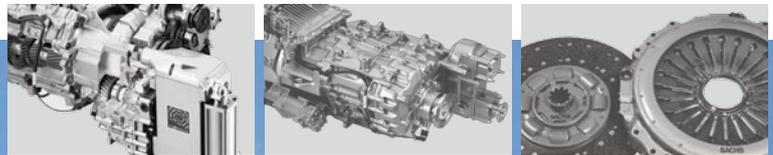




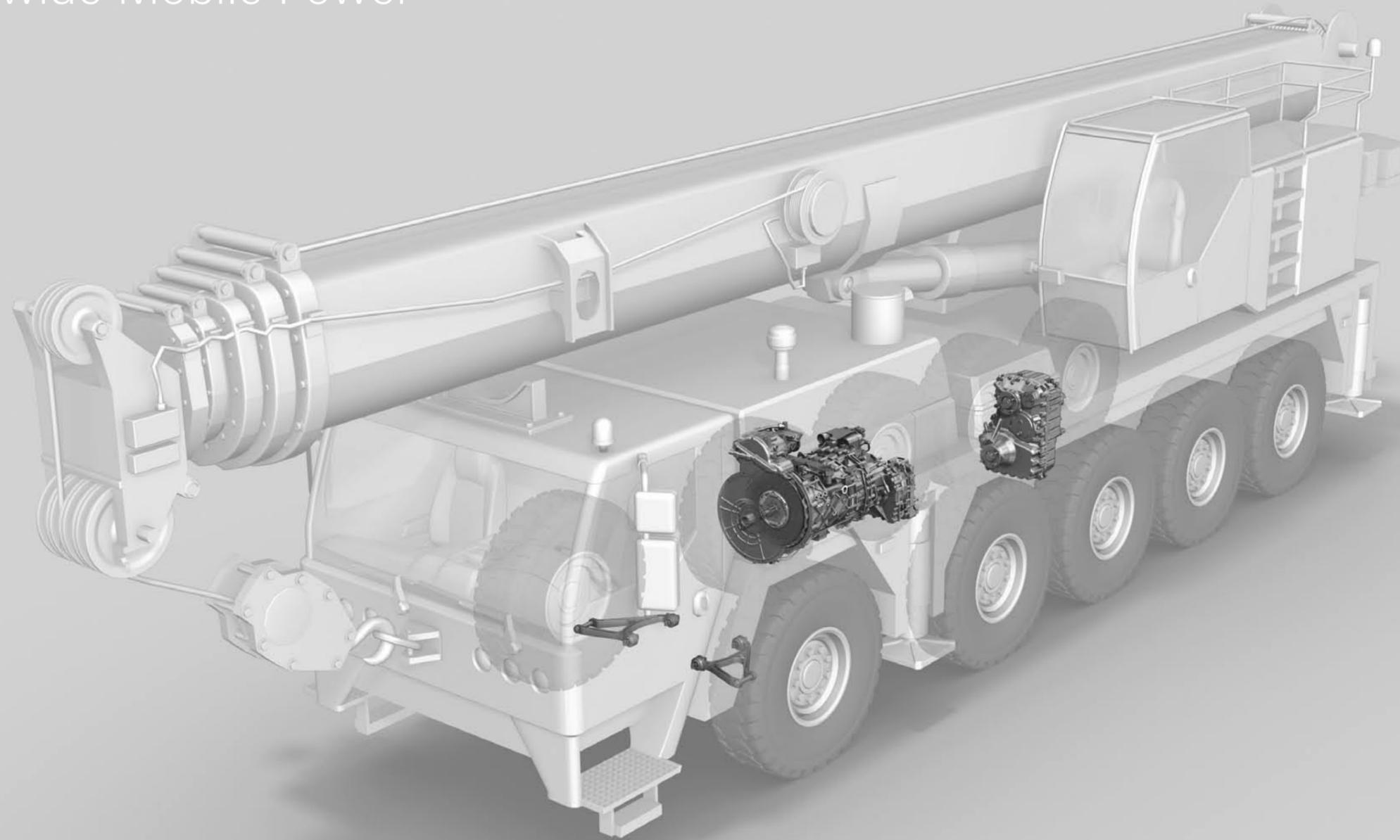
Technology that moves



Transmission Systems for
Mobile Cranes and Special Vehicles



Worldwide Mobile Power



Worldwide, ZF Friedrichshafen AG is recognized as an excellent and reliable partner for innovative driveline and chassis technology. We keep thinking, challenging the status quo, and always working on technological and also market-driven innovations – ever since the beginning of the 20th century, this core message has defined the thinking and action-taking of this company.

