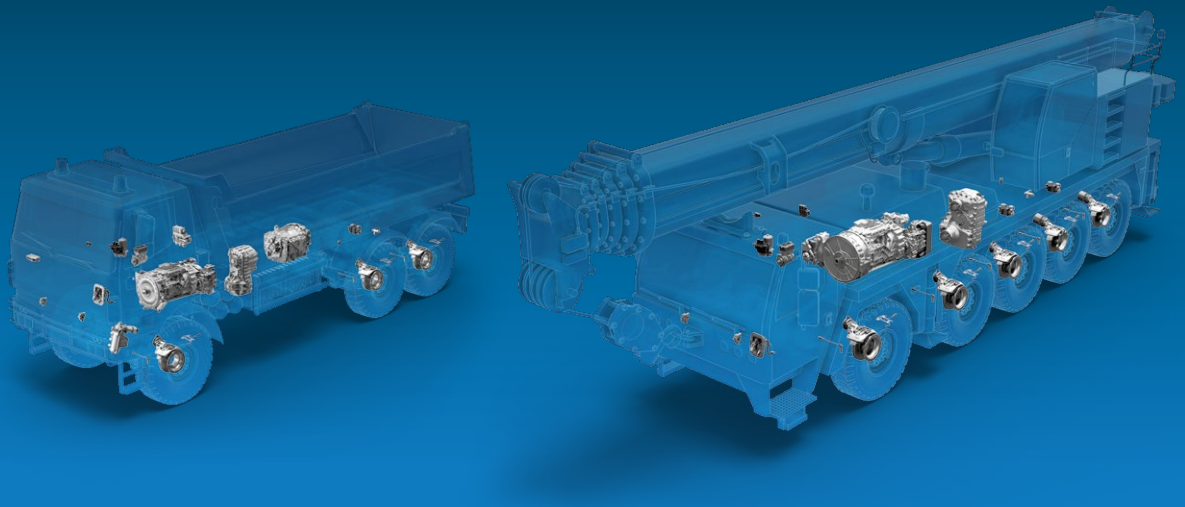
Maximum Performance in Every Terrain

Drive Systems for Mobile Cranes and Special Vehicles

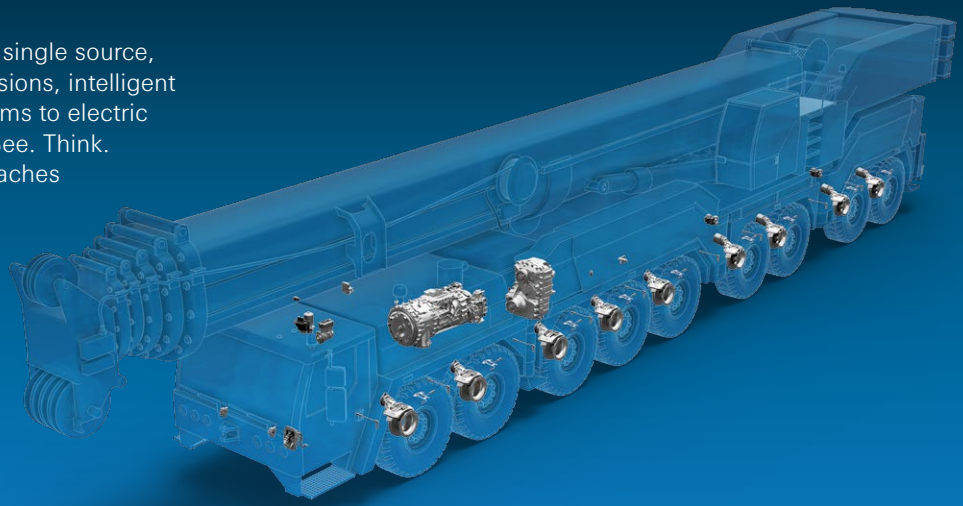



M 1110-5.2
LICCON3

Moving the Big Things!

Our enthusiasm for innovative products and processes and our uncompromising pursuit of quality have made us a leading global technology company. 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.

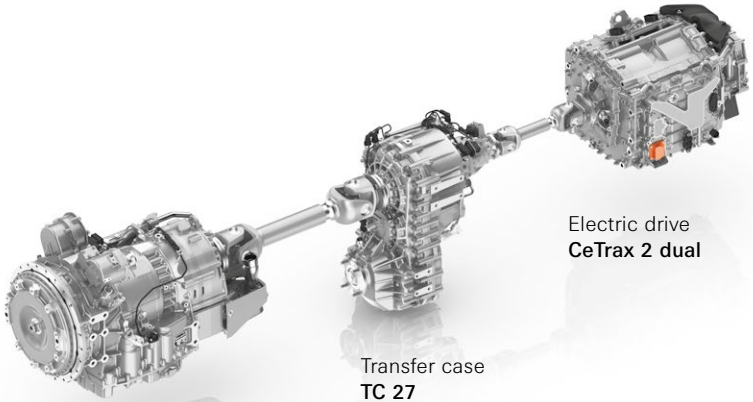
ZF offers system-based solutions from a single source, ranging from mechanical basic transmissions, intelligent automatically shifting transmission systems to electric all-in-one solutions. True to our claim, “See. Think. Act.”, we offer innovative solution approaches and ideas for the market of special vehicles.



