



PORSCHE

Press Information

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Porsche 919 Hybrid LMP1 racecar

Innovative technology for 2014 endurance racing season

Porsche is returning to the top class of the 24 Hours of Le Mans and the World Endurance Championship (WEC) with the newly developed 919 Hybrid. The LMP1 prototype is the most technologically advanced racecar Porsche has produced and is designed for extreme efficiency throughout an endurance race. Serving as a research and development platform for technology to be used in future production models, the combination of two different energy recovery systems and a smaller turbocharged engine will be pushed to the extreme throughout 2014.

The World Endurance Championship (WEC) launches racing into a new era, beginning on April 20, at Silverstone in Great Britain and continuing in June at the 24 Hours of Le Mans, the newly formulated regulations for the LMP1-H prototypes will be rated in direct relationship to efficiency. The allowable fuel quantity available per lap has been reduced by around 30 percent compared to 2013 and the amount of energy the hybrid systems can produce has been significantly increased. This shifts innovative technology into the limelight and will translate to the street and to customer vehicles in the future.

Maximum efficiency is the number one goal

Porsche engineers are taking on the challenges of the WEC regulations with innovative solutions and using every resource possible. Porsche 919 Hybrid development began in the middle of 2011 on a blank sheet of paper. With a 16 year absence from the LMP1 class, Porsche engineers have had to develop the racecar without the same experience of their competitors. However, the experience acquired in racing the 911 GT3 R Hybrid and production of the 918 Spyder has directly translated to the 919 Hybrid.

The high efficiency of the Porsche 919 Hybrid is the result of a balanced overall concept. From the combustion engine to the energy recovery systems, suspension and chassis, aerodynamics and driver ergonomics, the sum of the components form an incredibly efficient unit for maximum performance.

The newly formulated WEC regulations gave Porsche developers greater flexibility if they chose a hybrid drive system for the LMP1 racecar. Their solution is a drive system based on

a 4-cylinder gasoline engine that is compact and lightweight. The 2.0 liter V-engine is a structural component of the chassis, and reaches a maximum engine speed of approximately 9,000 rpm. It features direct injection, a single turbocharger and thermodynamic recovery capabilities.

Two different energy recovery systems harness energy to replenish the batteries and provide power. The first system is the innovative recovery of thermal energy by an electric generator powered by exhaust gases. The second hybrid system is a motor on the front axle utilizing brake recuperation to convert kinetic energy into electric energy. The electric energy is then stored in water-cooled lithium-ion battery packs and when the driver needs the stored power, the front motor drives the two front wheels through a differential during acceleration. This gives the Porsche 919 Hybrid a temporary all-wheel drive system, because the gasoline engine directs power to the rear wheels, just like the 918 Spyder.

Powerful and customizable hybrid drive system

Intelligent management of electricity was a focus of the racing engineers who designed the 919 Hybrid. Efficient use of available power helps to achieve an optimal lap time. The driver can select several automated driving modes that effect vehicle dynamics. Race traffic, course layout and weather conditions are all taken into consideration when selecting the driving mode. The developers had a chance to experience these adverse conditions with the 911 GT3 R Hybrid during the running of the Nürburgring 24 hour race in 2010 and 2011.

The allowable fuel consumption depends directly on the amount of electrical energy the driver can use per lap, known as the Boost function. There are four classes of racecars with electric boost levels ranging from 2 to 8 mega joules (MJ). Porsche is developing the 919 Hybrid for the "Premiere class" with an energy recovery capacity of 8 MJ. This requires high-performance energy recovery and storage systems, which are larger and heavier than the other classes. A flow meter limits the amount of fuel flow creating a challenge to balance the hybrid system between the use of electric energy and gasoline engine power. For example, at the 24 Hours of Le Mans, the turbocharged gasoline engine is driven at full load for 75 percent of the 8.48 mile lap and only has 1.23 gallons of fuel available.

Lightweight and efficient

In motorsports and production models, Porsche has always devoted attention to the theme of a lightweight design. This continues to be the case with the Porsche 919 Hybrid despite the addition of many new technical systems, race regulations have reduced the specified minimum vehicle weight by 66 lbs. to 1,918 lbs. compared to the prior year. This ambitious requirement has Porsche engineers optimizing the smallest details, using the right material in the right place for the intended purpose, just like our production cars.

