



The Best for the Best!

ZF Race Engineering - Innovative Services and Technologies for
Motorsports and the Automotive Future

race
engineering



Content

- | | | | |
|-----------|--|-----------|---|
| 04 | Fit for the Future:
ZF Race Engineering | 18 | Leading Automotive Products:
The ZF Special Series Portfolio |
| 06 | Performance counts,
Passion wins:
ZF Race Engineering GmbH | 20 | Tuning fueled by Passion:
SACHS Performance Brand |
| 08 | High-Tech for High-Speed:
The ZF Motorsports Portfolio | 22 | A good feeling:
ZF Technology for Motorcycles |
| 10 | Success is our Sport:
Winning is the Goal | 24 | High-Tech on 2 Wheels:
The ZF Motorcycle Products
Portfolio |
| 12 | The Team is the Star:
ZF as Technology Partner | 26 | Innovative Engineering Services:
The Technical Centre |
| 14 | Close to the Scene:
On-Site Service | 30 | Leaders throughout Centuries:
Historical Milestones |
| 16 | Get customized:
ZF Special Series | | |

The Best for the Best!

That's the claim of ZF Race Engineering, but we are much more than just a developer, manufacturer and distributor of driveline and chassis products specially for applications in motorsports. Whilst we continue to support customers from Formula 1, Formula E, WRC and DTM to amateur race series and tuning vehicles, we also provide customers with a full range of engineering services, from product development and testing to special applications, small volume production and motorcycle components.

Customers from all over the world rely on ZF's innovative technology and first-class service, underlined by the technical competence and reliability of ZF products.

Fit for the Future: ZF Race Engineering

ZF as a global technology company does not only operate with global automotive customers with large-scale volume production, we also have business units that focus on developing and manufacturing niche products.

ZF Race Engineering bundles ZF's business in the fields of motor-sports applications, small volume production applications, engineering, consultancy and testing, thus acting as a one-stop supplier of all ZF products for special requirements in the market.

ZF Race Engineering, Germany

Headquartered in Schweinfurt with currently around 120 employees, ZF Race Engineering GmbH is a wholly owned subsidiary of ZF Friedrichshafen AG. ZF Race Engineering develops, produces and distributes shock absorbers, clutches, transmissions and other ZF products for all kinds of applications worldwide.



ZF Race Engineering, United Kingdom

Headquartered in Solihull, and formerly known as Conekt, currently employs around 115 engineers. The company's main strength is the provision of complete engineering services, from product development and testing to small volume production in various industries, e.g., aerospace, automotive or the energy sector.

ZF Race Engineering, USA

Headquartered in Northville (MI), currently employs around 5 engineers and develops, produces and distributes shock absorbers, clutches, transmissions and other ZF products for all kinds of applications in motorsports for the US market.



Since the foundation of ZF, components, shock absorbers and clutches have been used in standard and motorsports vehicles. Both areas have been and will stay inseparably connected – with success. This holds true for the legendary Mercedes Silver Arrows of the 1930s as well as for the Formula 1 cars of today, for national and international long distance and circuit racing events as well as for rally championships.

Flexibility and experts

There is more to it than having new materials, technology and expertise – you also have to know how to apply them. Especially when top performance is required like in motorsports. For this purpose, experts are needed. Experienced employees who cooperate in small teams, find solutions and implement them. This requires a flexible company. The logical consequence was to establish ZF Race Engineering GmbH. Operating on an international level, ZF Race Engineering develops, designs, produces and distributes racing clutches and shock absorbers for top-class sports and national racing series as well as for renowned automotive manufacturers, tuners and specialist vehicle retailers.

Performance counts, Passion wins. ZF Race Engineering

One face to the customer

Approximately 100 employees work at ZF Race Engineering GmbH in Schweinfurt and deal exclusively with motorsports topics. Their mission is to provide individual support with a focus on the customers' wishes. One face to the customer is the philosophy. One employee is in charge of the complete process – from the technical specification, which is developed together with the customer, and the implementation of all required process steps to the completed product including on-site service.

