ZF IS EFFICIENCY

ZF DRIVELINE TECHNOLOGY AND AXLE SYSTEMS FOR CONSTRUCTION MACHINERY AND CONSTRUCTION SITE VEHICLES
ZF IS EFFICIENCY! ZF offers advantages for driver, carrier 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, comfort or environmental compatibility. ZF driveline and chassis technology is significantly involved in this development. Reducing fuel consumption, lower wear and emission, increase efficiency, extend service intervals, easier and better handling and more automation are all topics in the focus of ZF engineers.
ZF offers new follow-up 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 driveline systems and axles for construction machinery for half a century now. It has always been the objective of ZF engineers to develop and enhance components 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 drive 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, ZF presented the first CVT transmission for construction 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 gearboxes for multi-megawatt wind turbines. Shift- and test systems for all kinds of applications and the open telematics platform Openmatics 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. The Division employs a total workforce of approx. 9,000 persons at 20 locations worldwide.
ZF TECHNOLOGY: TOGETHER WE MOVE THE EARTH.

As a system supplier ZF focuses on the entire drive and combines advanced software features with transmissions and axles. The main focus of the developers are: Less fuel consumption, increased productivity, noise reduction, increased driving, and 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 millimeter accuracy 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 tried and tested 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 especially 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 criteria like rotational pressure compensation, set right bearings or short and stiff shafts are combined with the ZF-ERGOPOWER 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.

Slower hydro motor speeds helped reducing noise emission. This transmission can be mounted directly to the MT-L 3060 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 20 % 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.

Now with a remarkably reduced internal speed which results in less fuel consumption. The new transmission features onboard electronics, an integrated retarder and can optionally be mounted to the axle drive. The vertical arrangement of the spur gear ratios bridges the height difference between the input and output shafts. Consequently, the axle differential can be integrated into the housing. An additional transfer box is then unnecessary.

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 reducing noise emission. This transmission can be mounted directly to the MT-L 3060 ZF rigid axle or separately to the chassis.

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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, as well as loading capability. The low-speed brake of the ZF-MULTITRAC axles and the other sophisticated ZF design features form the basis of a highly efficient driveline. Through consistent systemization, 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.

40 years of experience
In the development and production of axles for construction machines ZF is offering optimum solutions for applications in the most arduous of operating conditions for example for mobile excavators or backhoe loaders. The axles are intended for high weights and rough terrains. With a huge output torque and a static axle load the axles also 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 and reduced power losses not only are higher road speeds possible, but a reduction in the fuel consumption too.

ZF is taking due account of the fact 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 would be improved efficiency ratings and reduced braking losses.

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.

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

ZF-MULTISTEER MS-T 3000 for telescopic handlers
ZF-MULTITRAC MT-L 3085 for wheel loaders
ZF-MULTITRAC MT-B 3065 for backhoe loaders
ZF-MULTITRAC MT-G 3000 for graders

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

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.

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**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.

- **-15%**

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

**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-ERGOPOWER**
5-speed automatic transmission

**ZF-ERGOLOCKUP**
torque converter lock-up clutch

**ZF-ERGOTRACTION**
differential lock management

**ZF-ERGOCONTROL**
transmission Control Unit

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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 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 (particular 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.

**100 % TRACTION ON ALL GROUNDS**

**ZF-ERGOTRACTION** ensures that the differential 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
- No over-speeding
- Higher operator comfort
- Automated diff-lock actuation
- Prevention of tire rut holes due to slipping tires
- Self locking differential
- Internal losses
- Internal wind-up
- Increased tire wear

**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.
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 continuous 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 hydrostatic 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.

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 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 up to 30% fuel savings compared to a conventional driveline.

The ZF hybrid component on the basis of the well-proven ERGOPOWER series is the logical evolutionary step towards an electric drive and is keeping pace with the trend towards more environmental protection and preservation of resources. The ZF-ERGOPOWER hybrid works as a parallel hybrid with an efficient electric machine, providing up to 85 or 120 kW performance, depending on the size. The complete hybrid system comprises a power electronics for the electric machine and a lithium ion battery as well as a hybrid control unit. It allows a reduction of operating costs through less consumption and simplified exhaust after treatment systems. Furthermore exhaust emissions are reduced while the performance output is increased by performance boost.
Combining Competence: ZF as a System Supplier

Heavy-duty transmissions, precision axles and intelligent electronic systems are the components that give 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 cooperation with the manufacturers. 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 cooperation with vehicle manufacturers come together to make ZF a valuable and dependable system partner who will help you share the load.

