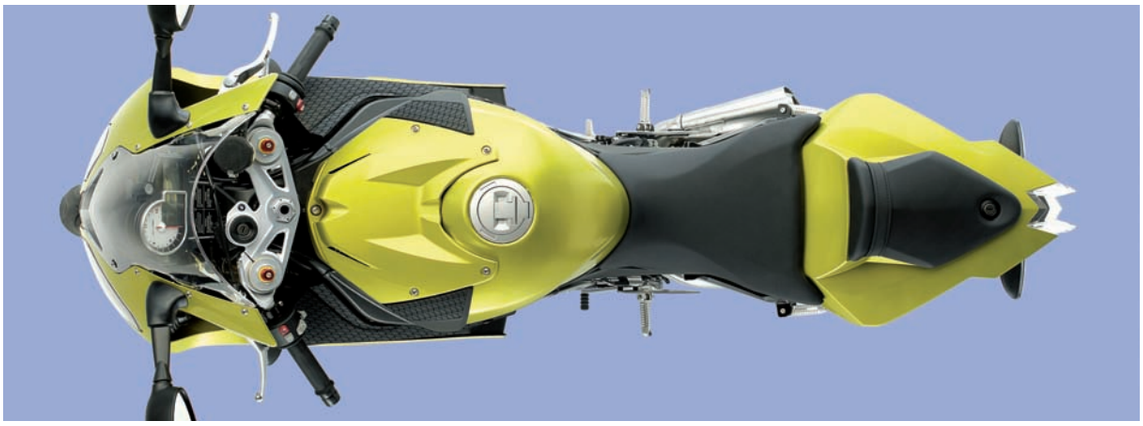
BMW Motorrad

Dealer Development and Training

The Ultimate Riding Machine



The new BMW S 1000 RR
Technical Features in Detail

BMW Motorrad Training

Introduction

When BMW Motorrad introduces the **S 1000 RR** in December 2009, fans of sports bikes across the world will witness new standards of motorcycle technology and performance. It is the only European supersports bike with an in-line four-cylinder engine that meets the challenge of the competition from the Far East.

The fact that the S 1000 RR as a supersports model is reflected in its fascinating and innovative high tech design and the unprecedented dynamism of its ride. Unparalleled riding properties combine with maximum engine power and road performance to achieve an outstanding performance package.

A rev-range of the newly developed 4-cylinder powerplant that just doesn't seem to end, an ergonomic yet sporty seating position which benefits from plenty of suspension reserves, playful and nimble handing and its low weight ensure a fantastic riding experience.

The new S 1000 RR is not only an outstanding supersports machine. It displays virtues that BMW bikes have long been associated with; innovative and detailed solutions which combine sheer riding pleasure with exceptional levels of comfort and safety. The end product of this meticulous attention to detail is a breath-taking addition to the supersports scene and one that is already out-performing well established class leaders.

Unique features such as Race ABS and **D**ynamic **T**raction **C**ontrol (**DTC**) together with four different riding modes ensure maximum safety under the most demanding and variable riding conditions.

The S 1000 RR is the supersports bike that will redefine "**The ultimate Riding Machine**" on public roads as well as on the racetracks of this world.

BMW Motorrad heralds its introduction into the world of the supersports motorcycle with a product that challenges the competition head-on and without compromise. In order to succeed in this segment, a performance package of exceptional quality is accepted as the designers starting point. High levels of top end power and a flexible yet versatile powerplant must be embraced by a dependable and responsive chassis. In order to provide maximum individuality, riding dynamics and safety, additional rider assist systems such as Race ABS and Dynamic Traction Control (DTC) will support the pilot in extreme riding situations.

The design philosophy of the S 1000 RR is unique. Front silhouette and lateral fairing panels are deliberately asymmetric and allow the front end to split into two different 'faces', giving the bike a prominent and unmistakable character. The centre part of the front fairing sports the central air inlet, which aids the development of power on account of the 'ram air' effect created by the airflow. The 1,000 cc bike is visually set apart by the slim fairing in conjunction with a strongly upswept angular rear end that carries a pillion passenger seat. Wind slats in the windshield ensure an airflow free from turbulence and thus a high level of ride comfort. The positioning of the attractive stainless steel exhaust system beneath the engine results in a low centre of gravity, whilst at the same time ensuring extreme banking angles combined with outstanding handling.