ZF motorsports developments

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. This also applies to motorsports. ZF Race Engineering's development objectives for all product segments encompass installation space optimization, weight reduction and performance enhancement. ZF Race Engineering distinguishes itself from its competitors thanks to OE standards, FMEA, project transfer and process management and the expertise from ZF Friedrichshafen AG's volume production business.

High-Tech for High-Speed: The ZF Motorsports Portfolio

Again and again, professionals in motorsports all over the world celebrate their successes thanks to ZF products and rely on our technological expertise. Our products offer excellent connection and installation options, optimal functions and a long service life – perfectly designed for applications at the technical limit.



Racing Clutch Systems (RCS)

Our modular clutch system for every motorsport car application. The RCS range comprises 4 different clutch diameters: 115 mm, 140 mm, 184 mm, and 200 mm. Friction linings are available in carbon, sintered, and organic materials. The RCS range offers 1, 2, 3, or 4-disc clutches with a transmittable engine torque from 370 up to 2,500 Nm.

Clutch Modules

ZF Race has developed complete racing clutch modules for a wide variety of vehicles. These modules include the following components:

- Specialized racing clutch
- Lightweight single mass flywheel
- Specialized slave cylinder

Anti-stall Clutches

Anti-stall clutches are dry-running multidisc clutches with engine-speed dependent contact pressure application and an optional release via a push-type clutch release mechanism. In combination with an adjustable speed limiter that can be activated via the start button, the transferred torque can be gradually set for a race start.



Formula 1 Clutch

- Special clutch development as a 97 mm pull type clutch
- Applicable for speeds of up to 22,000 rpm
- Transmittable torque > 800 Nm
- Carbon friction material
- Clutch housing: high-strength titanium



Formula 1 Shock Absorbers

- Linked damper system offering separate heave and roll adjustment
- Easier set-up work possible through independent adjustability
- Substantial weight saving possible compared to a conventional three-damper-layout
- Easy adjuster accessibility due to separate valve block



Suspension Technological Expertise

We offer damper solutions for Formula 1, Formula E, circuit racing cars, offroad applications, race trucks and Formula Student.



E-Drives

We not only provide electric drives for cars, buses and commercial vehicles. Our specially developed technology provides top efficiency in extreme motor racing where every watt-second from the battery, and every hundredth of a second counts. One example of our systems supplier competence is the electric drive with a maximum output of 250 kW that ZF has developed for Formula-E race cars.



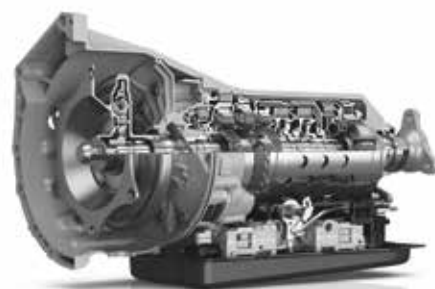
EPHS Motorsport Steering Pump

- Versatile and easy to install thanks to its compensating reservoirs in different shapes and sizes
- Flexible flow rate from 5 to 12 l/min at variable speeds ranging from 2,500 to 6,000 rpm
- Operating pressure of 113 to 124.5 bar
- Improved controllability at high speeds with generally lower steering effort
- No connection to the CAN bus required
- Lower costs due to shorter development time and volume production



8P45R Motorsport Transmission

The next evolution – the 8P45R motorsport transmission. It is even more dynamic, lighter and consequently perfectly suited for use in motorsport. The 8P45R had its first successful track appearance at the VLN race end of October 2014 at the legendary Nürburgring.



motorsport

Success is our Sport: Winning is the Goal

Be it Formula 1, Formula E or 24 Hours of Le Mans, DTM or European Truck Racing Championship and further international racing series like Super GT or V8 Supercars, ZF's shock absorbers and clutches contribute to achieving the decisive head start. We congratulate the teams supported by us on their outstanding successes.