Modular drive solution for off-road vehicles

Modular Drive System

- Flexible modular system from proven ZF volume production components
- Maximum flexibility: Conventional, electric, or combined drive
- System solution from a single source: drive, integrated power electronics, and function electronics
- Electric motor enables hybrid drive as well as purely electric driving, boost function, and zero-emission operation of equipment
- Electric motor acts as retarder or recuperator, which reduces brake wear and thus maintenance costs

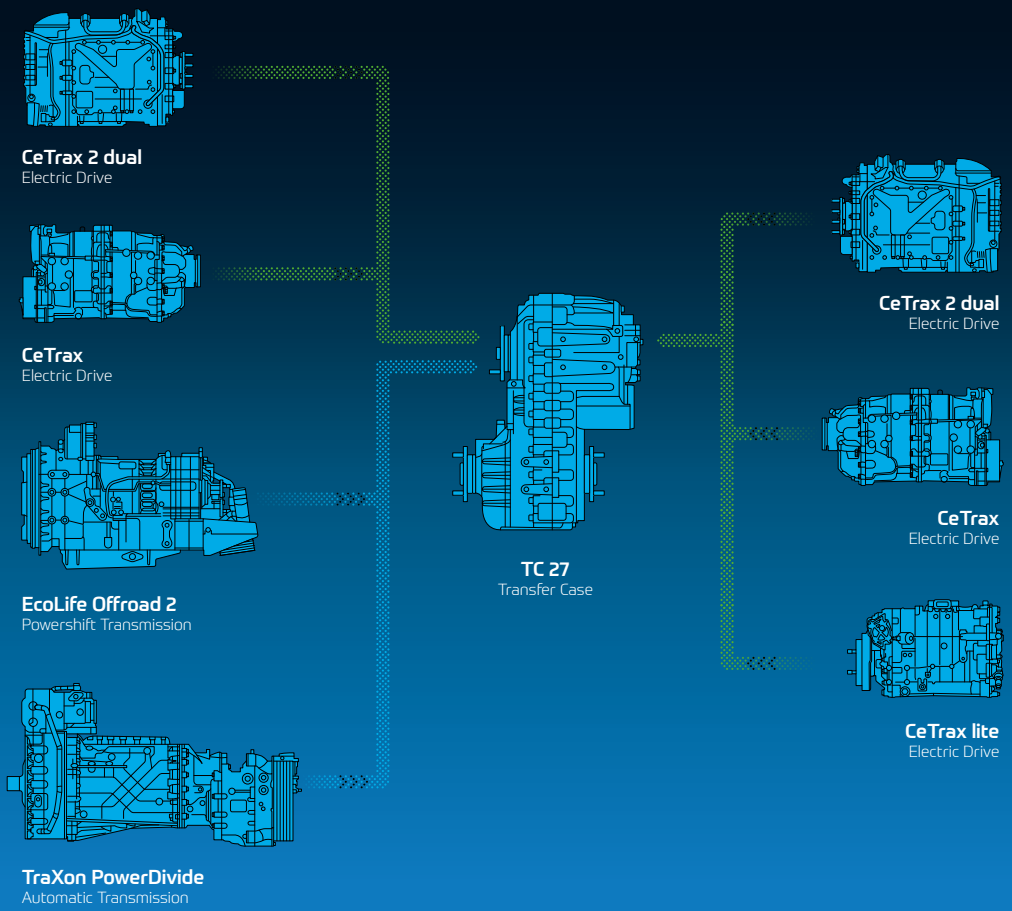


MAXIMUM FLEXIBILITY: Electric, conventional, or combined drive

COMBINED DRIVE FORCE: Optimal system solution from a single source

RELIABILITY: Modular system from proven ZF volume production products

Flexible modular system for hybrid or all-electric driving



Learn more:

Individuality through diversity

Automatic transmission TraXon

- Robust and tested components for utmost reliability
- Best power-to-weight ratio for maximum efficiency
- Statistics memory for recording operating data
- 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

MODULAR: Basic transmission can be combined with different modules

EFFICIENT: Transmission efficiency of 99.7%

VERSATILE: The optimum solution for every application

Technical data

	Automatic transmission			
	TraXon		TraXon Torque	TraXon Dynamic Perform
	12 TX 2610 SO	12 TX 3420 SO	12 TT 3021 SO	12 DX 3020 SO
Number of gears	12	12	12 + WSK	12/16
Max. input torque [Nm]	2,600	3,400	3,000	3,000
Length [mm]	from 866	from 898	from 1.272	from 998
Weight approx. [kg]	254	268	580	397
Transmission ratio	12.92-0.77	12.92-0.77	12.92-0.77	same as TraXon
Max. power [kW] [1)]	545	712	628	628

