

I.D. R Pikes Peak Guide to a new era in motorsport



Dear media representatives,

electromobility plays a central strategic role for Volkswagen. Fully-electric vehicles are an important part of the mobility of the future, and Volkswagen is working hard to develop topclass products for customers all over the world.

Nowhere is technical development progressing at such a high speed, nor ground-breaking innovations as sought-after as in motorsport. Production has always benefitted from the ideas, experience and findings acquired under competitive conditions. Major innovative advances are possible and particularly valuable in the field of electromobility, which is a highly dynamic development area. Today, we are unveiling the Volkswagen brand's first fullyelectric racing car, which will tackle the iconic hill climb on Pikes Peak. The I.D. R Pikes Peak embodies an uncompromising sports car, which combines performance and efficiency in a unique form. The I.D. R Pikes Peak is also a forerunner: The I.D. family, a new generation of fully-electric vehicles, will be launched in 2020. The fact that it also bears the letter "R" in its name is no coincidence – at Volkswagen, it is synonymous with performance-optimised vehicles, which will also be available with electric drive in the future.

It is now my pleasure to invite you to discover more about the I.D. R Pikes Peak in the following pages.

Dr. Frank Welsch Member of the Board of Management of the Volkswagen Passenger Cars brand with responsibility for "Technical Development"

#ChargedToThePeak, energised to the max

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Charged to the peak

Volkswagen travels to Pikes Peak with its sights set firmly on setting a new record for electric cars with a fully-electric super sports car: The Volkswagen I.D. R Pikes Peak.

A new era has begun for Volkswagen in motorsport: The brand has unveiled its fully-electric super sports car – the I.D. R Pikes Peak. With 500 kW (680 PS), 650 Nm of torque and weighing less than 1,100 kg, the super sports car will take on the iconic Pikes Peak on 24 June 2018. The goal: To set a new record for electric cars at the "Race to the Clouds". Following its record attempts with the legendary twin-engine Golf in 1985, 1986 and 1987, Volkswagen now returns with the first fully-electric racing car from Wolfsburg – also featuring a twin-engine solution. The brand has a score to settle on Pikes Peak – last time out, in 1987, the twin-engine Golf and its driver Jochi Kleint (D) came within a couple of corners of snatching sporting glory.

Compact but intense test programme for the I.D. R Pikes Peak

It is one of the unique challenges on Pikes Peak: Testing on the route of the hill climb in Colorado Springs is only very limited, and only possible on certain sections. For this reason, the bulk of the testing is not done on the actual route, but at racetracks. After the unveiling of the car in Alès on 22 April – a good two months before the record attempt – Volkswagen's Pikes Peak programme enters the next, crucial phase.

The big day: 24 June 2018!

A distance of just short of 20 kilometres, 1,440 vertical metres of climbing, 156 corners, and just one single attempt – not only must the technology and driver be on top form as they attempt to set a new record for electric cars on 24 June 2018, but the external conditions must also play ball. It is not unheard of for the summit of Pikes Peak, the end of the hill climb, to experience temperatures below freezing point at the end of June.



Announcement of the project

31/01

Signing of Romain Dumas 19/03

Publication of the first graphics



World premiere of the I.D. R Pikes Peak 24/06 Pikes Peak International Hill Climb 2018

A model athlete: The Volkswagen I.D. R Pikes Peak



Concept

A Pikes Peak super sports car

Wheelbase: 2,850 mm

Track width 1,600 mm

> Length/width/height: 5,200/2,350/1,200 mm

Total weight: < 1,100 kg (incl. driver)

Tyres: Michelin 31/71-18

Design: Safety/crash structure at front, carbon monocoque with steel roll cage

Under the shell



Permanent four-wheel drive with active torque distribution

> Fully-electric engine

Acceleration: 0–100 km/h in 2.25 seconds*

* depending on grip level

Driven to the summit

The Volkswagen I.D. R Pikes Peak is a pioneering technological feat, hunting down records with an intelligently designed overall package.

