

# The new BMW HP4 RACE. Table of contents.



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# 1. The new BMW HP4 RACE. (Short version)



## **The new BMW HP4 RACE: individually crafted high-tech and innovation for top performance on the race track.**

Fascinating technical solutions for maximum performance on the race track have always been the hallmark of hand-picked factory racing motorcycles modified to perfection down to the last detail. With the new HP4 RACE, BMW Motorrad presents a purebred racing bike in a production run of 750. It is individually crafted by a small, highly specialised team, ensuring the very highest level of quality.

In terms of engine, electronics and spring elements, the new HP4 RACE is in the same category as current superbike factory racing machines, even surpassing this level in the area of suspension with its carbon fibre frame. Weighing 171 kilograms when fully fuelled and road ready, the new HP4 RACE is even lighter than the factory racing bikes currently used in the Superbike World Championship and is only slightly above the MotoGP factory racers in terms of weight.

## **Industrially manufactured carbon fibre main frame in monocoque construction, self-supporting rear frame and wheels made of carbon fibre.**

With the HP4 RACE, BMW Motorrad is the first motorcycle manufacturer in the world to present a main frame made entirely of carbon fibre and weighing just 7.8 kilograms that is produced industrially in small series, thereby making this future-oriented technology available for anyone to purchase. The front and rear wheel are also made of this high-tech material, enabling a weight reduction of approximately 30 per cent as compared to light alloy forged wheels while retaining a deliberately rigid design.

## **Öhlins spring elements, light alloy underslung swingarm and Brembo monoblock brake calipers from the Superbike World Championship.**

The new HP4 RACE likewise meets the highest demands of racing technology in the area of spring elements and brakes. Both the FGR 300 upside-down fork and the TTX 36 GP spring strut are supplied by the Swedish manufacturer Öhlins, with identical parts being used both in the Superbike World Championship and in MotoGP. The light alloy underslung

swingarm made of milled and sheet metal parts is also a component used in the Superbike World Cup.

Featuring two Brembo GP4 PR monoblock brake calipers, the brake system of new HP4 RACE also has parts otherwise only to be found in World Cup machines. Coated titanium pistons and single-piece aluminium calipers with chemically nickel-plated surface make for what is currently the very best combination of materials available. In conjunction with 6.75 mm thick 320 millimetre T-type racing steel brakes, the system ensures stunning brake performance.

### **Purebred racing engine and close-ratio racing gearbox with adapted transmission ratios according to World Cup specifications.**

The new HP4 RACE has a purebred racing engine similar to specifications 6.2 and 7.2 as in the Endurance and Superbike World Championships. The peak output is 158 kW (215 hp) at 13900 rpm. The maximum torque of 120 Nm is reached at 10000 rpm. The maximum engine speed has been increased as compared to the engine of the S 1000 RR from 14200 rpm to 14500 rpm. With the aim of achieving the best possible performance, a 6-speed close-ratio racing gearbox is used with optimised transmission ratios and various secondary ratios (diverse pinions and chain sprockets included).

### **Weight-optimised electrical system, 2D dashboard along with Dynamic Traction Control DTC, Engine Brake EBR, Wheelie Control and other electronic features.**

The new BMW HP4 RACE comes with an extensive package of electronic control and assistance systems as well as a weight-optimised on-board electrical system which has been optimised to meet racing needs. A wealth of information is available on the 2D dashboard with transferable data memory (2D logger).

Wide-ranging set-up options for different track layouts and road surface conditions are provided by the audibly perceptible Dynamic Traction Control controlled by ignition cut, Engine Brake EBR and Wheelie Control. These can be programmed selectively for each gear according to rider preference, allowing optimum use of the enormous riding dynamics potential offered by the new HP4 RACE. Other electronic features are the Pit Lane Limiter for observing speed limits in the pit lane and Launch Control for perfect race starts.

### **Light trim carbon fibre trim parts and hand-brushed aluminium fuel tank.**

The carbon fibre trim, the intake silencer cover and the seat hump in the new HP4 RACE feature the BMW HP Motorsport colours. A hand-brushed aluminium fuel tank sealed with a clear finish underscores the bike's high-quality racing look.

### **An overview of the highlights of the new BMW HP4 RACE:**

- Carbon fibre main frame in monocoque construction weighing just 7.8 kilograms.
- Self-supporting carbon fibre rear frame with three-stage height adjustment function.
- Carbon fibre wheels offering a weight reduction of some 30 per cent as compared to light alloy forged wheels.
- Öhlins FGR 300 upside-down fork.
- Öhlins TTX 36 GP spring strut.
- Brembo GP4 PR monoblock brake calipers with 320 T-type racing steel brake disks (thickness: 6.75 mm) at the front.
- Racing engine at World Cup level with an output of 158 kW (215 hp) at 13 900 rpm and a maximum torque of 120 Nm at 10 000 rpm.
- Close-ratio racing gearbox with adapted transmission ratios.
- Weight-optimised electrical system featuring light lithium-ion battery with 5 Ah.
- 2D dashboard and 2D data recording including logger.
- Dynamic Traction Control DTC (programmable for selected gears at 15 levels).
- Engine Brake EBR (programmable for selected gears at 15 levels).
- Wheelie Control (programmable for selected gears).
- Launch Control.
- Pit Lane Limiter.
- Light trim parts made of carbon fibre with snap fasteners.
- Paint finish in BMW HP Motorsport colours.
- Production run of 750 units, each individually crafted.

