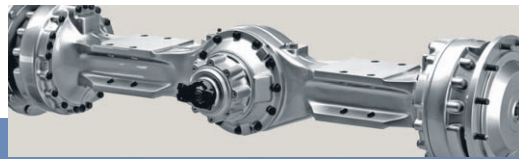




Driveline Technology and Axle Systems
for Construction Machinery



Innovations
of Great Value.



ZF Driveline Technology and Axle Systems for Construction Machinery



ZF – The Specialist for Driveline Technology	4
Driveline Systems for Wheel Loaders	6
Driveline Systems for Compact Loaders	7
Driveline Systems for Dump Trucks	8
Driveline Systems for Mobile Excavators	9
Driveline Systems for Backhoe Loaders	10
Driveline Systems for Telescopic Handlers	11
Axle Systems for Compactors	12
Driveline Systems for Graders	13
Transmissions Systems for Mixers	14



“There is a suitable construction machine for every application. Our flexible driveline systems technology accompanies and supports our customers on their way to specialization. We provide solutions delivering high standards of functionality for your headstart into the future.”

Hermann Beck
Vice President Construction Machinery Systems

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

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Together we move the earth

Modern construction machines perform a large variety of complex jobs. ZF transmission and axle systems are designed for specific application conditions. These driveline components stand for the ultimate in performance, economy and comfort. Reliability and easy operation provide maximum efficiency.

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.

Apart from the basic orientation to various types of construction machine, ZF driveline components are matched more precisely to the relevant vehicle requirements in co-operation with the manufacturers. The modular system structure allows lots of ways of achieving the best driveline design through coordinated development. Interfaces

are reduced and the manufacturer of the construction machine receives from a single source a perfectly tuned system ready for fitting. 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.

ZF is setting international benchmarks in the design of vehicle components. ZF manufactures transmissions, steering systems, axles, chassis components and complete systems for cars, commercial vehicles and off-road machinery.

Concentration of expertise within the ZF group generates extensive synergies. Basic research, state-of-the-art tools for simultaneous engineering as well as materials and surface technology are essential elements of the ZF know-how pool.

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.

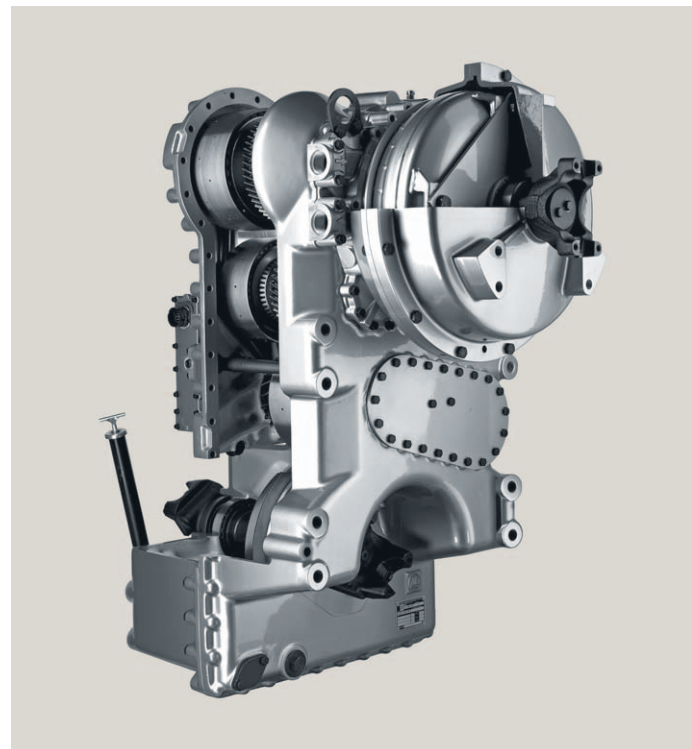


ZF – The Specialist for Driveline Technology

Based on decades of experience in the field of driveline technology for construction machines, ZF has developed into a pre-eminent specialist in transmissions and axles for construction machines. Not least due to the in-house development capability, continuous product inspection and modern production techniques, ZF products always reflect the latest state of technology.

