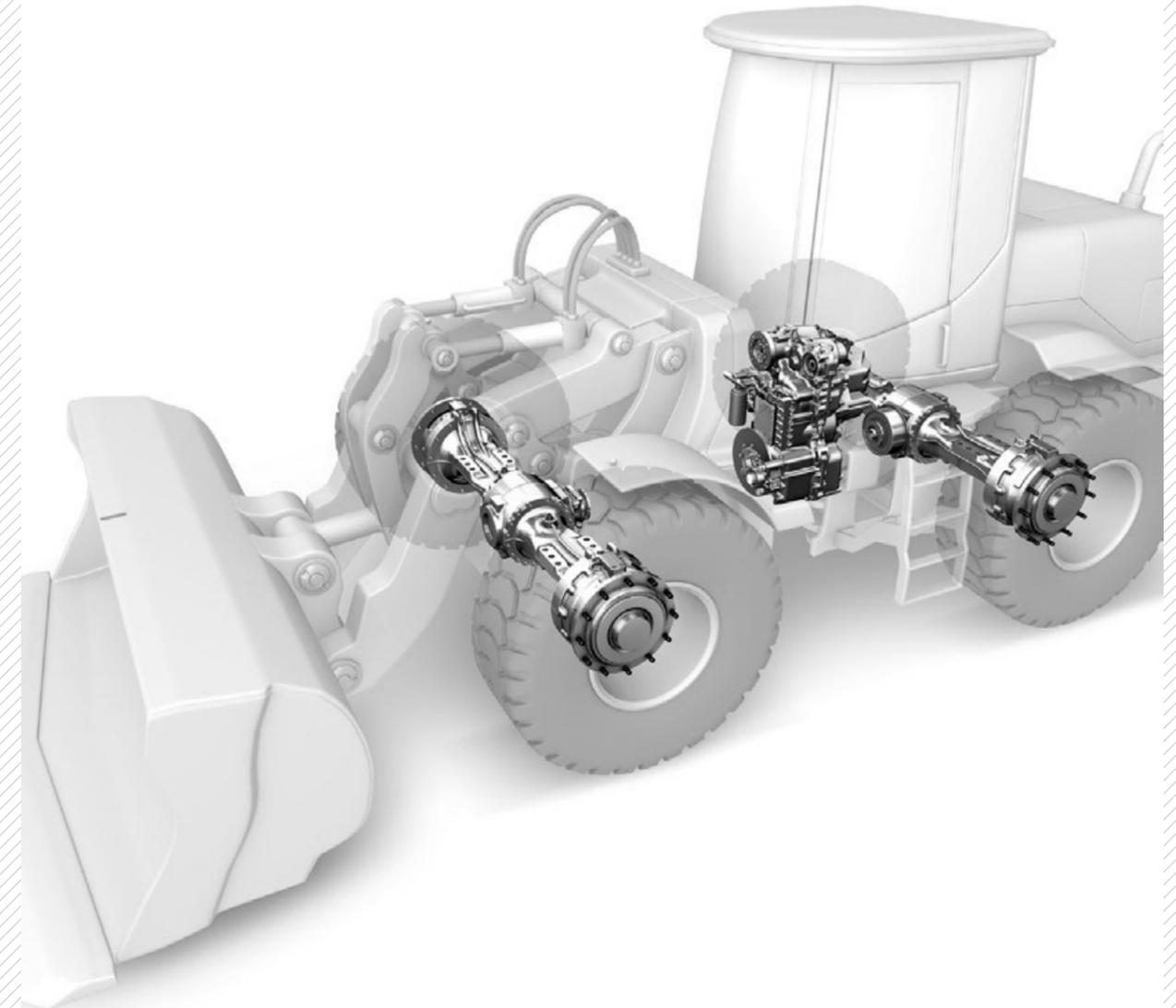
This transmission system has been optimized for different construction machinery types and offers the innovative, optional feature of 5 instead of 4 gears. Therefore,

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. With the modular construction and optimized design operating costs are kept as low as possible. Helical gears with high tooth contact reduce the noise level. Extremely short shafts reduce deflection and tooth contact faults.

Transmission for heavy loads

The ZF-ERGOPOWER LII transmission is a complete new countershaft design for the application specially in dump trucks, motor graders and heavy wheel loaders. The main features for this new development are high efficiency, higher speed, higher tractive effort and less noise emissions. Well known and accepted design features like rotational pressure compensation, set right bearings or short and stiff shafts are combined now with a remarkably reduced internal speed which results

INNOVATIONS OF GREAT VALUE In the field of construction machinery, ZF is one of the technology and innovation leaders worldwide. Our products set standards and provide added value to our customers.



ZF is a partner to the construction machinery industry throughout the world.

▪▪▪ ASTRA ▪ AUSA ▪ Bell ▪ Caterpillar ▪ Chengong ▪ CNH ▪ Dahua ▪ Doosan ▪ Doosan-Moxy ▪ HAMM ▪ HBM-Nobas ▪ Heli ▪ Hitachi ▪ Huddig AB ▪ Hyundai ▪ Hua Dong ▪ JCB ▪ JLG ▪ John Deere ▪ Kalmar ▪ Liugong ▪ Liebherr ▪ Linyi ▪ Longgong ▪ McNeilus ▪ Omniquip ▪ Sany ▪ Shangong ▪ Stetter ▪ TCM ▪ Telcon ▪ Terex ▪ Tianjin ▪ Volvo/VCE ▪ Xiagong ▪ Xugong ▪ Xingma ▪▪▪

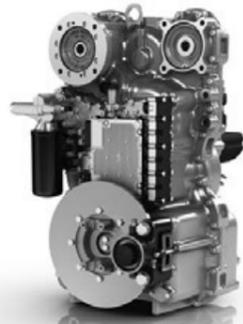


Learn more about our trend-setting continuously variable transmission technology.

TRANSMISSIONS ZF offers tailor-made transmissions for a wide range of off-highway applications – from wheel loaders to material handling vehicles and mobile cranes.



ZF-ERGOPOWER for wheel loaders, graders and cranes



cPOWER CVT for wheel loaders



ZF-ERGOPOWER LII for dump trucks



4 WG 94/98 for backhoe loaders



ZF-HYDROSTAR 2 HC 85 for compact loaders



ZF-ECOMIX II for concrete mixers



Learn more about the new transport mixer transmission ECOMIX II. Watch the animation on your smartphone.



in less fuel consumption. The new transmission features onboard electronics, an integrated retarder and as option a bolt-on axle drive. The vertical transmission drop eliminates the need for a transfer box and allows the integration of an interaxle differential.

Hydrostatic transmission

The stepless hydrostatic transmission ZF-HYDROSTAR is a complete new design and technology including the crankshaft radial piston motors. The two-speed version is designed for up to 40 km/h or even more. Through the continuously variable shifting the riding comfort and handling performance has been increased. The electronically controlled driveline management enables a low start speed. Due to the integration of the hydro motors into the transmission system, interfaces to the vehicle could be reduced. The low frequencies of the slower hydro motor speeds helped reduce noise emission. This transmission can be mounted directly to the MT-L 3045/55 ZF rigid axle or separately to the chassis.

The new generation of mixer transmissions

ZF-ECOMIX II is the new generation for concrete mixers up to 16 m³ drum capacity and an output torque up to 90,000 Nm. The compact lightweight construction makes ECOMIX II 24% lighter and 50% shorter in comparison to previous models. The use of patented elastomer gearbox to vehicle interface designed by ZF allows an increase of the axial run-out at drum bottom and an increase of misalignment of the drum. The acoustic and mechanical decoupling of drum and vehicle frame leads to considerable noise reduction during operation and improved driving comfort. Serviceability has been improved thanks to separate oil for transmission and hydrostatic system as well as an improved accessibility.

BEST PERFORMANCE ON ALL GROUNDS



Over the last years ZF was able to develop basic optimization in axle technology. Especially according to efficiency our engineers could achieve major improvements.

ZF axles are designed for utterly uncompromising hard work and represent the ideal system for all mobile construction equipment. As demonstrated in numerous tests in the company's own development center, a very long service life is ensured by ZF axles. The wheel-speed service brake of the ZF-MULTITRAC axles and the other sophisticated ZF design features form the basis of a highly efficient driveline. Steering axles in the series ZF-MULTISTEER and the powered rigid axles of the ZF-MULTITRAC series can be integrated like a modular kit into almost all vehicle and application profiles – both an economical and performance-optimized solution. Slim axle housings, small axle center drives and high ratios in the wheel heads are the essential parts of these innovative axle ranges.

More than 50 years of experience

In the development and production of axles for construction machines ZF is offering optimum solutions for applications in the most demanding applications for off-highway machinery. The axles are intended for high

weights and rough terrains and are capable to withstand extreme stress levels. The fabrication, which is in any case robust, provides the maximum longevity and with extended oil change intervals (2,000 h) minimizes unnecessary operating costs. With the optimized efficiency not only higher road speeds are possible, but a reduction in the fuel consumption, too.

ZF considers that vehicle manufacturers are looking for continuous improvements in terms of speed and caters for these trends in all its new developments. Examples of this are improved efficiency ratings.

ZF offers a wide range of axles specially designed for many different applications in order to provide maximum durability and efficiency, tailored to the demands of vehicle manufacturers and drivers in equal measure.

ZF AXLE TECHNOLOGY



HIGHEST POSSIBLE RELIABILITY AND EFFICIENCY

Strong, but light. High torque transmission, but in a compact size. Adaptable, but at costs acceptable to the market. ZF axles are based on well-established major product lines and offer all options to fulfill individual demands. Precise gear meshing ensures low-noise power transmission.

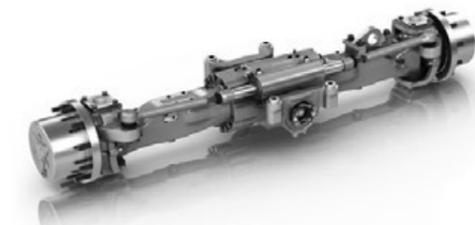
AXLES



ZF-MULTITRAC MT-L 3085 for wheel loaders



ZF-MULTITRAC MT-B 3065 for backhoe loaders



ZF-MULTISTEER MS-T 3000 for telescopic handlers



ZF-MULTITRAC MT-G 3000 for graders



Learn more about our portfolio of powerful transmissions and find more ZF products by applications.

