TECHNOLOGY THAT MOVES

TRANSMISSION SYSTEMS FOR
MOBILE CRANES AND SPECIAL VEHICLES
THE EXPERT FOR THE INDUSTRY!

Our enthusiasm for innovative products and processes and our uncompromising pursuit of quality have made us a global leader in driveline and chassis technology as well as active and passive safety technology. We are contributing towards a sustainable future by producing advanced technology solutions with the goal of improving mobility, increasing the efficiency of our products and systems, and conserving resources. Our customers in the automotive and industrial sectors welcome our determined focus on products and services, which provide great customer value.
Jobs of all kinds, maneuverability even on difficult terrain, constantly changing work sites – ZF provides flexible transmission technology that quickly, safely and economically increases the performance of mobile cranes both at work and on the road.

Top performance for driveline and chassis technology – with this aspiration, ZF Friedrichshafen AG has become a sought-after automotive industry partner over the past hundred years. ZF technology is installed in countless passenger cars, vans, trucks, buses – and thus moves people around the world. Apart from that, also the non-automotive sector has become an important support for the company and is to be extended further in the future.

**The off-road experts**
In the Industrial Technology Division, ZF pools 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 forklift trucks, rail and special 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 wind turbines. The division’s portfolio also encompasses large industrial transmissions and test systems for various applications. Within the division, the Special Driveline Technology Business Unit is the specialist for mobile crane and special vehicle drives.

**Powerful innovation driver in the Group**
ZF’s innovative power in the area of passenger car and commercial vehicle driveline technology is unbroken. Be it the intelligent networking of driveline components, hybrid solutions or the improvement of materials and components. Also the Special Driveline Technology Business Unit’s customers profit from this progress. The best from both worlds is integrated into the development of in-house drive solutions for mobile cranes and special vehicles. The system competence resulting from that is the ideal basis for perfectly harmonized, trend-setting ZF drive systems.

**High-tech with integrated cost-effectiveness**
When developing transmissions, efficiency with maximum performance and reliability are of utmost importance to ZF. Intelligent software always keeps
the transmission in the ideal performance range. Independent of driving situation and topography, the transmissions convince with their quick, smooth and precise gear shifts. Furthermore, a comparatively higher service life coupled with longer service intervals contribute to the recognized cost-effectiveness of ZF transmissions. Not least thanks to innovative modules, like the latest transmission brake generation, for instance, the bottom line life cycle costs of ZF transmissions are extremely low.

Remain flexible for the customer
Our customers are real movers and shakers – and they aim high not only with their mobile cranes, but in a figurative sense as well. Thus they need a partner who is open to special requests and who is ready to develop solutions that are “extraordinary” in both quality and performance. ZF offers transmission technology that fulfills the most challenging requirements already in the basic configuration and covers a wide range of performance classes and needs due to its modular principle.

In addition, there is still enough leeway for customization. Being a system supplier, ZF’s focus is on the function of the individual vehicle, flexibility and numerous options. To be able to implement the drive strategy ideal for the customer, transmission, shift software and operating concepts are designed individually.

Fit for the future
Comfort and reduced fuel consumption, less weight and size and more performance, longer service life and less maintenance – the transmission of the future needs to combine all these features. Furthermore, modularity in driveline technology is essential for vehicle manufacturers so that they can cover as many application scenarios as possible with a versatile modular system – without great adaptation effort. ZF achieves this, for instance, with its automatic, modular TraXon transmission system enabling trailblazing technology for special applications.
TraXon is the answer to increasing fuel prices and more stringent environmental regulations. One basic transmission with optional modules delivers the optimum solution for every application.

**The TraXon basic transmission**
The compact, robust design and the highest transmission efficiency in its category make the transmission the new standard in terms of efficiency. The intelligent software ensures an optimized shifting strategy and permits groundbreaking technology for special applications.

The modular system opens up new dimensions in terms of performance, economy, environmental compatibility and comfort – exactly where it is demanded.

**The single/twin plate clutch**
Effective transmission of power and a long service life make this starting module the perfect choice for both long-distance traffic as well as construction site transportation.
Irrespective of the clutch actuation status, this module ensures quick readiness for use for the most diverse applications. In doing so, this module is characterized by superior load capacity – even in continuous use.

**The power-take off PowerDivide**

The torque converter clutch module enables heavy load vehicles or construction site vehicles to launch quickly and, at the same time, is gentle on the transmission and driveline.

**PreVision GPS**

The intelligent networking between transmission and GPS system enables an anticipatory driving strategy that ideally adapts shifting points to the gradient and length of uphill and downhill slopes.

**Software-based additional functions**

A variety of software functions can be integrated into the automatic transmission control that are tailored to the specific applications and increase the added value for the user.