Maximum efficiency

ZF transmissions for construction machines offer the market completely new standards. In particular the quiet running and low peaks of stress enormously increase both the service life as well as the reliability. Consequently, construction machines offer more working comfort and better economic efficiency. With the modular construction and cost-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. 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.



ZF axles

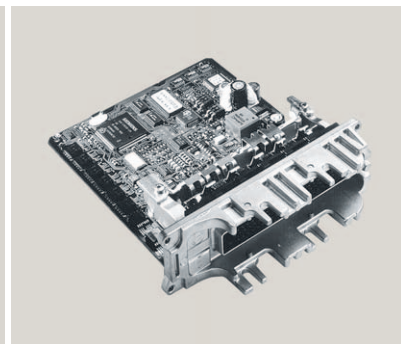
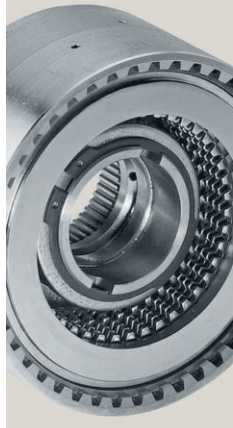
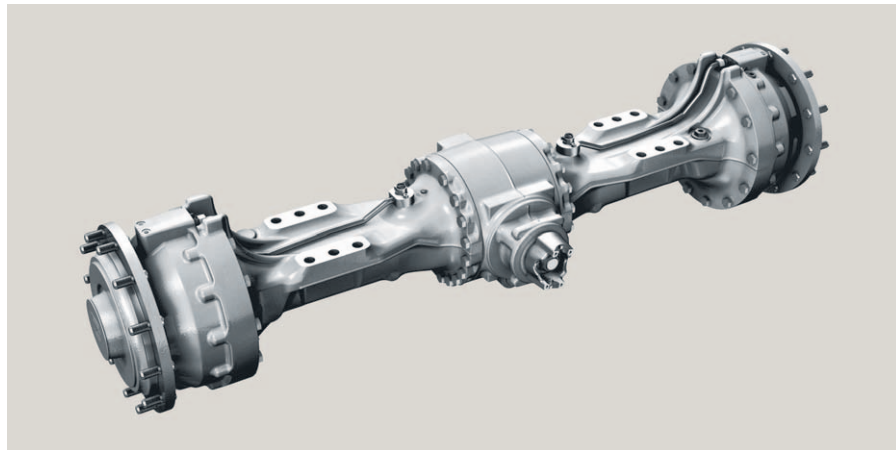
Strong, but light. High transmission power, but in a compact size. Adaptable, but at costs acceptable to the market. ZF axles are based on well-established major product lines and offer all options to fulfill individual demands.

ZF gearwheel technology

Precise gear meshing in all transmissions and axles ensures low-noise power transmission.

ZF electronics

Everything under fingertip control. The electronic controller handles the complete management of the transmission.



ZF transmissions

ZF develops innovative system transmissions which are a valuable asset to every construction machine. Maximum exploitation of available power, very good gear-shifting quality, easy maintenance and diagnosis as well as low noise emission – transmission technology for the benefit of vehicle manufacturer and driver alike.