## 2. Drive.



“The engine of the new HP4 RACE is a factory racing engine at World Cup level. It is individually crafted by a small, highly specialised team, ensuring the very highest level of quality in terms of power yield and reliability.”

### **Rudolf Schneider**

Head of 4 and 6-Cylinder Product Projects

### **The engine of the new HP4 RACE: purebred HP racing technology for absolute top-level performance.**

The new HP4 RACE features a purebred racing engine. In its basic form it is the same as the high-performance racing engine of the S 1000 RR developed for the Endurance and Superbike World Cup, but enhanced to meet World Cup specifications. The peak output is 158 kW (215 hp) at 13 900 rpm, 12 kW (16 hp) more than that of the RR, which is approved for use on public roads. The maximum torque of 120 Nm is reached at 10 000 rpm (RR: 113 Nm at 10 500 rpm). The maximum engine speed has been increased as compared to the basic engine from 14 200 rpm to 14 500 rpm.

### **Elaborately and enthusiastically hand-crafted racing engine with its own number series.**

Like the entire motorcycle, the racing engine of the HP4 RACE is elaborately crafted by hand by a small team of experts at the BMW Motorrad plant in Berlin. With their longstanding racing experience, the very highest level of technical expertise and not least a great sense of enthusiasm and attention to detail, the personnel involved provide the perfect basis for the creation of a high-end racing engine.

### **Altered camshafts and optimised intake area for significantly increased power and torque.**

The original RR cylinder head itself offers the ideal basis for a racing engine in terms of the geometry and manufacturing finish of the intake and exhaust ports, combustion chamber design and valve gear, as demonstrated by countless racing victories and titles gained in recent years.

In order to further enhance output and torque, work in this area therefore focused on the use of new intake and exhaust camshafts as well as selective

modifications and optimisations of the intake silencer and carburation. As a result, the camshafts allow larger strokes of the intake and exhaust valves adopted from the RR, creating the basic requirement for increased power in conjunction with newly calculated valve opening times and appropriately adapted valve springs.

As in the RR engine, the HP4RACE engine with a compression ratio of 13.7 - 13.9:1 is also fitted with intake funnels of varying length. Here, the length of the intake funnels is varied over two levels on a map-controlled basis by means of an electric motor positioned on the intake silencer. The shorter intake passages are released from an engine speed of 11 500 rpm, favouring maximum output. The intake funnels were newly calculated for use in the HP4 RACE, however: they are longer and have an enlarged cross-section. In addition, the intake silencer is combined with optimised air funnels and control levers.

**Crankshaft drive with reduced weight, high-strength connecting rods and selected pistons for optimum running smoothness and durability.**

The horizontally divided engine housing of the HP4 RACE is the same as that of the RR. The cylinder barrels integrated in the upper half of the engine housing are hot isostatic pressed (HIP) to ensure the basic material is as homogeneous as possible and are polish-honed so as to reduce friction. Together with the standard light alloy pistons of the RR, they already offer the perfect basis for a high-performance racing engine. For use in the new HP4 RACE, however, the pistons and connecting rods are weight-selected so as to reduce differences in the oscillating masses between the four cylinder units to a minimum with the aim of achieving the best possible running smoothness and stability.

In order to meet the increased mechanical demands of a racing engine, the engine of the new HP4 RACE has milled connecting rods made of high-strength forged steel, produced by the well-known Austrian supplier Pankl. A finely balanced crankshaft is provided in response to the change in mass ratios. A weight reduction of the crankshaft by approximately 200 grams meets race track demands and the need for particularly spontaneous revving. This is achieved by means of boreholes in the counterweights and in the primary drive wheel on the right-hand side of the crankshaft.

### **Bearing clearance optimised for racing use, with an oil supply that is adapted accordingly.**

An essential feature in the structure of any racing engine is the reduction of friction. This determines how much of the power produced by the engine ultimately reaches the rear wheel and is available for acceleration. For this reason, particular attention is paid to bearing clearance during assembly of the HP4 RACE engine. Insufficient bearing clearance is undesirable when striving to reduce friction to a minimum, which is why the plain bearing shells of the crankshaft main bearings and connecting rod bearings are selected according to a narrow tolerance window specially defined for the HP4 RACE.

In this connection, the adapted oil supply likewise serves the purpose of keeping friction to a minimum and ensuring an optimum supply of lubricant. Here the oil pressure has been matched precisely to the technical requirements of the engine during racing and also the engine oil used, namely Shell Advantec Ultimate 0W40.

Another optimisation of the oil supply is the black anodised oil sump milled out of solid aluminium and positioned on the right-hand side. Geometrically adapted to the exhaust ducting, the oil sump not only ensures maximum reliability in terms of the oil supply to the intake side of the oil pump but also has an adjustable oil pressure regulation valve.

The oil cooler and coolant radiator are identical to the standard components in the RR. There is no fan, however, as is common practice in racing. While the pressure in the standard radiator is 1.2 bar, the cooling system in the new HP4 RACE operates at a pressure of up to 1.8 bar. This increases the boiling point of the coolant to well over 100 degrees Celsius, resulting in drastically improved engine cooling.