**Your advantages at a glance**

- Robust and tested components for utmost reliability
- Best power-to-weight ratio for maximum efficiency
- High noise quality
- Maximum transmission ratio for less fuel consumption
- Less customization effort thanks to platform design
- Tailor-made and comprehensive system solutions for all applications
- New software functions for enhanced comfort
- Reduced mechanics concept and modular design facilitate service and repair

99.7%
TraXon incorporates a vast number of innovations in transmission hardware and control software. These innovations help ZF set new standards and enable enormous functional diversity in this transmission family.

Efficient basic transmission
At the core of the innovation, you will find a basic transmission featuring very compact dimensions with a splitter group, main group and range change group as well as two countershafts and one main shaft. It is this space-saving design in combination with the newly designed gearsets that turns the TraXon into a benchmark in terms of the power-to-weight ratio: The new ZF transmission can transmit torques considerably above 3,000 Nm / 2,212 lbft and is therefore also attractive for markets where mobile cranes and special vehicles are used. TraXon is available with 12 or 16 speeds – both types also available as overdrive version with a particularly long ratio of the highest gear. All TraXon basic transmission versions feature a very high transmission ratio resulting in a lower fuel consumption.

Thanks to the dynamic ConAct clutch actuation, the vehicles can also be maneuvered in a precise and comfortable way without the transmission becoming more prone to wear, e.g. due to excessive load on the clutch. ZF development engineers managed to considerably reduce the noise development of the TraXon compared to the AS Tronic by an average of 6 dB by introducing a new gearing design, innovations for the transmission housing and by integrating an anti-rattling damper.

Powerful Intarder
The latest transmission brake generation achieves a 25 percent higher braking performance than the preceding model. In addition, it weighs less and is more eco-friendly. The powerful secondary retarder with a braking torque of 4,000 Nm / 2,950 lbft offers enormous advantages compared to other primary retarder systems particularly for brake operations at speeds higher than 25 km/h / 15.4 mph.
MODULAR TRANSMISSION SYSTEM This means less installation effort and at the same time, more freedom of decision. Thanks to the trailblazing TraXon technology, you are set for tomorrow’s requirements.

UNITS AND PTOS For automatic and manual transmission systems.

SAVINGS THANKS TO INTARDER APPLICATION

Example:
Service life of service brakes tripled through the use of the Intarder

<table>
<thead>
<tr>
<th>YEAR</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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</thead>
<tbody>
<tr>
<td>Acquisition costs</td>
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<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td></td>
</tr>
<tr>
<td>Savings</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Omitted brake lining and/or brake disk replacements</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Additional expenses for Intarder</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
When heavy equipment is used, the torque converter clutch is the best choice to get things moving quickly and smoothly – also for the driveline. In the TraXon Torque, the basic transmission is combined with a torque converter clutch as starting element. Setting off and maneuvering is comfortable even when very high input torques are transmitted, without jerking or wear – thanks to the hydrodynamic torque converter. Once in motion, the torque converter is automatically bypassed and the engine power is efficiently transferred by the TraXon system. The driver can choose between automatic mode or manual gear selection in every driving condition.

Heavy devices in motion are hard to stop. Thus, for safety reasons, the ZF-Intarder is fully integrated into the transmission as a wear-free brake. To advance the torque converter clutch, a new peripheral and control unit concept was chosen. Thanks to a shared integrated control unit for Intarder and torque converter clutch, the system was considerably improved and designed with a view to the future. The advantages gained this way are less complex control units, reduced wiring and the application of a new control unit generation.

TraXon Torque is the module for wear-free setting off with heavy transport vehicles and stands for smooth and comfortable maneuvering at low life cycle costs.

A STRONG PIECE OF TECHNOLOGY

- Zero-wear setting off under the heaviest loads without jerking
- Torque converter lock-up during travel and zero-wear shifting and clutch actuation with the basic transmission
- Joint on-site control unit for Intarder and torque converter clutch
- Reducing the control unit complexity and reducing the wiring
- Clutch protection thanks to slip monitoring
- High system availability and long service life
- High efficiency and low life cycle costs
The engine-dependent PowerDivide PTO is the module for special and most diverse applications. Highly robust – even in continuous operation.

No matter whether in fire trucks, concrete pumps and mixers, mobile cranes or drill and winch drives: PowerDivide is an independent module that can always be shifted even in on load operation, and withstands the highest loads and stresses while in continuous operation. Like a ‘sandwich’ it is installed between transmission and vehicle engine (SAE interface) and features its own cooling circuit and oil sump.