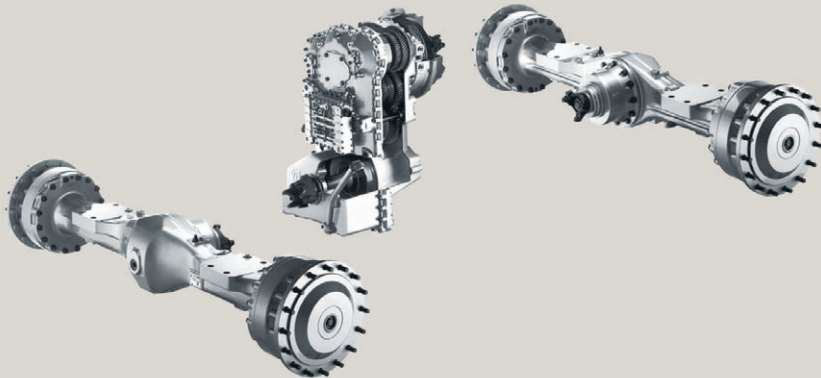
Maximum versatility

ZF axle systems form a solid basis for any vehicle design. 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.

The Multisteer axle systems were designed for extreme stresses. The steering cylinder is protected in the axle housing. Combined with the negative scrub radius, this allows high maneuverability even with large front wheels. Multitrac axles are equipped with integrated wet multi-disc brakes. They ensure a high braking torque, need only low maintenance and are self-adjusting.



ZF Driveline Systems for Wheel Loaders



Powerful driveline systems for the highest demands. When paired with intelligent electronic controllers, ZF-Multitrac axles and transmissions in the WG range make the wheel loader an efficient off-road vehicle.

Intelligent powertrain management

The efficiency of a wheel loader is shown in the working cycle: An intelligent driveline system always makes the power available where it is needed.

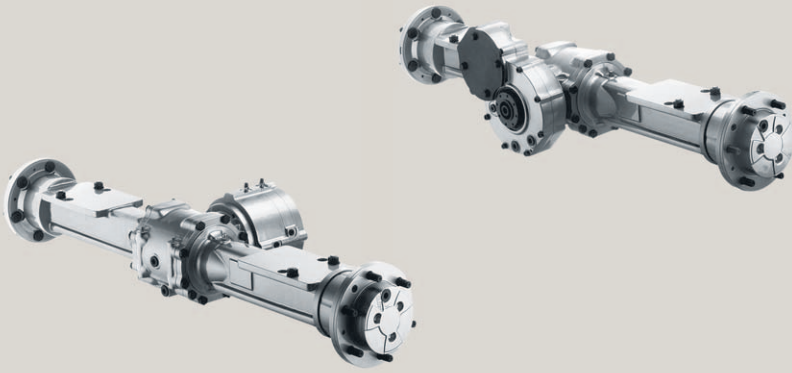
Wheel loaders are amongst the most purchased and technically most demanding off-road vehicles. They have to be quick and extremely maneuverable both forwards and backwards and also be able to concentrate powerful forces on the bucket for breaking and digging. Apart from high power, sensitive control is also a special requirement. Here, exact shunting is essential, along with easy shifting and a fast change of direction when reversing. Anyone watching a well-practiced driver operating his wheel loader can appreciate the significance of intelligent high performance driveline technology in the daily routine - in terms of both efficiency and safety.

ZF driveline technology: vehicles and performance classes for wheel loaders

Empty vehicle weight ¹⁾	Front axle	Rear axle	Electronic / gear selector	Transmission	Engine power max.
Class to 9 t	MT-L 3065-II	MT-L 3065-II	EST-37 A / DW 3	WG 115	90 kW
Class to 10 t	MT-L 3065-II	MT-L 3065-II	EST-37 A / DW 3	WG 130	130 kW
Class to 12 t	MT-L 3075-II	MT-L 3075-II	EST-37 A / DW 3	WG 160	160 kW
Class to 14 t	MT-L 3085	MT-L 3075-II	EST-37 A / DW 3	WG 190	190 kW
Class to 17 t	MT-L 3095	MT-L 3085	EST-37 A / DW 3	WG 210	230 kW
Class to 22 t	MT-L 3105	MT-L 3095	EST-37 A / DW 3	WG 260	270 kW
Class to 24 t	MT-L 3105	MT-L 3105	EST-37 A / DW 3	WG 260	270 kW
Class to 30 t	AP 420/R	AP 420/R	EST-37 A / DW 3	WG 310	320 kW

1) Empty vehicle weight without additional equipment

ZF Driveline Systems for Compact Loaders



Optimized for size, but still powerful – the driveline concept for compact loaders allows no compromises. The hydrostatic transmission is mounted directly on the rear axle.