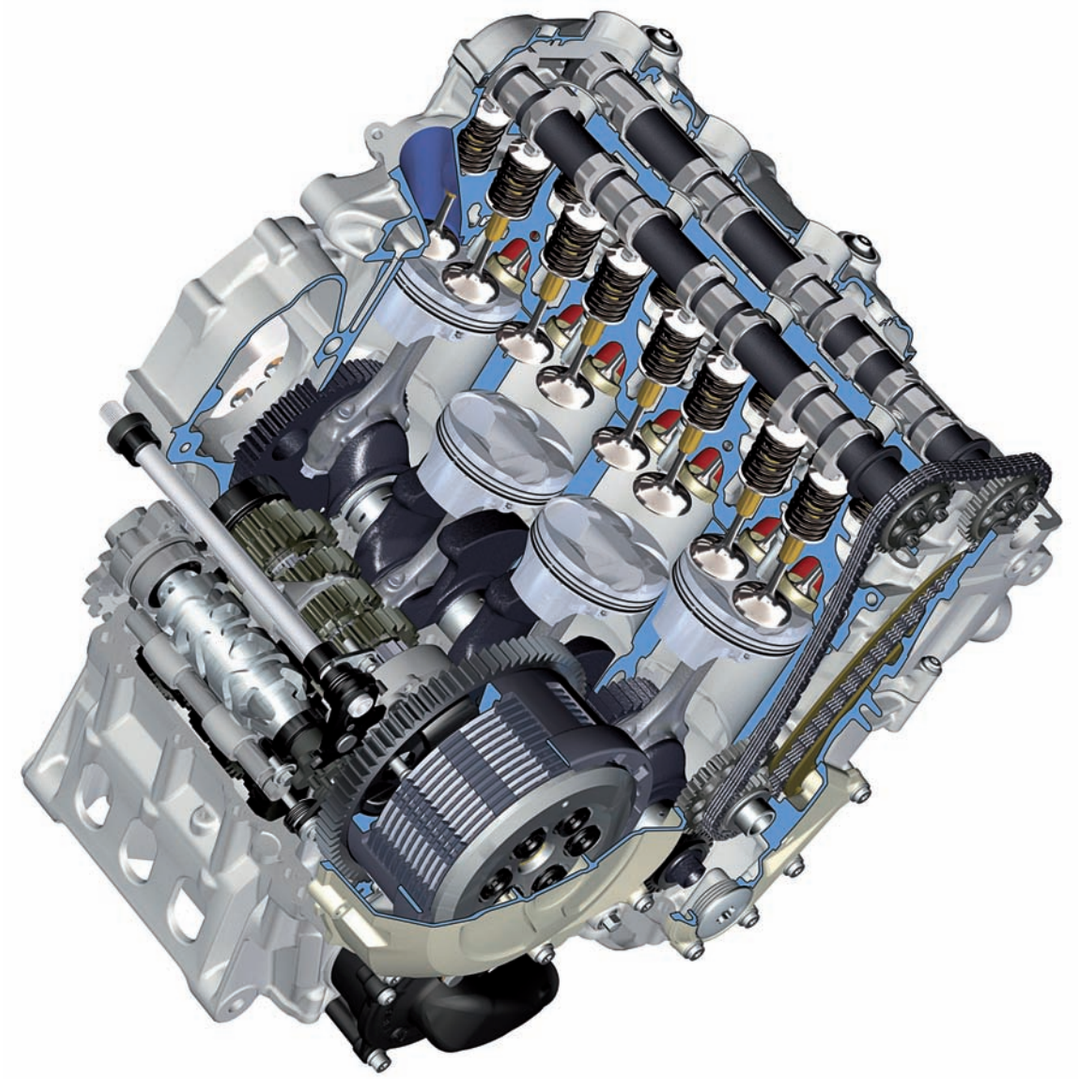
Brief Description

The chassis of the **S 1000 RR** is responsible for its unrivalled riding dynamics. The heart of the chassis is an aluminium bridge-type tubular frame of only 11.98 kgs, which accommodates a powerplant that is inclined forward by 32 degrees, as a load-bearing element. The front section of the frame not only carries the steering head but also functions as the intake air duct for the engine. The rear frame section is manufactured of square aluminium sections and bolted to the main frame. The front wheel suspension is achieved by an upside down fork with a stanchion diameter of 46 mm, supported in large ball bearings. Rebound and compression damping as well as spring preload are easily adjusted with the help of numbers ranging from 1 to 10, making the arduous counting of up to 30 'clicks' of the competitors' models a thing of the past. The rear wheel is connected by a dual lever swinging arm, with an effective length of 593 mm and manufactured of aluminium. Spring and shock absorber function are accommodated by a fully adjustable central suspension strut with settings ranging from 1 to 10 available. The ride position may also be adjusted. Die-cast aluminium rims with an intricate 10-spoke design carry a front tyre of 120/70 profile, whilst the rear sports a profile of 190/55.

Optimal brake performance is ensured by two 320 mm brake discs at the front and a 220 mm disc in the rear. The optional and newly developed Race Integral ABS features several different operating modes.

The in-line four of the S 1000 RR is a completely new development. A displacement of 999 ccs is achieved from a bore of 80 mm and a stroke of 49.7 mm. Its extremely oversquare bore & stroke ratio of 0.621 is the basis for a high-performance powerplant with top performance values. The nominal horsepower output is 142 kW at 13,000 rpm with a maximum torque rating of 112 Nm, output at 9,750 rpm. With these specs, the powerplant of the S 1000 RR establishes a new benchmark in the segment of supersports 1,000 cc bikes. Versatile and responsive performance dynamics, a sporty character, compact dimensions and the lowest possible weight, were the primary development targets for the new powerplant. With a weight of only 59.8 kgs, the engine of the S 1000 RR ranks among the lightest 1,000 cc 4-cylinder engines in the competitive environment.

BMW Motorrad also offers a wide range of products for personalisation of the new supersports bike.