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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 adaptation of the hydrostatic engine. A steering axle for this range is also available if it is not an articulated loader. These axles in connection with a possible mounted service and parking brake (BHF) have a very compact design.

PRODUCTS AND PERFORMANCE CLASSES

Empty vehicle weight1) Front axle Rear axle Transmission
Class up to 4.9 t MT-L 3015-II MT-L 3015-II AVG 150 / AVG 185
Class up to 5.8 t MT-L 3020-II MT-L 3020-II AVG 150 / AVG 185
Class up to 6.6 t MT-L 3025-II MT-L 3025-II AVG 150 / AVG 185
Class up to 9.8 t MT-L 3045-II MT-L 3045-II AVG 185 / 2 HC 85
Class up to 11.0 t MT-L 3055-II MT-L 3055-II AVG 185 / 2 HC 85

1) Empty vehicle weight without additional equipment

ZF DRIVELINE TECHNOLOGY FOR DUMP TRUCKS

To be able to satisfy these requirements in routine use, maximum ground contact, uniform distribution of the drive power to all wheels and uniform load distribution are important for a high level of 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 Electronics / gear selector Transmission Engine power max.
Class up to 12 t MT-L 3075 MT-L 3075-II MT-D 3085 MT-D 3085 AVG 150 / AVG 185 EST-37 A / VTS 3 WG 115 90 kW
Class up to 18 t MT-L 3085 MT-L 3085-II MT-D 3085 MT-D 3085 AVG 150 / AVG 185 EST-37 A / VTS 3 WG 160 160 kW
Class up to 18 t MT-D 3085 MT-D 3085-II MT-D 3085 MT-D 3085 AVG 150 / AVG 185 EST-37 A / VTS 3 WG 160 160 kW
Class up to 25 t MT-D 3085 MT-D 3085-II MT-D 3085 MT-D 3085 AVG 150 / AVG 185 EST-37 A / VTS 3 WG 210 230 kW
Class up to 27 t MT-D 3095 MT-D 3095-II MT-D 3095 MT-D 3095 EC 8” / VTS 3 EP 320 250 kW
Class up to 30 t MT-D 3095 MT-D 3095-II MT-D 3095 MT-D 3095 EC 8” / VTS 3 EP 320 250 kW
Class up to 35 t MT-D 3105 WH 3105 MT-D 3105 MT-D 3105 EC 8” / VTS 3 EP 370 300 kW
Class up to 40 t MT-D 3105 WH 3105 MT-D 3105 MT-D 3105 EC 8” / VTS 3 EP 420 350 kW
Class up to 45 t EC 8” / VTS 3 EP 470 375 kW
Class up to 50 t EC 8” / VTS 3 EP 520 400 kW

1) EC II ErgoControl II reduced electronics
ZF DRIVELINE TECHNOLOGY FOR MOBILE EXCAVATORS

The wheel drive enables a rapid change of position without disturbing the substrate. Easy tool changing makes the mobile excavator into a multifunction 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

<table>
<thead>
<tr>
<th>Empty vehicle weight</th>
<th>Front axle</th>
<th>Rear axle</th>
<th>Transmission</th>
<th>Input torque max.</th>
<th>Swing drives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class up to 15 t</td>
<td>MS-E 3050</td>
<td>MT-E 3850</td>
<td>HL-250</td>
<td>550 Nm</td>
<td>DR-148</td>
</tr>
<tr>
<td>Class up to 19.5 t</td>
<td>MS-E 3060</td>
<td>MT-E 3860</td>
<td>HL-270</td>
<td>770 Nm</td>
<td>DR-285</td>
</tr>
<tr>
<td>Class up to 25 t</td>
<td>MS-E 3070</td>
<td>MT-E 3870</td>
<td>HL-290</td>
<td>950 Nm</td>
<td>DR-355</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Empty vehicle weight</th>
<th>Front axle</th>
<th>Rear axle</th>
<th>Gear selector</th>
<th>Transmission</th>
<th>Engine power max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class up to 7.7 t</td>
<td>MS-B 3025</td>
<td>MT-B 3065</td>
<td>DW 3</td>
<td>WG 80</td>
<td>65 kW</td>
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<tr>
<td>Class up to 9.2 t</td>
<td>MS-B 3035</td>
<td>MT-B 3070</td>
<td>DW 3</td>
<td>WG 94</td>
<td>75 kW</td>
</tr>
<tr>
<td>Class up to 11.5 t</td>
<td>MS 2045</td>
<td>MT 2085</td>
<td>DW 3</td>
<td>WG 98</td>
<td>90 kW</td>
</tr>
</tbody>
</table>

1) Empty vehicle weight without additional equipment
## 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 in application in a wide variety of fields, from the construction site, industrial to agriculture. The ZF driveline versions for telescopic handlers are also versatile. Depending on the type, low-boom or high-boom, center or side mounted boom designs are possible. Special telescopic handler axles support the 4-wheel steering system.