Power packed into the smallest space

Due to their compact dimensions, “mini wheel loaders” excel with high maneuverability even in tight spaces. So they are not just a perfect complement to larger construction machines, but rather with their wide range of attachments they are also ideally suited to the most varied fields of application: in landscaping, recycling, in agriculture or as material and equipment carriers in the wider construction industry.

The reduced space available in compact loaders demands a compact but rugged design of the transmission and axles. The transmission must reliably react to quick gear-shifting and changes of direction, whereas the axles should ensure precise vehicle steering.

Compact loaders are employed where the large machine has no access or is overdimensioned. Apart from the amount of load, the requirements on the vehicle are however similar.

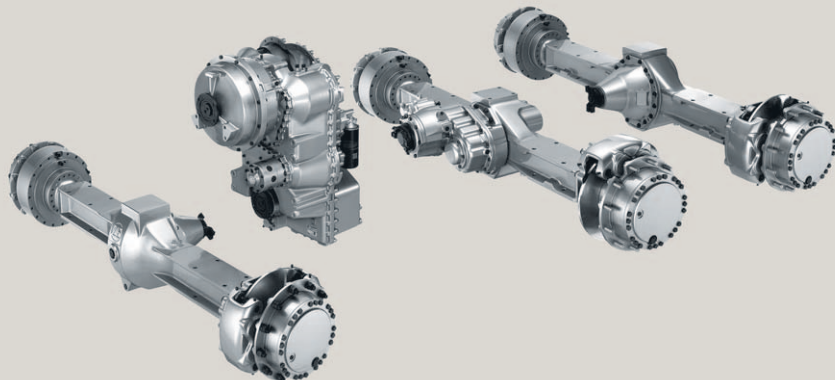
ZF driveline technology: vehicles and performance classes for compact loaders

Empty vehicle weight ¹⁾	Front axle	Rear axle	Transmission	Input torque max.
Class to 4.6 t	AP-R 715	AP-R 715	AVG 150 / AVG 185	660 / 1,300 Nm
Class to 6.0 t	AP-R 720	AP-R 720	AVG 150 / AVG 185	660 / 1,300 Nm

1) Empty vehicle weight without additional equipment



ZF Driveline Systems for Dump Trucks



A comprehensive and complete system range is provided by dump trucks from 12 to 40 tons load and with engine powers from 90 to 320 kW.

Optimized power play

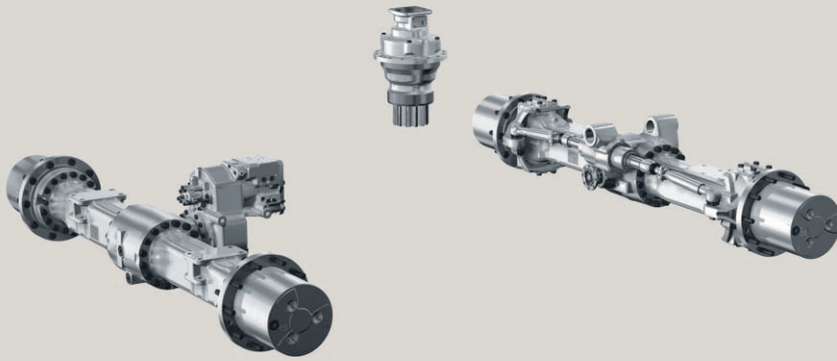
Fast loading and unloading, safe transport at maximum power and all on difficult terrain. These are conditions which today's generation of dump trucks has to meet.