### **Light 4-in-2-in-1 racing exhaust system made of titanium.**

A key aspect of the development of a racing engine is the design of the exhaust system. In line with the requirements of the 4-cylinder in-line engine, the HP4 RACE has a 4-in-2-in-1 exhaust system made of light titanium. Even the manifold flanges are made of titanium. This is the best possible solution for powerful torque in the medium engine speed range and top output while maintaining a low weight. Sheathed in carbon fibre and adapted in terms of exhaust counterpressure, the rear silencer also features a weight-optimised design.

**6-speed close-ratio HP racing gearbox with optimised transmission ratios and various secondary ratios for the best possible lap times.**

It is only possible to achieve the fastest lap times on the race track if the transmission ratios and therefore the overall ratios perfectly match local conditions. For this reason, the gear wheel pairs of the 6-speed gearbox in the new HP4 RACE were newly calculated, with the exception of the third gear.

In the area of transmission ratios in particular, motorcycles designed for road use have to make allowances for everyday operation. For this reason, the first gear is relatively short – for city traffic or hill starts, for example - and the subsequent gear ratios are spread further apart as a result.

However, the 6-speed gearbox in the new HP4 RACE, though based on that of the RR, is oriented entirely towards use on the race track. As such, the first and second gears have longer ratios while the ratios of gears four to six are shorter. With the primary ratio unchanged, this means that the connections between the gears are closer together with a view to optimum race track performance, thereby enabling the best possible acceleration. What is more, the HP4 RACE includes a selection of different chain rings and chain pinions to allow individual adaptation of the secondary ratio to differing track conditions.

<b>Gear</b>	<b>HP4 RACE</b>			<b>S 1000 RR</b>		
<b>1</b>	18	43	2.38889	17	45	2.64706
<b>2</b>	22	44	2.00000	22	46	2.09091
<b>3</b>	<b>22</b>	<b>38</b>	<b>1.72727</b>	<b>22</b>	<b>38</b>	<b>1.72727</b>
<b>4</b>	22	34	1.54545	24	36	1.50000
<b>5</b>	25	35	1.40000	25	34	1.36000
<b>6</b>	24	31	1.29167	23	29	1.26087
<b>Primary</b>	<b>46</b>	<b>76</b>	<b>1.65217</b>	<b>46</b>	<b>76</b>	<b>1.65217</b>

### **Reversed shift pattern and HP Shift Assistant Pro for perfect up and downshifting without using the clutch.**

As a standard feature, the new HP4 RACE meets many riders' preference for a so-called reverse shift pattern for use on the race track, with the first gear at the top and gears two to six going downwards.

In a special version for the HP4 RACE, the HP Shift Assistant Pro allows upshifting without activating the clutch, thereby enabling perfect acceleration virtually without torque interrupt. Thanks to a double-declutching function, it allows downshifting without clutch or throttle valve activation in the relevant load and engine speed ranges. This means that very fast shifts are possible on the race track with a view to achieving the best possible lap times, while clutch activation is reduced to a minimum.

The rider enjoys significant benefits when downshifting without clutch, especially when travelling at speed on the race track. The left hand can stay in an unchanged position on the handlebars since it is not required for clutch activation. What is more, undesirable load change impact on the rear wheel is noticeably reduced and the machine maintains even better directional stability.

### **Run-in and output measurement on the test bench for immediate race track use and top performance.**

On completion of individual assembly of each HP4 RACE engine – which has light titanium screws in the outer section – the power unit is run in on the engine test bench so that customers can later use the bike on the race track right away.

Measurement is also carried out on the test bench to ensure an output of 158 kW (215 hp). Finally, the valve opening times and the valve clearance are once again checked and adjusted if necessary. Before the engine is finally installed in the chassis of the HP4 RACE, it is given a new oil filling and sealed.

### 3. Suspension and frame.



“The industrially produced carbon fibre frame of the new HP4 RACE opens a whole new chapter in motorcycle chassis construction. Here we are bringing together optimum technical qualities, consistent manufacturing quality and economy for the first time.”

**Christian Gonschor**

Project Manager HP4 RACE

**The suspension of the new HP4 RACE: fascinating racing technology at the level of factory racing motorcycles – and even beyond this thanks to the use of innovative carbon fibre technology.**

The consistent racing design of the new HP4 RACE is not only reflected in engine technology is geared towards maximum performance. The supreme driving dynamics of the new HP4 RACE are in fact to a large extent due to the suspension technology used.

Being a technological pioneer in many areas such as Race ABS, Shift Assistant Pro, Dynamic Traction Control DTC and Dynamic Damping Control DDC, BMW Motorrad once again strikes out on a new path with the HP4 RACE. With this new model, BMW Motorrad is the first motorcycle manufacturer in the world to present a main frame made entirely of carbon fibre using RTM (Resin Transfer Moulding), produced industrially in a small series of 750 and making this future-oriented technology available for anyone to purchase.

The technical effort BMW Motorrad has invested in the new HP4 RACE, especially in the area of lightweight construction, is not limited to the carbon fibre frame, however. The front and rear wheel are also made of this light, high-strength material. Then there are the top-quality spring elements made by Swedish manufacturer Öhlins – which are the same as those used in the Superbike World Cup and the MotoGP, for example.

**The BMW Group as a pioneer in the industrial manufacture of vehicle components made of carbon fibre.**

The BMW Group ushered in a new era of automobile construction in 2013 with the introduction of carbon fibre as a material. The start of serial production of the electric drive BMW i3 and the plug-in hybrid sports car

BMW i8 not only saw the company put the first premium cars on the road that were specifically designed from scratch for these drive forms. The passenger cell of the BMW i3 is also made entirely of the extremely light and resilient material carbon fibre, thereby making up for the additional weight of the battery required for electric drive. The body structure of the BMW 7 Series also includes carbon fibre as part of an intelligent mix of materials.