### PRODUCTS AND PERFORMANCE CLASSES

<table>
<thead>
<tr>
<th>Empty vehicle weight</th>
<th>Payload max.</th>
<th>Front axle</th>
<th>Rear axle</th>
<th>Gear selector</th>
<th>Transmission</th>
<th>Engine power max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class up to 10.6 t</td>
<td>3.2 t</td>
<td>MS-T 3045</td>
<td>MS-T 3045</td>
<td>DW</td>
<td>WG 98 TSC</td>
<td>105 kW</td>
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<tr>
<td></td>
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<td>WS 98 TC</td>
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<td>2 HC 85</td>
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<tr>
<td>Class up to 12.9 t</td>
<td>3.9 t</td>
<td>MS-T 3056</td>
<td>MS-T 3045</td>
<td>DW</td>
<td>WG 98 TSC</td>
<td>105 kW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WS 98 TC</td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>2 HC 85</td>
<td></td>
</tr>
<tr>
<td>Class up to 13.3 t</td>
<td>4.0 t</td>
<td>MS-T 3060</td>
<td>MS-T 3045</td>
<td>DW</td>
<td>WG 98 TSC</td>
<td>105 kW</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>WS 98 TC</td>
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<td></td>
<td></td>
<td></td>
<td>2 HC 85</td>
<td></td>
</tr>
<tr>
<td>Class up to 15.3 t</td>
<td>4.6 t</td>
<td>MS-T 3060</td>
<td>MS-T 3055</td>
<td>DW</td>
<td>WG 98 TSC</td>
<td>105 kW</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>WS 98 TC</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>2 HC 85</td>
<td></td>
</tr>
<tr>
<td>Class up to 16.2 t</td>
<td>4.9 t</td>
<td>MS-T 3070</td>
<td>MS-T 3055</td>
<td>DW</td>
<td>WG 98 TSC</td>
<td>105 kW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WS 98 TC</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 HC 85</td>
<td></td>
</tr>
<tr>
<td>Class up to 19.2 t</td>
<td>5.7 t</td>
<td>MS-T 3070</td>
<td>MS-T 3060</td>
<td>DW</td>
<td>WG 98 TSC</td>
<td>105 kW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WS 98 TC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 HC 85</td>
<td></td>
</tr>
</tbody>
</table>

1) Empty vehicle weight without additional equipment

## 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

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Class up to 13 t</td>
<td>EST-37 A / VTS 3</td>
<td></td>
<td></td>
<td>MT-G 3075</td>
<td>90 kW</td>
</tr>
<tr>
<td>Class up to 19 t</td>
<td>EST-37 A / VTS 3</td>
<td></td>
<td></td>
<td>MT-G 3065</td>
<td>160 kW</td>
</tr>
<tr>
<td>Class up to 21 t</td>
<td>MT-G 3080</td>
<td>EST-37 A / VTS 3</td>
<td></td>
<td>MT-G 3085</td>
<td>190 kW</td>
</tr>
<tr>
<td>Class up to 23 t</td>
<td>MT-G 3090</td>
<td>EST-37 A / VTS 3</td>
<td></td>
<td>MT-G 3090</td>
<td>210 kW</td>
</tr>
</tbody>
</table>

1) System I: center axle, System II: center and wheel heads, System III: center axle, wheel heads and tandem
2) Standard: 489 speeds, optional 649 speeds

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29
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 stored-spring brakes are released by the hydraulic operating pressure.