As in Formula 1 racing, the chassis of the new Porsche 919 Hybrid consists of a carbon-fiber monocoque, combining lightweight materials and a high degree of torsional rigidity. The multilink suspension and 14 inch wide Michelin race tires are an important prerequisite for performance in all conditions.

The Porsche 919 Hybrid must not exceed a length of 183.1 inches, a height of 41.3 inches, and the width must be between 70.8 and 74.8 inches. The aerodynamics have been analyzed during some 2,000 hours of wind tunnel testing since February 2012. The adjustable aerodynamics add to overall efficiency of the racecar, reduce air drag while supplying increased cooling needed for the hybrid drive, and increase down force needed for high speed corners.

Safe and functional working conditions for the driver

Driver ergonomics play a crucial role, especially in endurance races like the 24 Hours of Le Mans. The motorsports experts devoted attention to the layout of the cockpit. The drivers have improved outward visibility because of a higher seat position in the chassis compared to the previous LMP1 rules. LED four-point headlights specially designed provide clear visibility during night hours.. Their distinctive design was created in conjunction with Style Porsche, the design studio for production models. This modern lighting technology will benefit Porsche customers in the future.

Around 200 employees and 6 drivers look forward to the start of the season

In mid-May 2011, Porsche decided to return to the World Endurance Championship and the 24 Hours of Le Mans with a LMP1 factory team. Consequently, the motorsport center in Weissach was expanded considerably with a service garage and administration building. Today, around 200 employees participate in the engineering, construction and operation of the Porsche 919 Hybrid. Fritz Enzinger (57) assumes overall management of the LMP1 project. Responsible for technology is engineer Alexander Hitzinger (Dipl.-Ing., 42). Andreas Seidl (38) is team leader.

The cockpits of the two Porsche 919 Hybrid racecars are shared by experienced Le Mans Porsche drivers Timo Bernhard (Germany, 33), Romain Dumas (France, 36) and Marc Lieb (Germany, 33) as well as Brendon Hartley (New Zealand, 24), Neel Jani (Switzerland, 30) and former Formula 1 driver Mark Webber (Australia, 37).

The 2014 WEC season includes seven 6-hour races and the world famous 24 Hours of Le Mans (June 14th and 15th) as a season highlight. On Easter Sunday, the racing begins in Silverstone. After, Spa-Francorchamps in Belgium (May 3rd). Other world championship races on the schedule include Austin (Texas, September 20th), Japan (Fuji, October 12th), China (Shanghai, November 1st), Bahrain (Sakhir, November 15th) and Brazil (São Paulo, November 30th).

The team for the 919 Hybrid

The LMP1 team in Weissach includes over 200 people. It's a mixture of endurance racing experience, company expertise and fresh Formula 1 precision.

Fritz Enzinger, Vice President LMP1 (Austria, age 57)

This native of Styria was employed by BMW for thirty years. He had positions of responsibility in touring car victories at Le Mans 1999 and in Formula 1 successes. At the end of 2011, he switched to Porsche and began to build up the LMP1 project in Weissach. Building and organizing personnel and the vehicle from scratch was an irresistible challenge. Two goals spur him on: first, to create sustainable top tier sports organizational structures for the company. Second, to score a 17th overall victory for Porsche at Le Mans as quickly as possible. Raising Icelandic horses is his hobby for unwinding, and is a passion that he shares with his wife and daughter.

Alexander Hitzinger, Technical Director of LMP1 (Germany, age 42)

At the end of 2011, he left Formula 1 to join Porsche. He was fascinated by the opportunity to be part of the brand's continuing motorsport history. As technical director of the LMP1 team, the Bavarian is responsible for the development of the 919 Hybrid. The engineer has a long résumé of experience in various high-class motorsport categories including "Head of F1 Development" for the English racecar engine builder Cosworth and most recently "Head of Advanced Technologies" at Red Bull Racing. He is married and has two children.

Andreas Seidl, Team Principal (Germany, age 38)

What is fascinating about motorsport to Seidl, an engineer, is the immediate feedback that it offers. Every modification undergoes a stress test in competition and the test is public. This Bavarian can handle the pressure and the results are what count. He is enthusiastic about the team spirit and the perfect staging of a race weekend – in both its technical and organizational aspects. At BMW, Seidl was responsible for testing and race events in Formula 1 racing. When the company returned to DTM racing, he was the racing director

and immediately attained the championship title. At Porsche, the father of two found a new challenge.