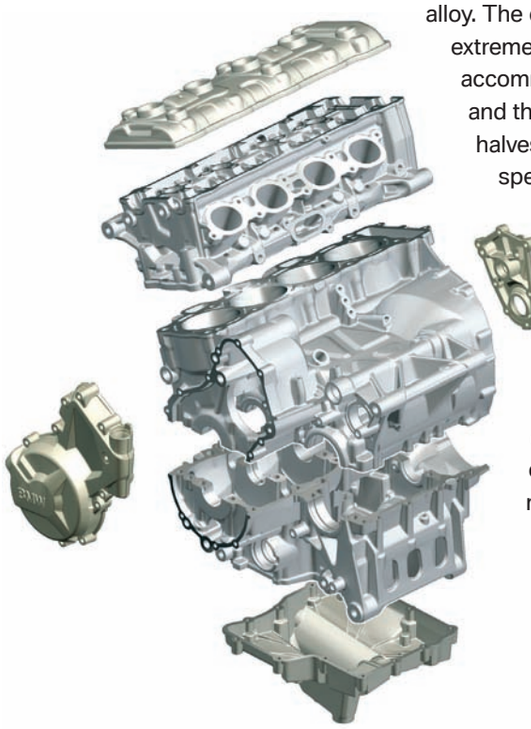


The completely new developed 4-cylinder powerplant of the S 1000 RR is the most powerful BMW production engine ever.

With a horsepower output of 142 kW at 13,000 rpm and a torque rating of 112 Nm at 9,750 rpm, it sits at the very top of the league of supersports bikes. The cylinder diameter of 80 mm in conjunction with a short stroke of only 49.7 mm result in a bore & stroke ratio of 0.621, allowing for a maximum engine speed of 14.200 revs. With this performance, the engine will accelerate the bike from 0 to 100 km/h in as little as 2.9 seconds and reach a top speed far in excess of 200 km/h. With only 59.8 kgs, the powerplant is one of the lightest 1,000 cc units in the competitive environment.

Highlights

Crankcase



The crankcase is horizontally split and manufactured of high-strength aluminium alloy. The compact upper half is an extremely stiff die-casting that accommodates the four cylinders and the upper crankshaft bearing halves. The light and compact 6-speed gearbox is also integrated into the upper crankcase half. The cylinder bank is inclined 32 degrees forward and features a water cooling jacket in a so-called closed-deck design for maximum stiffness. The cylinder liners are coated with wear-resistant and low-friction NiCaSil. The die-cast lower crankcase half accommodates the crankshaft main bearings as well as the bearings for the gearbox output shaft. The thin-walled die-cast magnesium oil pan is bolted to the lower crankcase section. Magnesium covers close off the engine on the right-hand clutch side and the left-hand alternator side. The top of the powerplant is closed by the cylinder head that sports a valve cover manufactured of lightweight magnesium.

Crankgear

The crankshaft of the **S 1000 RR** is a single-piece design forged from heat-treated steel. It is supported in plain bearings and features a traditional crank throw of 180 degrees for uniform firing intervals. The diameter of main and conrod bearing journals are both 34 mm. The cracked conrods are supported in plain bearings and feature a length of 103 mm. They weigh as little as 334 grams including the plain bearing. The small end of the conrod does not feature a bearing bush, but is equipped with two bores in the vertical axis that are offset by 45 degrees. These allow for lubrication of the gudgeon pin with splash oil. The 80 mm forged lightweight full slipper pistons feature an extremely short piston skirt, sporting two narrow compression rings and a three-piece oil scraper ring. The weight of the friction-optimised pistons including gudgeon pin is only 253 grams. Spraying nozzles in the crankcase cool the piston crowns that are subject to very high thermal loads from beneath.

The performance and environmental characteristics, as well as the fuel consumption are essentially determined by the cylinder head and valve gear. The 16-valve cylinder head of the S 1000 RR was developed with the focus on optimal port design, compact configuration, and exceptional thermodynamics. The compact valve angle results in an ideal shape of the straight intake ports together with a compact combustion chamber for high compression and optimal efficiency.

The S 1000 RR sports a cam follower valve gear with two overhead camshafts and compact, lightweight cam followers to actuate the valves. Another special feature is the arrangement of the shafts for the intake and exhaust cam followers rearward of the valves. This achieves a perfect combination of stiffness and minimum weight for the moving parts of the valve gear, combined with a very compact design of the cylinder head. The valve clearance is adjusted via extremely small and lightweight shims, guided in the spring collars. The collars on the intake side are manufactured of a lightweight aluminium fibre material and – thanks to their low oscillating mass – enable high valve acceleration values.

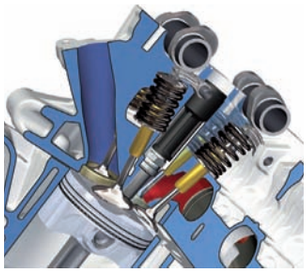
The two camshafts are made of heat treated steel and arranged directly on top of the valves, driven by a toothed chain via a countershaft that rotates above the crankshaft. The countershaft helps to shorten the timing chain that is used to drive the camshafts, resulting in increased precision of the valve timing and a reduction of the engine's width on the level of the crankshaft. The transmission ratio used for the countershaft in turn makes it possible to reduce the diameter of the cam sprockets, another aid to achieving the extremely compact design of the cylinder head.

Optimised valve springs together with a hydraulic low-friction timing chain tensioner contribute to the minimisation of the engine rotational drag and consequently to a further performance increase.