	Engine-dependent PTO		
	PowerDivide		
	NMV 2000 L1	NMV 2003 L1	NMV 1600 L1
Max power [kw]	314	314	251
Output torque [Nm]	2,000	2,000	1,600
PTO position	12 o'clock	3 o'clock	12 o'clock
Length [mm]	210	210	210
Weight [kg]	165	165	165
Speed factor [f]	1.21	1.21	1.54

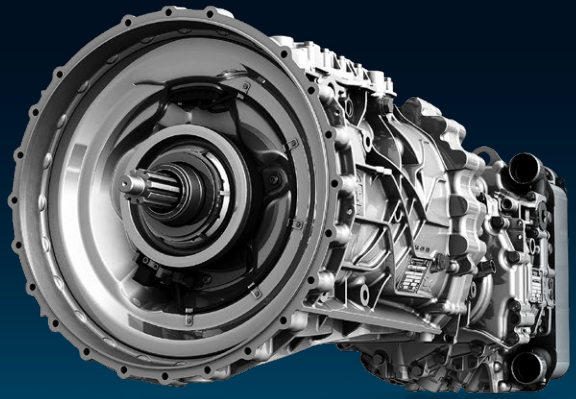
Learn more:

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

The optimum solution for every application

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.

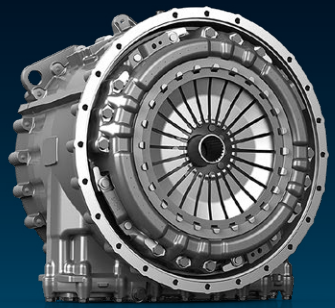


PowerDivide
Power-take off

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. It could be combined with all AMT and manual transmissions (SAE1).

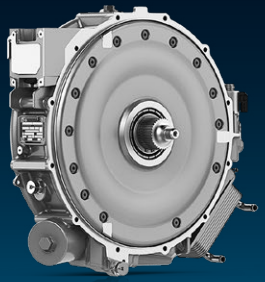
TraXon basic transmission
Basic transmission

ZF designed TraXon as a modular system. Customers can flexibly and economically combine the automatic transmission with various modules for the respective application.



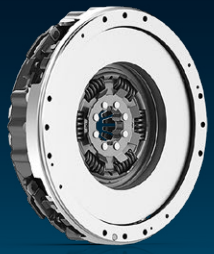
Torque
Torque converter clutch

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



DynamicPerform
Multidisk clutch

The new clutch module is perfectly suited for special vehicles and mobile cranes with three to five axles. It is designed as a multidisk starting clutch module. The clutch disks are constantly cooled by a separate oil circuit, which protects the clutch system from overheating. This enables nearly wear-free and long-term maneuvering even with high friction energy.



Perform
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.

System expertise for electric vehicles

Electric drive solution CeTraX

- System expertise for electrically driven vehicles
- Electric motor with integrated, tried-and-tested planetary gear stage from ZF-EcoLife
- ZF system including inverter and electronics: optimal performance and simplified vehicle homologation
- Use of proven series components
- Combination of conventional axles with common ratios possible
- High system efficiency
- High performance at low weight due to combination of water and oil cooling
- All-electric, low-noise and emission-free driving

Technical data

Performance peak / 30 min [kW]	300 / 200
Output torque peak / 30 min [Nm]	4,500 / 2,170
E-motor speed / Output speed [rpm]	8,500 / 2,530
Technology	Asynchronous motor
Voltage [V]	DC 650
Current AC (peak / continuous)	500 / 375 A_{rms}
Weight with Inverter [kg]	approx. 285

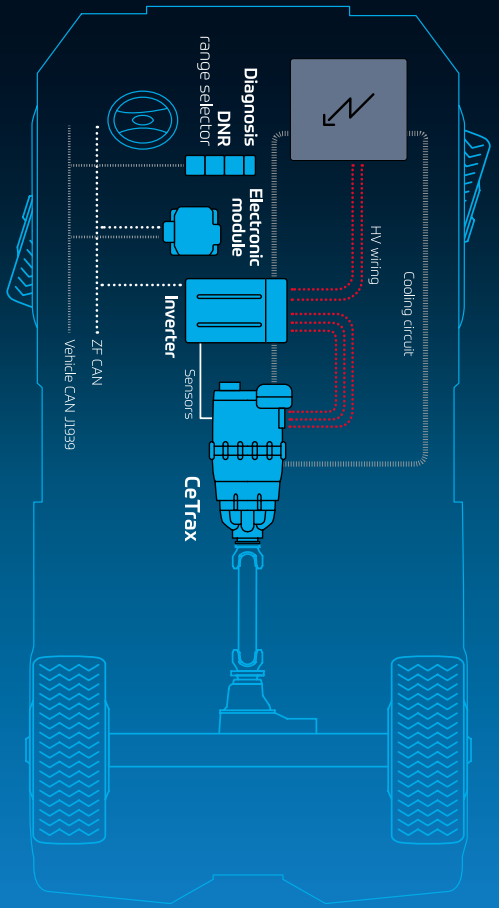
Learn more:

Compact and powerful

CeTrax electric central drive

Electronic module

Inverter



System expertise for electric vehicles

Electric drive solution CeTraX 2 dual

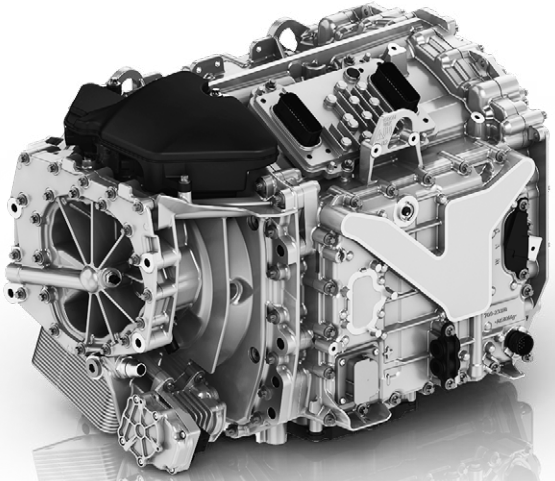
- Delivers powerful acceleration and seamless torque delivery
- High electrical efficiency helps extend vehicle operational range
- Features compact design and light weight
- Fulfills regulatory cyber security requirements and functional safety
- Enables zero emissions for battery electric and fuel cell vehicles
- Optimizes driving experience with quiet and smooth operation

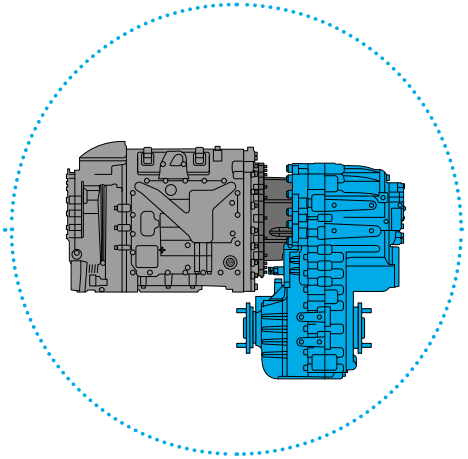
Features & Capabilities

- 360 kW continuous power and 24,700 Nm of peak output torque
- 2 integrated 800 Volt silicon carbide (SiC) inverters
- Equipped with 2 hairpin electric motors
- Features a 3-speed gearbox with 2 e-actuators for optimized efficiency
- State-of-the-art powershifting strategy
- Incorporated high-performance ECU

Learn more:

Modular and integrated system





CeTrax 2 dual with directly connected TC 27

The new driving experience

Powershift transmission PowerLine

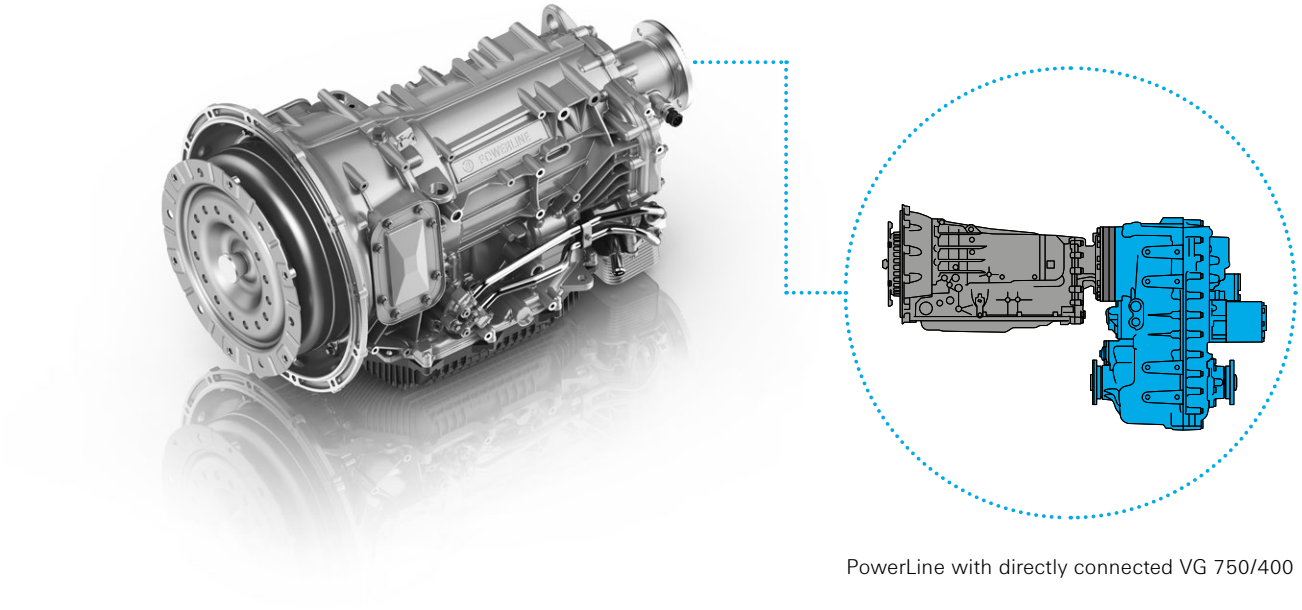
- 8-speed automatic powershift transmission
- For up to 1,200 Nm engine torque
- Benchmark torque-to-weight ratio: 8 Nm/kg
- Best in class fuel efficiency by using 8HP gear set concept. Fuel savings up to 10%
- High torque capacity reduces portfolio complexity: One transmission for 600 Nm to 1,200 Nm
- On-board transmission control unit
- Converter lock-up clutch with integrated torsional damper
- Excellent drivability and comfort
- For special vehicles up to 90 tons
- Optional interface for direct mounted transfer cases