With the market launch of the BMW M3 CSL in 2003, the BMW Group became the first company in the world to industrialise the carbon fibre manufacturing process for large-scale volume production in carmaking. The industrialised production method is also economical – which makes the manufacture of large composite carbon fibre components for vehicles possible in the first place.

**The HP4 RACE marks the introduction of carbon fibre technology to motorcycles for groundbreaking chassis construction.**

With the new BMW HP4 RACE, the BMW Group further extends its pioneering role in the industrial use of carbon fibre in vehicle construction, presenting the first ever motorcycle with a carbon fibre main frame produced industrially in small series using the RTM process. It is a method of frame construction which only BMW Motorrad offers in this form.

Carbon fibre technology has a number of variants which differ in terms of purpose and production technique. For example, the term **“Carbonview”** refers to components such as trim parts or prominently showcased design components that primarily draw on the aesthetic visual quality of carbon fibre. Saving weight and increasing strength are only of secondary importance in this context. The materials used are generally carbon fibre fabric and epoxy resin, processed using the so-called hand lay-up method (hand lay-up laminate) or compression moulds.

By contrast, the term **“Carboncore”** refers to components where carbon fibre is used as a functional material so as to reduce weight and/or increase the strength of a part as compared to alternatives such as steel, aluminium or magnesium. The starting materials here are woven or non-woven bonded fabrics. They are inserted in the manufacturing mould and then injected with a reactive dual-component resin (RTM process: Resin Transfer Moulding).

The category **“Carbondrive”** includes non-woven bonded fabrics with continuous fibres produced using the RTM process. The aim here is to achieve an optimum balance between stiffness qualities such as bending,

transverse rigidity and weight for highly stressed components that are crucial to riding dynamics, such as the frame and wheels.

**Main and rear frame made of carbon fibre as a weight-saving measure while also optimising stiffness qualities such as bending, torsion and transverse rigidity.**

The main frame of the new HP4 RACE is a carbon fibre bridge frame with the engine integrated as a load-bearing element and tilted forwards by 32 degrees. The self-supporting rear frame is also made of carbon fibre and bolted on at four mounting points. In order to achieve the best possible response and feel for the rider, the frame has been designed in structure and shape so as to exhibit various stiffness qualities such as a defined bending and torsional response as well as transverse rigidity. In the past this was one of the main weak points in the design of carbon fibre frames – especially in racing, where the so-called flex of the chassis impacts on mechanical grip and can even make the difference between victory and defeat.

While torsion in the chassis around the vertical axis is generally not desirable, a certain elasticity of the frame in a transverse direction ensures smoother cornering – factors which were central to the development of the carbon fibre frame of the HP4 RACE. Here the overall main and rear frame structure and the swingarm were designed to strike an optimum balance between stiffness and flexibility so as to offer the HP4 RACE rider an optimum in terms of traction, riding precision and feedback.

**Light monocoque main frame weighing just 7.8 kilograms with bulkhead partitions and inserts integrated as part of the manufacturing method for long-term durability.**

The carbon fibre main frame of the new HP4 RACE weighs just 7.8 kilograms – 4 kilograms less than its aluminium counterpart in the 2017 RR. It is produced in monocoque construction and therefore made from a solid piece of material. This means there are no neuralgic weak points such as individually bonded or bolt-on components.

Both the production of the frame as a solid entity and the industrial RTM process make for a consistently high level of manufacturing quality as well as uniform physical properties. The hollow frame body with reinforcing bulkhead partitions in the frame side profiles thus ensures optimum application of carbon fibre manufacturing technology, in turn providing the ideal basis for a perfect ride response in the new HP4 RACE. Together with the wheels and rear frame, also made of carbon fibre, it contributes significantly to the very low weight of the new HP4 RACE, which is just 171 kilograms when road-ready and fully fuelled.

Long-term durability was also at the very top of the list of priorities in the development of the carbon fibre main frame. The metal bearing mounts and bolting points are especially important here – the so-called inserts. In the new HP4 RACE they are directly integrated in the carbon manufacturing process, with corrosion protection added by means of fibreglass insulation, and they also provide the permanently firm fit as is urgently required – not least due to their positive-locking design.

### **Easily adaptable ergonomics with height-adjustable self-supporting carbon rear frame and adjustable footrests.**

The rear frame section of the new HP4 RACE is likewise made of carbon fibre with the aim of combining low weight with high strength. In this case it was not necessary to use the elaborate RTM process, however: instead it is produced in the conventional manner as a laminate using the classic hand lay-up technique. The materials selected here are a twill weave carbon fibre fabric and epoxy resin. This component is also annealed in order to achieve maximum strength and temperature stability. The carbon fibre rear frame allows adjustment of the seat height to three levels. As supplied the seat height is 831 mm, while in the bottom position it is 816 mm and in the highest position 846 mm. Further ergonomic adaptation of the HP4 RACE is supported by the HP footrest system made of milled aluminium which can be adjusted to eight different positions.