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

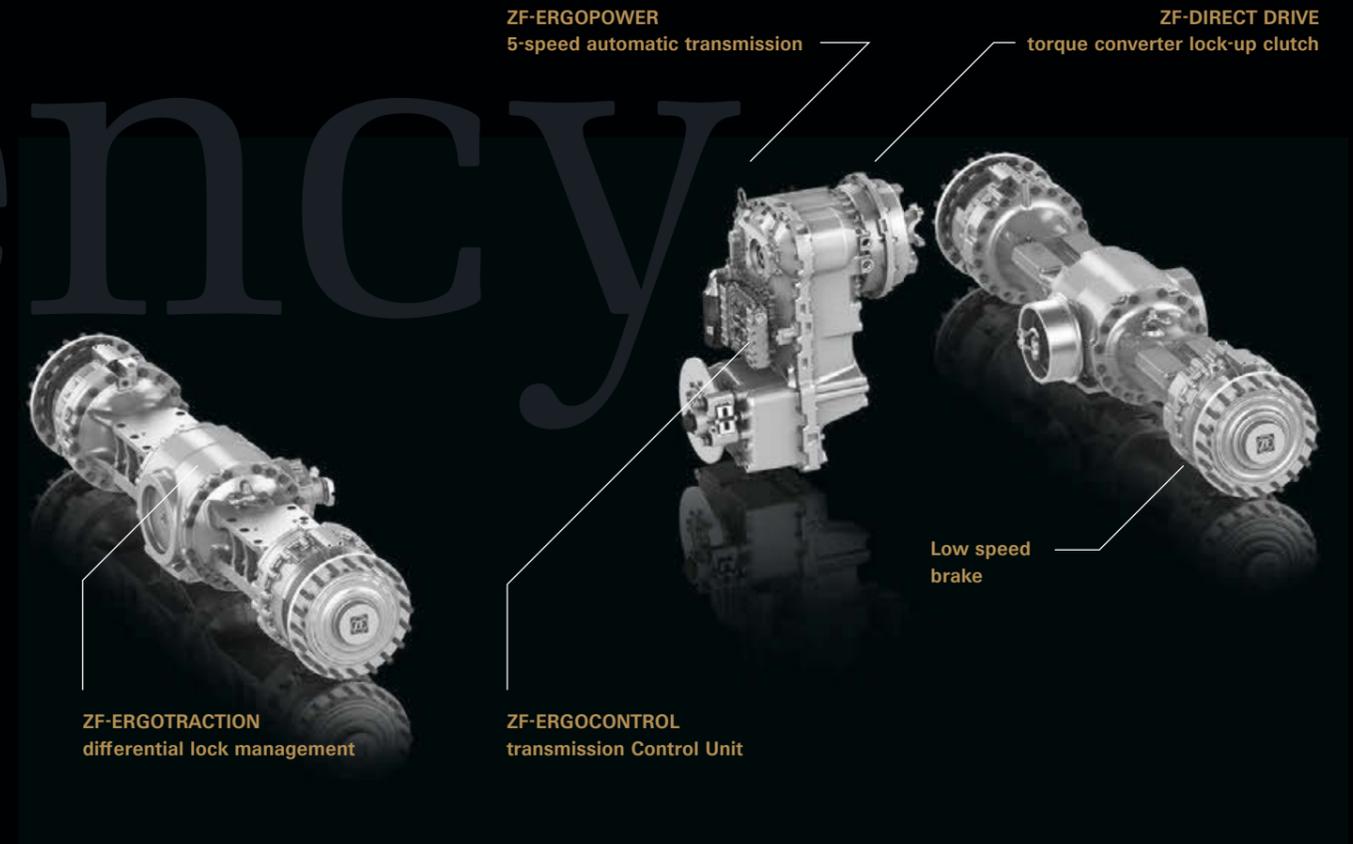
and maintenance costs for the vehicle owner. This approach makes it possible to reconcile the frequently conflicting demands for:

- 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 reduce 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.

cPOWER

Trend-setting premium driveline technology

Even if wheel loaders and other construction machines appear large and cumbersome, they must precisely apply force and power in measured amounts. Here, the ZF driveline technology ensures the necessary sensitivity.

ZF has set two milestones in transmission technology for construction machinery with the new ZF cPOWER, the continuously variable transmission, and the highly efficient future technology ZF-ERGOPOWER hybrid transmission.

Prepared for future challenges

With the development of the cPOWER transmission, ZF follows a rising demand for continuously variable transmissions in the construction and agricultural machinery market. Hydrostatic technology is more and more displacing hydrodynamic (torque converter) transmissions especially in construction machinery systems. A trend towards lower engine speeds and the demand for engine stabilization by a constant

speed concept are the future challenges. The continuously variable cPOWER from ZF meets both requirements. Movement sequences flow easier using continuously variable transmissions from ZF. Therefore, construction machines can be controlled more precisely. With gear shifting, the drop in power associated with the change of gear does not occur. This ensures more constant engine speeds. The driver profits from the continuously variable technology as well, since manual gear shifting is no longer needed and he can completely concentrate on his work.

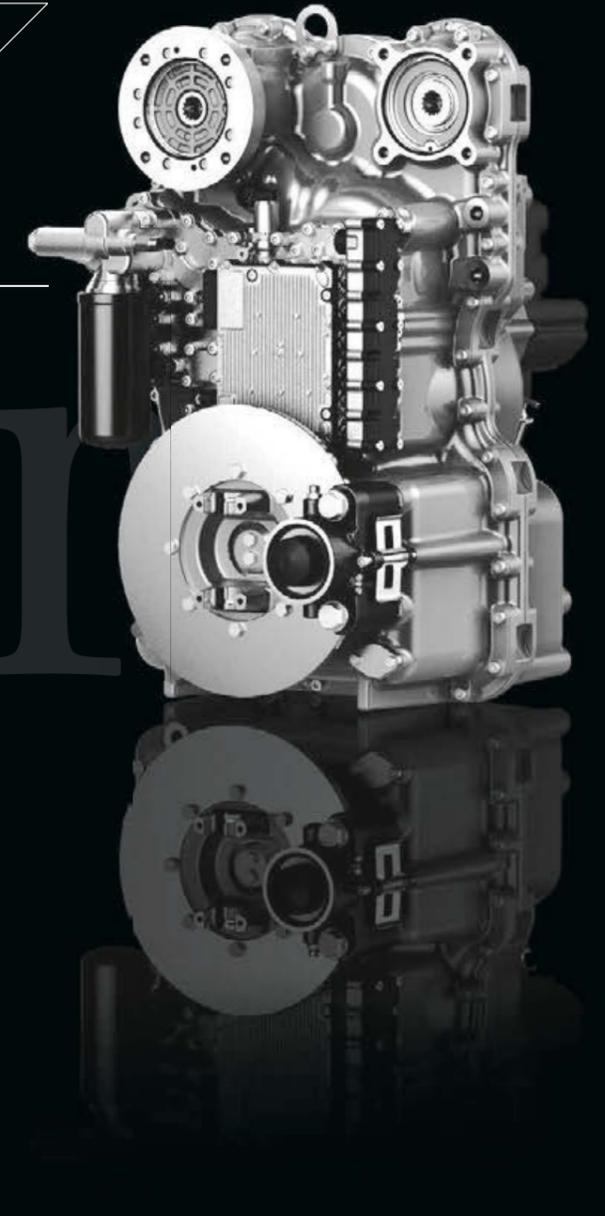
Higher efficiency with ZF cPOWER

The new ZF cPOWER offers full power-split and perfectly combines

hydrostatical and mechanical advantages throughout the whole range. It benefits from the high degree of hydrostatical efficiency at low speeds and at the same time from the great mechanical efficiency at high speeds. Reduced fuel consumption of more than 25% and an increase of productivity of more than 20% are possible. The high tech CVT is 100% assembly-compatible with ZF-ERGOPOWER transmissions. The application of an elaborate hydraulic transmission-control unit and transmission-integrated on-board electronic unit optimally completes driving functions.

CONSUMPTION SAVINGS The power-split continuously variable transmission keeps the construction machinery engine in the most economical engine speed range.

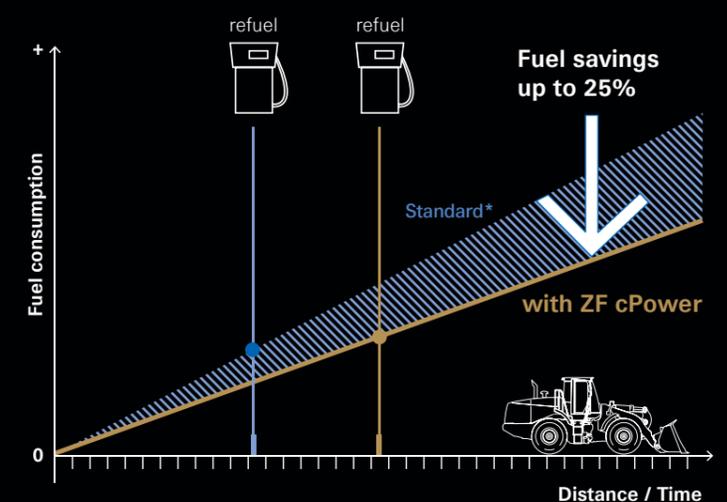
-25 %



But not only in wheel loaders does ZF's cPOWER transmission help reduce fuel and increase productivity. In the Diesel-engine-powered lift truck market, a trend towards lower engine speeds and the demand for engine stabilization by a constant speed concept are the future challenges. The continuously variable cPOWER meets both requirements.

As for forestry equipment, ZF is already supplying the cPOWER transmission design for the Skidder application. In addition, this transmission system is also the ideal driveline solution for the forwarder application. The installation of the cPOWER in these vehicles guarantees a maximum in traction, excellent driving comfort and easy handling.

SIGNIFICANT REDUCTION OF FUEL CONSUMPTION



*4-speed transmission

Hybrid

CONSUMPTION SAVINGS The ZF hybrid component in combination with the cPOWER series allows significant fuel savings compared to a conventional driveline.

-30%

Highly efficient future driveline technology

Efficient drive concepts that reduce fuel consumption and conserve natural resources. These are just some of the benefits provided by the new, intelligent hybrid solutions from ZF.

ZF is one of the few independent automotive suppliers, whose hybrid technology is already being used as a standard. The Group has adjusted its product program to the increasing demand for hybrid technology and thus covers the entire range: components, modules, and complete hybrid systems based on the parallel hybrid design. They can be used as a basis for all hybrid designs, from the micro and mild hybrid to the full hybrid, which leads to up to 30% fuel savings compared to a conventional driveline.

With the electrically driven wheel hub units ZF engineers have developed an innovative driveline solution for applications in off-highway

engineering which is suitable for professional applications with the highest requirements. Due to the sharing of the drive power between the vehicle and trailer or attachment there are substantial advantages in difficult driving situations, e.g. with movement across a slope. The highly dynamically controlled traction support from the electrical drive facilitates working under arduous conditions. Consequently, working off-road during adverse weather conditions with softened ground is possible.