About 100 years later, the core brand was clearly defined. ZF leads in terms of technology, quality, and service. One reason for this: every year, ZF invests approximately five percent of its sales in Research and Development. Thanks to the cooperation of the divisions, we warrant the manufacture of flawless, reliable, and long-lasting products to manufacturers and operators.

Driveline Technology for Mobile Cranes

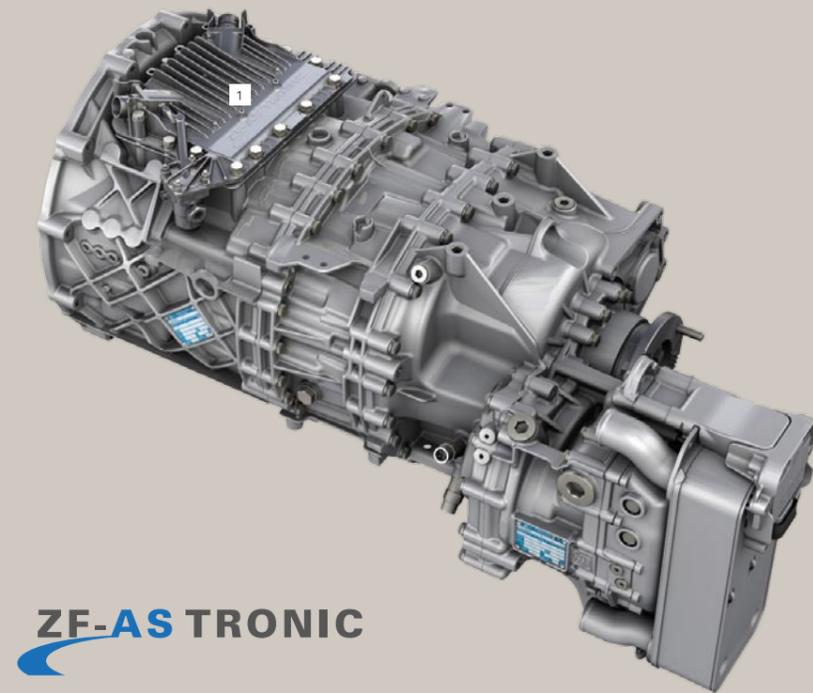
Jobs of all kinds, maneuverability even on difficult terrain, constantly changing work sites – ZF provides transmission technology that quickly, safely, and economically increases the performance of mobile cranes both at work and on the road. To do this requires flexibility.

Our multitalented transmissions can perform various functions. And our transmissions, shifting software, and operating concepts are customized. In the process, our company relies on its comprehensive know-how. We have access to various product areas, and in each case we can integrate the best transmission components into a perfectly fine-tuned system adapted to individual customer needs.