The valve angle of the titanium valves is 11.2 degrees on the intake and 13.3 degrees on the exhaust side. The cylinder bore of 80 mm makes it possible to use large diameter valves that have a positive effect on the performance. The valve head diameter is 33.5 mm on the intake and 27.2 mm on the exhaust side with a valve stem diameter of 5 mm for both. In the transition area to the valve seat insert, the intake ports sport an asymmetric finish to enhance the flow and to thus increase the cylinder charge for a higher horsepower output at high revs.

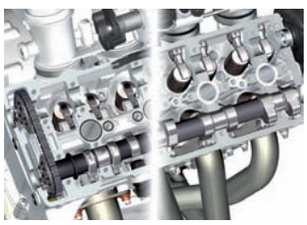
The flat shape of the combustion chamber and also the piston, combine to achieve a very high compression ratio. With a compression ratio of 13 : 1, the S 1000 RR's powerplant ranks at the very top of production petrol engines.

Cylinder head and Valve Gear



Cylinder head: S 1000 RR

Cylinder head: K 1300 R



Lubrication

The lubrication system used on the **S 1000 RR** is a wet sump lubrication with Eaton oil pump, the tried-and-proven solution widely used throughout this segment. An oil cooler helps to keep the oil temperatures low. It is aerodynamically integrated into the lower section of the fairing beneath the radiator. Utilisation of an oil cooler prevents undesirable additional thermal loads on the coolant, thus allowing for the utilisation of a more compact and lighter radiator and consequently reduction of the coolant volume. The oil is conveniently checked via an oil sight glass located on the left side of the engine beneath the alternator cover. The oil volume is 3.9 l including oil filter. The engine spoiler features an aerodynamically designed air duct to cool the oil pan.

Cooling System

An innovative cooling concept ensures optimal thermal balance of the S 1000 RR's powerplant. Coolant flows transversely through the cylinder head, with the cooled coolant entering on the right side, i.e. on the hotter exhaust side. The intensive cooling of the cylinder head is directed to the points of highest thermal loads and thus a better temperature balance for optimal performance is achieved.

The water pump is flanged to the right side of the engine and driven via a single-roller chain from the gearbox input shaft, just as is the oil pump. The coolant (50 % water and 50 % antifreeze) volume is as little as 2.9 litres.

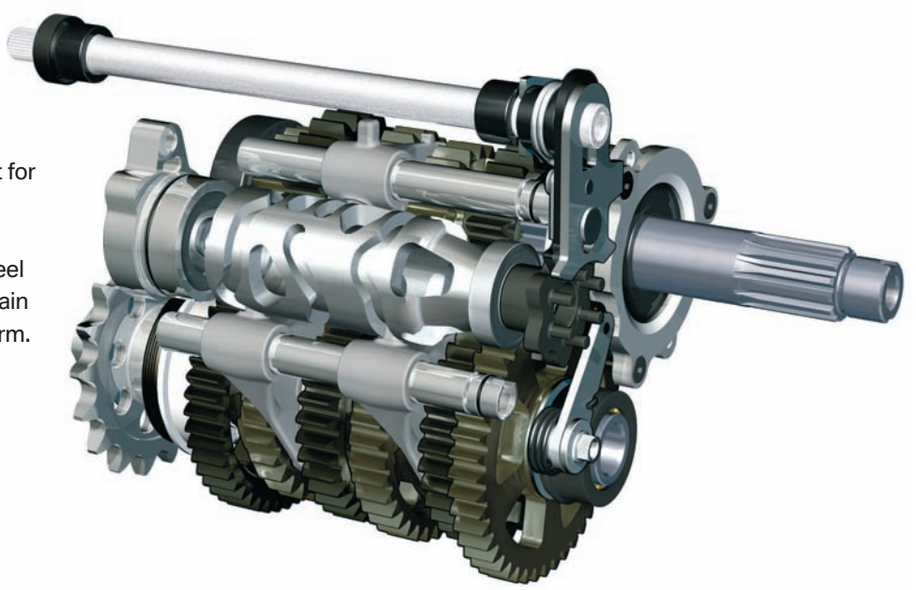
The trapezoidally curved radiator is positioned beneath the steering head, favourable from a centre of gravity as well as flow point of view. On account of its high efficiency and aerodynamic optimisation of the fairing and airflow, a comparably small surface area of only 955 cm^2 reliably dissipates the heat under all operating conditions. BMW Motorrad has developed a patented concept for the air routing to the radiator that ensures maximum efficiency of the heat dissipation. The perfect match for it is a comprehensively computed and wind tunnel tested aerodynamic concept for optimal air extraction from the fairing.

Gearbox

The constant mesh countershaft 6-speed gearbox is a very compact and lightweight unit. The gears are shifted via a lightweight steel selector drum and shift forks with 3 contact points. Primary and secondary shaft are compactly arranged on top of one another for the shortest and most compact design possible. This compact overall design length, allows for the utilisation of a long rear swinging arm for superior traction. The hollow selector drum (for reasons of weight) is supported in roller bearings, whilst the shift forks are manufactured of steel and lubricated by pressurised oil. The gears are straight cut and the shifting dogs and recesses are undercut for precise gear engagement.

The power is transmitted to the rear wheel via a 525 O-ring roller chain, with the chain routed through a shaft in the swinging arm.