Drivers of the Porsche 919 Hybrid

Timo Bernhard (Germany, age 33)

He knows how to win the most famous sports car race in the world. In 2010, he was part of the victorious Audi team at Le Mans together with Romain Dumas and Mike Rockenfeller. He wants to do that again. "To do this with Porsche would be awesome. It's impossible to describe my enthusiasm for the brand." Bernhard, who began his Porsche career in 1999 as a junior, has attained seven overall victories in 24 hour races – five times on the Nürburgring and once each at Le Mans and Daytona. Endurance racing is not his only passion: In 2013, he won a stage of the German Rally Championship in his homeland of Saarland, driving a 911 GT3.

Romain Dumas (France, age 36)

He lives and breathes Porsche. When the Swiss citizen by choice is not driving on the Porsche factory team, he is off on private missions, such as at Pikes Peak, in Macau or in the French Rally Championship, where he won four stages in 2013, driving a 911 GT3 RS. His résumé includes seven overall victories in 24-hour races – a Le Mans win in an Audi along with Timo Bernhard and Mike Rockenfeller in 2010, four times at the North Loop of the Nürburgring and twice at Spa in a Porsche. The Mediterranean is not far from his birthplace of Alès, and boats are another of his long cherished passions. Dumas' most recent passion, however, is named Gabin, who was born in late 2013.

Brendon Hartley (New Zealand, age 24)

From the generation of computer kids, a highly sought-after simulator driver with Formula 1 experience – a genuine racer. As a teenager, he left his home down under to pursue a professional career in Europe, which really took an upward swing in 2007 with the championship title in the World Series by Renault. As a Formula 1 test driver, he lacked competition, so Hartley turned to sports car racing. To him, the most emotional race in the

world is the 24 Hours of Le Mans. "A rollercoaster of feelings; never have I seen so many grown-up men with tears in their eyes."

Neel Jani (Switzerland, age 30)

A Swiss citizen with Indian roots is an experienced endurance driver who was hooked on Porsche even as a child. Sunday excursions in the back seat of his father's 911 helped shape his future. Formula Renault, Champ Car World Series, victory in the A1GP series, and several years as a Formula 1 test driver add to his experience. Jani, who lives in the Swiss city of Port with his wife Lauren, drove in his first Le Mans race in 2009. In 2011, he won the Le Mans Series with Rebellion; in 2012, he just missed the podium at Le Mans, finishing overall in fourth place, once again in the LMP1 Rebellion. "At Le Mans, it is only possible to compete for the overall victory with a top factory team."

Marc Lieb (Germany, age 33)

As a 20-year-old, the native of Stuttgart won the Porsche Junior Driver Selection. Ever since, he has celebrated Porsche victories across the globe, including five overall victories at 24-hour races: four times at the Nürburgring and once in Spa. At Le Mans, he won in the GT class with Porsche and now he wants to compete in the top class. The young father of two has not only applied his talents to the development of racecars, but his services as a vehicle technology engineer were also highly appreciated in the development of the 918 Spyder. In autumn 2013, he set the production car course record on the North Loop of the Nürburgring with the super sports car.

Mark Webber (Australia, age 37)

This Formula 1 star has 215 Grand Prix races under his belt, 13 pole positions and nine victories, has once again taken up the challenge of sports car racing. Born in Queanbeyan (New South Wales), he moved to England in 1996. Formula Ford, Formula 3, sports cars, Formula 3000, Formula 1 make up his experience. The outdoor sports enthusiast still has a score to settle at Le Mans. In 1999, he rolled over twice in his AMG Mercedes CLR due to an aerodynamic problem. What Porsche means to him: "Super highly developed sports cars

that can make do without overstatement, perfect in every mood and in every scenario." He lives with Ann Neal and several dogs in Aylesbury (UK).

Porsche 911 RSR

2014 season begins with a class win in Daytona

In its first appearance at the 2013 24 Hours of Le Mans the Porsche 911 RSR placed first and second in the GT-Class. The GT racer from Weissach has been further improved in many aspects for 2014 and it started the 2014 season with a class victory at the Rolex 24 At Daytona.