### **Light carbon fibre wheels for optimum handling, acceleration and braking.**

The rigorous approach adopted in developing the new HP4 RACE with the aim of achieving the very highest level of riding dynamics is also reflected in the 17-inch wheels with a width of 3.5 inches at the front and 6.0 inches at the rear. Like the main frame, they are produced as “Carbondrive” components. However, the manufacturing process here is known as “braiding”, which involves the entire fabric structure required for the wheel being wrapped by machine in one piece.

Manufactured as single entities, the carbon fibre wheels of the new HP4 RACE are approximately 30 per cent lighter than conventional light alloy forged wheels and develop a gyroscopic force which is some 40 per cent less. These massive reductions translate into drastically improved handling, faster changes of direction in chicanes and also improved acceleration and braking due to the reduced rotating masses – once again fundamental requirements for fast lap times on the race track.

The carbon fibre wheels of the new HP4 RACE also offer benefits in terms of flexibility and breaking strength as compared to light alloy forged wheels. In

tests involving running over a 70 mm high obstacle at a speed of 120 km/h, a forged wheel suffered breakage and sudden loss of air while the carbon wheel absorbed all the energy in its rim base. It was subsequently fully restored to its original shape. For riders, this type of incident does not lead to an abrupt loss of air and they can carry on to the pits at a reduced speed.

The damage chain in the new HP4 RACE is structured in such a way that the carbon fibre frame and wheels are the last motorcycle components to fail in the event of a fall.

### **High-quality Öhlins FGR 300 upside down fork and Brembo GP 4 PR monoblock brake calipers from the Superbike World Cup.**

While motorcycles approved for use on public roads are forced to compromise when it comes to the set-up of their spring elements in particular, purebred racing bikes observe the rigorous requirements for achieving fast lap times. As a result, the new HP4 RACE features an Öhlins FGR 300 upside down fork as is also used in the Superbike World Cup. Together with the rear spring strut, BMW Motorrad thus offers a package of spring elements that is otherwise reserved almost solely for World Cup motorcycles.

In addition to outstanding manufacturing quality and titanium nitride coated slider tubes for a perfect response, the Öhlins FGR 300 fork also offers a full adjustment range. The rebound and compression stage of the damping is adjustable as are low and high-speed damping. For use in the new HP4 RACE, adaptations have been applied to the fork in the area of the spring rate, the shims used for the damping valves and the entire hydraulic system. The total spring travel is 130 mm. The outstanding exclusivity of the new HP4 RACE is underscored by a carbon fibre badge on the upper fork bridge showing the production serial number from 1 to 750.

For excellent deceleration and extreme stability, the new HP4 RACE has high-quality Brembo GP4 PR monoblock fixed calipers which are otherwise only used in the Superbike World Cup and even the MotoGP. They have titanium brake pistons with a friction-reduced coating and chemically nickel-plated brake caliper body including the brake piston running surfaces, ensuring maximum functional reliability and brake performance. The diameter of the floating T-type racing steel brake discs with a thickness of 6.75 mm is 320 mm. Activation is by means of a milled aluminium RSC 19 x 18 handbrake pump made by Brembo Racing. At the rear wheel, a 4-piston fixed caliper with titanium pistons provides deceleration support in conjunction with a floating 220 mm brake disc (thickness: 4.0 mm).

### **Elaborate light alloy swingarm and high-tech Öhlins spring strut with height adjustment from the Superbike World Cup.**

Rear wheel control is taken care of by an underslung swingarm measuring 604 mm in length, as is successfully used in the Superbike World Cup. A deliberate decision was taken here not to take the option of using carbon fibre as the material. With a main body made of solid high-strength aluminium in conjunction with welded aluminium sheets, the Superbike World Cup swingarm already offers a tried-and-tested optimum in terms of weight, stiffness, traction and feedback.

Suspension and damping are taken care of by an Öhlins TTX 36 GP spring strut controlled by a lever system that is optimised for the race track. Like the lever kinematics, which has altered attachment points as compared to the RR, the spring strut is used in the Superbike World Cup. The spring strut is adjustable both in the rebound and compression stage of damping and in low and high-speed damping. It also allows height adjustment of +/- 3 mm. The spring rate is  $95 \text{ Nmm}^{-1}$ , while the spring length is 317 mm. The total spring travel at the rear axle is 120 mm. An insert for the upper mounting point of the spring strut allows the height to be adjusted by +/- 2 mm.

### **Suspension geometry with a wide range of adjustment options for an optimum set-up.**

Racing motorcycles require selective adaptation of the suspension geometry according to race track layout and riding style, but the machines do not always offer the necessary technical facilities. For this reason, BMW Motorrad provides a clear statement with the new HP4 RACE, offering a whole range of adjustment options for both front and rear wheel control.

As supplied, the offset (front end) of the fork bridges is 30 mm. But using the inserts it is also possible to set this to 26, 28 or 32 mm. What is more, the steering head angle can be adjusted within a range of 64.5 to 66.5 degrees (RR: 66.5 degrees). The corresponding castor figures are between 95 and 112 mm (delivery status: 102.5 mm; RR: 96.5 mm). In addition to the adjustment options in the front section, inserts can also be used to change the position of the swingarm centre of rotation by +/- 4 mm in 1 millimetre stages so as to be able to adapt the HP4 RACE entirely to the rider's individual preferences and achieve ideal conditions for race performance. The ride height setting commonly used in racing can also be applied by means of an adjustable tension strut (113 mm, +/- 5 mm).