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.

ZF driveline technology: vehicles and performance classes for dump trucks

Vehicle payload	Front axle	Wheel head	Rear axle 1	Rear axle 2	Electronic / gear selector	Transmission	Engine power max.
Class to 12 t	MT-L 3075-II	-	MT-L 3075-II	-	EST-37 A / VTS 3	WG 115	90 kW
Class to 18 t	MT-L 3085	-	MT-L 3085	-	EST-37 A / VTS 3	WG 160	160 kW
Class to 18 t	AP 9	RP 9	AP 9	AP 9	EST-37 A / VTS 3	WG 160	160 kW
Class to 25 t	AP 9	RP 9	AP 9	AP 9	EST-37 A / VTS 3	WG 210	230 kW
Class to 27 t	AP 9	RP 9	AP 9	AP 9	EST-37 A / VTS 3	WG 260	270 kW
Class to 35 t	MT-D 3105	WH 3105	MT-D 3105	MT-D 3105	EST-37 A / VTS 3	WG 310	320 kW
Class to 40 t	MT-D 3105	WH 3105	MT-D 3105	MT-D 3105	EST-37 A / VTS 3	WG 310	320 kW

ZF Driveline Systems for Mobile Excavators



The newly developed range of axles and transmissions, precisely matched to one another, underlines ZF's system capabilities in mobile excavator applications.

Power and precision combined

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.

Quickly moving from site to site, versatile tools for the boom – mobile excavators are characterized by high versatility in job scheduling. In this respect, both power and precision are demanded.

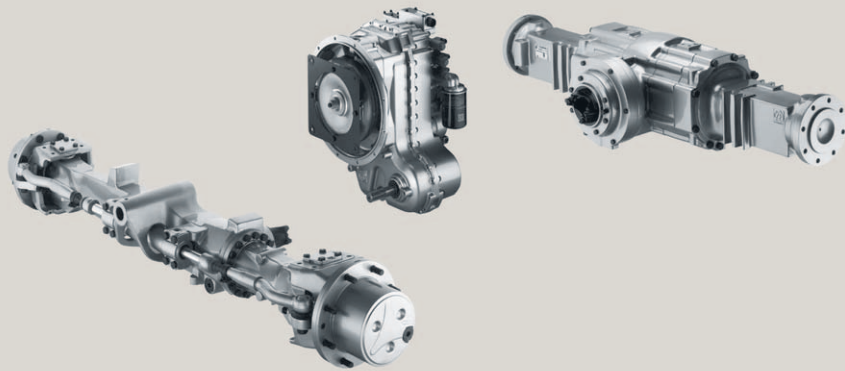
ZF driveline technology: vehicles and performance classes for mobile excavators

Empty vehicle weight ¹⁾	Front axle	Rear axle	Transmission	Swing drives	Input torque max.
Class to 15 t	MS-E 3050	MT-E 3050	HL-250	DR-140	550 Nm
Class to 19 t	MS-E 3060	MT-E 3060	HL-270	DR-250	770 Nm
Class to 25 t	MS-E 3070	MT-E 3070	HL-290	DR-350	950 Nm

1) Empty vehicle weight without additional equipment



ZF Driveline Systems for Backhoe Loaders



The system for backhoe loaders consists of a steerable front axle, the compact, powered rear axle and a synchronized four-gear or powershift transmission.

More mobility and maneuverability

The demands on compact, self-propelled off-road vehicles are continually increasing. This is particularly true in inner-city areas where modern vehicles must in future be more mobile and maneuverable. This trend is also expected to continue with backhoe loaders.