Pioneering technical performance requires free thinking to become reality. That is why the I.D. R Pikes Peak is driven by the vision of cutting-edge electric technology, running at maximum efficiency. Volkswagen has opened up a whole universe of possibilities beyond the search for improved performance and the yearning for energy that is inherent in motorsport. And this has resulted in the development of a groundbreaking prototype.

19.99 kilometres, including 1,440 metres of elevation, in just nine minutes. Just one attempt. But with a clearly-defined vision and no restrictive regulations. Starting from a blank sheet of paper and daring to think the impossible and produce pioneering technical performance – that is every engineer's dream. "Developing a car specifically for these 20 kilometres is really something special for engineers," says François-Xavier Demaison, known simply as "FX", Technical Director at Volkswagen Motorsport and responsible for the development of the Pikes Peak car.

This work has produced an all-electric Volkswagen prototype that is the antithesis of a muscle car. It is more like a wiry

electric sports car with plenty of high-speed strength – to stay in the picture. The primary objective was not just to achieve the maximum level of performance, but to reach the ideal balance between energy capacity – and therefore weight – and applied power. Volkswagen's prototype for Pikes Peak deservedly bears two seals of quality. The "R", to represent performance vehicles. And the "I.D." – emblematic of smart, future-oriented line of products.

The engineers followed the template of the spectacular Twin-engine Golf from the years 1985, 1986 and 1987, selecting a solution with two drive sources. The I.D. R Pikes Peak is powered by two identical electric motors delivering a system performance of 500 kW (680 PS)

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> François-Xavier Demaison, Technical Director Volkswagen Motorsport

Charging to the peak – when designing the I.D. R Pikes Peak, the engineers strived to find the perfect balance between power and weight



Technology

Competing in the prototype class allows technical freedom

The I.D. R Pikes Peak will be competing in the "Unlimited" prototype class at the "Race to the Clouds". And justifiably so: this allows total freedom without restrictive technical regulations. The safety regulations are the only exception to this, as these demand that the same criteria be met as for the formula cars. Vehicle dimensions, rating the performance of the electric motors, aerodynamic design, sizing the energy storage system – the Volkswagen engineers did not have to take any restrictions into account in these areas when defining their ideal concept. Their philosophy: the most lightweight construction possible to reach the summit – perfectly balanced with applied performance.

A savvy power source: battery technology

Lithium-ion batteries are used as the energy storage system – just as in the construction of electrically-driven production cars. The battery cells must deliver high performance: their power density is the decisive criterion in the high-voltage area of the system. Unlike with series production, the motorsport engineers are not asked to achieve the maximum range possible, "On Pikes Peak, we need the batteries to provide the best power density they can. That is different to the electric vehicles that you see every day. Their energy density must be high enough to generate a larger range."

> François-Xavier Demaison, Technical Director Volkswagen Motorsport

but could concentrate on achieving the highest power output figures over the 20 kilometres to Pikes Peak – literally driving the battery technology to the summit in new ways. "On Pikes Peak, we need the batteries to provide the best power density they can," explains Demaison. "That is different to the electric vehicles that you see every day. Their energy density must be high enough to generate a larger range."

In the eternal interplay between power and weight, simulations were used to determine the ideal battery weight and motor performance, as battery performance must be balanced against the performance of the motor. At a hill climb such as Pikes Peak, with an altitude difference of 1,440 metres between the start and finish lines and an average gradient of seven percent, ►

the weight of the vehicle is enormously important. Storing more energy means a heavier battery, which increases the weight of the overall system. More weight requires the motors to provide more power. Volkswagen Motorsport used these parameters as the basis for calculating the ideal set-up for the record attempt. The race version of the I.D. R Pikes Peak weighs in at under 1,100 kg, including the driver – depending on the battery configuration in use.

Record attempt generates a fifth of the electrical energy itself

Around 20 percent of the electrical energy required is generated during the 20-kilometre run itself – thanks to the recovery of energy generated during braking, which can be used by the driving motors. When braking, some deceleration is achieved by the mechanical effect of the brake discs and some is provided with the support of the electric motors, which simultaneously act as generators in this case.