Precision

ZF AS Tronic. Synonymous with perfect engine power transfer



ZF-AS TRONIC

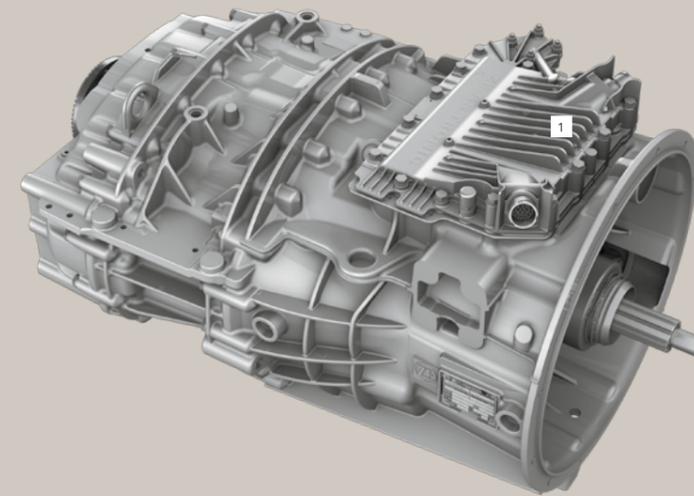


ZF-AS Tronic with integrated ZF-Intarder

- 1 Shift module
- 2 Speed range selector
- 3 Clutch

Comfort

Thoroughly convincing thanks to lightweight design:
ZF-AS Tronic mid



ZF-AS TRONIC mid



ZF-AS Tronic mid with PTOs installed

- 1 Shift module
- 2 Speed range selector
- 3 Clutch

The 12 or 16-speed ZF AS Tronic is available for mobile cranes in direct speed or overdrive transmissions. The main components, including dry clutch, are fully integrated into a light metal alloy housing. There is no need for an additional transmission cooler in the standard vehicle configuration under normal usage when the outside temperature is at max. 40°C. And there is still room for additional safety features. The transmission system is available with the ZF Intarder. Directly connected to the drive wheels, this hydraulic, wear-free high-powered retarder provides consistent braking power during auxiliary braking. The service brakes thus stay cool and provide full power in case of emergency for the protection of the driver, the vehicle, pedestrians, and surrounding vehicles.

CAN communication allows for full integration of the Intarder into the vehicle's brake management system. And this kind of safety pays for itself: the service life of the

service brakes is increased. Oil changes become less frequent. Both transmission and Intarder share a common oil supply. If the Intarder is deactivated, its heat exchanger acts as an additional transmission cooler. When the Intarder is switched on, the driver can regulate the braking effect via five steps or, to operate more quickly and economically, can choose among three kinds of automatic operation (Bremsomat; Bremsomatic; Bremsomatic and Tempomat [cruise control]).

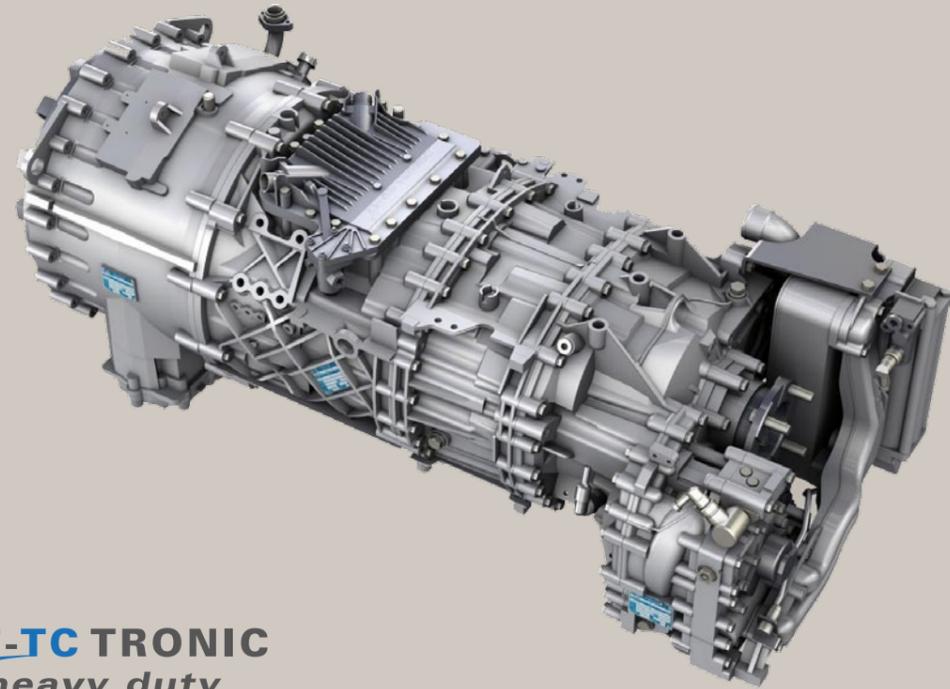
But the ZF AS Tronic is able to do more than driving and braking. The transmission can be combined with up to two clutch-dependent or drive-dependent PTOs that can be engaged independently of one another.