The optionally available HP shift assistant – first introduced on the HP2 Sport – gives the rider of the S 1000 RR the possibility to upshift without the need to actuate the clutch and thus nearly without any interruption of the tractive power. During the gear change, ignition and fuel injection will be interrupted for fractions of a second.



Oil-immersed Anti-Locking Clutch

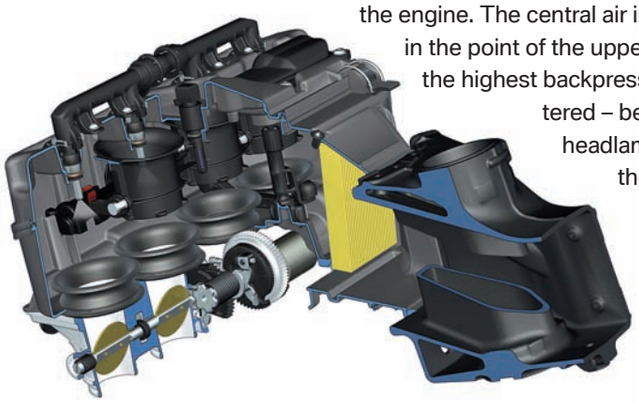
The torque is transmitted from the crankshaft to the oil-immersed anti-locking clutch via a straight cut primary drive with a ratio of 1 : 1.652. The clutch accommodates ten friction discs each with a diameter of 132.4 mm. With the so-called anti-locking principle, only part of the engine's braking torque will be transmitted to the rear wheel while the engine is coasting. During severe braking combined with a simultaneous downshift, this prevents a brief locking and hopping of the rear wheel as a result of the reduced load on the rear wheel caused by the dynamic wheel load shift.

The directional stability of the motorcycle and thus its rideability is retained even during the deceleration phase. The clutch is disengaged mechanically when coasting via a ramp-type sliding mechanism.

The clutch is actuated via the clutch lever with a maximum force of 80 N. The actuating force is transmitted to the release lever on the left side of the engine by a cable and from there to the clutch pressure plate on the right engine side via a push rod. Saving valuable weight was also possible in comparison with a hydraulic clutch actuating mechanism.

Intake System

Every bit of available space in the motorcycle was made use of in order to provide as much volume as possible for the intake system. The intake plenum with its clean air volume of 7.9 litres is accommodated directly above the engine. The central air inlet is located in the point of the upper fairing where the highest backpressure is encountered – between the two headlamps. From there, the intake air is routed along an ideal – i.e. straight – path through the steering head shaft and to the left and right of the steering head, directly to the vertical filter cartridge inside the air plenum. The 'Ram Air' effect creates an overpressure of up to 30 mbar within the air plenum, dependent on the actual riding speed, which results in an additional 4 kW of extra power at a speed of 250 km/h. The air passage from the air inlet opening to the steering head shaft is at the same time used as carrier for the instrument cluster, rear view mirrors, headlamps and horn. This lightweight die-cast magnesium component thus substitutes various separate brackets and thus helps to save more weight.

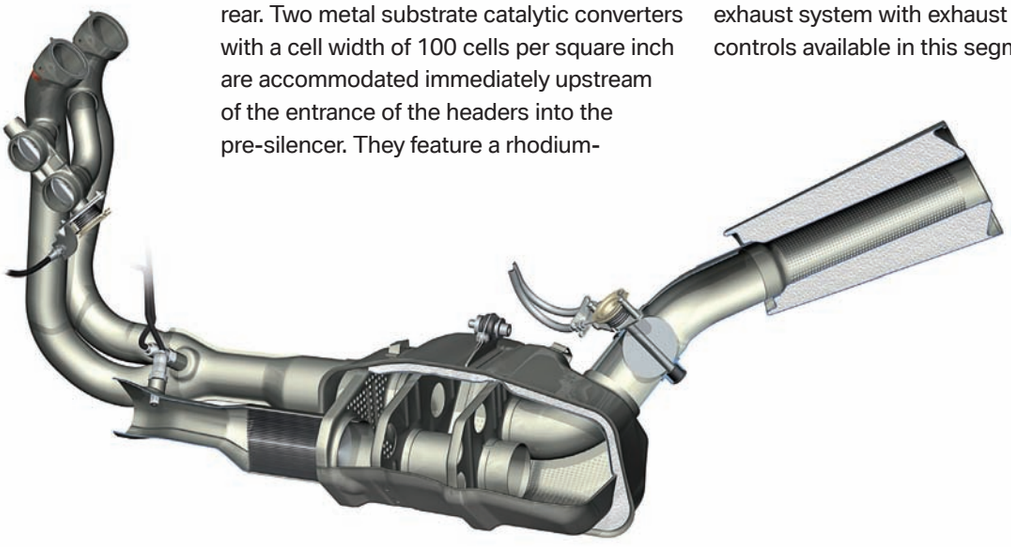


Variable Induction System

The **S 1000 RR** features a complex system of variable intake trumpets to improve the torque curve. Dependent on the engine speed, an actuator that is mounted on the air plenum varies the length of the intake trumpets in two steps, controlled by a specific map.