Intensive cooperation with technical departments in Wolfsburg

A rapid charging system means that the time required to charge has been reduced to 30 minutes. During development of the integral batteries for the I.D. R Pikes Peak, Volkswagen Motorsport benefited from the expertise of the technical departments for e-mobility in Wolfsburg. "The Technical Development department of Volkswagen has the right workshops and laboratories to perform a range of various stress tests on the batteries," explains Demaison. "They also have plenty of experience in the area of high-voltage technology. You have to be

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I.D. R Pikes Peak

Aerodynamics

When it came to aerodynamics, Volkswagen was able to call on resources within the group. The decision was made in favour of a closed prototype, which had the ideal prerequisites for Pikes Peak. Sure, the components still have to be cooled down with an electric drive system – but not to the same degree as with a combustion engine. As such, it was possible to do away with many air inlets, which have a negative effect on aerodynamics.

20 %



The I.D. R Pikes Peak will not just consume electricity during its record attempt on Pikes Peak – it will also generate about 20 percent of the energy required itself during the race. During braking, the electric engines are used to achieve the most efficient deceleration possible – at the same time, they also act as generators.



Charging time: 30 minutes

Rapid charging is a hot topic with electric cars. Thanks to specially-developed rapid charge technology, it takes just 30 minutes to fully charge the Volkswagen I.D. R Pikes Peak. This was made absolutely necessary by the regulations: For example, should the race be suspended during a record attempt, the team affected has just 30 minutes to be back ready on the start line.

		Combustion engine	Electric drive
0, ,	4,302 m (Finish line)	57%	100%
	2,862 m (Start line)	71%	100%
	0 m (Sea Level)	100%	100 %

Effects of altitude

As the altitude increases, air pressure decreases – as does the oxygen content in the air. For this reason, the performance of combustion engines decreases in proportion to the lower oxygen content – compared to the figures at sea level, engine power decreases by 29 percent at the start line on Pikes Peak, and by 43 percent at the summit. That is not the case with fully-electric drive technology, which can call on 100 percent system performance throughout the entire distance on Pikes Peak.

Acceleration from 0 to 100 km/h:

The Volkswagen I.D. R Pikes Peak is fast – faster, for example, than comparable concepts in Formula E and the pinnacle of motor racing, Formula 1. It accelerates from 0 to 100 km/h in just 2.25 seconds.*



aware of special requirements for cabling and insulation. It was a massive help to be able to make use of that. Conversely, we were able to use our experience of competitive racing and this very specific use case to provide our colleagues in Wolfsburg with supplementary information."

In addition to battery technology, this included valuable information and developments regarding battery management – such as charging technology and battery monitoring during the charging process. "That is an electronic development that can certainly be applied in other areas," says Demaison.

The I.D. R Pikes Peak represents pioneering work by Volkswagen. On 24th June 2018, the goal is to beat the current record for electric vehicles at this mountain of mountains in the world of motorsport. The record is currently 8m 57.118s, set by Rhys Millen in 2016.

* depending on grip level

Countdown to the future

The I.D. R Pikes Peak racing car is the motorsport ambassador for a whole family of electric-powered Volkswagen production vehicles. Its name: I.D.

The growth of cities around the world, the shortage of fossil fuels, and climatic changes bring with them new challenges. The I.D. range of fully-electric vehicles is one of Volkswagen's responses to these challenges.

A compact, five-door limousine with a range of up to 600 kilometres* will get the ball rolling in 2020. I.D. is based on Volkswagen's Modular Electrification Toolkit, MEB for short. Via Volkswagen's Home-Net, it will be possible to network the I.D. with one's flat or house, in order to be able to control certain functions remotely while on the move.

The range will be expanded with the I.D. CROZZ, which combines the authority of an SUV with the dynamics of a coupé. The 4MOTION four-wheel drive is achieved through an engine on both the front and rear axle. The range is up to 500 kilometres*.

* according to the New European Driving Cycle (NEFZ)
I.D., I.D. CROZZ, I.D. BUZZ und I.D. VIZZION – concept vehicles are not offered for sale, and therefore Directive 1999/94 EV does not apply

22|23

The interior of the I.D. CROZZ has been developed from scratch. The so-called "Open Space" offers a generous amount of space and highly variable seating concept. The I.D. CROZZ has no B-pillar, allowing the large swinging and sliding doors to open wide.