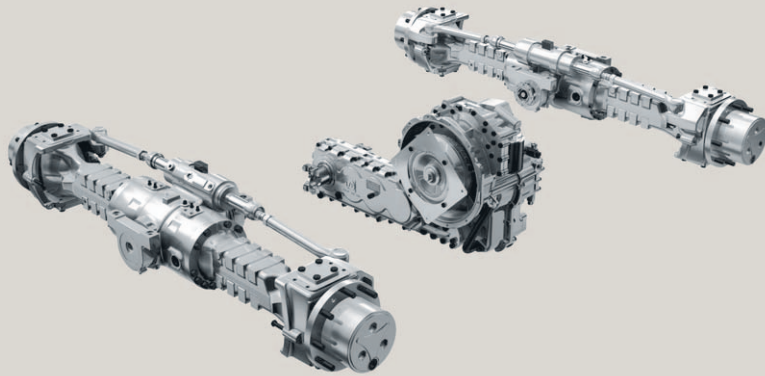
Backhoe loaders are a combination of wheel excavators and wheel loaders: loading at the front, digging at the back - and in between a power drive, embedded in a maneuverable vehicle design. As genuine all rounders they can also be combined with various hydraulic attachments, for example for drilling, 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.

ZF driveline technology: vehicles and performance classes for backhoe loaders

Empty vehicle weight ¹⁾	Front axle	Rear axle	Gear selector	Transmission	Engine power max.
Class to 7.0 t	MS-B 3025	MT-B 3065	DW 3	WG 90	65 kW
Class to 7.0 t	MS-B 3025	MT-B 3070	DW 3	WG 94	75 kW
Class to 8.5 t	MS-B 3025	MT-B 3070	DW 3	WG 94	75 kW
Class to 12.0 t	MS 2045	MT 2085	DW 3	WG 98	90 kW

1) Empty vehicle weight without additional equipment

ZF Driveline Systems for Telescopic Handlers



The axle series was specially designed for telescopic handlers. The WG 92/98 transmissions are rated for fast reversing and speedy travel between jobs.

Driveline with high versatility

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 through to agriculture. The ZF driveline versions for telescopic handlers are also versatile. Depending on the type, low-boom or high-boom designs are possible. Special telescopic handler axles support the 4-wheel steering system.

Versatility and maneuverability are the strengths of the telescopic handler. This flexibility is due to intelligent driveline technology. ZF transmissions and axles as complete drivelines with easy handling.

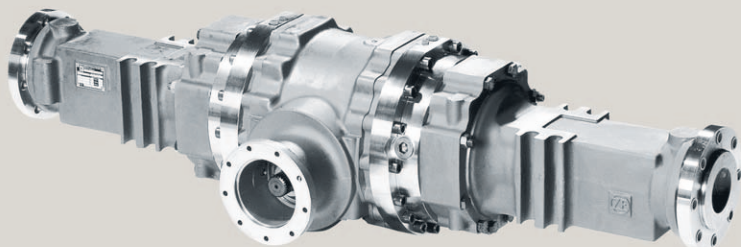
ZF driveline technology: vehicles and performance classes for telescopic handlers

Empty vehicle weight ¹⁾ (Lift capacity)	Front axle	Rear axle	Gear selector	Transmission	Engine power max.
Class to 10.0 t (3.5 t)	MS-T 3045	MS-T 3045	DW	WG 98 TSC WG 98 TC	105 kW
Class to 13.0 t (4.0 t)	MS-T 3055	MS-T 3045	DW	WG 98 TSC WG 98 TC	105 kW
Class to 14.0 t (4.5 t)	MS-T 3060	MS-T 3045	DW	WG 98 TSC WG 98 TC	105 kW
Class to 15.0 t (5.0 t)	MS-T 3060	MS-T 3055	DW	WG 98 TSC WG 98 TC	105 kW

1) Empty vehicle weight without additional equipment



ZF Axle Systems for Compactors



ZF has developed extremely rugged and powerful rear axles for single drum compactors.

Compressed power

Single drum compactors are compacting machines with a front facing drum and treaded wheels on the rear axle. They are designed for applications demanding high tractive and grade performance.