Formula 1

In the royal league of motorsports it's meanwhile a tradition that championships in the last decades have been won with ZF technology.

WEC/24 Hours of Le Mans

In the last 19 years, cars and LMP1 teams equipped with ZF technology secured the overall win 17 times.

DTM

In the past, ZF Race Engineering had already contributed to many individual DTM race victories and title victories as highly sought-after supplier. In the most popular, international touring car race series, the three premium manufacturers Audi, BMW and Aston Martin rely on ZF's clutch systems. They are characterized by high-quality materials, great reliability and extensive durability.

24 Hours at Nürburgring

Over 60 percent of cars competing in the „green hell“ regularly rely on ZF products. Twelve of the top 20 cars in the 2019 overall ranking were equipped with ZF technology.





World Rally Championship (WRC)

In the 2019 World Rally Championship, the Ford Fiesta WRC of ZF partner M-Sport is fighting for podiums. The ZF shock absorbers specially developed for the WRC contribute to the Fiesta WRC's success.

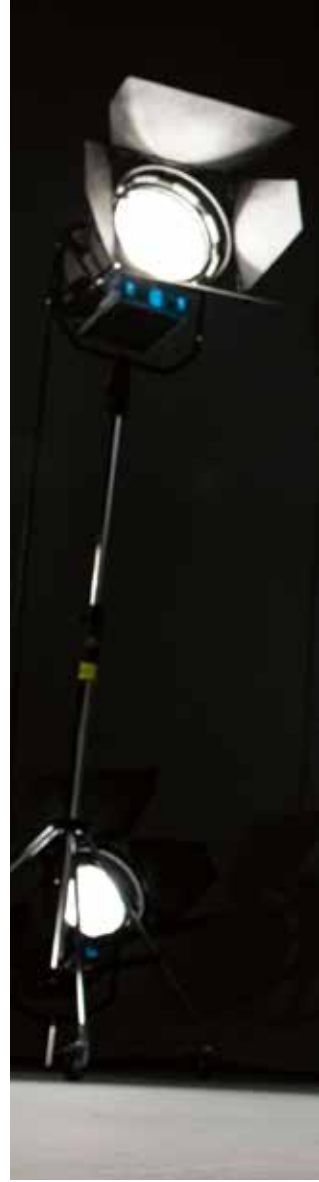


FIA European Truck Racing Championship

Jochen Hahn and his IVECO team were able to take the driver's title five times in the last eight years and always finished on the podium in the overall championship in the other years.

The Team is the Star: ZF as Technology Partner

ZF Race Engineering GmbH is the technology partner of many famous motorsports teams, from Formula E and DTM to different brand cups and the most important premium vehicle manufacturers. ZF maintains a particularly close cooperation with some teams in order to develop products for special applications. ZF has supported the teams of the international Formula Student competition for many years in order to promote talented new engineers.





Mahindra Racing

Since the 2019/2020 season, ZF is the official powertrain partner of Mahindra Racing in the fully electric FIA Formula E. The objective of the partnership is the development of an all-electric ZF driveline for the 2020/2021 season.

BMW Motorsport

Since 2002, ZF Race Engineering has been the technical partner of BMW Motorsport. In racing series such as DTM or endurance racing like the 24 Hour race at the Nürburgring, BMW relies on technology from Schweinfurt.

Porsche

As the official partner of Porsche Motorsport, ZF supports in particular the young trainee drivers who will be the future factory drivers of Porsche Motorsport. In addition, all international cup vehicles use shock absorbers and clutches from ZF Race Engineering in Schweinfurt.

Super GT

Since the 2013 season, ZF has been an official supplier of Super GT, the most popular touring car racing series in Asia. The cars of the GT500 class have exclusively been using clutches from Schweinfurt since the 2014 season.

DTM

The three premium brands Audi, BMW and Aston Martin have been relying exclusively on ZF clutch systems for all DTM cars since the 2012 season.

motorsport

Close to the Scene: On-Site Service

Excellent support – the claim of ZF Race Engineering. However, it is not limited to technological developments. Thanks to the extensive support system, ZF motorsports technicians are available around the globe for motorsports applications and small volume production development.