ZF-Hybrid system

- Up to 30% fuel savings compared to a conventional driveline
- Applicable for direct and separate transmission mounting
- Conserves natural resources

Electrification

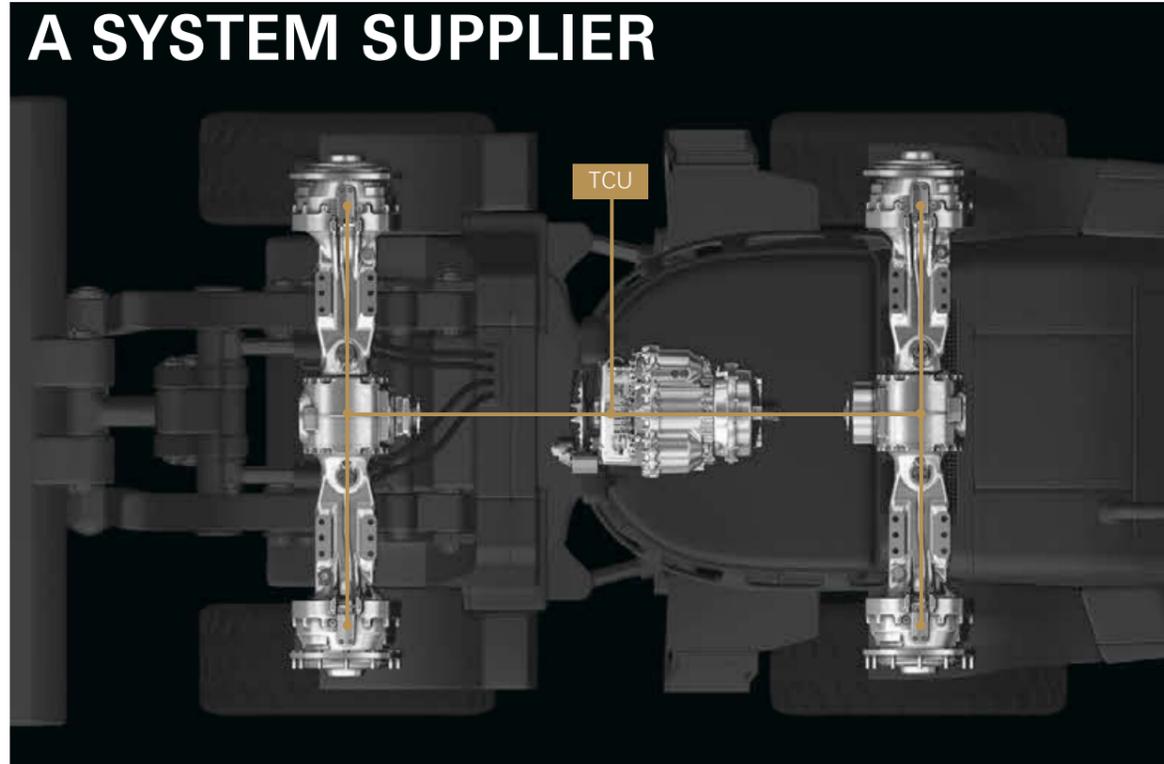
ZF E-DRIVE

ELECTRICAL WHEEL DRIVE GPE50

- Electrical single-wheel drive with three-phase asynchronous motor for off-highway applications
- Compact high-integration motor design
- Fluid cooling
- Improved traction, increased driving safety, ground conservation
- 400 V AC engine
- 15 kNm maximum output torque
- 50 kN maximum wheel load
- Integrated brake



COMBINE COMPETENCE: ZF AS A SYSTEM SUPPLIER



Heavy-duty transmissions and axles and intelligent electronic systems are the components that form a superior driveline package – right at the heart of every construction machine.

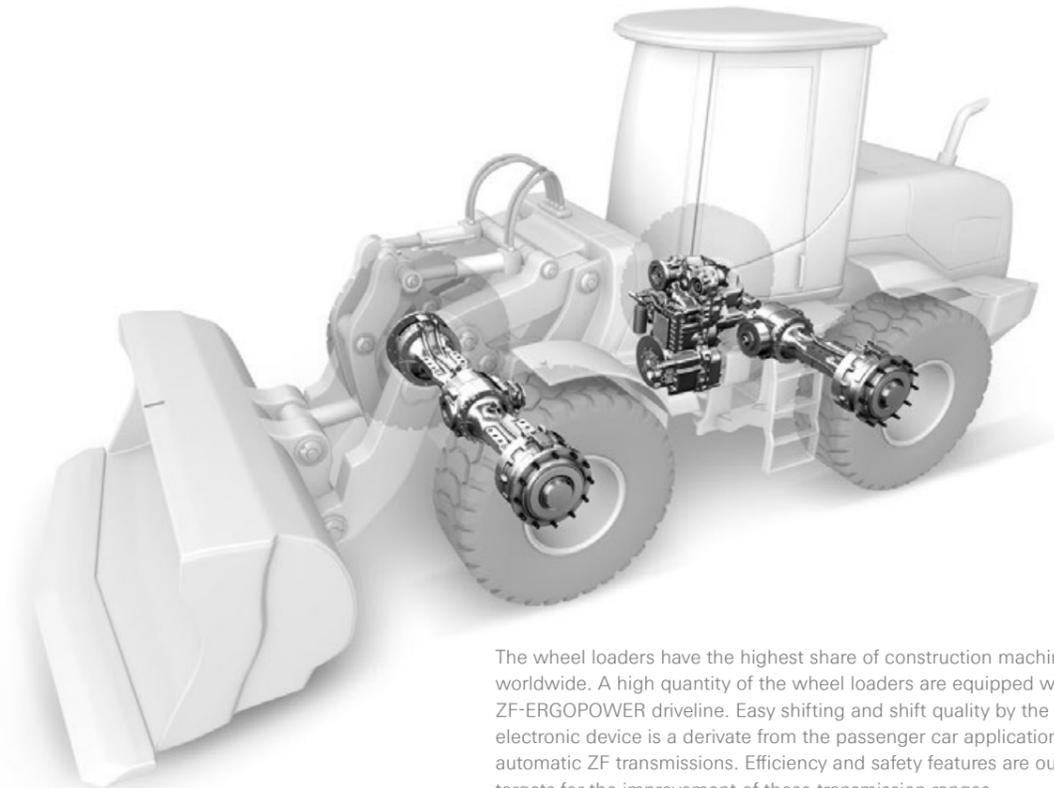
Thanks to ZF technology, mobility and driving comfort can be combined with reduced fuel consumption, preservation of resources, high efficiency, and additional safety. The technology company supplies driveline, electronic, and software technology for all kinds of construction machinery and construction site vehicles worldwide. ZF is setting the pace for the future too – with electrified drivelines and automotive lightweight construction.

Apart from the basic orientation to various types of construction machines, ZF driveline components are matched more precisely to the relevant vehicle requirements in co-operation with the manufactu-

urers. The modular system structure allows lots of ways of achieving the best driveline design through co-ordinated development. Interfaces are reduced and the manufacturer of the construction machine receives a perfectly tuned system ready for fitting and from a single source. At the same time, attention is always paid to the requirements of the fleet operator and driver, both in their work with the machine as well as with upkeep and maintenance.

An innovative spirit, quality consciousness and smooth co-operation with vehicle manufacturers come together to make ZF a valuable and dependable system partner who will help you share the load.

ZF DRIVELINE TECHNOLOGY FOR WHEEL LOADERS



The wheel loaders have the highest share of construction machinery worldwide. A high quantity of the wheel loaders are equipped with ZF-ERGOPOWER driveline. Easy shifting and shift quality by the electronic device is a derivative from the passenger car application with automatic ZF transmissions. Efficiency and safety features are our main targets for the improvement of these transmission ranges.

PRODUCTS AND PERFORMANCE CLASSES

Empty vehicle weight ¹⁾	Front axle	Rear axle	Electronics / gear selector	Transmission	Engine power max.
Class up to 10.5 t	MT-L 3065-II	MT-L 3065-II	ES1C (CAN)	WG 115/WG 130	90 kW/110 kW
Class up to 12.5 t	MT-L 3075-II	MT-L 3065-II	ES1C (CAN)	WG 130/WG 160	110 kW/130 kW
Class up to 13 t	MT-L 3075-II	MT-L 3075-II	ES1C (CAN)	WG 160	130 kW
Class up to 14.5 t	MT-L 3085-II	MT-L 3075-II	ES1C (CAN)	WG 160/WG 190	130 kW/160 kW
Class up to 15.5 t	MT-L 3085-II	MT-L 3085-II	ES1C (CAN)	WG 190	160 kW
Class up to 17.5 t	MT-L 3095-II	MT-L 3085-II	ES1C (CAN)	WG 210	190 kW
Class up to 19.5 t	MT-L 3095-II	MT-L 3095-II	ES1C (CAN)	WG 210	190 kW
Class up to 21 t	MT-L 3105-II	MT-L 3095-II	ES1C (CAN)	WG 260	240 kW
Class up to 24.5 t	MT-L 3105-II	MT-L 3105-II	ES1C (CAN)	WG 260	240 kW
Class up to 26 t	MT-L 3115-II	MT-L 3105-II	ES1C (CAN)	WG 260/WG 310	240 kW/290 kW
Class up to 28 t	MT-L 3115-II	MT-L 3115-II	ES1C (CAN)	WG 310	290 kW
Class up to 31 t	MT-L 3125-II	MT-L 3115-II	ES1C (CAN)	WG 310	290 kW
Class up to 35 t	MT-L 3125-II	MT-L 3125-II	ES1C (CAN)	WG 310	290 kW

¹⁾ Empty vehicle weight without additional equipment

ZF DRIVELINE TECHNOLOGY FOR COMPACT LOADERS



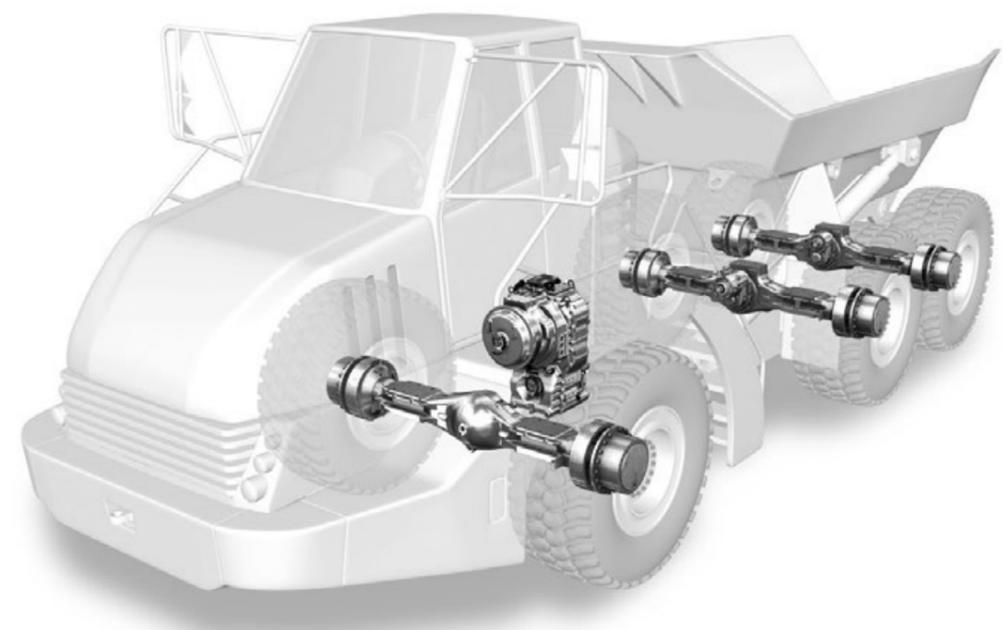
For the smaller range of articulated wheel loaders up to 10 tons empty vehicle weight ZF can offer the axle range MT-L 3055 in connection with the transmission AVG 185 or the new CVT transmission 2 HC 85 for the adaption of the hydrostatic engine. These axles in connection with a possible mounted service and parking brake (BHF) have a very compact design.