Technical data	8 AP 1200 S
Number of gears	8
Max. input torque [Nm]	1,200
Length [mm]	768
Weight approx. [kg]	149
Transmission ratio	4.89-0.64
Max. power [kW] [1)]	440

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

Learn more:

Lightweight, powerful and economical



PowerLine with directly connected VG 750/400

LIGHTWEIGHT: Lightest transmission in its class

ECONOMICAL: Fuel savings up to 10% by using 8 HP gear set concept

INTELLIGENT: On-board transmission control offers many driving functions

Powershift transmission for off-road vehicles

EcoLife Offroad 2

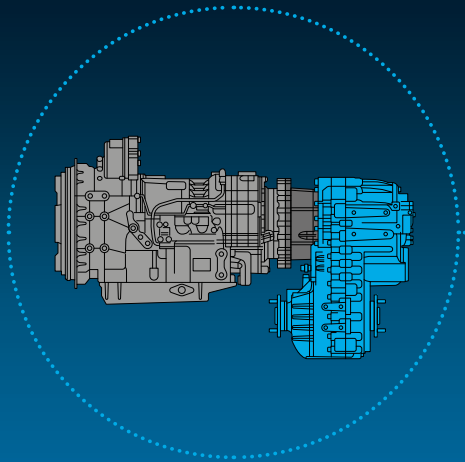
- Fully automatic 7-speed off-road transmission with integrated retarder
- Powerful: application dependent input torque with up to 3,000 Nm
- Two engine-dependent PTOs with max. 1,000 Nm available for different applications
- On-board electronics
- Best performance thanks to Smart Driveline Torque Control: Intelligent transmission function that guides the engine along the permissible converter turbine torque
- Dual cooling system consisting of integrated oil cooler and separate retarder oil cooler for optimized offroad performance
- High efficiency, high power-to-weight ratio
- Optional interface for directly attached TC 27 transfer case

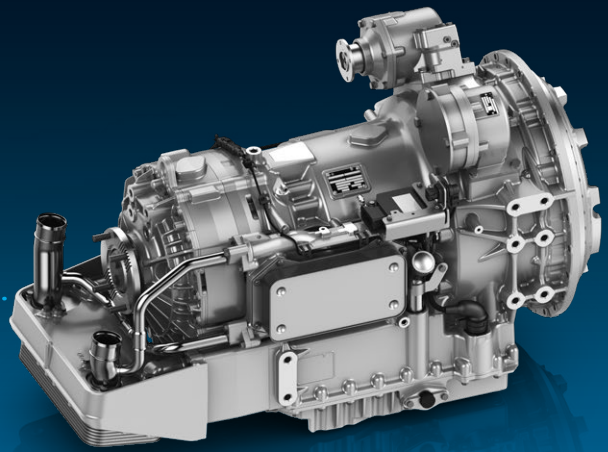
Technical data	6/7 AP 2600 S
Number of gears	6 / 7
Max. input torque [Nm]	2,600
Length [mm]	732 / 871
Weight approx. [kg]	410 / 456
Transmission ratio	5.6-0.559
Max. power [kW] 1)	545

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

Learn more:

Viable for the future





EcoLife Offroad 2 with directly connected TC 27

POWERFUL: Input torque up to 3,000 Nm, two PTO's up to 1,000 Nm

RELIABLE: Best performance under the toughest conditions

CUSTOMER-SPECIFIC: Individual adaption of the transmissoin to the vehicle

Maximum traction and mobility

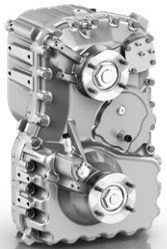
Transfer case series

- No reversal of rotational direction thanks to 3-shaft design
- Suspension via three and four screw-on surfaces, respectively
- Permanent all-wheel drive with lockable planetary gear differential, alternative: front axle activation and deactivation, both pneumatically operated
- Pneumatic two-speed shift system
- Robust, weight-optimized design
- Ground, noise-optimized gearing
- Robust sealing system, fordable thanks to hose breather, if required
- Integrated oil pump (partly optional), designed for external cooling system
- ADM-capable (Automatic Drive-Train Management)

VG 750

VG 750l400

TC 27



VG 2700

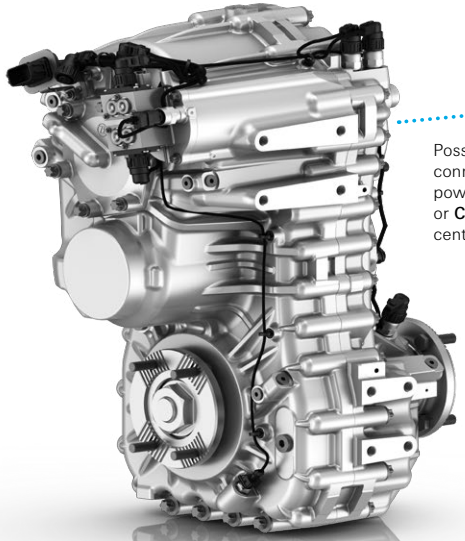
Designed for tough use

Technical data	VG 750 2-speed	VG 750|400 2-speed	TC 27 2-speed	VG 2700 2-speed
Max. input torque [Nm]	10,000	12,500	27,000	35,000
Max. input speed [rpm]	3,500	4,500	3,200	2,800
Gear ratio high gear / low gear option	1.00 / 2.00 (1 / 2.39)	1.09 / 2.10 (1 / 2.52)	0.87 / 1.54	0.91 / 1.41
Spreading	2.00	1,93	1,76	1,55
Differential torque distribution option	1:2	1:2 (1:1)	1:2.636 (1:1)	1:2.60
Shaft distance [mm]	270	400	300 or 396	400
Weight from, dry [kg]	from 115	from 155	from 246	from 450

All-rounder for all-wheel drives

TC 27

- Weight-optimized thanks to aluminum housing
- Higher payload or reduced fuel consumption due to lower weight
- New suspension method reduces installation cost
- Compact design
- Improved efficiency
- Noise-optimized
- Optional:
  - Central electrical / pneumatic connection
  - With control unit directly on transmission, all types of software applications can be implemented
  - Oil level and oil temperature sensors



Possibility to directly connect **EcoLife Offroad 2** powershift transmission or **CeTrax 2 dual** electric central drive

Learn more:

LIGHTWEIGHT: Weight-optimized thanks to aluminum housing

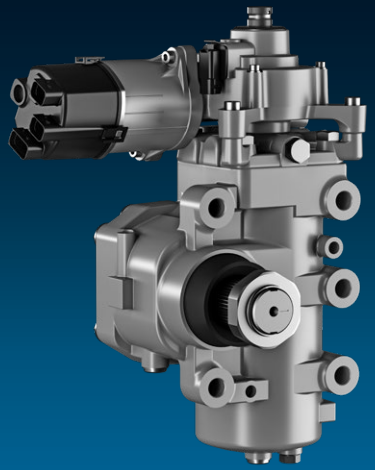
POWERFUL: Higher payload and less fuel consumption

EFFICIENT: Noise-optimized and improved efficiency

Adaptive steering system

ReAX

ZF's ReAX adaptive steering technology utilizes market leading automotive electric steering technology to optimize steering performance in commercial vehicles. This system adapts to signals from the vehicle and analyzes driver input to provide smoother, more precise steering, helping to improve performance and reduce driver fatigue.