Exhaust system

The exhaust system is designed for maximum performance. It is routed beneath the engine for a lower centre of gravity. The separate headers are collected in two tubes that enter a large pre-silencer with three chambers based on the principle of reflection. The exhaust flow is channelled through a short, lightweight and dynamically shaped rear absorption silencer, which it exits at the rear. Two metal substrate catalytic converters with a cell width of 100 cells per square inch are accommodated immediately upstream of the entrance of the headers into the pre-silencer. They feature a rhodium-palladium coating, characterised by a high temperature resistance and a long service life. The very compact rear silencer in turn emphasises the slim design of the motorcycle, whilst at the same time ensuring a superb banking clearance. The entire exhaust system is manufactured of high-grade stainless steel and weighs only 10.7 kgs. Due to this it is the most compact exhaust system with exhaust emission controls available in this segment.



The S 1000 RR features the BMS-KP engine management system, further developed to cater for the various additional functions and upgraded with a faster processor capability. A fully sequential, cylinder-selective fuel injection system, electronic immobiliser, integrated knock control, extremely fast processing of the comprehensive range of sensor signals by state-of-the-art micro-electronics, a compact layout, low weight and self-diagnosis capability are the most important characteristics of this system. The torque-based engine management takes into account multiple individual variables.

For example, it allows for a maximum torque output and a sensitive adaptation of the engine operation during various riding conditions. The basis for control is the amount of air drawn in, indirectly determined via throttle angle and engine speed. Additional engine and ambient parameters (among others engine temperature, air temperature, barometric pressure) are used by the engine management system together with stored maps and correction factors to create individually tailored values for injection quantity and ignition timing.

Ride-by-Wire

Ride-by-wire or electronic accelerator is a system that actuates the throttle valves via an electric actuator rather than by cables. An ‘open’ and ‘close’ throttle cable is nevertheless still available to transmit the rider request to a rotary sensor. The sensor information is converted into a ‘torque request’ signal by the engine management system and an electric actuator then moves the throttle valve to the required position.

The recording of all parameters in a torque ‘map’ makes it possible to achieve optimal rideability in different riding conditions, up to and including the interference of the Traction Control. A mechanical linkage of the cable to the electronic actuator was also included on the S 1000 RR, which puts the rider in a position to close the throttle valve under any circumstance.

Engine Management

Pre-Injection

The injection system is fully sequential, which means that the fuel is injected individually into the intake port of the respective cylinder exactly when that cylinder needs it. Four injectors on the throttle rail and above the intake trumpet are used to inject the amount of fuel required for an optimal cylinder charge. The injectors are activated either in combination or separately, dependent on engine speed and power request.

Fuel Pressure Regulation

The fuel supply is a non-return system that utilises a pressure sensor to deliver the precise amount of fuel to the injectors that the engine actually requires. The fuel pump is activated via a transistor with the system pressure varying between 3 and 5 bar, dependent on the power requested.

A/F Control

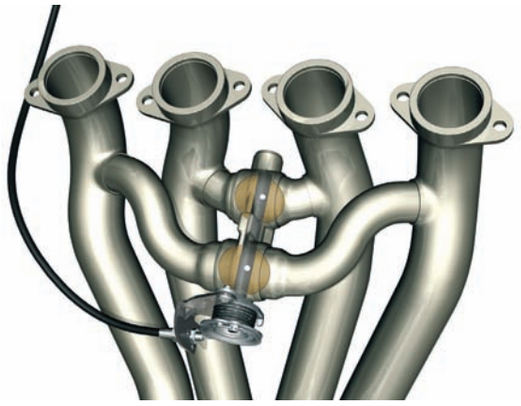
2 oxygen sensors, located where cylinders 1 & 2 and 3 & 4 merge, measure the composition of the exhaust gas. The engine management system will correct the quantity injected into the respective cylinder in case of deviations.

Idle Speed Control

The idle speed control and fast idle functions are realised via the electronically controlled throttle valve unit. The engine management system specifies a higher value for the idle speed (fast idle) in case of a cold engine. This value is reduced to the actual idle speed as the engine temperature increases.

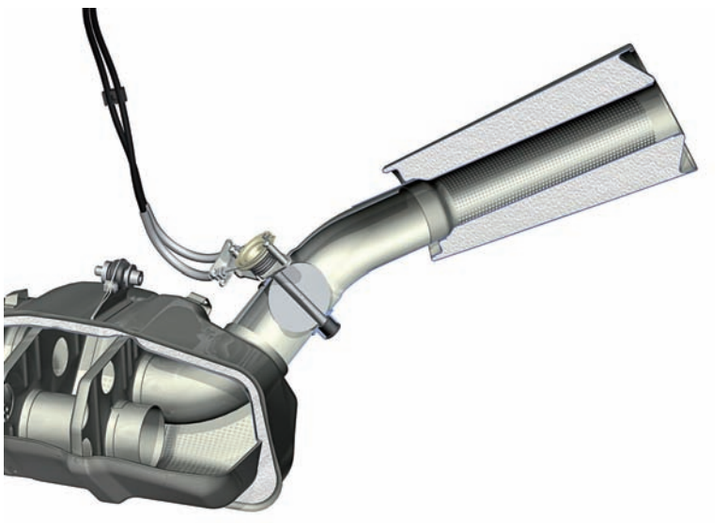
Crossover Tube Valves

The exhaust system is equipped with two crossover tube valves, each located in a crossover tube for the two outer and inner exhaust pipes. Being placed in the immediate vicinity of the exhaust ports, these valves help create a uniform delivery of horsepower and torque. Dependent on various map variables, such as engine speed and throttle valve position, an actuator will open or close both valves to thus connect or disconnect the two header tubes. This is used to timely balance the vibrations of the exhaust gas mass flows in such a way that the exhaust backpressure is reduced at the decisive point in time to thus increase the cylinder charge. This technology is unprecedented in a production motorcycle and essentially contributes to the high overall performance of the **S 1000 RR**.