Even in lightweight classes, it is possible to enjoy the usual comfort of ZF-AS Tronic shifting while achieving high performance in mobile cranes that operate in the middle rpm range on two or three axles.

At 840 or 900 mm in length and 50 or 65 kg in weight, the two ZF-AS Tronic mid variants are both shorter and lighter than the "original" model. The 12-speed transmission works with a direct speed or overdrive ratio. Clutch-dependent or drive-dependent PTOs can be engaged independently of one another via two PTO locations.

Performance

A fine piece of technology: ZF-TC Tronic HD



ZF-TC TRONIC
heavy duty

The ZF-TC Tronic HD builds on ZF-AS Tronic technology by adding a wear-free converter module.

The unit features a torque converter that uses hydrodynamic torque boost to increase driving power when starting up and maneuvering heavy mobile cranes; this helps preserve the driveline.

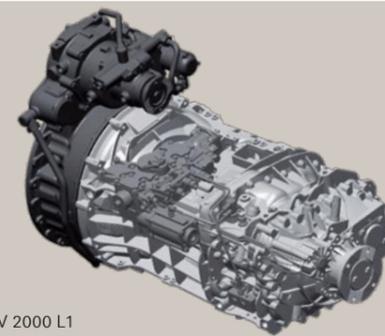
If the crane is in motion, the torque converter is automatically locked up and the engine power is efficiently transferred – just as with the ZF-AS Tronic – by the 12-speed overdrive transmission. The crane operator chooses between automatic mode or manual gear selection and in either case is spared the work of shifting or working the clutch.

Slow to start means hard to stop. Thus, for safety reasons, the ZF-Intarder is fully integrated into the transmission as a zero-wear brake.

Using its two PTO locations, ZF-TC Tronic HD converts driving power into working power. The combinable clutch-dependent or drive-dependent PTOs can be engaged independently of one another.

By the way...

Engine-dependent power take-off (PTO) for ZF transmission



NMV 2000 L1



NMV 1075 K1

The new engine-dependent PTO is particularly attractive for commercial vehicles which require very high torques for their auxiliary power units, such as concrete pumps, mobile cranes, fire-fighting vehicles, or sewer cleaning vehicles. Like a 'sandwich', the engine-dependent PTO is installed between the engine and the transmission; it disposes over a cooling circuit of its own.

Advantages:

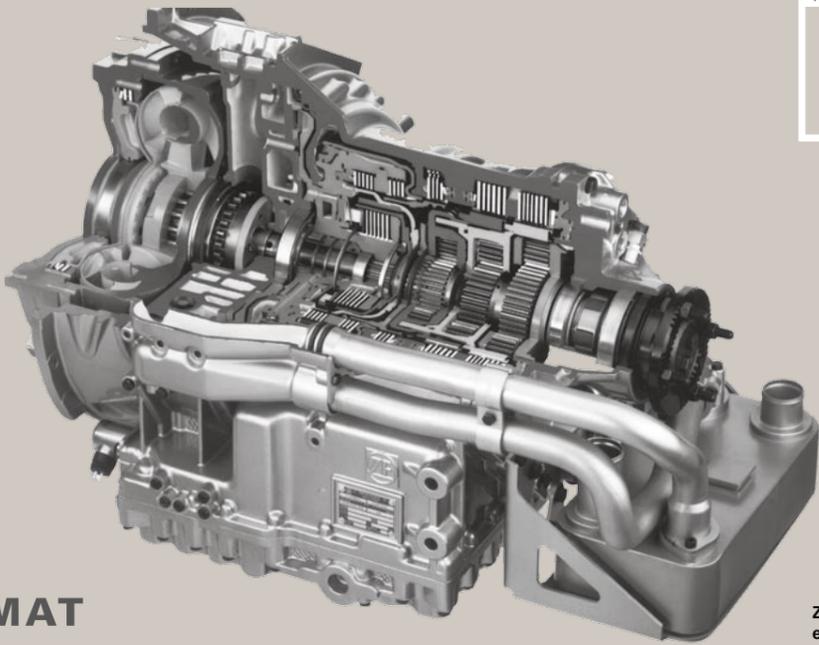
- The PTO is independent of the clutch and always runs with the engine speed
- One or two PTO locations double the output power vis-à-vis the clutch-end PTOs
- Higher level of cost-effectiveness since the setting time for e.g. mobile cranes is halved
- The SAE interface fits all common commercial vehicle diesel engines
- Two designs are available: with an output torque of 1,000 or 2,000 Nm