The 911 RSR is raced in the new TUDOR United Sports Car Championship as well as being part of the WEC World Sportscar Championship series, including the 24 Hours of Le Mans. The 470 hp 4.0 liter 911 RSR is the successor to the 911 GT3 RSR, which Porsche customer teams have driven to numerous victories and titles all around the world in endurance championships since 2004, including finishing first and second in their racing debut last year at the 24 Hours of Le Mans. The rear wheel drive 911 RSR is based on the seventh generation of the 911 Carrera, type 991. Its wheelbase has been lengthened by 3.9 inches and a new wishbone front suspension replaces the previously used MacPherson strut. The lightweight racing gearbox is a special new development by Porsche Motorsport; the six gears are shifted by paddles on the steering wheel.

A central focus in the development of the 911 RSR was to attain balanced weight distribution. The center of gravity is significantly lower than the previous model. Carbon-fiber is used in the front and rear fenders, front and rear lids, the doors, underbody, wheel arch panels, rear wing, dashboard and center console. In addition, all windows are made of very thin and lightweight polycarbonate. The familiar lightweight lithium-ion battery of the GT street models also makes a contribution towards weight savings.

Designed for shorter pit stops

The look of the new 911 RSR is marked by broad flared fenders and a deep cooling air duct in the front bumper. The new air flow system enables a centrally located radiator at the front, which operates even more efficiently than in the previous model. Climate control of the interior was also made more efficient. For enhanced service and shorter repair times, a quick-change concept for body parts was tuned for endurance racing. The nose, front lid and rear apron are attached with quick-action clips and can be replaced within a few seconds.

The static cornering lights are positioned low in the front end improve the driver's view through corners. This improves night driving safety. The reflective labels on cockpit controls, combined with anti-glare interior lighting, provide for optimal legibility in darkness. The layout of switches on the new steering wheel was developed together with the Porsche factory drivers. From the beginning, they contributed their wealth of experience in the design of the 911 RSR.

Numerous improvements

The 911 RSR has a redesigned front end and the new rear wing provide for optimal aerodynamic balance and contributes to greater stability. Even more precise steering response leads to better vehicle handling at slow to moderate speeds and was attained by optimizing front suspension kinematics. Further improvements to the structural rigidity result in more precise steering response. The new engine air intake system was optimized with a new air filter geometry, which contributes towards reducing the effects of contamination on power output. The new FT3 safety fuel tank has a lowered center of gravity and enables improved filling under race conditions.

Live telemetry that is permanently transmitted to the command station via the car's roof antenna ensures that engineers are always well informed of all relevant vehicle data with over 200 measurement values. In addition, all data is stored on a memory card in the vehicle.

"The 911 RSR was further optimized in many aspects. The wide rear wheel rims and refined aerodynamics have improved consistency over a sprint," says Porsche factory driver Jörg Bergmeister. "This is undoubtedly the best 911 that I have ever driven. It still always feels like a 911, but it can do practically everything better than the previous model. And on top of that, it is also in my eyes the most beautiful and most spectacular 911 ever." His teammate Patrick Pilet adds this: "Last season, we strove constantly to develop the car further. The better weight distribution, in particular, has had a positive effect on performance. The 911 RSR is now more stable over the rear axle and gives the driver a greater sense of trust. This allows the driver to probe performance limits faster."

The team for the 911 RSR

Hartmut Kristen, Vice President Motorsport (Germany, age 59)

He had already worked at Porsche for 20 years before he became head of the Motorsport division in 2004 after ten years of heading up the customer sport car program. Ever since, he has not only been successful in making his mark in racing with the RS Spyder and the 911 GT3 R Hybrid, but today he is responsible for the global activities of Porsche in the GT classes including global customer sport activities, which are “the backbone of Porsche Motorsport.” He creates opportunities for promising talent. Under his guidance, Porsche has certainly developed the most extensive program of support for new motorsport drivers. In 2013, he led the factory team of the new 911 RSR to first and second place finishes in its class at Le Mans, while he and his team kicked off the 2014 season with a victory of the further advanced 911 RSR at the Rolex 24 at Daytona.

Dieter Georg Steinhauser, Director Motorsport Development (Germany, age 55)

He sees new tasks primarily as a challenge. As manager for all technology in motorsport and in sports cars (except LMP), he and his team have already initiated many projects that have attracted attention. The GT3 R Hybrid is an example and was “highly innovative and exciting.” The veteran Porsche manager has been with the company since 1984 and worked on Indy and Formula 1 engines. He has advanced the development and successful implementation of the RS Spyder sports car prototypes in the USA and at Le Mans in his role as overall project manager. And then there was the GT1-98, the car that Porsche used to achieve its most recent overall victory at Le Mans in 1998.