PRODUCTS AND PERFORMANCE CLASSES

<table>
<thead>
<tr>
<th>Vehicle weight</th>
<th>Axle</th>
<th>Axle output torque max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class up to 10 t</td>
<td>MT-C 3045</td>
<td>25,000 Nm</td>
</tr>
<tr>
<td>Class up to 14 t</td>
<td>MT-C 3055</td>
<td>32,000 Nm</td>
</tr>
<tr>
<td>Class up to 18 t</td>
<td>MT-C 3065</td>
<td>42,000 Nm</td>
</tr>
<tr>
<td>Class up to 25 t</td>
<td>MT-C 3075</td>
<td>52,000 Nm</td>
</tr>
</tbody>
</table>

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 up to 16 m³ mixing capacity and an output torque 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, more noise reduced and easier to service. 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

<table>
<thead>
<tr>
<th>Mixing capacity</th>
<th>Transmission</th>
<th>Total ratio</th>
<th>Output torque max.</th>
<th>Installation angle max.</th>
<th>Hydraulic motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class up to 8 m³</td>
<td>P-3301</td>
<td>141.0</td>
<td>54,000 Nm</td>
<td>15°</td>
<td>none</td>
</tr>
<tr>
<td>Class up to 10 m³</td>
<td>P-4300</td>
<td>195.3</td>
<td>60,000 Nm</td>
<td>15°</td>
<td>none</td>
</tr>
<tr>
<td>Class up to 12 m³</td>
<td>P-6300</td>
<td>195.3</td>
<td>72,000 Nm</td>
<td>13.5°</td>
<td>none</td>
</tr>
<tr>
<td>Class up to 12 m³</td>
<td>P-7300</td>
<td>144.3</td>
<td>80,000 Nm</td>
<td>13.5°</td>
<td>none</td>
</tr>
<tr>
<td>Class up to 10 m³</td>
<td>CML 8</td>
<td>7.8</td>
<td>64,000 Nm</td>
<td>20°</td>
<td>adapted</td>
</tr>
<tr>
<td>Class up to 12 m³</td>
<td>CML 10</td>
<td>7.8</td>
<td>80,000 Nm</td>
<td>20°</td>
<td>adapted</td>
</tr>
<tr>
<td>Class up to 16 m³</td>
<td>CML 16</td>
<td>6.3</td>
<td>90,000 Nm</td>
<td>20°</td>
<td>adapted</td>
</tr>
</tbody>
</table>
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 both in operation and on the roads. To do this requires flexibility. The transmission components are perfectly harmonized with one another. The range of available power/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 for its reliability around the world.

PRODUCTS AND PERFORMANCE CLASSES

<table>
<thead>
<tr>
<th>Lifting capacity (Vehicle weight)</th>
<th>Front axle</th>
<th>Electronics / gear selector</th>
<th>Transmission (short-drop)</th>
<th>Engine power max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 t</td>
<td>MT-F 3065</td>
<td>EST-65 / DW 3</td>
<td>WG 90</td>
<td>65 kW</td>
</tr>
<tr>
<td>63 t</td>
<td>MT-F 3070</td>
<td>EST-65 / DW 3</td>
<td>WG 94</td>
<td>90 kW</td>
</tr>
<tr>
<td>90 t</td>
<td>EST-66 / DW 3</td>
<td></td>
<td>WG 94</td>
<td>90 kW</td>
</tr>
<tr>
<td>120 t</td>
<td>EST-66 / DW 3</td>
<td></td>
<td>WG 94</td>
<td>90 kW</td>
</tr>
<tr>
<td>160 kW</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>WG 131</td>
<td>130 kW</td>
</tr>
<tr>
<td>230 kW</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>WG 161</td>
<td>160 kW</td>
</tr>
<tr>
<td>270 kW</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>WG 171</td>
<td>180 kW</td>
</tr>
<tr>
<td>320 kW</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>WG 191</td>
<td>200 kW</td>
</tr>
</tbody>
</table>

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 derivates from the long-drop version used in construction machinery. This design allows a very compact assembly in the vehicle.

PRODUCTS AND PERFORMANCE CLASSES

<table>
<thead>
<tr>
<th>Lifting capacity (Vehicle weight)</th>
<th>Front axle</th>
<th>Lifting capacity (Vehicle weight)</th>
<th>Engine power max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5-3.5 t (9 t)</td>
<td>MT-F 3070</td>
<td>EST-65 / DW 3</td>
<td>65 kW</td>
</tr>
<tr>
<td>6-7 t (17 t)</td>
<td>MT-F 3070</td>
<td>EST-65 / DW 3</td>
<td>90 kW</td>
</tr>
<tr>
<td>8-9 t (21 t)</td>
<td>MT-F 3070</td>
<td>EST-65 / DW 3</td>
<td>90 kW</td>
</tr>
<tr>
<td>10 t (23 t)</td>
<td>EST-66 / DW 3</td>
<td></td>
<td>90 kW</td>
</tr>
<tr>
<td>16 t (36 t)</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>130 kW</td>
</tr>
<tr>
<td>22 t (44 t)</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>160 kW</td>
</tr>
<tr>
<td>32 t (72 t)</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>180 kW</td>
</tr>
<tr>
<td>42 t (98 t)</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>200 kW</td>
</tr>
<tr>
<td>50 t (120 t)</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>240 kW</td>
</tr>
<tr>
<td>60 t (140 t)</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>280 kW</td>
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<tr>
<td>78 t (175 t)</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>330 kW</td>
</tr>
<tr>
<td>90 t (200 t)</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>360 kW</td>
</tr>
<tr>
<td>120 t (265 t)</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>400 kW</td>
</tr>
<tr>
<td>160 kW</td>
<td>EST-37 A / DW 3</td>
<td></td>
<td>450 kW</td>
</tr>
</tbody>
</table>