PRODUCTS AND PERFORMANCE CLASSES

Empty vehicle weight ¹⁾	Front axle	Rear axle	Transmission
Class up to 3.9 t	MT-L 3010-II	MT-L 3010-II	1 AVG 150/185
Class up to 4.9 t	MT-L 3015-II	MT-L 3015-II	1 AVG 150/185
Class up to 5.8 t	MT-L 3020-II	MT-L 3020-II	1 AVG 150/185
Class up to 6.6 t	MT-L 3025-II	MT-L 3025-II	1 AVG 150/185
Class up to 9.8 t	MT-L 3045	MT-L 3045	1 AVG 185/2 HC 85
Class up to 11.0 t	MT-L 3055	MT-L 3055	1 AVG 185/2 HC 85

¹⁾ Empty vehicle weight without additional equipment

ZF DRIVELINE TECHNOLOGY FOR DUMP TRUCKS



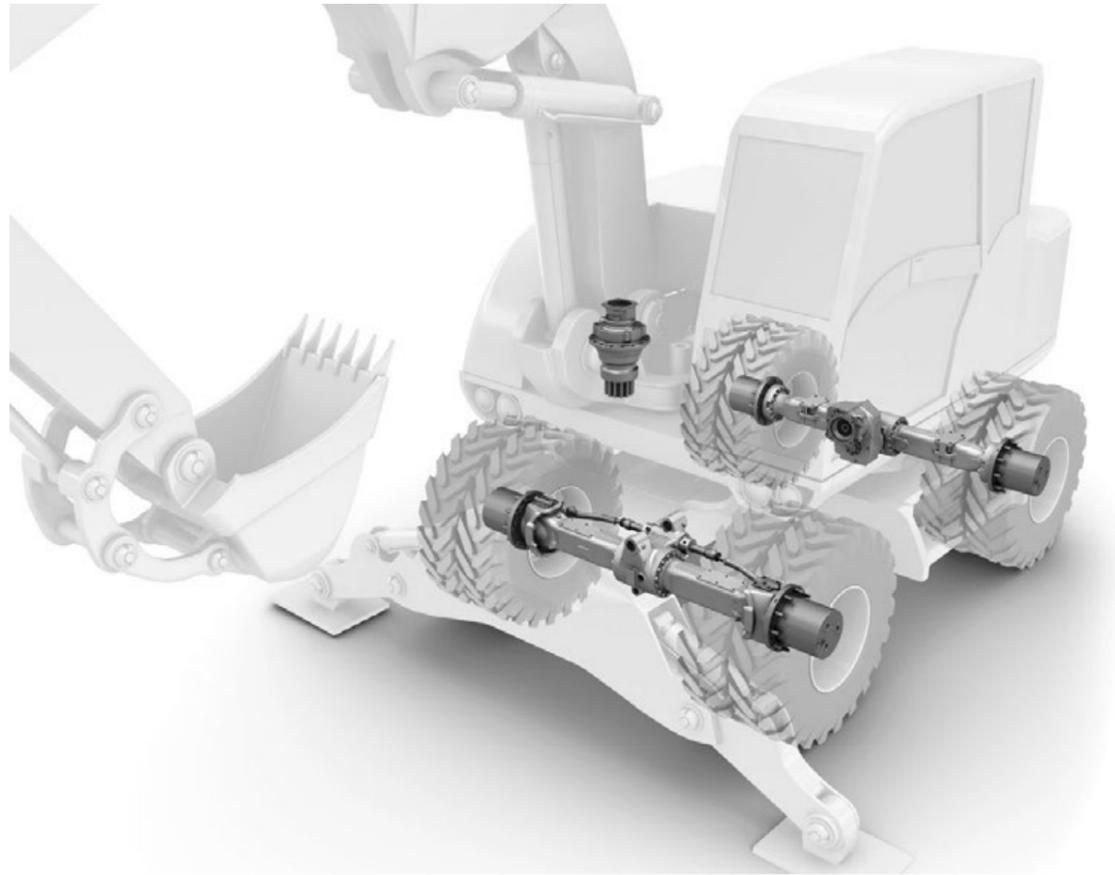
To meet these requirements in everyday use, maximum ground contact, uniform distribution of drive power to all wheels and uniform load distribution are essential for a high level of driving safety. Apart from these viewpoints for reduced cycle times and more operator comfort, economic efficiency and service life should not be forgotten. The stresses which come into play demand the highest level of ruggedness and reliability from all components in the transmission chain.

PRODUCTS AND PERFORMANCE CLASSES

Vehicle payload	Front axle	Wheel head	Rear axle 1	Rear axle 2	Gear selector	Transmission	Engine power max.
Class up to 12 t	MT-L 3075 II	–		MT-L 3075 II	VTS 3	6 WG 115	90 kW
Class up to 18 t	MT-L 3085 II	–		MT-L 3085 II	VTS 3	6 WG 160	160 kW
Class up to 25 t	MT-D 3085 II	–	MT-L 3085 II	MT-L 3085 II	VTS 3	6 WG 210	230 kW
Class up to 30 t	MT-D 3095 II	–	MT-D 3095 II	MT-D 3095 II	VTS 3	8 EP 320	270 kW
Class up to 30 t		WH-D 3105	MT-D 3095 II	MT-D 3095 II	VTS 3	8 EP 320	270 kW
Class up to 35 t	MT-D 3105	–	MT-D 3105	MT-D 3105	VTS 3	8 EP 370	300 kW
Class up to 35 t		WH-D 3105	MT-D 3105	MT-D 3105	VTS 3	8 EP 370	300 kW
Class up to 40 t	MT-D 3105		MT-D 3105	MT-D 3105	VTS 3	8 EP 420	350 kW
Class up to 40 t		WH-D 3105	MT-D 3105	MT-D 3105	VTS 3	8 EP 420	350 kW
Class up to 45 t					VTS 3	8 EP 470	375 kW
Class up to 45 t					VTS 3	8 EP 470	375 kW
Class up to 50 t					VTS 3	8 EP 520	400 kW
Class up to 50 t					VTS 3	8 EP 520	400 kW

¹⁾ EC II: ErgoControl II onboard electronics

ZF DRIVELINE TECHNOLOGY FOR MOBILE EXCAVATORS



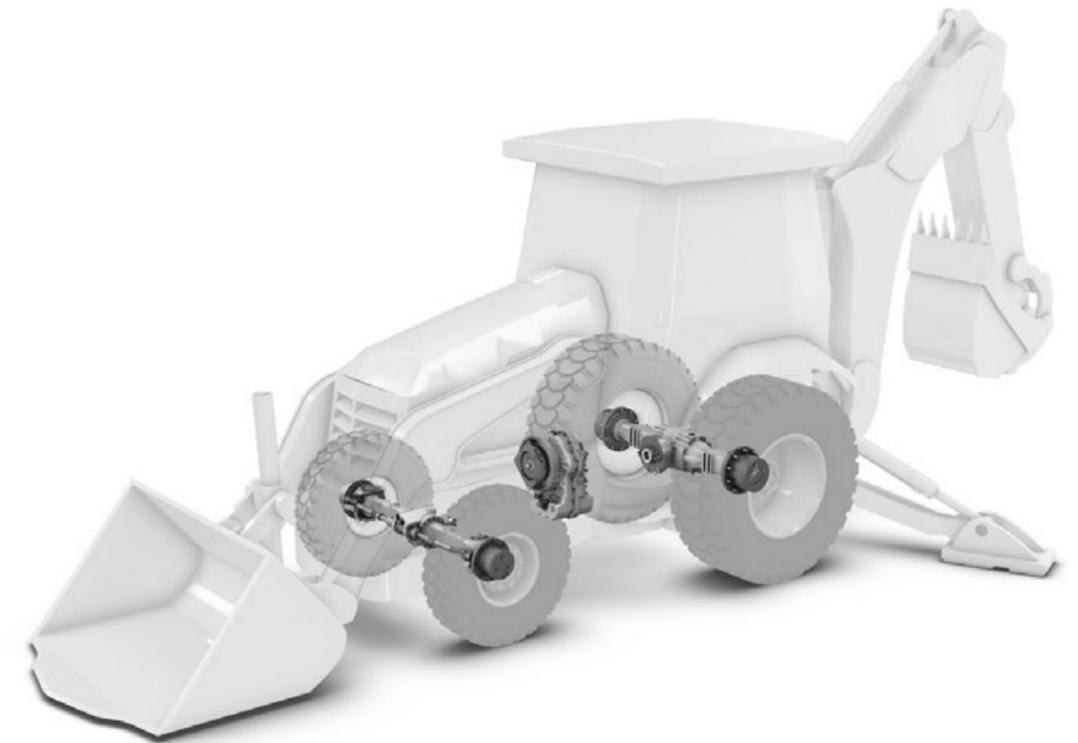
The wheel drive enables a rapid change of position without disturbing the substrate. Easy tool changing turns the mobile excavator into a multifunctional working machine which however needs to be moved precisely. Along with the skill of the excavator operator, well-conceived mechanical driveline technology is required to provide smooth movements when swiveling and braking. With the ZF driveline technology high power transmission and millimeter positioning are perfectly combined. Depending on the application, the axles are in this respect stressed differently. In tight construction sites a precise response of the steering axle should also support accurate positioning.

PRODUCTS AND PERFORMANCE CLASSES

Empty vehicle weight ¹⁾	Front axle	Rear axle	Transmission	Input torque max.	Swing drives
Class up to 15,5 t	MS-E 3050 II	MT-T 3050 II	HL-250	550 Nm	DR 140
Class up to 20 t	MS-E 3060 II	MT-T 3060 II	HL-270	770 Nm	DR 250
Class up to 25 t	MS-E 3070 II	MT-T 3070 II	HL-290	950 Nm	DR 350

¹⁾ Empty vehicle weight without additional equipment

ZF DRIVELINE TECHNOLOGY FOR BACKHOE LOADERS



Backhoe loaders are a combination of wheel excavators and wheel loaders: loading at the front, digging at the back – and in between a power drive, embedded in a maneuverable vehicle design. As genuine all rounders they can also be combined with various hydraulic attachments, for example for drilling, digging, pumping, breaking, compacting or cutting. Consequently, backhoe loaders are seen where the most varied work has to be done and special machines would not be economical. In particular a lot is demanded from the front axle. It has to overcome the conflict between high loadability and high steering precision. The universal axle concept facilitates front-wheel and four-wheel steering.