Focus

Shifting gears without interruption of traction

ZF-ECOMAT



ZF-Ecomat with heat exchanger installed

1 ECU

Make your way through traffic and focus on driving instead of worrying about shifting or working the clutch. You can stay relaxed even during trips that require maneuvering with frequent gear shifting because there is no strenuous pedal work. An automatic transmission from the ZF-Ecomat family makes operating and working pretty easy.

ZF-Ecomat transmissions have five to seven gears. Shifting gears is barely noticeable and there is no lull in tractive power. A converter/clutch unit is integrated into the transmissions so that the vehicle can start up even under difficult conditions: a torque converter increases the engine torque hydrodynamically and helps preserve the driveline. Once underway, the vehicle saves on fuel as a result of the automatic lockup of the converter.

Vehicles equipped with a ZF-Ecomat transmission always come to a safe stop thanks to an integrated primary

retarder. Its power helps relieve the service brakes and can be included in the vehicle's brake management system via CAN communication.

Good working results are achieved with two drive locations for engine-dependent PTOs that can be engaged independently of one another. Moreover, auxiliary components like a heat exchanger can be combined with the transmission. The transmission does it all by itself: gear changes are constantly monitored via its self-diagnostics. Thus, shift quality is uplifted, reliability is enhanced, and fuel consumption is being reduced.

Drive

ZF-AS Tronic/ZF-AS Tronic mid, clutch-dependent drive

Model	Number of gears	[Nm] Input torque ¹⁾	[approx. kg] Mass / Weight
12 AS 1210	12	1200	200
12 AS 1602	12	1600	210
12 AS 2302	12	2500	250
16 AS 2602	16	2600	270
12 AS 3002	12	3000	270

ZF-TC Tronic HD

Model	Number of gears	[Nm] Input torque ¹⁾	[approx. kg] Mass / Weight
12 TC 3041 SO ²⁾	12 + WSK ³⁾	3000	560

ZF-Ecomat, engine-dependent drive

Model	Number of gears	[Nm] Input torque ¹⁾	[approx. kg] Mass / Weight
HP 502 C ⁴⁾	5-7	1200	330
HP 602 C ⁴⁾	5-7	1600	350
HP 902 C ⁴⁾	5-7	2000	380

1) Reference values
 2) 12 TC 3040 SO without Intarder, 545 kg
 3) Torque converter clutch
 4) CAN communication

For up-to-date data sheets, go to: www.zf.com/special-transmission.

PTO

These PTOs can be installed upstream of numerous transmission.

Model	[Nm] Input torque at the PTO	PTO position	Shift type	SAE connection	Length
NMV 2000 L1	2000	12 o'clock	Multidisk shift system	SAE 1	210
NMV 2003 L1	2000	3 o'clock	Multidisk shift system	SAE 1	210
NMV 1075 K1	1000	5 and 7 o'clock	Dog clutch (constant-mesh transmission) shift system	SAE 1	210

Clutch-dependent drive, ZF-AS Tronic, ZF-AS Tronic mid, ZF-TC Tronic HD

Model	[Nm] Input torque ZF-AS Tronic mid	[Nm] Input torque ZF-AS Tronic, ZF-TC Tronic HD	Direction of rotation	Speed	Short-term operation ^{2)/} / Continuous operation
NH/1	800	1000	counter-engine-wise	low	■
NH/4	430	430	engine-wise	medium	■
N AS/10	430	630-360	engine-wise	low - high	■

Drive-dependent drive, ZF-AS Tronic, ZF-AS Tronic mid, ZF-TC Tronic HD

Model	[Nm] Input torque ¹⁾	Direction of rotation	Speed	Short-term operation ^{2)/} / Continuous operation
N AS/PL	-	engine-wise	-	■

Engine-dependent drive, ZF-Ecomat

Model	[Nm] Input torque ¹⁾	Direction of rotation	Position	Engageable / Non-engageable (permanently engaged)
D 01, D 02, D 03, D 04	650	counter-engine-wise	11 and 1 o'clock	■ ■
D 05.3	600	counter-engine-wise	11 and 1 o'clock	■
D 05.4	400	counter-engine-wise	11 and 1 o'clock	■

1) Reference values
 2) Up to 60 min.