**Light trim, seat hump and wheel cover in carbon fibre, aluminium fuel tank with brushed surface.**

The bike's racing concept and a consistent endeavour to optimise lightweight construction and functionality are also reflected in the bodywork of the new HP4 RACE. Parts such as the trim with snap fasteners, seat hump and front wheel cover are also made of carbon fibre, providing impressively low weight and excellent surface quality. In the upper trim section, the surface is finished in a carbon fibre look, making the fine-quality appearance of this high-tech material visible underneath a clear varnish coating. The high-quality impression and visual presence of the materials used is also underscored by the brushed finish and clear varnish coating of the fuel tank. The colour scheme of the new HP4 RACE is based on the traditional BMW Motorsport colours, entirely in keeping with the style of a racing machine.

## 4. Electrical system, electronics and equipment.



“In the area of electronics, too, BMW Motorrad provides a range of functions in the HP4 RACE that is otherwise only equalled by factory motorcycles in the Superbike World Cup or the MotoGP.”

### **Marc Bongers**

Head of BMW Motorrad Motorsport Technology

### **The new BMW HP4 RACE: consistent racing technology and lightweight construction in the area of the electrical system and electronics, too.**

Even in a road-approved supersports bike like the RR, electronic assistance systems such as Dynamic Traction Control DTC are indispensable in view of output levels of 200 hp. This applies even more so to purebred racing motorcycles such as the new BMW HP4 RACE, which is fitted with an extensive package of electronic control and assistance system as well as on-board electrical system geared specifically towards racing needs. The electrical system has been reduced to the absolute racing essentials as compared to the serial production RR. Together with a light lithium-ion battery with a capacity of 5 Ah, this again enables a reduction in weight.

### **Robust switch panels that are reliable to handle – as in the Superbike World Cup.**

The handlebar panels of the new HP4 RACE are the same as those used in the tough racing conditions of the Superbike World Cup. On the right-hand side there is the kill switch designed as a button (red), the riding mode switch (blue) and the Pit Lane Limiter / starter button (black). On the left, the blue button is a selection switch for Dynamic Traction Control DTC and Engine Brake (EBR; adjustable engine braking effect). A red or green button can be used to adjust DTC or EBR according to the rider's preferences. The menu can be scrolled through using a yellow button which is also located on the left.

### **Dynamic Traction Control DTC, Engine Brake EBR and Wheelie Control.**

For top acceleration performance, the new HP4 RACE has Dynamic Traction Control DTC with an adjustment range of -7 to +7. It draws its information from the angular rate sensor, which is mounted much less rigidly than in the RR version. With the various riding modes (Wet, Intermediate, Dry1, Dry2), it

allows adjustment of rear wheel traction to dry or damp track conditions with a high or low level of grip. But like Wheelie Control, it also offers the option of intervention based on selected gears, for example applying regulatory intervention to gears 1, 2 and 3 but with no intervention at all in drive positions 4, 5 and 6. Regulation is effected via ignition cuts and cylinder suppression patterns of varying strength, depending on slip error. The maximum permitted slip is defined for each riding mode based on speed and banking position.

Another key requirement for top-level lap times is the function Engine Brake EBR, also adjustable from -7 to +7 for individual adaptation of the engine braking effect. While Dynamic Traction Control provides a riding dynamics support function for the rider when accelerating, EBR – which can also be adjusted based on selected gears – provides assistance when decelerating, for example when applying the brakes or simply closing the accelerator twist grip. The new HP4 RACE allows the engine brake torque (drag torque) to be set according to rider preference and track conditions in such a way that it enables more effective deceleration and braking manoeuvres.

Wheelie Control is another gear-selective function with regulatory intervention ranging from level 1 to 5: this suppresses the forceful tendency of the front wheel to lift during acceleration, which is otherwise very difficult for the rider to control. The latter is especially beneficial when accelerating in the lower gears 1 to 3, in particular at the start.

### **Launch Control for perfect race starts.**

The new HP4 RACE features Launch Control, an assistance system for perfect race starts. Launch Control is triggered as soon as the first gear is engaged. From the technical point of view, Launch Control also limits engine torque so that the maximum transferable drive torque is available at the rear wheel when setting off in first gear. When the rider shifts into second gear, the engine torque is corrected in line with the change in ratio so that the maximum transferable drive torque continues to be available at the rear wheel during this phase.

### **Pit Lane Limiter for precise speed control in the pit lane.**

Riders of the new HP4 RACE also have at their disposal a function that limits the speed of the motorcycle in the pit lane. The Pit Lane Limiter is ready for use in first gear, and activation simply requires the starter button (black) to be pressed. Once it has been activated, the rider can turn up the accelerator twist grip to maximum level, but the engine speed is limited to the previously programmed level by means of ignition interruption. If a shorter or longer

secondary ratio is installed, the rider can increase or reduce the engine speed required for 60 km/h, for example.