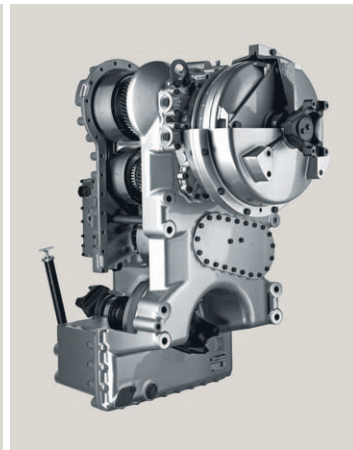
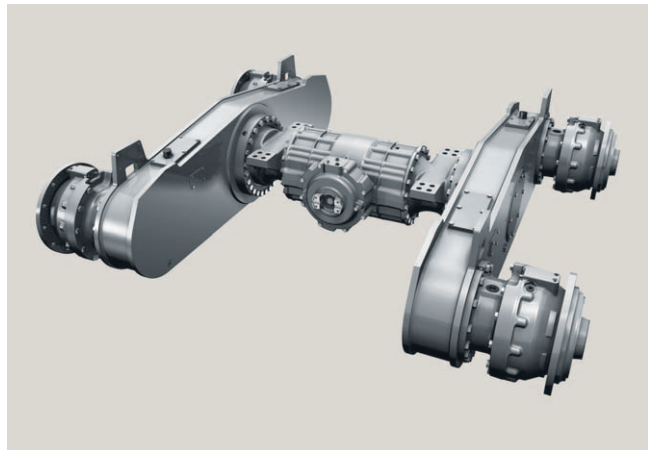
Compactors are found in road building and on large construction sites. For the best compacting results the maximum transfer of power to the substrate is just as important as a stepless change of the driving speed. For use on uneven terrain optimum weight distribution is also essential for increasing 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.

ZF driveline technology:
classes for compactors

Vehicle weight	Axle
Class to 9 t	MT-C 3035
Class to 18 t	MT-C 3075 (P3)
Class to 25 t	MT-C 3075 (P4)

ZF Driveline Systems for Graders



ZF driveline systems for graders are a combination of front and rear axles from the APG range and transmissions from the WG range.

Sensitivity and pulling power

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. This system is supported by an operational hydraulic system which, with precise and sensitive movements, contributes to exact, fine leveling.

Irrespective of whether rough-working in creating site roads or under laser control for the fine leveling of large areas, the grader is the specialist for a level substrate.

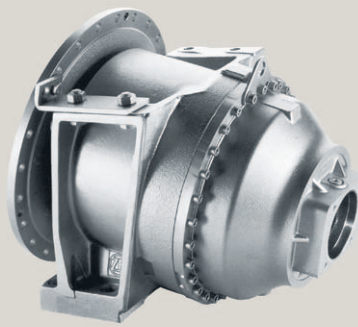
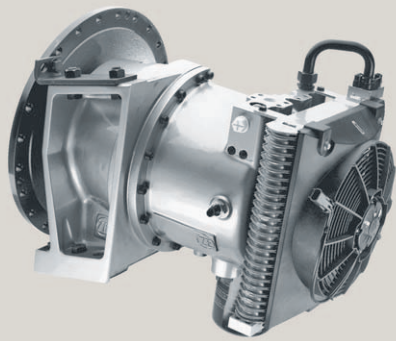
ZF driveline technology: vehicles and performance classes for graders

Empty vehicle weight ¹⁾	Tandem	Electronic / gear Selector	Transmission	Engine power max.
Class to 18.5 t	MT-G 3085	EST-37 A / VTS 3	WG 160	135 kW
Class to 18.5 t	MT-G 3085	EST-37 A / VTS 3	WG 190	170 kW
Class to 18.5 t	MT-G 3085	EST-37 A / VTS 3	WG 210	200 kW

1) Empty vehicle weight without additional equipment



ZF Transmissions Systems for Mixers



Two types of transmission are available for mixers. Transmissions from the PLM range with integral engine and fan as well as the transmissions of the P range with an external hydraulic motor for drum sizes up to 12 m³.