The CleanAir system, developed by Volkswagen, ensures that the air inside the car is always clear, regardless of conditions outside. A voice assistant makes it possible to open and close doors and activate the fully-automated "I.D. Pilot" mode by voice command.

The I.D. BUZZ is a multi-variable e-van with a fully-automated driving mode. The spacious van, with up to eight seats and two luggage compartments, is capable of a range of up to 600 kilometres*.

The I.D. BUZZ has special LED headlights, which react similarly to eyes. They open when the car is started. When the I.D. BUZZ registers people at the side of the road, it looks at them. The steering wheel has also been completely rethought. The inner area has a form of touchpad with capacitive sensors. The I.D. BUZZ is navigated using an AR head-up display.

And finally, the I.D. VIZZION is a concept sedan for the premium sector. With a range of up to 700 kilometres*, the I.D. VIZZION is also set up to allow autonomous driving.



"As with the Volkswagen brand's production vehicles, fully-electric racing cars will also play an increasingly important role for us in the future"

> Sven Smeets, Director Volkswagen Motorsport



Bring on the future

Volkswagen Motorsport has enjoyed success with conventional racing cars for decades. Electric drive is a new challenge for the engineers.

They designed the Race Touareg, which won the Rally Dakar on three occasions. The Polo R WRC and Polo R Supercar – holders of 14 world titles between them on the rally and Rallycross scene – are also their work. However, as well as efficient and, despite intelligent downsizing, powerful combustion engines, the engineers at Volkswagen Motorsport have for some time now been dedicating their efforts to another form of engine technology – electric drive.

"As with the Volkswagen brand's production vehicles, fully-electric racing cars will also play an increasingly important role for us in the future," says Sven Smeets, Volkswagen Motorsport Director. With this in mind, the facilities at the workshops and development laboratories in Hannover, the home of Volkswagen Motorsport, were upgraded at an early stage. The employees were also given the necessary training for the tasks ahead.

The I.D. R Pikes Peak has been an extremely demanding introduction for the technicians, who have started from scratch. Not only does the electric drive represent a new challenge, but they were also lacking any previous experience in the Prototype vehicle category. "The cooperation within the group really helped us, particularly given the tight schedule. We received support from the Volkswagen battery plant in Braunschweig and worked together with the technical development department in Wolfsburg," says Smeets.

The next projects are already on the horizon. Volkswagen is a member of the task force working on the electric category of the FIA World Rallycross Championship, which is planned for 2020. "Electric drive will also be introduced in other motorsport disciplines, which will also make them interesting to us," says Smeets, looking ahead.

The focus is also already on the I.D. family – the range of electric production vehicles, which Volkswagen plans to launch as of 2020. "That is still a way off," says Sven Smeets. "However, the I.D. family will also feature models in the future, which could conceivably be used as the basis for motorsport vehicles."

From the racetrack to the streets

Performance-optimised cars with fully-electric drive systems are a matter for Volkswagen R in the future.

The letter R is synonymous with success in motorsport. It was a four-time world rally champion in the Polo R WRC. In 2018, it lines up in the World Rallycross Championship in a Polo R Supercar, with defending champion Johan Kristoffersson at the wheel. With the I.D. R Pikes Peak, Volkswagen R is now breaking new ground. For the first time, the brand responsible for Volkswagen's top performance cars is involved in a project, at the heart of which lies a fully-electric powertrain.

This project sees Volkswagen R prepare for a future, in which Volkswagen will offer an entire family of electric production vehicles – the I.D. range. "Technology developed for motor racing will also be used in performance-enhanced electric cars. Greater driving pleasure, but still with zero emissions," explains Jost Capito, Managing Director of Volkswagen R. "The close cooperation with Volkswagen Motorsport, as we have seen now with the I.D. R Pikes Peak, is essential to this." Complete cars like the Golf R and Golf R Estate, as well as Volkswagen R accessories, which are offered in the R-Line range, are synonymous with performance, know-how and details transferred from motorsport to road vehicles. Developed under the extreme conditions encountered at the racetrack, the technology gives the customer the peace of mind that their car will reliably do its job under the toughest possible conditions, whilst still being a pleasure to drive.