Comprehensive service at the race track

ZF Race Engineering is using three service trucks with modern shock absorber test benches. A workshop area makes it possible to implement specific requirements. Here, shock absorbers can be re-calibrated, repairs can be performed immediately, clutches can be checked and examined, and they can even develop complete vehicle setups.

Quality assurance at every race

During the race season, ZF Race Engineering supports customers at motorsports events in 24 countries on four continents. This extensive service significantly contributes to the many worldwide victories supported by ZF.





Warranty and guarantee

If you have questions, complaints, warranty or guarantee issues, the service and consultancy team will gladly support you anytime.

motorsport

Get customized: ZF Special Series

Our customers trust in ZF products for more than 120 years. As a wholly owned subsidiary of ZF Friedrichshafen AG, we have access to the products and innovations of the entire ZF group. We are cross-linked with more than 16.000 developers of the ZF central research and advance development departments and countless colleagues from ZF's business units and production plants.





Our goal: automotive technology with tailor-made services for special OE projects

The success of companies in the automotive industry will largely depend on their innovative strength in the coming years. Autonomous driving, e-mobility and light-weight body construction are no longer a dream of the future, but are already a key influence on profit and loss. ZF Race Engineering knows the strengths of the automotive industry and sets the decisive parameters for its future viability.

We develop the feasibility study for your alternative powertrain, take over the quality management of your new product features or completely plan a project tailored to your individual requirement profile. Test engineers, software developers and production planners consistently pursue their goals. We adapt to your processes and at the same time support you in optimizing your processes. Design the mobility of the future with us.



Our quality management system is certified to DIN EN ISO 9001:2015 & DIN EN ISO 14001 ensures the highest level of process, planning and legal certainty across all contractual models of cooperation – regardless of whether you opt for temporary employment, a service contract, a work contract or direct placement of candidates. Regular internal audits form the basis to get even better – and always deliver the highest quality.

special series

Leading Automotive Products: The ZF Special Series Portfolio

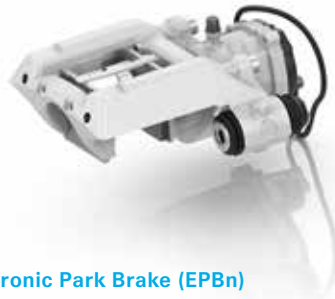
Our Special Series vehicle components are available both as unique products for prototype vehicle development and for volume production. On top of that, we offer expertise in product application and test support to help customers effectively integrate components into new vehicles.



CDC Shock Absorber

CDC® - damping for more driving safety and comfort. Continuous Damping Control solves the conflict between driving safety and ride comfort by setting the damper – and uncompromisingly. Whether fully loaded or only with the driver, the CDC®-system adjusts the optimum damping wheel-individually according to the driving situation.

This ZF technology is combined with our race derived high performance shock absorbers. On the front axle our in-house developed lift system can be used to overcome speed bumps or curbs.



Electronic Park Brake (EPBn)

The advanced system eliminates the need for mechanical cables. The compact EPB actuators electronically apply the park brake offering improvements in packaging, performance and driver convenience:

- Removes need for the cables greatly simplifying installation
- Leaves centre tunnel free for other features
- Independent dynamic braking (max. 0.3g)
- Satisfies park brake regulations
- Lightweight and compact
- Intelligent and safe electronic control
- Universal system designed for ease of installation

Additional features available such as auto apply & release, configurable logic or CAN bus integration.



Brake Actuation System

Our ZF Brake Actuation System combines a tandem brake booster with compact master cylinder and a remote reservoir, providing an easily integrated system that can be tailored to meet the requirements of high performance vehicles. As part of the Brake Actuation System, the Brake Booster provides a brake boost ratio of 5.5 and a performance curve based on our standard configuration.