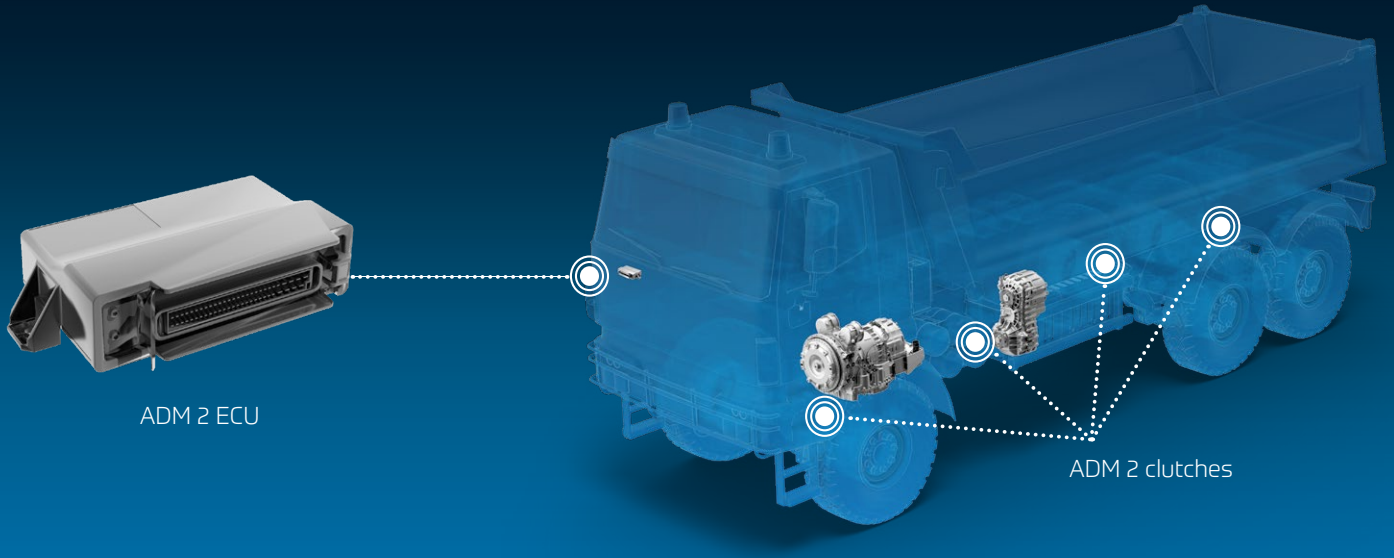


ENABLER FOR ADAS: Can be integrated with ZF driver assist systems

REDUCED FATIGUE: Reduced input forces for greater comfort and reduced fatigue

ENHANCED MANEUVERING: Reduced low-speed efforts

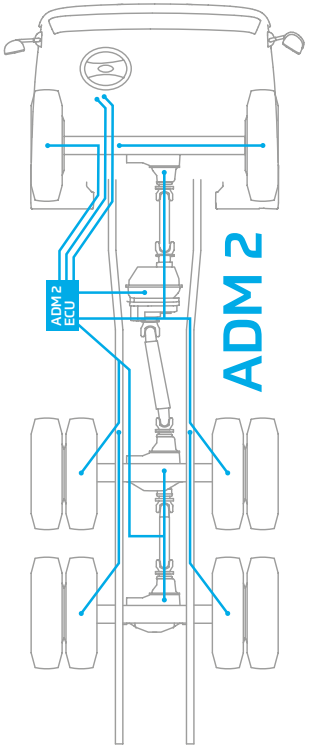
Always the perfect traction



More safety by ADM 2

Automatic Drive-Train Management ADM 2

- Automatic engagements of all driveline functions at the right time and on the fly
- Always 100% of physically possible traction available
- Increase of driving stability
- Relief of the driver
- Minimum of driver training required
- Reduced wear of tires
- No driveline damages by incorrect engagements of differential locks
- Less fuel consumption



AUTOMATIC SYSTEM: Driveline management at the right time and on the fly

MAXIMUM TRACTION: Always 100% of possible AWD traction

MORE SAFETY: Increase of driving stability and safety

Intelligent Assistance

ZF develops products for all applications that make driving and working with mobile cranes and special vehicles easier. The next generation of our intelligent sensors, central control units and actuators forms the basis for Advanced Driver Assistance Systems.

See.

Sensors are the “eyes” of the vehicle. They capture the environment and send their data to the central control unit for processing. Multiple sensors such as cameras, Radar and Lidar sensors are used in order to meet different requirements for resolution and contour accuracy, range and scope of operation. Detecting objects with several different sensors increases the performance, availability and safety of the functions.