"Motorsport greatly accelerated technical innovation in the early days of the automobile. It will continue to play a similar role in the development of powerful electric cars in the future," says Capito, drawing parallels to the history of the combustion engine.

"Technology developed for motor racing will also be used in performance-enhanced electric cars. Greater driving pleasure, but still with zero emissions"

> Jost Capito, Managing Director Volkswagen R

A strong team

Volkswagen can rely on strong partners during its record attempt on Pikes Peak. This is particularly valuable when entering uncharted territory. We have enjoyed a long-term cooperation, which has matured over the years, with many of our partners. An overview.

Volkswagen Motorsport



Partners:











Driver

"This circuit really reminds me of the Nordschleife at the Nürburgring. I like demanding tracks like that."

Romain Dumas

Career at a glance

2017	Victory at the Pikes Peak International Hill Climb (Norma RD Limited)
	1st place in the FIA R-GT Cup (rallying, Porsche)
2016	Victory at the Pikes Peak International Hill Climb (Norma RD Limited)
	World champion in the FIA World Endurance Championship, including
	Victory at the 24 Hours of Le Mans (Porsche)
	Rally Dakar (Peugeot)
2014	Victory at the Pikes Peak International Hill Climb (Norma RD Limited)
2010	Victory at the 24 Hours of Le Mans (Audi)
2008	Winner of the American Le Mans Series (LMP2, Porsche)
2007	Winner of the American Le Mans Series (LMP2, Porsche)
	Victory at the Nürburgring 24 Hours (Porsche)
2003	Victory at the 24 Hours of Spa-Francorchamps (Porsche)
1995-2002	Various Formula racing series
1992-1994	Karting

A bundle of energy

Romain Dumas is a world-class racing driver. He is also a relentless driving force, who is always highly motivated. A profile.

Romain Dumas goes into the "Race to the Clouds" with Volkswagen as defending champion. And as a pioneer. Even for the jack of all trades from southern France, a fully-electric racing car like the I.D. R Pikes Peak is something a bit special.

If only there were 25 hours in a day. If there were, Romain Dumas could afford to take on a few extra projects. The thoroughbred racer from Alès in the south of France is restlessness personified. It has been known for him to warm up with the Rally Dakar in January, before contesting the entire season in the FIA World Endurance Championship (WEC) for the Porsche works team, including victory at such prestigious races as the 24 Hours of Le mans, whilst still finding time to fit in a few rounds of the World Rally Championship – oh, and he has also won the Pikes Peak International Hill Climb on three occasions.

"Endurance races are my profession. Hill climbs and rallies are my hobbies. They are all my passion," says Dumas. Quite how he manages to cope with this workload is sometimes a puzzle to his partner Elysia – Dumas lives with her and their son Gabin in Geneva. Maybe it just comes down to the fact that he simply cannot get enough of motor racing.

The well-toned bundle of energy's real strength is on the endurance circuit. He now has eight victories at 24-hour races to his name. He has won in Le Mans with Audi and Porsche prototypes, and has driven a Porsche 911 to victory four times at the Nürburgring and twice at Spa-Francorchamps.

At just 20 kilometres, the short sprint up Pikes Peak is something of an exception to the norm for Dumas. "This circuit really reminds me of the Nordschleife at the Nürburgring. I like demanding tracks like that," is Dumas' logical explanation for his success. He has long-since established himself as something of a hero in Colorado. His winning drive in 2014, in a racing prototype run by his own team, was the third fastest in the 102-year history of the race.



The pinnacle of motorsport

Legendary – careers have been made, accelerated and crowned on Pikes Peak.

The idea was a clever one. To get people talking about his new private road up Pikes Peak, businessman Spencer Penrose decided to organise a race for cars and motorcycles. That was back in 1916. Since then, the 4,300-metre mountain in the US state of Colorado has been widely regarded as the holy grail of hill climbing. Once a year, competitors are summoned to the pinnacle of motorsport – a challenge that always attracts illustrious representatives from all over the world.