- Tuneable performance
- High efficiency
- Low hysteresis
- Reduced threshold force with and without vacuum

Clutches

We are offering a wide variety of clutch systems for different applications:

- Push and pull type
- Single and multi-disc
- Several friction material combinations to suit your application

We can offer all components of the clutch system like clutch housing, disc with optional torsional damper, flywheel and releaser.



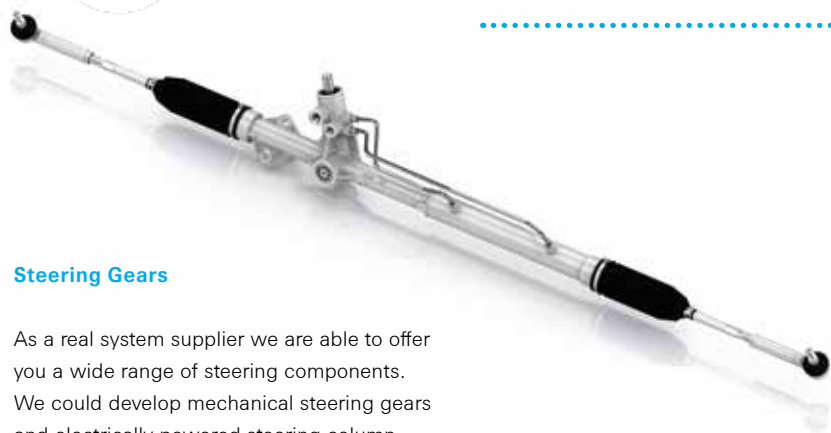
.....

This is just a selection of our Special Series product portfolio. If you are interested in other ZF products like gearboxes, safety technology or anything else get in contact with us.



Steering Pump

- Versatile thanks to its compensating reservoirs in different shapes and sizes
- Flexible flow rates at variable speeds
- Operating pressure up to 124.5 bar
- Improved controllability at high speeds with generally lower steering effort
- No connection to the CAN bus required
- Lower costs due to shorter development time and volume production



Steering Gears

As a real system supplier we are able to offer you a wide range of steering components. We could develop mechanical steering gears and electrically powered steering column drives for our customers. ZF's column drive electrically powered steering products are based on a modular, scalable design for A to C/D segment vehicles with up to 12 kN rack loads. This technology supports CO₂ reduction, fuel economy and automated driving.

special series

Tuning fueled by Passion

SACHS Performance products are the first choice for demanding car drivers. Their extraordinary resilience guarantees an unforgettable driving experience with maximum dynamics. ZF Race Engineering develops these high-performance tuning products of top quality combined with profound motorsports know-how. When only the best is enough – SACHS Performance Coilover Suspensions and reinforced Clutches.



Sachs Performance Coilover Suspensions

- German TÜV certified, "ready-to-install" solutions for sportive or tuned road vehicles
- Adjustable in height, bump and rebound
- Upside-down-design
- Best response behaviour by friction optimised sealings and proven valve parts





Sachs Performance Clutches

Reinforced clutches for:

- Chip tuning, turbocharger and supercharger conversions
- 1/4 mile-, hill climbs-, circular tracks such as endurance racing, club sports, autocross, rally racing, slaloms and drifts
- Vehicles with maximum payload or subject to high load



As prime features of SACHS tuning products, quality and high performance are a result of the company's years of involvement in the motorsports industry. It has been an equipment supplier for numerous race teams that have won over 100 races and made it to the podium more than 600 times. The comprehensive expertise gained on the toughest race tracks in the world has been directly applied to the development of SACHS Performance coilover suspensions and clutches, which means that even the most ambitious drivers are perfectly equipped with SACHS Performance tuning products.

A good feeling: ZF Technology for Motorcycles

Derived from ZF's expertise in pass car business we serve motorcycle manufacturers with customized products and solutions for vehicle motion control.