A powerful mixture

Reliable, powerful and eco-friendly
 - ZF mixer transmissions fulfill all the demands placed on modern driveline designs.

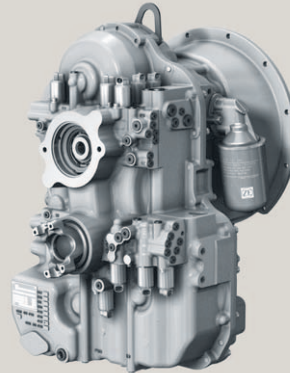
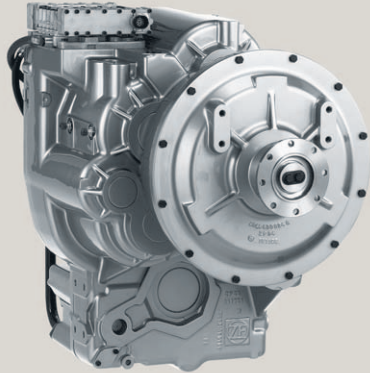
Fleet operators and superstructure manufacturers are placing increasing requirements on the drive to the mixing drum. Higher power and harder duty cycles are only one aspect here. With two series ZF has established a remarkable capability in mixer drivelines.

The PLM range, with its slow running hydraulic motor integrated into the transmission and a following planetary drive stage, is a compact unit with a powerful drive. The driveline of the P/PK 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.

ZF driveline technology: vehicles and performance classes for mixers

Mixing capacity	Transmission	Total ratio	Output torque max.	Installation angle max.	Hydraulic motor
Class to 7 m ³	PLM 7	7.20	48,000 Nm	15°	integrated
Class to 10 m ³	PLM 9	6.94	60,000 Nm	11°	integrated
Class to 7 m ³	P 3301	141.0	48,000 Nm	15°	none
Class to 9 m ³	P 4300	135.3	54,000 Nm	12°	none
Class to 10 m ³	P 5300	135.3	60,000 Nm	11°	none
Class to 12 m ³	P 7300	144.3	72,000 Nm	10°	none
Class to 12 m ³	PK 7500	138.6	72,000 Nm	10°	none

ZF Driveline Systems for Material Handling Vehicles



The transmission series for combustion engine driven material handling machinery fulfills all challenges of modern equipment in the full range from 6 to 60 tons lifting capacity.

High precision with heavy loads

ZF GmbH has a wide range of powershift transmissions available in the Ergopower series to provide driveline systems technology in the field of lift-trucks as well as many other material handling equipment like Ro-Ro-/Terminal-Trucks and Yard-Tractors. ZF systems technology, tailored to users, represents excellent quality and reliability.

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

ZF driveline technology: vehicles and performance classes for material handling machinery

Lifting capacity (Vehicle weight)	Transmission (short-drop)	Electronic / gear Selector	Turbine torque max.	Engine power max.
10 t (23 t)	WG 94	EST-65 A / DW 3	750 Nm	90 kW
16 t (36 t)	WG 131	EST-37 A / DW 3	950 Nm	130 kW
22 t (44 t)	WG 161	EST-37 A / DW 3	1.100 Nm	160 kW
32 t (72 t)	WG 171	EST-37 A / DW 3	1.300 Nm	180 kW
37 t (80 t)	WG 191	EST-37 A / DW 3	1.500 Nm	200 kW
42 t (98 t)	WG 211	EST-37 A / DW 3	1.700 Nm	240 kW
50 t (120 t)	WG 261	EST-37 A / DW 3	2.500 Nm	280 kW
60 t (140 t)	WG 311	EST-37 A / DW 3	2.750 Nm	330 kW

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Driveline and Chassis Technology

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