Nowhere in the world are external conditions tougher. The competitors start at almost 2,900 metres above sea level – pretty much the same height as Germany's highest peak, the Zugspitze. The finish is at the summit, at 4,300 metres – higher than any other racetrack in the world.

For decades the "Race to the Clouds", as the race was soon named, was an American affair. Anybody who was anybody on the US racing scene put themselves to the test on the demanding route, which was yet to be asphalted. The legendary Unser family, known above all for their success in the Indianapolis 500, claimed a remarkable three dozen overall victories between them. From the mid-1980s, however, European brands have taken an interest in the "Pikes Peak International Hill Climb". The battle between world rally champions Walter Röhrl (Audi) and Ari Vatanen (Peugeot) made the headlines, as did the spectacular twin-engine Golf, with which Hamburg's Jochi Kleint stormed to the summit. The current record was set in 2013 by nine-time world rally champion Sébastien Loeb in a Peugeot prototype. Among those attempting to break the record forfully-electric cars in 2018 will be Volkswagen – with the I.D. R Pikes Peak.

When the motorsport circus departs Pikes Peak at the end of June, life will return to usual there. Even then, however, it is still worth a visit, because Spencer Penrose's idea was a great success. Today, only Mount Fuji in Japan attracts more visitors. Most drive to the summit in their own car. Nowadays, however, the toll of up to 50 dollars per car goes to the city of Colorado Springs.

The king of the mountains in motorsport – the Unser family and Walter Röhrl were instrumental in shaping the legend of Pikes Peak 32|33



course length: 19.99 km

25,000 NUMBER OF VISITORS TO THE PIKES PEAK FAN FEST IN COLORADO SPRINGS IN 2017

AVERAGE SPEED: 133.98 km/h





FINISH LINE ALTITUDE ABOVE SEA LEVEL:







MODIFIED ELECTRIC VEHICLES CATEGORY COURSE RECORD (SET IN 2016):

8m 57.118s



A score to settle

Volkswagen has already come close to victory on Pikes Peak once, back in the mid-1980s. The misfortune suffered back then is now providing extra motivation in 2018.

The concept was so unique that even US racers, who are used to seeing bizarre solutions, could hardly believe their eyes: The year was 1985 and Volkswagen was competing at the iconic "Pikes Peak International Hill Climb" with a Golf. But not just any golf: As well as the engine at the front, this car also boasted a second power unit at the rear. A completely new type of four-wheel drive. Never before had anybody been bold enough to try anything quite like this at this race.

The twin-engine racer has been a Kurt Bergmann idea. Back in his day, he was regarded as one of the top technicians in the Formula Vee junior series, which featured small single-seaters with Volkswagen engines. The twin-engine Golf generated 280 kW/380 PS, distributed between two naturally aspirated 1.8-litre engines. At the wheel was Jochi Kleint, a Volkswagen works driver since 1977 and European rally champion in 1979. However, Pikes Peak was new territory for the man from Hamburg. While other rally drivers practiced with a





So close, and yet so far away – Jochi Kleint certainly caused quite a stir with the twin-engine Golf between 1985 and 1987, but came to a stop just a few metres from the finish on his last attempt – whilst on course for a new record

co-driver – Kleint recorded his own pace notes on a dictation device and listened to them over and over again. The debut was a successful one. Kleint and the remarkable Golf finished third.

Volkswagen returned with a modified car in 1986. Under the chassis, a tubular frame now served as the load-bearing structure. The car was powered by two 1.3-litre engines with a G-Lader supercharger, which produced roughly 368 kW/500 PS. However, fourth place was some way short of Volkswagen's expectations.

"We were really up for it in 1987," Kleint recalls. Two 1.8-litre turbo engines provided the car with 480 kW/652 PS. The main competition came from the Audi works team and world rally champion Walter Röhrl. "I had a great interim time and was just behind Walter at that point," says Kleint. But his challenge then came to a premature end. A broken part in the suspension forced Kleint to retire with just a few corners remaining.

Volkswagen returns for another shot at Pikes Peak in 2018, once again with a twin-engine powertrain. This time, however, it is fully electric. 31 years down the line, there is a good chance that the I.D. R Pikes Peak prototype will finally settle the score.

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