### **Multifunctional 2D dashboard with a wealth of information.**

The 2D dashboard likewise reflects the consistent racing design of the new HP4 RACE. It has a so-called mechanic side for use in the pits or during the warm-up phase. Information such as oil and fuel pressure as well as oil and coolant temperature is displayed here. The mechanic side is only available when idling: when the first gear is engaged, the display automatically switches to the rider side. In addition to the engine speed, selected riding mode, DTC and EBR settings, the display can also be used to access a range of other information such as:

Rider side:

- Lap time
- Lap time gap
- Best lap time
- DTC setting
- EBR setting
- Map setting
- Water temperature (tw – temperature water)

Mechanic side:

- Brake pressure, front (bf – brake front; if sensor is installed)
- Brake pressure, rear (br – brake rear; if sensor is installed)
- Spring travel, front (sf – suspension front; if sensor is installed)
- Spring travel, rear (sr – suspension rear; if sensor is installed)
- Current (Ub)
- Total km
- Throttle grip position (tpd – throttle position demand)
- Throttle valve (tp – throttle position)
- Front wheel speed (vf – velocity front)
- Rear wheel speed (vr – velocity rear)
- Banking position (la – lean angle)
- Water temperature (tw – temperature water)

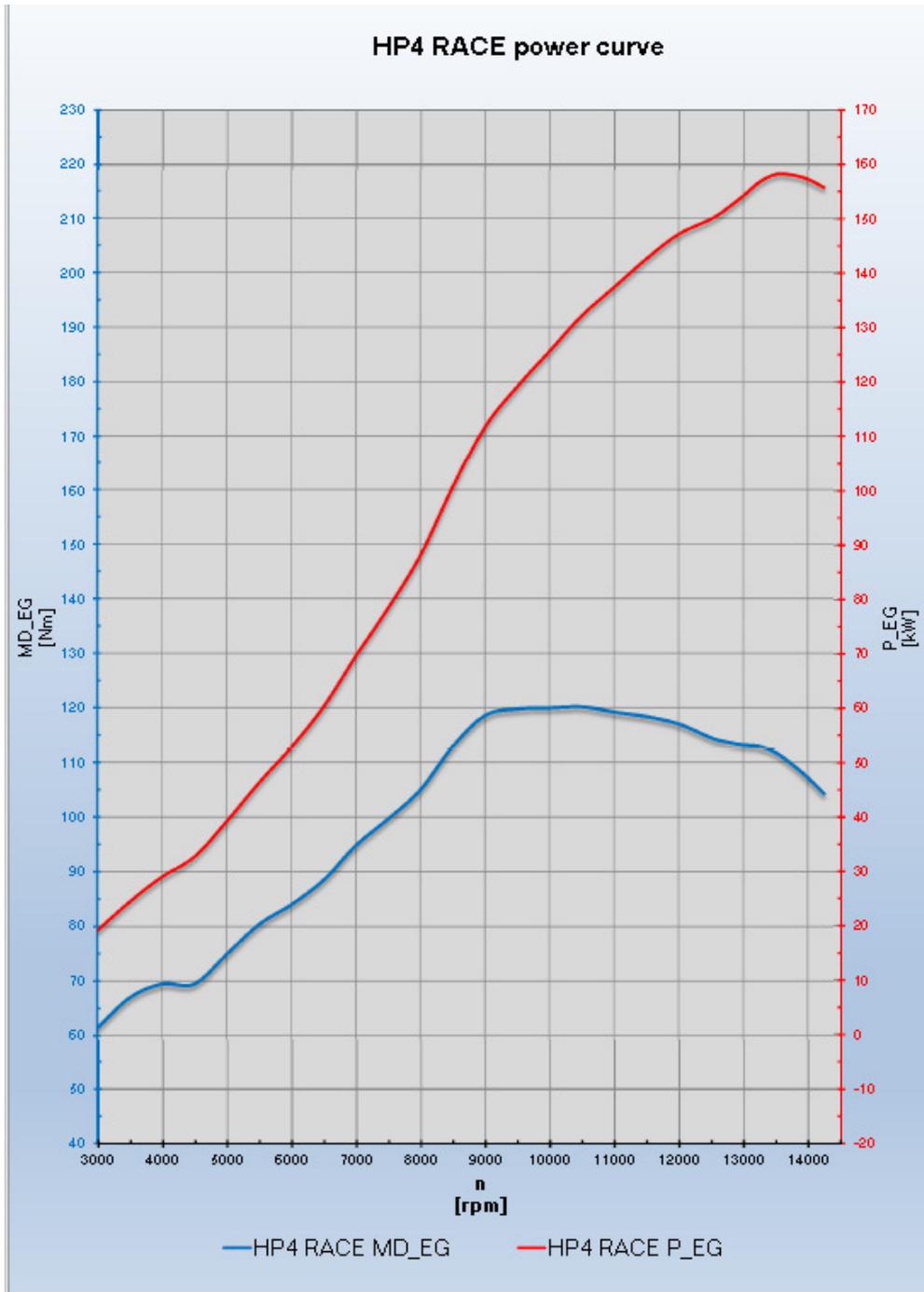
The 2D data recording system offers the possibility of recording lap times by means of GPS, for example. It is also designed for use with additional sensors – such as those for spring travel and brake pressure levels.

### **Fittings to adjust set-up for the race track.**

The new HP4 RACE is supplied with the following special parts so as to enable optimum configuration for racing use:

- Inserts for the fork bridges for the purpose of offset adjustment (26 mm, 28 mm, 32 mm). Delivery status: 30 mm.
- Inserts for steering head angle adjustment (+/- 0.5°, +/- 1°). Delivery status: 0°.
- Inserts for the frame to adjust swingarm centre of rotation (+- 4 mm, + 3 mm, +- 2 mm, +- 1.0 mm). Delivery status: - 3 mm.
- Pinion with 15 and 17 teeth. Delivery status: 16.
- Chain rings with 41, 42 44 and 45 teeth. Delivery status: 43.