■ Short-term operation
 ■ Continuous operation
 ■ Engageable
 ■ Non engageable (permanently engaged)

ZF. As Good As The People Behind It

A leader in technology, quality, and service, while still remaining competitive: this is not a contradiction but also not a matter of course. Every single day, the employees at ZF face up to this challenge in order to meet these high standards.



The high skills level attained by its employees is therefore a core success factor for ZF. Employees have a key role to play in the success of the company by identifying future requirements at an early stage and by devising appropriate solutions for its customers. They are the backbone of ZF's ability to innovate and to compete. The high quality of ZF products and the unique development capabilities of the Group are the result of targeted personnel development and skills training. Management, teamwork, experience, specialist knowledge, and personal responsibility are all directed consistently towards the goals of added value and customer benefits.

References



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- Changsha Zoomlion
- Liebherr
- Link-Belt
- Marchetti
- Manitowoc
- NAMS
- NHL

- Tadano Faun
- Terex Demag
- Terex PPM
- Sany Heavy Industry
- SCM srl
- Spierings
- XCMG



Reliability

ZF. The brand name that stands for on and off-road mobility around the world

The quality of innovative transmission systems is also a question of experience. For many decades, ZF transmissions have been a major impetus for on and off-road driving and technological progress.

ZF provides comprehensive system solutions all from a single source. 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.

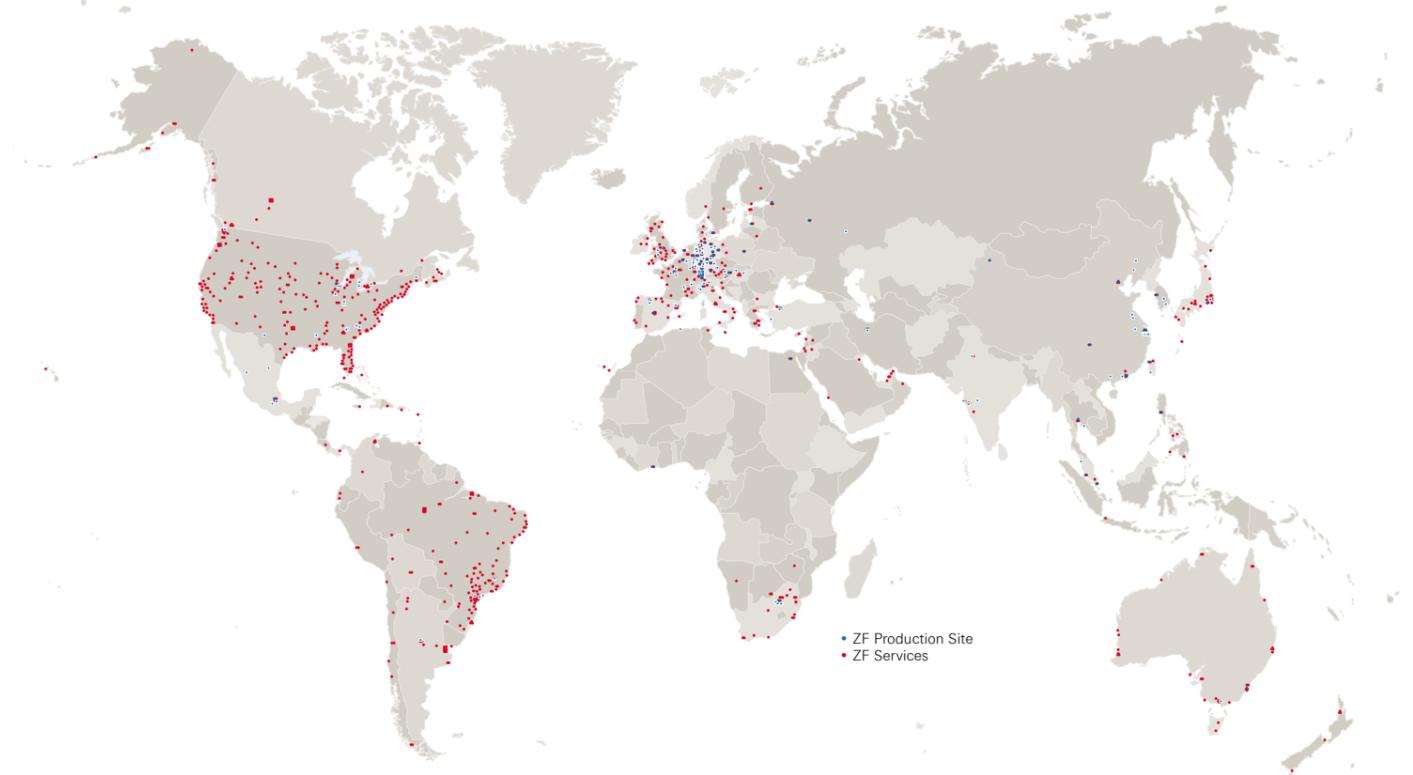
Around the world, around the clock: ZF's service specialists are available anywhere and at any time.