Enjoy the difference

Our products are available with numerous features: Passive and semi-active damping, manual and electronic spring rate and ride-height adjustment, load compensation function or simply as space-, weight- or cost-optimized units. Whatever you need, we have it! We only use state-of-the-art engineering, simulation and testing equipment in combination with high-strength materials and friction optimized components to ensure great driving experience over lifetime.





Let's define the future together

Based on ZF Race expertise in motorsport and niche business we daily search for innovations to set new standards in regards of performance, but also to find ways for saving the natural resources of our environment and to help preventing accidents.



motorbike

High-Tech on 2 Wheels: The ZF Motorcycle Products Portfolio

Our portfolio contains front forks, damping modules, steering dampers, ECU's and software for touring and adventure bikes, trial, enduros, roadsters, heritage and sports bikes and vehicles for urban mobility.



Front Fork Assemblies

- Front fork assembly available as:
 - Conventional design
 - Upside-down design
 - Open or closed cartridge
 - Non or manually adjustable (damping and spring preload)
 - Electronically adjustable
- Single leg or assembly with fork bridge and steering tube
- Low weight by high strength and light weight materials
- Best response behavior by friction optimized sealings and oil

Steering Dampers

- Steering damper available as:
 - Adjustable or non adjustable
- Highly scalable modular design
- Low weight by high strength and light weight materials
- Best response behavior by friction optimized sealings and oil





Damping Modules

- Damping module available with:
 - Manual damping control (low-speed, high-speed)
 - Electronic damping control (CDCi, CDCivo with or without OCV)
 - Manual or electronic ride height adjustment
 - Spring rate adjustment
- Monotube design for upside-down installation
- Low weight by high strength and light weight materials
- Best response behavior by friction optimized sealings and oil

Semi-active Suspension Systems

- Semi-active suspension system:
 - Front fork assembly
 - Rear damper module
 - ECU
 - Software
- Best motion control by electronic pass car valves (CDCi, CDCivo) combined with special OCV motorcycle valves (orifice control valves)
- Spring preload and ride height adjustable (manually or electronically)
- Spring rate adjustment as further option
- “Ready-to-install” solution



Innovative Engineering Services: The Technical Centre

Technical Centre, the engineering services provider at ZF Race Engineering, offers consultancy, test and analysis services to product development, production and validation functions world-wide.

Technical Specialists and in-house approved ISO 17025 test facilities gives our Technical Centre a unique capability to provide full engineering services from concept design, development and prototyping to testing and evaluation.





Advantages

Our experienced engineering teams work closely with our customers to define project requirements and scope, taking account of the skills and knowledge of both partners, whether for a part of or the entire product development pipeline. The Technical Centre's expertise in Consultancy, Product Validation and Product Reliability has enabled leading companies to deliver winning products in a diverse range of industries, including automotive, aerospace, defence, energy, healthcare and intelligent transport systems.



special series

Full Service Engineering



Consultancy Services

Technical consultancy and problem solving supporting the development of complex, intelligent, motion and mobility systems. Technology identification and evaluation, provision of technical capability, technical management and design analysis services.