## 5. Engine output and torque.



## 6. Technical specifications.



<b>HP4 RACE</b>		
<b>Engine</b>		
Capacity	cc	999
Bore/stroke	mm	80/49.7
Output	kW/hp	158/215
at engine speed	rpm	13 900
Torque	Nm	120
at engine speed	rpm	10 000
Type	Water-cooled in-line 4-cylinder engine	
Compression/fuel	13.7-13.9:1/min Super Unleaded, min. octane number 98 (RON)	
Valve/accelerator actuation	DOHC (double overhead camshaft) Valve activation via individual rocker arms	
Valves per cylinder	4	
Ø intake/outlet	mm	33.5/27.2
Throttle valve diameter	mm	48
<b>Electrical system</b>		
Alternator	W	406
Battery	V/Ah	12/5, Li-ion maintenance-free
Headlight	W	-
Starter	kW	0.8
<b>Power transmission - gearbox</b>		
Clutch	Multi-plate anti-hopping wet clutch, mechanically activated	
Gearbox	Constant-mesh 6-speed racing gearbox (EVO) with spur toothing (gear 1, 2, 4, 5, 6 optimised)	
Primary ratio	1.652	
Transmission ratios	I	2.388
	II	2.000
	III	1.727
	IV	1.545
	V	1.400
	VI	1.291
Rear wheel drive	Chain	
Transmission ratio	2.647	
Traction control	DTC 15-level adjustment	
Engine brake	EBR 15-level adjustment	
<b>Suspension</b>		
Frame construction type	Carbon fibre monocoque RTM frame with adjustable steering head angle and swingarm centre of rotation, load-bearing engine	
Front wheel control	Öhlins FGR 300 Superbike World Cup fork, adjustable rebound and compression damping, adjustable spring preload, adjustable Öhlins SD052 steering damper, quick front wheel changing system by means of rotating forklegs with mounted front wheel cover (brake calipers do not have to be dismantled to change wheels)	
Rear wheel control	Aluminium underslung double-sided swingarm, Öhlins TTX 36 GP central spring strut, adjustable rebound and compression damping, adjustable spring preload, spring strut attachment point adjustable at the top (0/3 mm), adjustable spring strut deflection (tension strut length), support surfaces for wheel spacer sleeve on chain tensioners for simple/hands-free wheel mounting, titanium chain tensioner on the outside, aluminium on the inside, CFRP assembly stand mountings on	

		the swingarm
Spring travel, front/rear	mm	130/120
Wheel castor	mm	102.5 (adjustable from 95-112)
Wheelbase	mm	1 440
Steering head angle	°	65.5° (adjustable by 0.0°, +-0.5°, +-1°)
Tension strut		113 mm (variably adjustable +- 5mm)
Swingarm centre of rotation		-3 mm as compared to K46MR3 (adjustable by +-4 mm,+3 mm,+2 mm,+1.0 mm) -> (HP4R designation "-2" corresponds to K46MR3 "-3" = standard)
Swingarm length		604mm
Fork bridge offset		30 mm (adjustable to 26 mm, 28 mm, 32 mm)
Wheels		Carbon fibre wheels incl. firmly fitted wheel spacer sleeves for simple wheel mounting
Wheel size, front/rear		3.50 x 17" / 6.00 x 17"
Tyre, front		120/70 ZR 17 Pirelli Diabolo Superbike Slick SC2
Tyre, rear		200/60 ZR 17 Pirelli Diabolo Superbike Slick SC2
Brake, front		Brembo Racing twin disc brake , T-floated racing brake discs, diameter 320 x 6.75 mm, 4-piston monoblock Superbike World Cup fixed caliper GP4-PR with titanium pistons, Brembo Racing handbrake pump RCS19x18 incl. adjustable Brembo Racing brake lever, Brembo Racing clutch lever (without clutch switch)
Brake, rear		Brembo Racing single disc brake, 4-piston Superbike World Cup fixed caliper with titanium pistons, brake disc diameter 220 x 4.0 mm
Footrest system		Rigid footrest system in milled aluminium, adjustable to eight positions

#### **Dimensions and weights**

Seat height at unladen weight		816 mm (lowest position), 831 mm (delivery state), 846 mm (highest position)
Usable fuel tank volume		17.5 l
incl. reserve		approx. 4 l
Dry weight		146 kg
Unladen weight, road ready, fully fuelled 1)		171.4 kg

#### **Equipment (selection)**

Standard equipment		BMW Motorrad Race DTC (Dynamic Traction Control) +/-7; EBR (Engine Brake Regulation) +/-7, 4 riding modes (WET, INT, Dry1, Dry2), 2D data recording/stick logger/lap timing/GPS, 2D dashboard, 2D data recording prepared for spring travel sensors / brake pressure sensors, Pit Lane Limiter, Launch Control, adjustable footrest (8 levels), adjustable handlebars (tapering), fork bridge with offset adjustment (variable using accessory kit), seat height adjustment, steering head angle adjustment (variable using accessory kit), swingarm centre of rotation adjustment (variable using accessory kit), HP4 Race Shift Assistant (Up/ Down), shift pattern reversed as delivered, Superbike World Cup button unit, HP Race Brake lever guard, secondary ratio variable using accessory kit (pinion 15, 16, 17 / chain ring 41, 42, 43, 44, 45)
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Relevant figures refer to DIN unladen weight

<sup>1)</sup> According to Directive 93/93/EEC with all operating fluids, fuelled with at least 90 % of usable fuel tank volume