The engine-dependent PTO is generously dimensioned with an output of 314 kW / 421 hp and a maximum torque of 2,000 Nm / 1,476 lbft. It is available for different installation positions and with two different ratios. This enables high application flexibility and cost-effectiveness.

Another advantage of ZF’s PowerDivide is the fact that it is designed for longer operating times. This is ensured by a separate oil and cooling circuit.

A powerful torsional vibration damper, which balances the shocks caused by the irregular rotation of the crankshaft at the engine output, is also key.

BY THE WAY
- Engine-dependent PTO for high torques up to 2,000 Nm / 1,476 lbft (direct drive up to 3,000 Nm / 2,212 lbft)
- Modular system for different transmission ratios (f=1.21 and f=1.54), torques and installation spaces
- Compatible SAE interface fits all common commercial vehicle diesel engines
- The shift system is completely independent of the drive clutch
- Transmission gear shifts in operation are possible while driving
- Long service life thanks to DynaDamp vibration damper
- Possible to combine with third-party transmissions
Also in low weight classes, in mobile cranes with two or three axles and operated in the medium torque range, you can profit from AS Tronic’s typical shift comfort and be powerful and yet lightweight at the same time.

**Fast gear changes save fuel**

With twelve gear steps, the AS Tronic mid ensures the efficient progress of mobile cranes with a gross weight of between 12 and 36 tons. The automatic transmission system represents dynamic driving with reduced fuel consumption. Smooth gear changes preserve the clutch and the downstream driveline. The AS Tronic mid provides relief to the driver thanks to the proven operating concept. Shifting errors are eliminated thanks to the electronic control unit. Even in manual gear selection is accomplished with the simple push of a button. The service-friendly modular design makes compact installation dimensions possible.

At 840 or 900 mm / 33 or 35 inch in length and 50 or 65 kg / 110 or 143 lb in weight, the two ZF-AS Tronic mid variants are both shorter and lighter than the “original” model. The 12-speed transmission works as overdrive transmission. The optional PTOs (clutch and drive-dependent) create further interfaces to power auxiliaries.

**TOP-LEVEL RIDE COMFORT**

- Fully automatic gear changes, manual gear selection possible
- Quick and accurate shifting
- Higher level of driving safety – maximum driving comfort
- Reduced fuel consumption
- Low clutch wear
- No extra cooling system necessary
- Simple and compact design (lightweight transmission)
- PTOs and emergency steering pump available as an option
### DRIVE

<table>
<thead>
<tr>
<th>Number of gears</th>
<th>AS Tronic mid 12 AS 1210</th>
<th>12 AS 1620</th>
<th>12 TX 2610</th>
<th>TraXon 12 TX 3420</th>
<th>16 TX 3440</th>
<th>TraXon Torque 12 TT 3021</th>
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</thead>
<tbody>
<tr>
<td>Max. input torque [Nm]</td>
<td>1,200</td>
<td>1,600</td>
<td>2,600</td>
<td>3,400</td>
<td>3,400</td>
<td>3,000</td>
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<tr>
<td>Max. input torque [lbft]</td>
<td>885</td>
<td>1,180</td>
<td>1,917</td>
<td>2,506</td>
<td>2,506</td>
<td>2,212</td>
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<tr>
<td>Max. power [kW / hp]</td>
<td>246 / 330</td>
<td>336 / 450</td>
<td>537 / 720</td>
<td>702 / 941</td>
<td>702 / 941</td>
<td>626 / 840</td>
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<tr>
<td>Weight [kg / lb]</td>
<td>193 / 425</td>
<td>211 / 465</td>
<td>253 / 558</td>
<td>265 / 585</td>
<td>290 / 640</td>
<td>575 / 1,268</td>
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<tr>
<td>Transmission ratio</td>
<td>10.37-0.81</td>
<td>10.37-0.81</td>
<td>12.92-0.77</td>
<td>12.92-0.77</td>
<td>14.68-0.82</td>
<td>12.92-0.77</td>
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1) Indicative value only (engine auxiliaries are not covered)