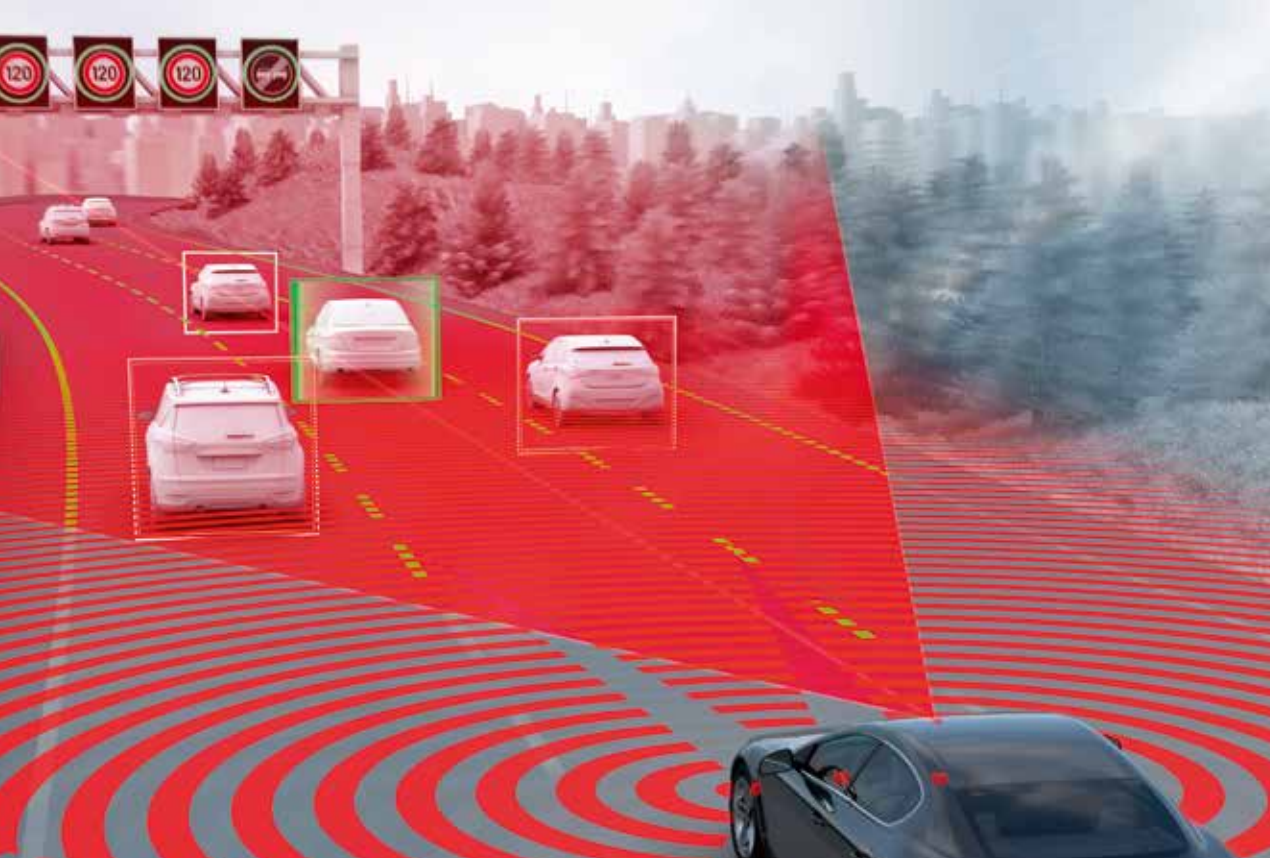
We provide fundamental technical capabilities to support the development of complex, intelligent, motion and mobility systems. Our services include technology identification and evaluation, provision of technical capability and problem solving, technical management and design analysis using flexible project methods of engagement, often with immediate availability.

With breadth of expertise in systems and safety engineering, sensor technologies, fusion and perception, embedded software and hardware design, advanced and robust control we are well placed to enable the See, Think and Act capabilities needed for increasingly electric, autonomous, safe and secure systems.

Product Validation

Our Technical Centre's expertise in new product development and applications engineering is supported by its state-of-the-art product validation facilities in Solihull, UK. With external ISO 17025 accreditation by UKAS, we are highly experienced in the areas of Environmental Testing, EMC Testing, Instrumentation, Prototyping and Advanced Test.

Our full testing, reliability and validation capabilities document is available or contact us to discuss your specific requirements. In addition to our certifications, UKAS accredited testing laboratory No. 0332, we also provide a range of testing support services. Our experienced test equipment design engineers are available to support all testing performed on or offsite.



Product Reliability

In-depth technical knowledge of reliability and failure analysis enables the Technical Centre to address a number of quality issues in product design and manufacturing. This allows customers to further improve the operational performance and integrity of their electronic and electromechanical products.