Drivers of the Porsche 911 RSR

Jörg Bergmeister (Germany, age 38)

Of all the successes that Jörg Bergmeister has already celebrated with Porsche, it is primarily the victories in the major endurance races that make him especially proud. Le Mans, Daytona, Sebring, Nürburgring, Spa; they are all part of the success statistics of the tall fair-haired driver. In 2000 he won the Carrera Cup Germany and in 2001 the Porsche Supercup. Afterwards, he was named a factory driver. His collection of titles speaks for itself. He even set a record with five wins in the popular American Le Mans Series; in 2006 he won championship titles in both the Le Mans and Grand-Am series, a feat that only he has ever pulled off.

Marco Holzer (Germany, age 25)

In motorsport the training years are not always the winning years. Marco Holzer, who was sponsored as a Porsche Junior in 2008 and joined the Porsche factory team in 2011, certainly knows a thing or two about it. The golden boy, who celebrated an overall victory at the 24-hour race in Dubai in 2010 and a year later successfully drove the first hybrid racecar from Porsche at the endurance classic on the Nürburgring, showed maximum flexibility in his racing efforts with customer teams across the globe. Now he is getting the opportunity of his life. He says: "I have always dreamed of driving for the Porsche factory team at Le Mans."

Richard Lietz (Austria, age 30)

His victory with the 911 RSR at the Rolex 24 At Daytona was a season opener entirely to his liking. The Austrian, who has been a Porsche factory driver since 2007 and participates in rally's and ice races in his free time with as much virtuosity. In the previous year, he celebrated his second Le Mans victory since 2010 and is looking for a third victory to follow in June. This time, starting at Le Mans would be icing on the cake for him, because his primary goal is to win the championship title for Porsche at the new TUDOR United Sports

Car Championship in North America. He has already made a good start with his victory in Daytona.

Frédéric Makowiecki (France, age 33)

His ambitious efforts and patience in trying to win the Porsche Carrera Cup in France show just how much his heart beats for Porsche. Twice he had to settle for second place and once he finished third, before finally winning the long sought-after title in 2010. Even back then, he had a reputation as one of the world's fastest GT drivers. He proved this in high-caliber championships such as the FIA GT1 world championship, where he finished second in 2012, and in the WEC. He now returns to his roots as a Porsche factory driver. "To drive for Porsche," he says, "is exactly what I have always wanted to do."

Patrick Pilet (France, age 32)

He is a man for all seasons. Regardless of which championship Patrick Pilet is racing, he is always in the hunt for a victory. In the American and European Le Mans Series as well as the International GT Open, he won the Rolex 24 At Daytona in 2014 and the 24 hour race in Dubai in 2010. He was also named Carrera Cup France champion in 2007. Only at the WEC has he not climbed to the top step of the victor's podium yet. This season, he wants to fix this situation, preferably at Le Mans. "For a Frenchman," he says, "a victory at Le Mans is as valuable as a victory at Wimbledon for an English tennis player. There is nothing greater."

Nick Tandy (Great Britain, age 29)

The Brit started the new season just like he ended the last one, with a great victory. In October 2013, he won the Petit Le Mans at Road Atlanta and in January 2014 he won the Rolex 24 At Daytona with Patrick Pilet and Richard Lietz. In 2011, he was the overall victor in the Carrera Cup Germany and in 2012 he won the Porsche Cup as the most successful private driver in a 911. In the following year, he was named a factory driver. He wants to fulfil his next dream at Le Mans.

Technology proven at the racetrack and implemented on the street

The DNA of a racecar in every Porsche

Back in 1951, the first sports car from Zuffenhausen was sent to race at Le Mans and the knowledge acquired during competition has benefited Porsche street cars ever since then. Technology such as dual ignition, disc brakes, the dual-clutch transmission and powerful hybrid drives were first proven on the racetrack before being introduced to the street. As a result, there is the DNA of a racecar in every Porsche.