### PTOS

<table>
<thead>
<tr>
<th>PTO</th>
<th>PowerDivide (Engine-dependent)</th>
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<tbody>
<tr>
<td>NMV 2000</td>
<td>L1</td>
</tr>
<tr>
<td>NMV 2003</td>
<td>L1</td>
</tr>
<tr>
<td>NMV 1600</td>
<td>L1</td>
</tr>
<tr>
<td>Max. power [kW / hp]</td>
<td>314 / 421</td>
</tr>
<tr>
<td>Output torque [Nm]</td>
<td>2,000</td>
</tr>
<tr>
<td>Output torque [lbft]</td>
<td>1,476</td>
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<tr>
<td>PTO position</td>
<td>12 o’clock</td>
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<tr>
<td>Shift type</td>
<td>Multidisc shift system</td>
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<tr>
<td>SAE connection</td>
<td>SAE1</td>
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<tr>
<td>Length [mm / in]</td>
<td>210 / 8.27</td>
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<tr>
<td>Approx. weight [kg / lb]</td>
<td>165 / 363</td>
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<tr>
<td>Speed factor [f]</td>
<td>1.21</td>
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<tr>
<td>Output rotation direction</td>
<td>same as engine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PTO</th>
<th>Drive-dependent</th>
<th>Clutch-dependent</th>
<th>Clutch-dependent</th>
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<tbody>
<tr>
<td></td>
<td>NH/PL</td>
<td>NH/1</td>
<td>NH/4</td>
</tr>
<tr>
<td>Output torque [Nm]</td>
<td>1,000</td>
<td>430</td>
<td>430 / 690</td>
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<tr>
<td>Speed factor [f]</td>
<td>1.85</td>
<td>1.08</td>
<td>0.97</td>
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<tr>
<td>Output rotation direction</td>
<td>---</td>
<td>opposed</td>
<td>same</td>
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<tr>
<td>Shift type</td>
<td>---</td>
<td>Pneumatic dog</td>
<td></td>
</tr>
<tr>
<td>Approx. weight [kg]</td>
<td>10/15</td>
<td>3.5</td>
<td>5.5-7.5</td>
</tr>
<tr>
<td>Approx. weight [lb]</td>
<td>22/33</td>
<td>6.6-11</td>
<td>12.1-16.5</td>
</tr>
</tbody>
</table>

1) Indicative value only (engine auxiliaries are not covered)

2) Pump speed for transmission ratio: \( n_{pump} = n_{output} \times \text{Factor} \)

3) Fast / Slow
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 available power range 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. And if necessary, our ZF service specialists are always available for our customers, anytime, anywhere.

Highest customer satisfaction is one of the top targets ZF wants to achieve with its products and services. This claim determines the quality of all services linked to our products, starting with development and consultancy up to after sales service.

Thus, being close to its international customers is essential for ZF and consequently, ZF has more than 230 production locations around the globe in more than 40 countries as well as 17 main development centers. In addition, the ZF Services Business Unit is the Group’s worldwide service organization which ensures that ZF products are working reliably throughout their complete service life. A total of 77 in-house service centers as well as more than 650 service partners in all important markets are close to the customers and ensure a global representation together with regional approaches that also take the different requirements of individual markets and applications into account.

**Worldwide Mobile Power**

ZF offers you a comprehensive and attractive range of products and services to ensure mobility anywhere, anytime. Being close to the customer is an essential element.
Research and development to secure mobility

Research and development is the best investment in the future. It is the key to delivering innovation and outstanding technical performance for machines with high user benefits. ZF is an innovation-driven company that develops volume production-ready products based on its own research and development efforts and thus invests in the future in a targeted way.

ZF employees work at more than 100 development locations worldwide, including 17 main development locations. 13,600 employees work in research and development worldwide, of which around 1,450 are employed in the Group’s Corporate Research and Development. ZF invests approximately five percent of sales in R&D. Successfully so because innovative products from ZF set the standards for state-of-the-art technology – again and again.
Internationality is more than just selling products worldwide. ZF has known this for a long time. With the inauguration of the first production facility outside of Germany in São Caetano do Sul, Brazil, in 1958, the company already started to work on what is today referred to as globalization.
RESEARCH AND DEVELOPMENT AT ZF

What’s more, the innovative power of ZF is set to increase in the future. The research departments successfully complete more than 10,000 projects every year.

17
MAIN DEVELOPMENT CENTERS

1.4
BILLION EURO INVESTED IN RESEARCH AND DEVELOPMENT IN 2015

>1,000
PATENT APPLICATIONS IN 2015

5
PERCENT OF SALES ANNUALLY

ZF SERVICES

With its attractive one-stop-shop service portfolio, ZF Services seamlessly carries forward ZF’s system expertise to the aftermarket. And does so worldwide!

4,200
EMPLOYEES INCL. CUSTOMER SERVICE

>650
SERVICE PARTNERS WORLDWIDE

72
LOGISTICS LOCATIONS WORLDWIDE

77
IN-HOUSE SERVICE COMPANIES

Learn more about Research & Development at ZF.

ZF Service-Network
www.zf.com/service-netzwerk
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
Learn more about the company. View MOTION AND MOBILITY on your smartphone.
Learn more about ZF’s products for special vehicles

www.zf.com/special-transmission

The „ZF XtraFair” app contains product information on special driveline technology and is available free of charge for the iPad® in the App Store™.