We provide reliability analysis services to enable our clients to improve the operating performance and integrity of electronic and electromechanical products. By combining a wide variety of skills in metallic and non-metallic systems and expert knowledge of materials processing and electronics manufacturing techniques with modern analytical methods, we are able to meet the most challenging client requirements.



Leaders throughout Centuries: Historical Milestones

- | | | | |
|-------------|---|--------------------|---|
| 2019 | ZF becomes "Official Powertrain Partner" of Mahindra Racing in Formula E.
First victory for the ZF all-electric drivetrain in Formula E at the Hong Kong E-Prix. | 2014 - 2016 | The FIA World Championships in WEC & WRC are won by ZF equipped vehicles once again. |
| 2018 | Dakar hat trick for Peugeot with shock absorbers and clutches from ZF.
20 year anniversary ZF Race Engineering. | 2013 | All FIA World Championships (WEC, WTCC, F1, WRC) are obtained with products from ZF. |
| 2017 | Porsche wins the 24 Hours of Le Mans with a ZF clutch for the third consecutive time. | 2012 | ZF provides the Audi R18 at the 24h race of Le Mans with a clutch and a special steering system. |
| 2016 | Integration of Conekt in Solihull UK into ZF Race Engineering. | 2012 | All three DTM teams are equipped with ZF clutches.
ZF partner BMW wins the manufacturer ranking of the DTM. |
| 2016 | ZF is an official technology partner of the Venturi Formula E Team. | 2011 | Volkswagen wins the Rally Dakar for the third time in a row with shock absorbers and clutches from ZF. |
| 2015 | ZF celebrates the 100 year anniversary after founding the company in the year 1915.
Merger and integration of the company TRW into the ZF group. | 2009 | The newly founded Team Brawn GP is equipped with rotational dampers from ZF; Brawn wins the world championship. |

- 2007** „Official Supplier“ relationship with the BMW Sauber F1 Team (rotational dampers).
- 2001** Conekt brand established
- 1999 - 2004** Ferrari and Michael Schumacher win a total of six constructors' championships with ZF shock absorbers.
- 1998** Foundation of Sachs Race Engineering GmbH.
- 1993** Debut of Sachs in the Formula 1 with Mercedes and Sauber.
- 1985 - 1986** The Porsche-Team of Joest Racing wins the 24h race of Le Mans with Sachs products, and defends the title in the following year.
- 1966** Opening of the Motodrome and the new Sachs curve at the Hockenheimring.
- 1965** Lucas Technical Centre opened in Shirley, UK
- 1964** Jim Clark wins the Grand Prix in the Formula 1 with the Lotus 33 R9, provided with ZF transmissions.
- 1937** The first Mercedes „Silver Arrows“ are equipped with Sachs shock absorbers and clutches.
- 1915** Foundation of ZF Friedrichshafen AG.
- 1895** Foundation of „Schweinfurter Präzisions-Kugellagerwerke Fichtel & Sachs“ by Ernst Sachs and Karl Fichtel.

ZF Friedrichshafen AG

ZF Race Engineering GmbH
Ernst-Sachs-Straße 62
97424 Schweinfurt
Germany
Phone +49 9721 98-4300
Fax +49 9721 98-4299
service.zre@zf.com

ZF Race Engineering
The Hub, Central Boulevard
Blythe Valley Park, Shirley
B90 8BG
United Kingdom
Phone +44 (0)121 506 5000
zfrace.uk@zf.com

ZF North America, Inc.
ZF Race Engineering
15811 Centennial Drive
Northville, MI 48168
USA
Phone +1 (734) 416-6200-7
NRT-Sales-ZRNA@zf.com

www.zf-race-engineering.com



[instagram.com/zf.motorsport](https://www.instagram.com/zf.motorsport)
[linkedin.com/company/zfraceengineering](https://www.linkedin.com/company/zfraceengineering)
[facebook.com/zfmotorsport](https://www.facebook.com/zfmotorsport)
[youtube.com/zffriedrichshafenag](https://www.youtube.com/zffriedrichshafenag)