Exhaust System Valve

Compliance with the strictest noise and emission legislation combined with maximum engine performance of the S 1000 RR is – among others – achieved by an electronically controlled exhaust system valve, accommodated upstream of the rear silencer. It makes available the optimal tube diameter as the engine speed increases. The throughput cross-section thus varied ensures a throaty sound in the low to medium rpm range, whilst the larger cross-section promotes maximum horsepower output and a sporty sound at higher revs.

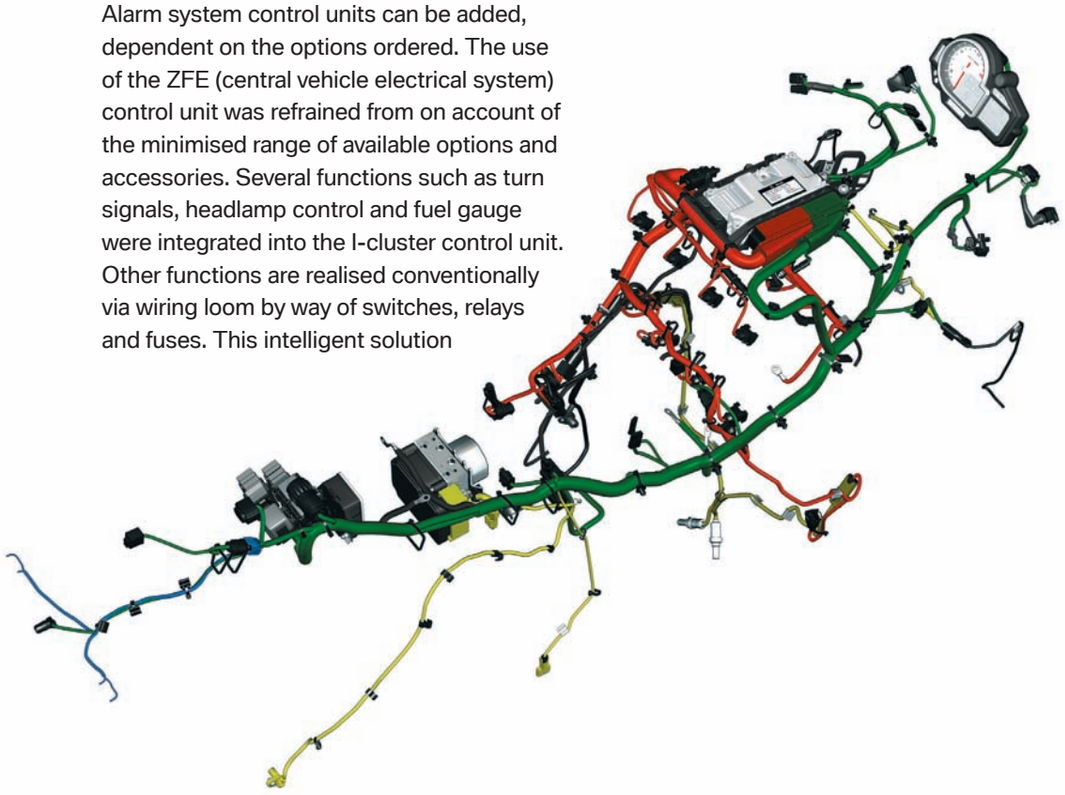


Electrical System

Hybrid Electrical System

As the name indicates, the electrical system of the **S 1000 RR** consists of two combined systems. This is a combination of the known network of control units through CAN bus technology with a conventional section that accommodates fuses and relays. A maximum of 4 control units exchange information in the CAN network. BMS-KP control unit and instrument cluster are standard on all bikes, additional ABS and/or Vehicle Theft Alarm system control units can be added, dependent on the options ordered. The use of the ZFE (central vehicle electrical system) control unit was refrained from on account of the minimised range of available options and accessories. Several functions such as turn signals, headlamp control and fuel gauge were integrated into the I-cluster control unit. Other functions are realised conventionally via wiring loom by way of switches, relays and fuses. This intelligent solution helps to save weight and package space and is thus perfectly in line with the requirements of the supersports segment.

A targeted and rapid diagnosis is possible using the BMW diagnostic systems – as usual, with the BMS-KP taking over the function of 'gateway' for the diagnostic interface. The S 1000 RR is equipped with a standard 10 Ah AGM battery.



Alternator and Starter

A reduced width, compact and most of all lightweight design were the priority also for the arrangement of the electrical ancillary systems and their drives. The alternator with permanent magnet excitation is thus located on the left-side crankshaft stub. It outputs 434 W at 6,000 rpm and is designed to handle a maximum engine speed of as much as 16,000 rpm. The regulator / rectifier unit was installed rearward of the powerplant.

The 800 W countershaft starter is accommodated behind the cylinder bank in the upper crankcase half and weighs 1,050 grams. It is connected to the outboard left crank web – designed as a spur gear – via an overrunning clutch with a transmission ratio of 1 : 24.61.