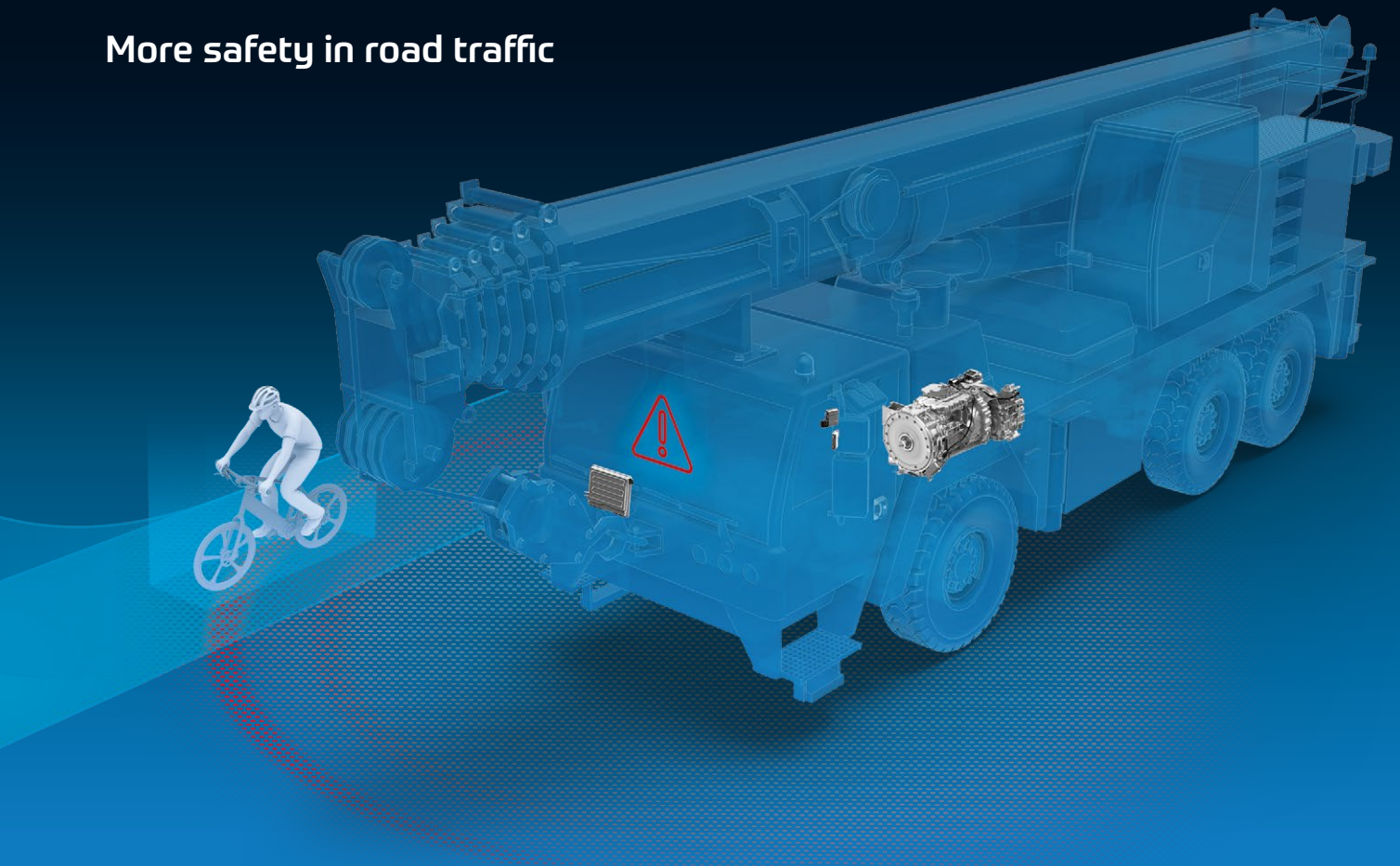
Think.

The central control unit is the „brain“ that controls automated driving. It collects and analyzes the data that has been captured by the sensors and determines the instructions/functions that are required for accelerating, braking and steering the vehicle and assisting the driver. Among other functions, these include adaptive cruise control, collision avoidance systems, automatic light control as well as more complex functions such as turn assist.

Act.

The central control unit analyzes the sensor data and then uses functions that control the vehicle’s actuators for longitudinal and lateral guidance. These include steering and safety functions, damping, and braking and transmission control.

More safety in road traffic



Worldwide Mobile Power

As technology leader, ZF considers itself not only a manufacturer, but also a reliable partner who supports you throughout the lifecycle of your vehicles. And that worldwide. Wherever you may need us, ZF Aftermarket supports you with its own comprehensive service network and the entire range of after-sales services. From prompt genuine parts supplies via technical service, up to consultancy and training. Quickly, directly, reliably. In a nutshell: ZF Aftermarket links powerful top-quality products with excellent services to provide a unique, premium offer.

Comprehensive service from one hand

Our products are used around the world and our technical staff is available and ready to support our products through the entire lifecycle.

Internationally, ZF Aftermarket is represented with its own locations and partner operations and is well equipped for the relevant markets. The German organization of ZF Aftermarket for example, is present locally throughout Germany with sixteen service points – nine of its own locations together with nine authorized service partners – just where the customers need them. ZF after-sales specialists ensure the operational readiness for ZF chassis and driveline technology in the sectors of cars, commercial vehicles, buses, construction machinery, agricultural machinery, materials handling, railways and marine. The manufacturer's engineering expertise, the high quality of spare parts and processes, short throughput times and good accessibility are features of these service locations.

Learn more about the services from ZF Aftermarket.
aftermarket.zf.com

Globally present, locally anchored

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