PRODUCTS AND PERFORMANCE CLASSES

Empty vehicle weight ¹⁾	Front axle	Rear axle	Gear selector	Transmission	Engine power max.
Classification Backhoe Loader 2WS					
Class up to 7.5 t	MS-B 3025	MT-B 3065	DW 3	WG 90	65 kW
Class up to 7.5 t	MS-B 3025	MT-B 3070	DW 3	WG 94	75 kW
Class up to 8.5 t	MS-B 3035	MT-B 3070	DW 3	WG 98	85 kW
Class up to 11.5 t	MS-B 3045	MT 2085 ²⁾	DW 3	WG 98	85 kW
Classification Backhoe Loader 4WS					
Class up to 8 t	MS-B 3045	MT-B 3065	DW 3	WG 98	80 kW
Class up to 10.5 t	MS-B 3045	MT-B 3070	DW 3	WG 98	90 kW

¹⁾ empty vehicle weight without additional equipment

²⁾ series production end 2016

ZF DRIVELINE TECHNOLOGY FOR TELEHANDLERS



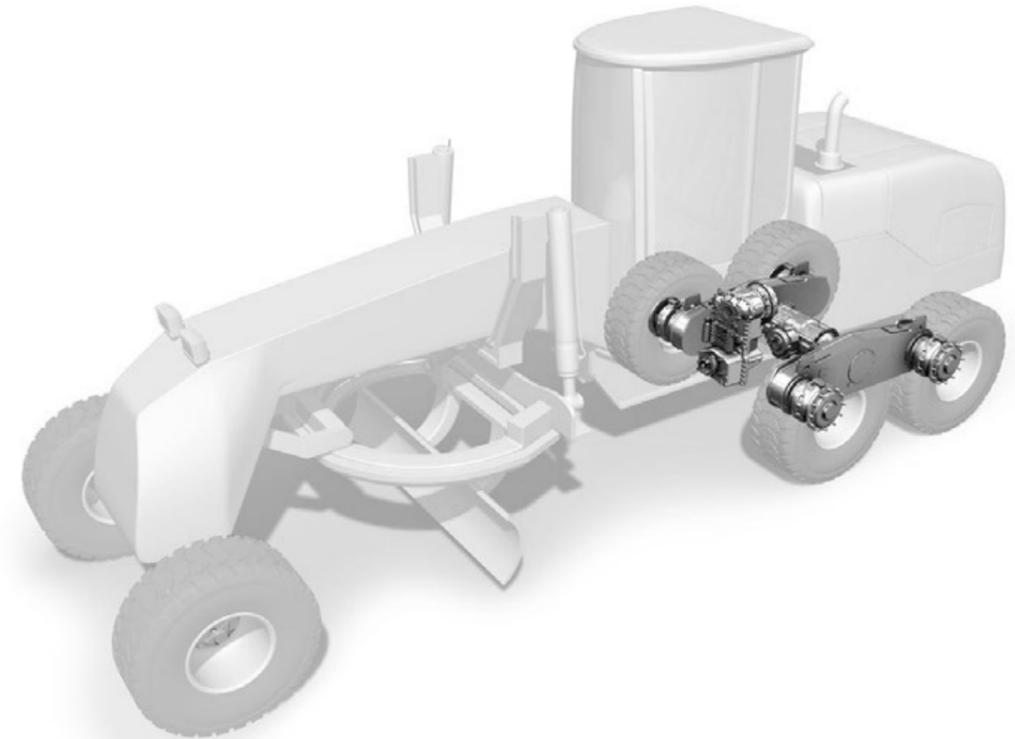
The telescopic handler can be quickly fitted with shovel, fork, grab, working platform, and other tool attachments for the most varied jobs. This means versatility for use in most different areas, ranging from construction sites to industrial and agricultural applications. The ZF driveline versions for telescopic handlers are also versatile. Depending on the type, low-boom or high-boom, center or side mounted transmission designs are possible. Special telescopic handler axles support the 4-wheel steering system.

PRODUCTS AND PERFORMANCE CLASSES

Empty vehicle weight ¹⁾	Payload max.	Front axle	Rear axle	Gear selector	Transmission	Engine power max.
Class up to 10.6 t	3.2 t	MS-T 3045 II	MS-T 3045 II	DW 3	WG 98 TSC*/WG 98 TC 2 HC 85**	105 kW 100 kW
Class up to 12.9 t	3.9 t	MS-T 3055 II	MS-T 3045 II	DW 3	WG 98 TSC*/WG 98 TC 2 HC 85**	105 kW 100 kW
Class up to 13.3 t	4.0 t	MS-T 3060 II	MS-T 3045 II	DW 3	WG 98 TSC*/WG 98 TC 2 HC 85**	105 kW 100 kW
Class up to 15.3 t	4.6 t	MS-T 3060 II	MS-T 3055 II	DW 3	WG 98 TSC*/WG 98 TC 2 HC 85**	105 kW 100 kW
Class up to 16.0 t	4.9 t	MS-T 3070***	MS-T 3055 II	DW 3	WG 98 TSC*/WG 98 TC 2 HC 85**	105 kW 100 kW
Class up to 19.2 t	5.7 t	MS-T 3070***	MS-T 3060 II	DW 3	WG 98 TSC*/WG 98 TC 2 HC 85**	105 kW 100 kW
Class up to 9.6 t	4.3 t	MS-T 3060 II	MS-T 3045 II	DW 3	WG 98 TSC*/WG 98 TC 2 HC 85**	105 kW 100 kW
Class up to 11.1 t	5.0 t	MS-T 3070***	MS-T 3045 II	DW 3	WG 98 TSC*/WG 98 TC 2 HC 85**	105 kW 100 kW
Class up to 11.6 t	5.2 t	MS-T 3070***	MS-T 3055 II	DW 3	WG 98 TSC*/WG 98 TC 2 HC 85**	105 kW 100 kW

¹⁾ Empty vehicle weight without additional equipment
^{*} max. engine power for transmission WG 98 TSC = 105 kW / TC = 90 kW
^{**} max. engine power for transmission 2 HC 85 = 100 kW
^{***} MS-T 3070 available only on request

ZF DRIVELINE TECHNOLOGY FOR GRADERS



Graders must adapt to the most varied ground conditions quickly and impressively. Optimum weight distribution for achieving maximum tractive effort is one of the primary requirements. To master difficult conditions in the working routine, smooth movements in conjunction with a high pulling power are decisive for excellent working performance and for overcoming high material resistances. The optional lock-up clutch offers Direct-Drive condition with 8 forward / 4 reverse speeds.

PRODUCTS AND PERFORMANCE CLASSES

Gross vehicle weight	Tandem axle	Driveline System ¹⁾	Gear Selector	Transmission ²⁾	Engine power max.
Class up to 17 t	MT-G 3080	I	VTS 3	WG 160	140 kW
Class up to 17 t	MT-G 3075	II / III	VTS 3	WG 160	140 kW
Class up to 21 t	MT-G 3080	I	VTS 3	WG 190/210	160 kW
Class up to 21 t	MT-G 3085	II / III	VTS 3	WG 190/210	160 kW
Class up to 27 t	MT-G 3090	I	VTS 3	WG 260	270 kW

¹⁾ System I: center axle, System II: center axle and wheel heads, System III: center axle, wheel heads and tandem
²⁾ Standard: 6/3 speeds, optional 8/4 speeds

ZF DRIVELINE TECHNOLOGY FOR COMPACTORS



Compactors are found in road building and on large construction sites. For the best compacting results the maximum transfer of power to the substrate is just as important as a stepless change of the driving speed. For use on uneven terrain optimum weight distribution is also essential for increasing the tractive effort. The ZF compactor axle profits from the application of well-proven components from other axle ranges, particularly with regard to service life and flexibility. Very good mounting methods can be realized due to the compact modular design. For example, various hydraulic motor connections for direct mounting, the mounting of a transfer box and also a number of different differential systems are possible. The internal spring-loaded brakes are released by the hydraulic operating pressure.

PRODUCTS AND PERFORMANCE CLASSES

Vehicle weight	Rear Axle	Transfer box	Axle output torque max.
Class up to 10 t	MT-C 3045	1 AVG 150	25,000 Nm
Class up to 10 t	MT-C 3045	without	25,000 Nm
Class up to 14 t	MT-C 3055	1 AVG 150	32,000 Nm
Class up to 14 t	MT-C 3055	without	32,000 Nm
Class up to 18 t	MT-C 3065 II	1 AVG 150	42,000 Nm
Class up to 18 t	MT-C 3065 II	without	42,000 Nm
Class up to 25 t	MT-C 3075 II	1 AVG 150	52,000 Nm
Class up to 25 t	MT-C 3075 II	without	52,000 Nm

ZF DRIVELINE TECHNOLOGY FOR TRANSPORT MIXERS

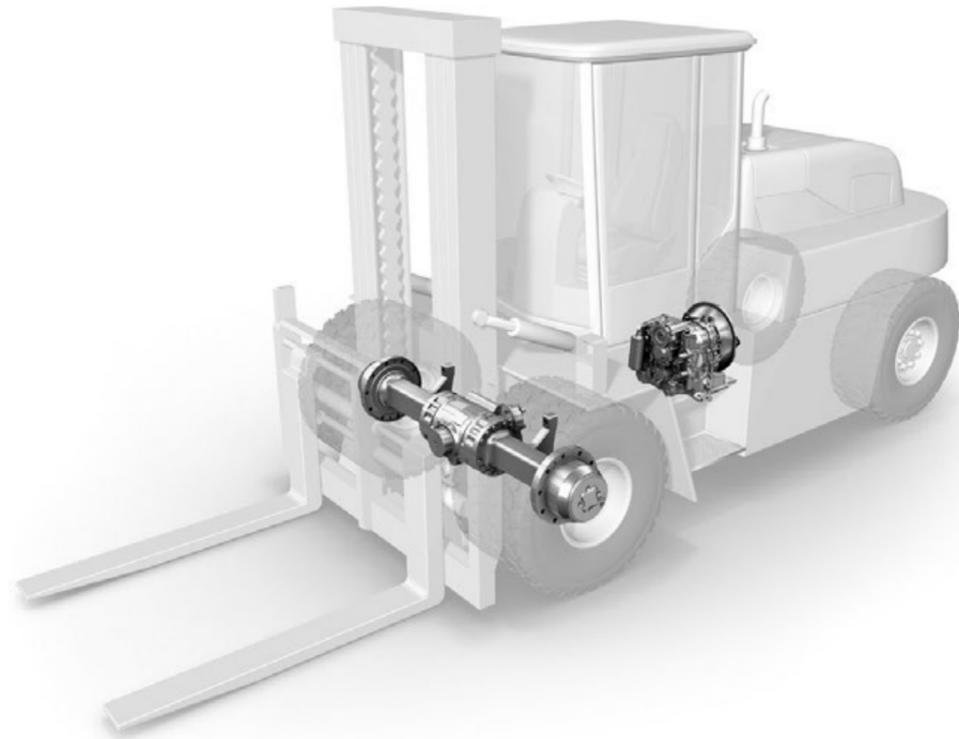


Fleet operators and superstructure manufacturers are placing increasing requirements on the drive of the mixer drum. Higher power and harder duty cycles are only one aspect here. With two series ZF has established a remarkable capability in mixer drivelines. ZF has developed the new generation of the ECOMIX range type CML (Concrete Mixer Lowspeed) for transport mixers of up to 16 m³ mixing capacity and an output torque of up to 90,000 Nm. The new CML transmissions of the ECOMIX II range are based on the achievements of the first Ecomix generation. However, they are smaller, lighter, tougher, more flexible, quieter, easier to service and have a better noise reduction. The driveline of the P range consists of a two-stage planetary drive which is driven by an external hydraulic motor. Both ranges offer economical and well-proven technology along with low-maintenance and low-wear operation also under high stress conditions.