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 derivates from the long-drop version used in construction machinery. This design allows a very compact assembly in the vehicle.
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 maneuvering 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**

<table>
<thead>
<tr>
<th>Vehicle weight</th>
<th>Transmission (short-drop/long-drop)</th>
<th>Electronics / gear selector</th>
<th>Engine power max.</th>
<th>Axles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 t</td>
<td>WG 90</td>
<td>EST-65 / DW 3</td>
<td>65 kW</td>
<td>upon request</td>
</tr>
<tr>
<td>10 t</td>
<td>WG 94</td>
<td>EST-65 / DW 3</td>
<td>75 kW</td>
<td>upon request</td>
</tr>
<tr>
<td>16 t</td>
<td>WG 98/WG 115</td>
<td>EST-65/37 A / DW 3</td>
<td>90 kW</td>
<td>upon request</td>
</tr>
<tr>
<td>20 t</td>
<td>WG 131/WG 130</td>
<td>EST-37 A / DW 3</td>
<td>115 kW</td>
<td>upon request</td>
</tr>
<tr>
<td>25 t</td>
<td>WG 161/WG 160</td>
<td>EST-37 A / DW 3</td>
<td>130 kW</td>
<td>upon request</td>
</tr>
<tr>
<td>30 t</td>
<td>WG 191/WG 190</td>
<td>EST-37 A / DW 3</td>
<td>175 kW</td>
<td>upon request</td>
</tr>
<tr>
<td>45 t</td>
<td>WG 211/WG 210</td>
<td>EST-37 A / DW 3</td>
<td>190 kW</td>
<td>upon request</td>
</tr>
<tr>
<td>60 t</td>
<td>WG 261/WG 260</td>
<td>EST-37 A / DW 3</td>
<td>250 kW</td>
<td>upon request</td>
</tr>
<tr>
<td>70 t</td>
<td>WG 311/WG 310</td>
<td>EST-37 A / DW 3</td>
<td>300 kW</td>
<td>upon request</td>
</tr>
</tbody>
</table>

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. In addition to this the gearbox does have a drop of either 500 mm or 550 mm distance and enables a four-wheel-drive mode and optimized traction conditions in sprayer application.

**PRODUCTS**

**ZF-ERGOPOWER**

This proven and tested fully automatic powershift transmission system has been optimized for different construction machinery types and offers the innovative feature of five instead of four gears for wheel loader applications. 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 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.
The ZF Group benefits from an international network of development centers: The main development locations are Friedrichshafen, Dillingen, Passau, Schwäbisch Gmünd, Northville near Detroit (USA), Pilsen (Czech Republic), and Shanghai (China). Worldwide, more than 7,100 employees work in Research and Development. Corporate R&D coordinates and supports the activities at the development center in Tokyo (Japan). 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 central 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 functional development areas 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 9-speed automatic transmissions for cars as well as hybrid transmissions and hybrid management for cars, commercial vehicles, and construction machinery. Groundbreaking innovations from ZF are in use today not just in passenger cars on the road, but also in all kinds of off-highway vehicles and 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 occupies 8th place among applicants for patents – on a 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 through 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.

Innovations are not a purpose in themselves for ZF; 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.
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 121 production companies in 26 countries and eight main development locations. In addition to that, ZF has 32 service companies as well as 650 service points. 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 eight production sites worldwide: Passau (Germany), Steyr (Austria), Stankov (Czech Republic), Gainesville (USA), Sorocaba (Brazil), Hangzhou (China), Liuzhou (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. Allover the world the service network and central sales teams are available.

Tailor-made for the markets
This starts with engineering. Most ZF products, which are also produced outside Europe, first 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.

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.
Our enthusiasm for innovative products and processes and our uncompromising pursuit of quality have made us a global leader in driveline and chassis 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.

Shaping the future responsibly