Mid-engine, synchronization, dual ignition

The Porsche 550 was created for the company's first factory racing program and it won the 1953 Nürburgring race. The horizontally opposed 4-cylinder mid-engine Spyder design was agile and an important advancement for future products. In 1996, the mid-engine concept was continued in the Boxster. A five-speed transmission with Porsche synchronization was used in the 550; it is similar to the transmission introduced to the 1963 911. Two spark plugs were used per combustion chamber in the 550 for better combustion; this dual ignition was introduced to Porsche production cars in 1988 in the 911 Carrera (type 964).

Trailing edge, duck tail, active aerodynamics

Ferdinand Alexander Porsche sketched the 1963 904 Carrera GTS with a trailing aerodynamic edge at the rear of the car. The first front spoiler was introduced on the 911 S in 1971. It accelerated air flow under the vehicle, diverted a portion of the air to the sides and this reduced lift at the front of the car. In 1972, the Carrera RS 2.7, which was designed for motorsports, set new standards. Not only was it equipped with a front lip that extended low to the ground, but it had a distinctive spoiler over the engine lid, the legendary "duck tail." However, the phenomenal technology platform of the 1970s, in terms of aerodynamics, was the Porsche 917. The 12-cylinder racecar was built in two versions; one with a short rear section and high down force for race courses with lots of turns and one with a long rear section with less drag intended for high-speed. To increase down force in corners, adjustable flaps were added at the rear and connected to the suspension. When the driver steered into a corner, the flap above the unloaded rear wheel at the inside of the corner

would be extended to increase wheel load and, improved stability. This is the first step taken towards active aerodynamics, which Porsche introduced to production cars in 1988 with the automatically extending rear spoiler of the 911 Carrera. On the 2014 911 Turbo, the Porsche Active Aerodynamic (PAA) system is used to adjust the rear wing and for the first time the front spoiler. The extensive system of adjustable aerodynamic elements in the 918 Spyder represents pure racing technology on the street.

Turbocharging and intercooling

For the American Can-Am series, Porsche further developed the 917 into a Spyder, but the 560 hp output of the 4.5 liter V12 engine was inferior to the 750 hp engine giants of the U.S. competition. Porsche reacted and developed both a 16-cylinder engine and a forced induction system for the 12-cylinder engine. The pressure buildup of the charging air would be regulated to make it suitable for high dynamic load changes and speed changes in the racing engine. The engineers turned away from increasing charge pressure in the induction air system, opting instead for the use of turbocharging. Undesirable excess pressure was diverted from the charger via a bypass valve. The 917/10, initially with 850 hp, was the dominating racecar of the Can-Am series in 1972 and the introduction of turbocharging to Porsche production sports cars became legendary. The 911 Turbo went into production in 1974. Meanwhile, turbocharging technology in the 917/10 went one step further with intercoolers that reduced the temperature of the compressed air for increased power. The 911 Turbo 3.3 benefited from this technology in 1977.

Porsche Doppelkupplungsgetriebe

Back in 1964, Porsche worked on a power shifting dual-clutch transmission. Four years later, tests were conducted on an automatic four-speed transmission based on the dual-clutch principle and other designs followed in 1979. Finally, the Porsche Doppelkupplungsgetriebe (PDK) was created in 1981. In 1986, the electronically-controlled power shifting spur gear transmission was tested in the Group C Porsche 956 racecar as well as in production sports cars. The ability to offer shifting without interruption in the flow of power was especially advantageous for turbocharged engines, because the driver could continue to push the accelerator pedal during shifting to avoid a drop in charge pressure.

Initial tests of the direct shifting transmission were conducted in 1983 in the Group C Porsche 956 racecar. In 1986, the 962 C PDK won the World Championship race in Monza. Progress in the engineering of the control electronics finally enabled the introduction of the PDK to production cars. In 2008, Porsche introduced PDK in the 911 Carrera.

All-wheel drive control

The 959 development began in 1983 for what was known as Group B at that time and had an advanced all-wheel drive system with variable control of the center differential lock; it controlled the distribution of torque between the two axles as a function of load and friction at the wheels. This system proved to be so successful that Porsche developed it further and adapted it for use in the Carrera 4 in 1988. To optimize vehicle dynamics further, the engineers equipped it with a torque distribution of 31 to 69 percent (front to rear axle). The system had a hydraulically activated locking center differential and a transverse locking differential for nearly step-less adjustment of the distribution ratio. Its operation was controlled by electronics that embodied technology from the 959.