PRODUCTS AND PERFORMANCE CLASSES

Mixing capacity	Transmission	Total ratio	Output torque max.	Installation angle max.	Hydraulic motor
Class up to 8 m ³	P-3301	141.0	54,000 Nm	15°	none
Class up to 10 m ³	P-4300	135.3	60,000 Nm	15°	none
Class up to 12 m ³	P-5300	135.3	72,000 Nm	13.5°	none
Class up to 12 m ³	P-7300	144.3	80,000 Nm	13.5°	none
Class up to 10 m ³	CML 10	7.8	64,000 Nm	20°	adapted
Class up to 12 m ³	CML 12	7.8	80,000 Nm	20°	adapted
Class up to 16 m ³	CML 16	6.3	90,000 Nm	20°	adapted

ZF DRIVELINE TECHNOLOGY FOR MATERIAL HANDLING VEHICLES

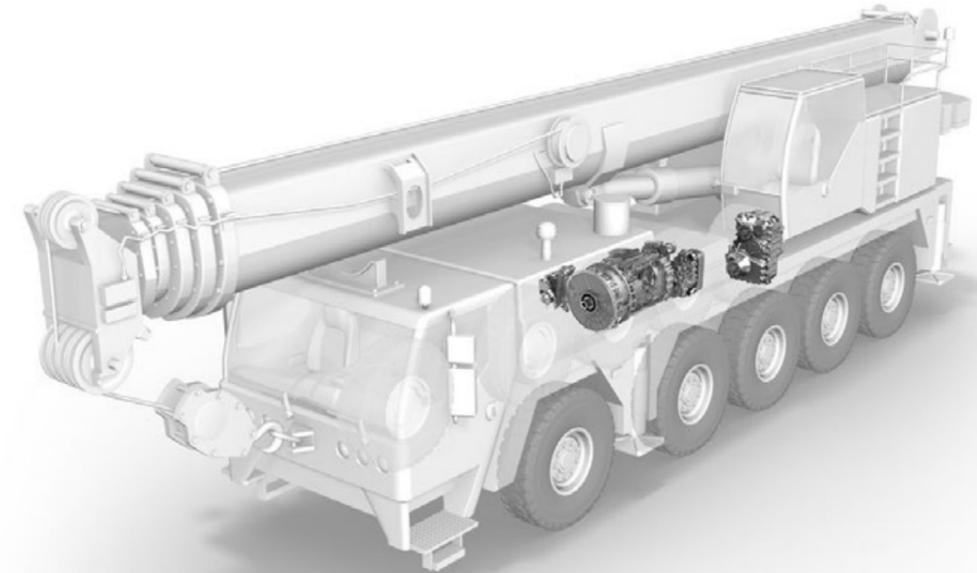


The whole range of the ZF-ERGOPOWER automatic transmission is also available in a short-drop version specially designed for the application in lift-trucks, reach stackers, Ro-Ro trucks, terminal trucks and yard tractors. These short-drop versions are derivatives from the long-drop version used in construction machinery. This design allows a very compact assembly in the vehicle.

PRODUCTS AND PERFORMANCE CLASSES

Lifting capacity (Vehicle weight)	Electronics Gear selector	Transmission (short-drop)	Engine power max.
1.5-3.5 t (9 t)	ES1C	WG 90	65 kW
6-7 t (17 t)	ES1C	WG 94	90 kW
8-9 t (21 t)	ES1C	WG 94	90 kW
10 t (23 t)	ES1C	WG 94	90 kW
16 t (36 t)	ES1C	WG 131	130 kW
22 t (44 t)	ES1C	WG 161	160 kW
32 t (72 t)	ES1C	WG 171	180 kW
37 t (80 t)	ES1C	WG 191	200 kW
42 t (98 t)	ES1C	WG 211	240 kW
50 t (120 t)	ES1C	WG 261	280 kW
60 t (140 t)	ES1C	WG 311	330 kW

ZF DRIVELINE TECHNOLOGY FOR MOBILE CRANES



Jobs of all kinds, maneuverability even on difficult terrain, constantly changing work sites – ZF provides comprehensive system solutions all from a single source. Thus, mobile cranes are quick, safe, and cost-effective in operation as well as on the roads. To do this requires flexibility. The transmission components are perfectly harmonized with one another. The range of available power and performance is, in each case, tailored to the specific demands of the market and manufacturers. The result: every ZF transmission system is a brand name product known around the world for its reliability. The famous ZF-ERGOPOWER transmission in a 6-speed version (6F/3R) with its special options like an inter-axle-differential, an axle-disconnection, a torque converter with lock-up-clutch, an emergency steering pump, etc. is a top of the line product for RT-Cranes. The new, modular TraXon transmission opens up new dimensions in terms of performance, economy, environmental compatibility, and comfort – exactly where it is demanded. Thanks to the combination of the transmission platforms with several modules it is perfectly suited for highest demands in all terrain cranes.

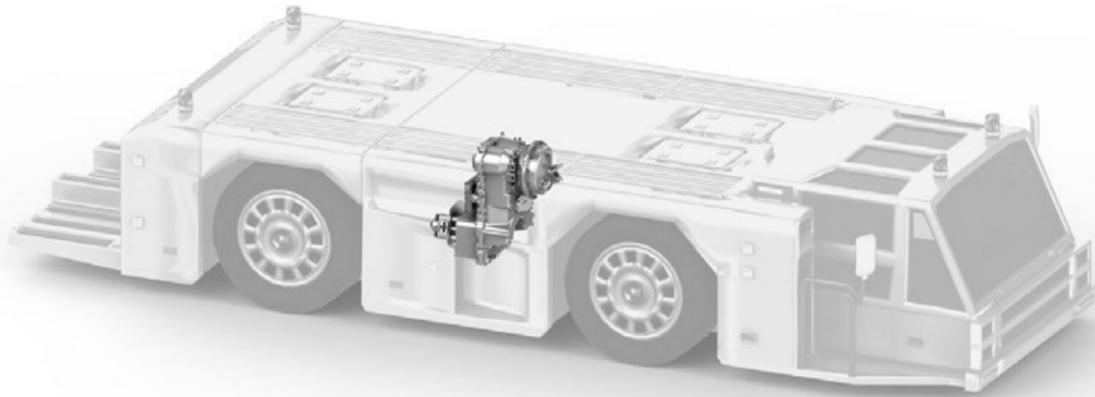
PRODUCTS AND PERFORMANCE CLASSES

RT cranes (Gross vehicle weight)	Max. Input torque (Nm)	Transmission	Engine power max.
31 t	900	WG 160	160 kW
63 t	1,200	WG 210	230 kW
90 t	1,600	WG 260	270 kW
120 t	1,900	WG 310	320 kW

AT cranes (number of axles)	Max. Input torque (Nm)	Transmission	Engine power max.
2	1,200	AS Tronic mid 12 AS 1210	243 kW*
2 / 3	1,600	AS Tronic mid 12 AS 1620	330 kW*
3 / 4 / 5	2,600	TraXon 12 TX 2610	540 kW*
3 / 4 / 5 / 6	3,400	TraXon 16 TX 3440	700 kW*
3 / 4 / 5 / 6	3,400	TraXon 12 TX 3420	700 kW*
6 / 7 / 8 / 9	3,000	TraXon Torque 12 TT 3020	618 kW*

*Indicative value only
(engine auxiliaries are
not covered)

ZF DRIVELINE TECHNOLOGY FOR GROUND SUPPORT EQUIPMENT



ZF offers adequate components for ground support equipment in airport and baggage tow tractors, cargo loaders and passenger stairs. The ZF-ERGOPOWER transmission in tow bar airplane tractors and smaller tow tractors enables soft shifts without tractive interruption. This feature prevents shocks to the front wheel of the airplane which is a very important safety aspect. A control system for a second driver cabin for easy manoeuvring in both directions can be installed optionally. Furthermore, for ground service transports of the airplane, a converter lock-up clutch in combination with the 5- or 6-speed version is available to increase fuel savings and productivity. Axle proposals can also be made upon request.

PRODUCTS AND PERFORMANCE CLASSES

Vehicle weight	Transmission (short-drop/long-drop)	Gear selector	Engine power max.	Axles
2 t	WG 90	EST-65 / ES1C	65 kW	upon request
10 t	WG 94	EST-65 / ES1C	75 kW	upon request
16 t	WG 98/WG 115	EST-65/37 A / ES1C	90 kW	upon request
20 t	WG 131/WG 130	EST-37 A / ES1C	115 kW	upon request
25 t	WG 161/WG 160	EST-37 A / ES1C	130 kW	upon request
30 t	WG 191/WG 190	EST-37 A / ES1C	175 kW	upon request
45 t	WG 211/WG 210	EST-37 A / ES1C	190 kW	upon request
60 t	WG 261/WG 260	EST-37 A / ES1C	250 kW	upon request
70 t	WG 311/WG 310	EST-37 A / ES1C	300 kW	upon request

ZF DRIVELINE TECHNOLOGY FOR SPRAYERS

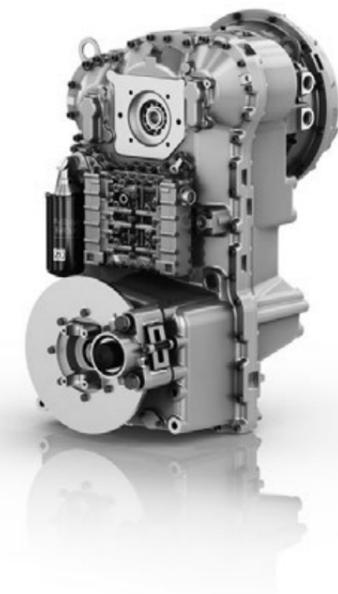


The ERGOPOWER series up to 6-speed offers an excellent solution for sprayer application. The transmission is a fully automatic powershiftable unit with optimized gear steps and intelligent shifting control. The torque converter lock-up clutch will be engaged already in first gear and remains activated during all shifting operations. In addition to this the gearbox has a drop of either 500 mm or 550 mm distance and enables a four-wheel-drive mode and optimized traction conditions in sprayer application.