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ZF Worldwide



123 Production Companies Europe Germany 32, France 7, Great Britain 3, Italy 3, the Netherlands 1, Austria 2, Russia 1, Slovakia 3, Spain 5, Czech Republic 2, Turkey 2, Hungary 2 North America Mexico 4, USA 12 South America Argentina 1, Brazil 5 Asia-Pacific Australia 2, China 19, India 4, Indonesia 1, Iran 1, Malaysia 1, South Korea 2, Taiwan 1, Thailand 1 Africa Algeria 1, South Africa 5

6 Main Development Locations, 37 Service Centers, 12 Representative Offices, more than 650 Service Partners worldwide



The Foundations of Success

ZF is a leading worldwide automotive supplier for Driveline and Chassis Technology with 123 production companies in 27 countries. In 2009, the Group achieved a sales figure of roughly EUR 9.4 billion with approximately 60,000 employees. In order to continue to be successful with innovative products, ZF annually invests at least five percent of its sales (2009: EUR 663 million) in Research and Development.

ZF develops and produces products serving the mobility of human beings and goods. Innovations in Driveline and Chassis Technology provide increased driving dynamics, safety, comfort, and economy, as well as lower fuel consumption and emissions in the vehicles of the customers: by land, by sea, and in the air.

ZF's main priority is to meet its customers' needs by using leading technology, quality, and service; this is the key to strengthening the international market position. In addition to the benefits of component expertise, the customer profits from the Group's system expertise.

ZF is a decentralized company. Its divisions and business units operate independently and flexibly on the market;

they are managed strategically and financially by the Group.

ZF plays an active role in society and is continuously engaged in a dialog with the public and its employees. The company promotes employees based on qualification, performance, work ethics/commitment, and mobility.

The company assumes social and societal responsibility. Environmental protection is a professed corporate objective.



Driveline and Chassis Technology



Car Driveline Technology
ZF Getriebe GmbH

Commercial Vehicle and Special Driveline Technology
ZF Friedrichshafen AG

Off-Road Driveline Technology and Axle Systems
ZF Passau GmbH

Marine Propulsion Systems
ZF Padova S.p.A.

Aviation Technology
ZF Luftfahrttechnik GmbH

Service
ZF Friedrichshafen AG



Car Chassis Technology
ZF Lemförder GmbH

Rubber-Metal Technology
ZF Boge Elastmetall GmbH



Powertrain and Suspension Components
ZF Sachs GmbH



Steering Technology
ZF Lenksysteme GmbH*

* Joint venture of ZF Friedrichshafen AG and Robert Bosch GmbH



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Driveline and Chassis Technology