Racecars with hybrid drives

In 2010, Porsche nearly achieved a race upset with its 911 GT3 R Hybrid that lead until just two hours before the end of the 24-hour race on the Nürburgring. This 911 GT3 had power output of 465 hp from a horizontally opposed 4.0-liter 6-cylinder rear engine and two electric motors at the front axle, each producing 75 kW of power. This innovative electric front wheel drive was of the test bed of the hybrid system of the 918 Spyder, which includes an electric motor at the front axle. The 919 Hybrid will be the next research and development tool with this technology.

Porsche motorsport innovations for production cars

Technology	First use in a racecar		Year introduced to a production model *(not model year)*	
Transmission Ring synchronization	1952	356	1952	356
Dual ignition	1953	550	1955	356 A 1500 GS Carrera
Five-speed gearbox	1955	550 A Spyder	1963	901/911
Mid-engine	1955	550 Spyder	1963	904 Carrera GTS
Disc brakes, internally gripping	1959	356 B 1600 GS Carrera GT	1961	356 B Carrera 2
Multi-joint rear axle	1961	718 RS 61 Spyder	1977	928
Fuel injection	1964	904/8	1968	911 E, 911 S
Internally ventilated brake discs	1965	Porsche 906-8 Mountain Spyder	1966	911 S
Polymer fuel tank	1967	911 R	1973	911 E, S, RS, 2.7
Active aerodynamics	1969	917	1988	911 Carrera
Disc brakes, perforated and internally vented	1970	908/03	1974	911 Carrera RS 3.0
ABS	1968	908/02	1983	928 S
Automatically adjustable chassis stabilizer	1971	917	2007	Cayenne Turbo (PDCC)

Turbocharging with bypass valve	1972	917/10	1974	911 Turbo
Four-piston aluminum brake calipers	1973	917/30	1977	911 Turbo 3.3
Intercooling	1974	917/10	1977	911 Turbo 3.3
Four-valve cylinder head, water-cooled	1978	935-78	1985	928 S
Tire pressure monitoring system (TPMS)	1980	924 GTP Le Mans	1988	928 S4
Aluminum monocoque (mixed construction)	1981	956	2011	911 Carrera
Monobloc aluminum brake caliper	1982	956	1996	Boxster
Motronic	1982	956	1983	911 Carrera 3.2
Porsche Doppelkupp- lungsgetriebe (PDK)	1984	956	2008	911 Carrera
All-wheel drive control	1983	959	1988	911 Carrera 4
Damping and levelling control	1983	959	2005	911 Carrera S
Titanium connecting rods	1983	959	1983	911 Carrera

Metal catalytic converter	1990	944 turbo Cup	1990	911 Turbo
Ceramic brakes	1991	962	2001	911 Turbo S
Carbon-fiber monocoque	1998	911 GT1-98	2003	Carrera GT
Hybrid drive with e-motor on front axle	2010	911 GT3	2013	918 Spyder

A proud history

Porsche at the 24 Hours of Le Mans

Porsche has an extensive history at Le Mans. From 1951 to today, Porsche has raced at the 24 Hours of Le Mans without interruption. It is still the record holder on the Sarthe with 16 overall victories. Porsche is continually reasserting its claim of proving the performance capabilities of technical innovations in motorsport and transferring them to production cars.

When the new Porsche 919 Hybrid rolls toward the starting line on June 14, 2014, at 3 p.m., they will be following the tracks of other Porsche icons. On the 8.48 mile Le Mans course, Porsche history has become legendary. Winning models like the radical 917, the nearly indestructible 935 and the 956/962 winners have long become motorsport icons.

In June 1951, just three months after the first production cars were assembled in Stuttgart-Zuffenhausen; Porsche launched the 356 SL (Super Light). Its premiere was a success with Auguste Veuillet and Edmond Mouche who won in their class. 101 other class victories have followed to date.

In 1968, the 370 hp 908 would be the first Porsche to take the pole position. In 1970, Porsche celebrated its first overall victory with the legendary 917, when Hans Herrmann and Richard Attwood got the checkered flag after completing 2,863.16 miles or 343 laps of the course. 28 years later, Porsche scored its most recent win with Allan McNish, Laurent Aiello and Stéphane Ortelli in a 911 GT1-98.