PRODUCT

ZF-ERGOPOWER

This proven and tested fully automatic powershift transmission system has been optimized for different off-highway machinery types and offers the innovative feature of six instead of four or five gears. The noise-optimized transmission allows even more comfortable and easier handling, high shifting quality and flexibility. Moreover, the operating costs can be further reduced due to various features like converter lock-up, Engine de-rating, Operating mode selection and much more. The ZF-ERGOPOWER provides additional possibilities for connecting an electronic driveline management, thus enabling vehicle-specific controls.



Components

More safety and comfort for construction machinery vehicles

Shock absorbers from ZF allow greater comfort levels, reduce driver fatigue, increase performance, and thereby driving safety. Torsional dampers significantly enhance economy and reliability of off-highway vehicles. The highly efficient torque converters from ZF with integrated lock up clutch also contribute to less fuel consumption.

Mobile off-highway machines require a large number of measures to reduce vibrations, both in chassis and driveline. The call for short loading and unloading times, uneven grounds as well as long operating times are placing high demands on concentration and precision during operation. Legal specifications force the operators to purchase appropriately designed vehicles, with the main focus being on vibration damping, noise level, ergonomic and safe operation in the machine, as well as fuel efficiency. Rising power density increases the load on all components coupled with growing expectations regarding reliability and lifetime. With its driveline and chassis components, ZF presents solutions for the future.

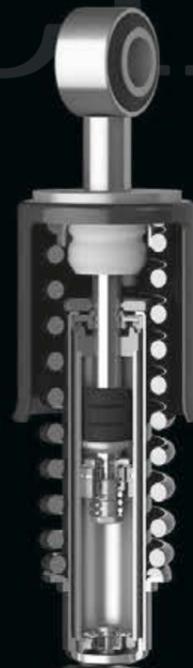
Generally operation profiles of construction machinery vehicles are exposed to high loads under difficult conditions. The requirement for enhanced comfort through reduced vibration and improved levels of vehicle safety is therefore particularly high in this sector.

Various ZF components ensure that these requirements can increasingly be met. Depending on the application of the construction machines, most different types of clutches, dampers and springs provide optimum riding comfort and relief for both driver and vehicle and demonstrate that innovative solutions in comfort, performance and efficiency at the same time are no contradiction.

ZF TORQUE CONVERTERS

- Efficient torque converters for construction machinery with engine torques of 500 to 2,700 Nm
- Hydrodynamic diameters from 280 to 440 mm
- Individual adaptation to any given application
- Compact and weight-optimized design in sheet-metal technology and the geometry of the oil circuit ensure maximum flexibility in the fields of vehicle peripheries

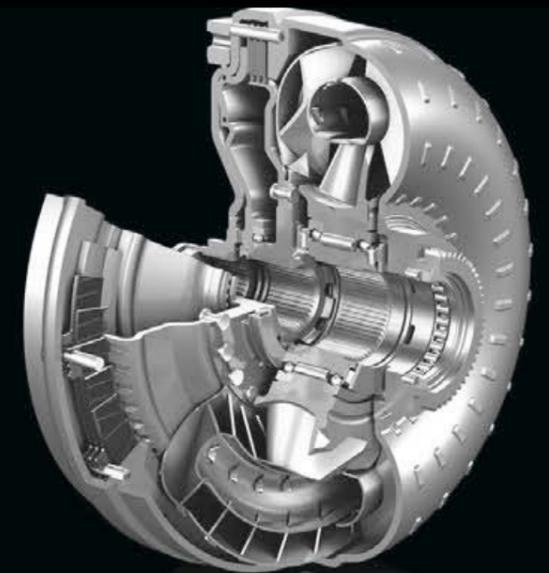
CONSUMPTION SAVINGS ZF Direct Drive (converter lock-up clutch) ensures fuel savings and a high level of economic viability.



TORSIONAL DAMPER DynaDamp

- Standard design based on clutch disc technology
- Economical solution for a wide range of applications
- Easily adaptable to existing flywheels
- DynaDamp design with superior vibrational damping technology from the dual-mass flywheel
- Meets highest demands for reducing vibrations
- Available in different sizes

REDUCTION IN ENGINE VIBRATIONS Greater driving comfort and protection for powertrain units



COIL OVER SHOCK MODULE FOR CAB SUSPENSION

- Independent from other systems (e.g. air supply)
- Excellent cost-benefit-ratio
- Natural frequency from 1.8 to 3.0 Hz
- Broad range of joint designs
- Small installation space required

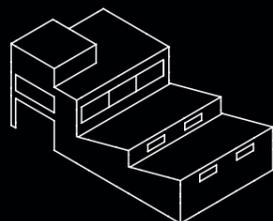
HIGHER COMFORT Ideal for off road applications like mining or construction vehicles



ZF not only makes motion possible, the company itself is also on the move. Growth over the past few years has helped us expand our global presence and our technology portfolio. More than ever, we are now able to fulfill our goal of giving people access to this technology worldwide: ZF – Motion and Mobility.



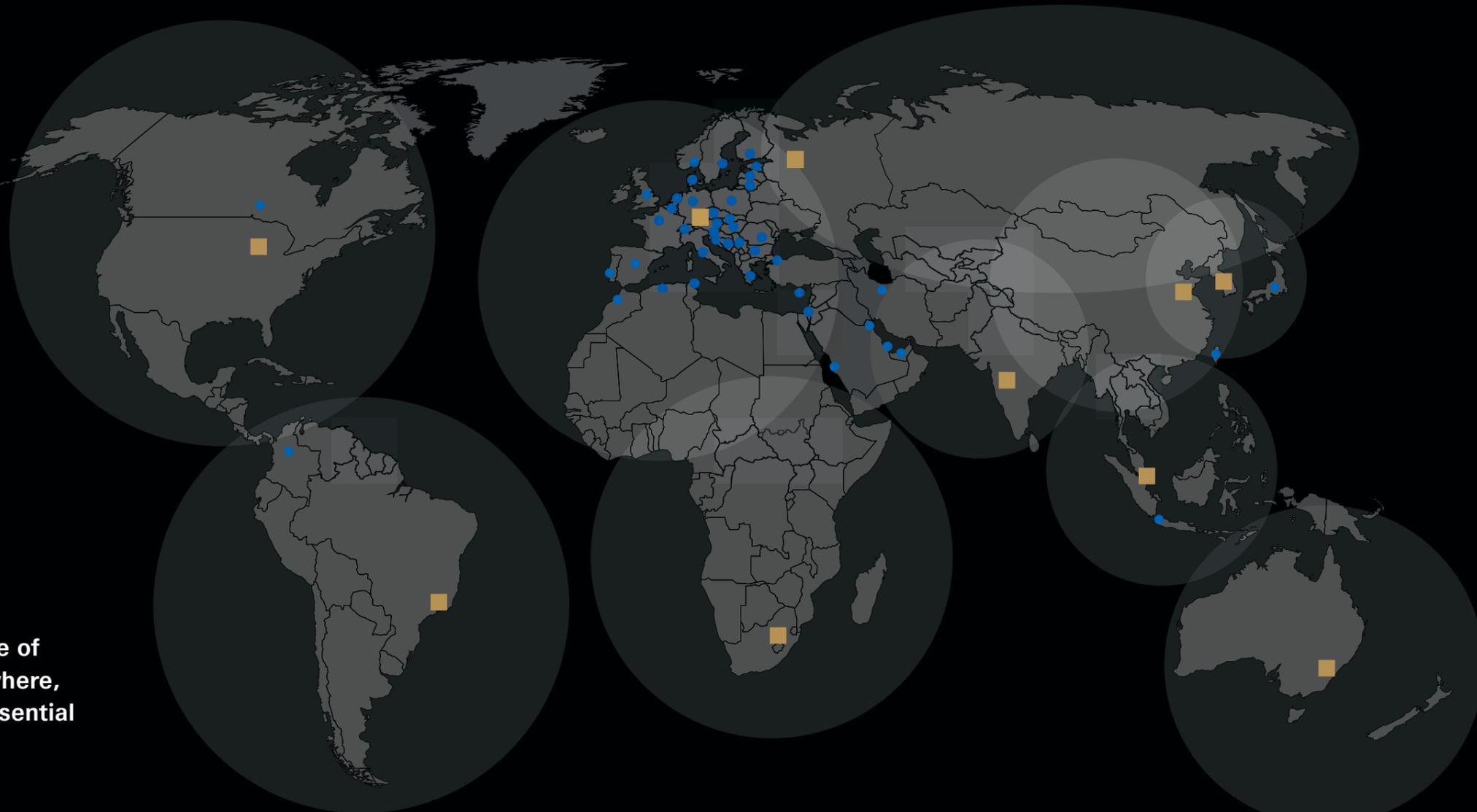
10



REGIONAL COMPETENCE CENTERS
OFF-HIGHWAY SERVICE

>42

COUNTRIES WITH LOCAL
COMPETENCE CENTERS
OFF-HIGHWAY SERVICE



Aftersales services for off-highway systems

ZF offers a comprehensive and attractive range of products and services to ensure mobility anywhere, at any time. Proximity to the customer is an essential element of the corporate performance.

In the strategic setting up of its network, the off-highway service sector of ZF co-operates closely with OEMs to achieve the greatest possible, demand-based coverage of the markets with the required services. For this purpose the service strategies, plans and objectives of our internationally operating OEMs are continuously compared and served appropriately. Furthermore, ZF develops its own service concepts in order to be able to fulfil proactively current and future demands with comprehensive services. Here, we consider the most varied market needs, also particularly in the emerging markets.

“Think globally, act locally” – a widely used statement which nevertheless is still relevant to ZF Services. Our objective is to establish global standards in service and to act flexibly on a local basis. To this end, the ZF Services network is divided into two categories of competence centers.

Regional Competence Centers

In all the important markets there are regional competence centers which offer the most comprehensive service – Service Level 3 – and they operate as the pivotal point in their region or in their major markets. This means that strategic regions are covered according to geographical, political and cultural viewpoints or opened up as required. Not least, they ensure that internationally defined ZF standards in relation to service quality and availability are rolled out and ensured.

Local Competence Centers

In the countries service concepts for applications and products are exactly matched to the needs of the end customer. Local competence centers have Service Levels 1 and 2 at their disposal. Our local specialists are the first contacts since they know the customers and the local practices. They are optimally qualified for the local market and have plenty of experience with ZF products.

Strong service organisation

An expert service team consisting of staff in the business unit Off-Highway Systems and ZF Services along with representatives in each region continually analyses new or future service demands and implements them proactively in the relevant regions. The competence centers are supported through a widely covering network of ZF Service locations and a partner network with the required off-highway expertise.

GLOBAL AND LOCAL ZF Services is represented with regional competence centers in all the important markets for comprehensive wide-area supply. Local competence centers are orientated to the actual local requirement.

■ OFF-HIGHWAY SERVICE REGIONAL COMPETENCE CENTERS

- Service Level 3, i.e. remanufacturing expertise
- Test bench runs ensure „as new quality“
- Full diagnostic and field service capability
- Training competence
- Comprehensive ZF warranty process
- Stocks of spare parts
- Stocks of replacement units

● OFF-HIGHWAY SERVICE LOCAL COMPETENCE CENTERS

- Local proximity to end customers/fleets
- Restricted product range
- Service Level 1+2, i.e. component replacement in the vehicle
- Limited diagnostic and field service capability
- Warranty claim acceptance
- Reduced stocks of spare parts
- Maintenance capability

DIAGNOSIS AND TESTMAN



Digital diagnostic systems are nowadays an indispensable instrument for economical maintenance and repairs, but also for efficient driving dynamics. For ZF products there is the ZF-TESTMAN.

Everything o.k.? If you want to find out, you do not need to make a special trip to the workshop. ZF-Testman checks the functions of all electronically controlled ZF products by means of telemetry or laptop, on-line while on the move or with the vehicle at standstill. Here, a notebook equipped with the diagnostic software is simply connected via an interface to the electronic system on the vehicle. With ZF-Testman you are always best informed about the state of your vehicle and can react specifically and effectively to problems.

Always up to date

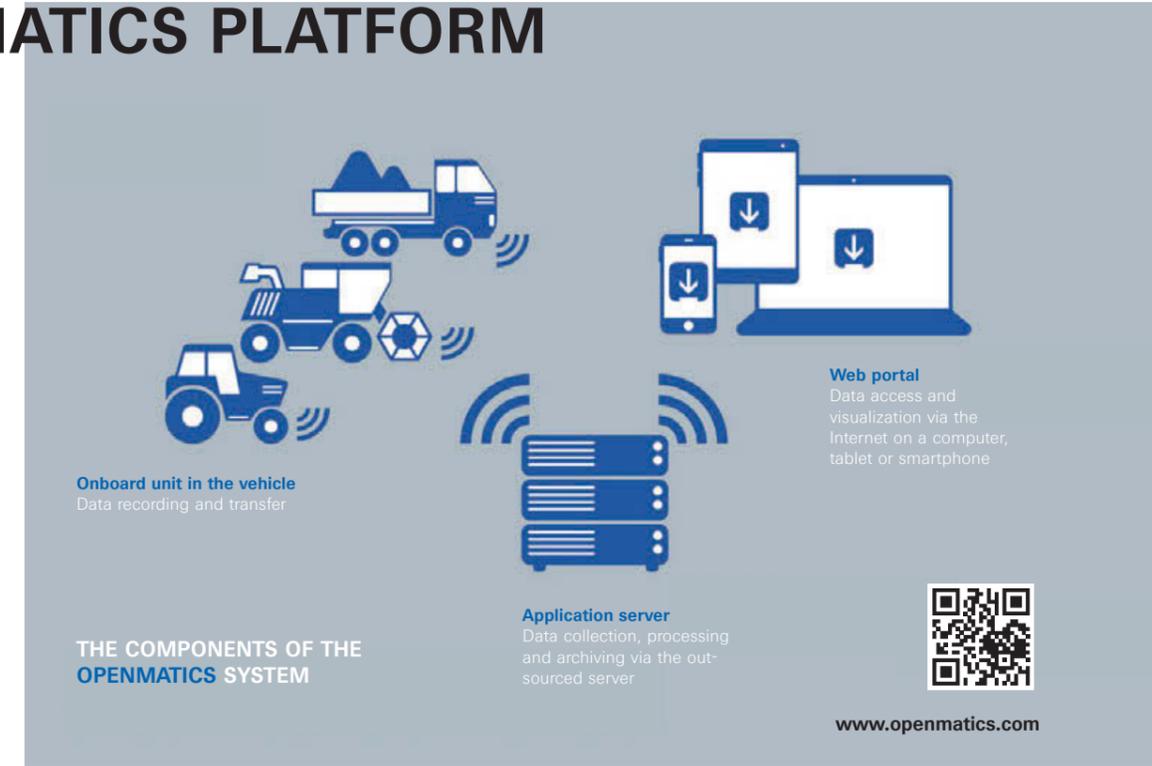
To ensure that your diagnostic application always corresponds to the state of the art, you receive with your ZF-Testman license automatic access to our on-line update service. Data for products which have recently been put into large-scale production and technical product changes are regularly loaded and updated. With its update service and integral protection which prevents unauthorised copying of the software, ZF-Testman always corresponds to the highest quality demands.

Additional support, personal consultancy and more far-reaching information is offered by our premium telephone consultancy. After transmission of the diagnostic data our experts analyse the diagnostic results with you in direct interchange. They recommend further measures and possibilities for repair and give valuable hints of how unnecessary expensive repairs and vehicle downtimes can be avoided.

Advantages

- Extensive ZF product range, e.g. continuously variable and powershift transmissions as well as lift truck steering systems tailored to your workshop business
- Comprehensively compiled diagnostic expertise for easy, intuitive use and fast diagnostic result
- Exclusive service documentation and functions such as training electrical steering systems, resetting of transmission adaptation values, finding loose contacts in the cable harness, etc.

OPENMATICS – THE OPEN TELEMATICS PLATFORM



With Openmatics ZF is establishing a new telematics standard on the market which facilitates the connection of the most varied applications on one platform.

More and more users take advantage of support from telematics services to be more economical, efficient with resources, punctual with deadlines and relaxed both on the road and in the field. Openmatics can interchange data with all relevant vehicle systems. Consequently, it is suitable for on-line documentation in the acreage file, just as for fleet management and vehicle diagnosis. Openmatics is not bound to any manufacturer, i.e. third parties such as vehicle and component manufacturers or other application developers can offer their telematics services in the form of apps for Openmatics.

Each app is tested and certified by Openmatics before it is released. The Openmatics system is simple: An on-board unit in the vehicle acquires the data for all the desired telematics applications.

External servers handle the data conversion and storage. The user accesses the data through a web portal. The various telematics services are offered in the App Shop of Openmatics as modular software applications, so that the fleet or vehicle operators can select them

and combine them according to their own individual requirements.

Openmatics: Your partner in efficient engineering

Innovation cycles have become shorter, technical services more specific and low life-cycle costs more important. Against this background if you want your engineering systems guaranteed to be high-quality and efficient, Openmatics will support you with tailor-made diagnostic and communications systems. Until now an internal development partner, Openmatics is today also providing its engineering products and services to interested parties outside of the corporate group.

Advantages

- Independent of manufacturer – ideal solution for mixed fleets
- Limitless expandability of software solutions
- High-performance hardware
- Forward-looking and open for further applications
- Reliable support through ZF service partners worldwide

RESEARCH AND DEVELOPMENT TO SECURE MOBILITY

Innovations are not an end in themselves, they must pay off: For manufacturers, fleet owners, and drivers, but also for the environment and society. Each new development must prove itself among the conflicting priorities of these criteria.

The ZF Group draws on an international network of more than 100 development centers. Approximately one fifth thereof are main development locations for certain products and technologies. These can be found at several locations in Germany and Europe as well as in the USA and China. Corporate Research and Development at the Corporate Headquarters in Friedrichshafen coordinates and supports the activities of the development centers. Every year, ZF invests approximately five percent of its sales in Research and Development. With success, because innovative products from ZF set the standards for state-of-the-art technology – again and again.

Development work at ZF is organized according to decentralized and corporate functions. The divisions and business units focus on markets and product expertise, ensuring customer-centered, competitive technological product development. Corporate R&D works with a strong emphasis on basic research and theory, and supports the operational development departments in the divisions.

Groundbreaking innovations

Over the past years, this partnership has produced product innovations that have since become benchmarks in the industry: Just some examples are the

9-speed automatic transmission for cars as well as hybrid transmissions and hybrid management for cars and commercial vehicles, or the modular TraXon transmission system for commercial vehicles. Ground-breaking innovations from ZF are in use today not just in passenger cars and commercial vehicles on the road, but also in all kinds of craft on the water and in the air.

What's more, the innovative power of ZF is set to increase in the future. Proof of this is already provided by the number of patents pending: A look at the statistics of the German Patent and Trademark Register shows that ZF is among the top ten applicants for patents – at eye level with many large automotive manufacturers. Each year, the research departments successfully complete more than 10 000 projects, covering the full range from basic research to product applications. This high project volume is necessary to ensure mobility in the future. The trend toward hybrid solutions already shows that green drive technology is very complex. The same goes for pure electric drives and lightweight design engineering. Currently, ZF engineers are conducting pioneering work on alternative materials, broader approaches in design and testing, and new production processes.

THE ZF GROUP

Shaping the future responsibly

Our enthusiasm for innovative products and processes and our uncompromising pursuit of quality have made us a global leader in driveline and chassis technology as well as active and passive safety technology. We are contributing towards a sustainable future by producing advanced technology solutions with the goal of improving mobility, increasing the efficiency of our products and systems, and conserving resources.

Our customers in the automotive and industrial sectors welcome our determined focus on products and services, which provide great customer value. Improvements in energy efficiency, cost-effectiveness, dynamics, safety, and comfort are key to our work. Simultaneously, we are aiming for continuous improvement in our business processes and the services we provide. As a globally active company, we react quickly and flexibly to changing regional market demands with the goal of always providing a competitive price/performance ratio.

Our independence and financial security form the basis of our long-term business success. Our profitability allows us to make the necessary investments in new products, technologies, and markets, thus securing the future of our company on behalf of our customers, market affiliates, employees, and the owners of ZF.

Our tradition and values strengthen our managerial decisions. Together, they are both an obligation and an incentive to maintain a reliable and respectful relationship with customers, market affiliates, and employees. Our worldwide compliance organization ensures that locally applicable laws and regulations are adhered to. We accept our responsibility towards society and will protect the environment at all of our locations.

Our employees worldwide recognize us as a fair employer, focusing on the future and offering attractive career prospects. We value the varied cultural backgrounds of our employees, their competencies, and their diligence and motivation. Their goal-oriented dedication to ZF, beyond the borders of their own field of work and location, shapes our company culture and is the key to our success.

ZF Friedrichshafen AG

Division Industrial Technology
Construction Machinery Systems
94030 Passau
Germany
Phone +49 851 494-0
Fax +49 851 494-905000
sales.iac@zf.com
www.zf.com

twitter.com/zf_konzern
facebook.com/zffriedrichshafen
youtube.com/zffriedrichshafenag



MOTION AND MOBILITY