Instrument Cluster

The instrument cluster is equipped with a large and easy-to-read LCD display as well as an analogue tachometer. Apart from the vehicle speed and gear engaged, the display also shows which mode of the four different engine characteristics is currently selected.

The instrument cluster of the S 1000 RR makes available a distinctly higher number of functions than usual in this vehicle segment. The rider may for instance, switch the display to the “Racetrack” mode and read information on the current, fastest or last few lap times. In conjunction with the optional lap trigger, precisely clocked laps are available for subsequent data analysis. An integrated shift lamp with adjustable frequency and brightness puts the rider in a position to optimally approach the shift rpm. Another function of the shift lamp is the possibility to use it as an rpm display for racing starts. Whenever the optimal engine speed is reached – approx. 9,000 rpm – the shift lamp will start flashing make an optimal start possible.

The display in the I-cluster is also used for displaying warning and information messages. The function of the mileage and time-dependent service indicator is also integrated into the I-cluster. To reduce the load on the battery, a ‘light deactivation function’ is integrated, which switches off the headlamp / high beam after 10 seconds whenever the engine is not running. The I-cluster is furthermore responsible for automatic turn signal cancellation. As soon as a distance of 210 m has been covered and a time of >10 seconds elapsed, the flashers will be deactivated. The hazard warning flasher function is also the job of the I-cluster. For diagnosis and CIP applications, the vehicle order (priority 1), the VIN and the date, mileage and time-of-the-day will be saved in the I-cluster. The instrument cluster used on the S 1000 RR is the lightest application of its kind.

Lighting System

The asymmetric design of headlamp and high-beam is adopted from Endurance racing. It follows the principle of maximum effect combined with minimum weight. This is the reason why the high-beam is distinctly smaller than the low-beam headlamp.

The front turn signals are quickly removed for the racetrack. The license plate carrier including rear turn signals may be removed simply by separating a connector and loosening three mounting screws.

LED turn signals are optionally available for further personalisation. The LED taillight with clear glass look is standard. Utilisation of LEDs instead of conventional bulbs ensures a trouble- and maintenance-free operation and extends the service life considerably.

Operation

The latest generation of handlebar switchgear are distinctly smaller and characterised by a high level of functionality and convenient ergonomics. The previously separated functions for left and right turn signals are now combined in a single function located on the left side of the handlebar, reliably preventing a mix-up of turn signals and horn. The hazard warning flasher is activated via a separate easy-to-reach switch on the left handlebar controls. The low- and high-beam as well as flash-to-pass functions are integrated into a single switch that is conveniently reached by the left index finger.

Instrument cluster functions and settings are accessed via the left handlebar switchgear.

Apart from being a unique facility in the competitive environment it is practical and enhances safety (rider's right hand free). A toggle switch on the left side enables the Race ABS and DTC system; the mode for the engine characteristics is selected via the 'mode' switch on the right-side handlebar controls.

Selecting the Ride Mode "Rain" – "Sport" – "Race" and "Slick"

The rider has a choice of various ride modes to cater for a change in riding situations, such as dry or wet road or racetrack. Whenever the "mode" button is actuated, the display in the I-cluster will alternate from "Rain" to "Sport" and on to "Race". If the rider simply pulls the clutch lever whenever the desired mode is displayed and rotates the twist grip to the idle speed position, a different ride mode will be possible to select, even while riding. The mode last selected will remain active whenever the motorcycle is restarted.

When riding on wet tarmac and thus with reduced grip, the '**Rain**' mode reduces the maximum available horsepower output to 110 kW. A particularly uniform power and torque curve are additionally activated in this specific mode and the response of the engine as well as the power development will be smoother.

When riding on dry tarmac, the '**Sport**' mode will enable the full engine power of 142 kW in conjunction with a more spontaneous throttle response. This ride mode is particularly suitable for country roads.

The '**Race**' mode in turn was specifically developed for utilisation of the S 1000 RR equipped with street legal supersports tyres on the racetrack. The full engine power is equally available, but the throttle response will be extremely direct and noticeably more dynamic.

The '**Slick**' mode is exclusively intended for use on the racetrack in conjunction with treadless racing slicks. Similar to the "Race" mode, the full engine power will be available together with maximum spontaneity of the throttle response for racing or spins under race-like conditions. The "Slick" mode may be activated only if a specific jumper is installed in the respective connector of the vehicle's wiring loom, located beneath the seat. If this jumper is in place, the pilot has the choice of four different modes.

The Race ABS of BMW Motorrad is an entirely new development of a partial integral system, which is again distinctly lighter than the previously used partial integral systems. With a weight of as little as 1.6 kgs for the control unit and a total weight of only 2.5 kgs, it offers outstanding prerequisites for application in supersports bikes. Apart from its low weight, the system is primarily characterised by its enhanced control behaviour. The utilisation of 4 pressure sensors results in an even more sensitive response and control behaviour under the most varying of operating conditions. A complex rear wheel lift-off detection allows for differentiating between a road bump and a lifting rear wheel even better than was the case before.

Accordingly adapted characteristics are also available for the Race ABS for different areas of application such as wet tarmac (‘**Rain**’), dry road (‘**Sport**’), racetrack with supersports tyres (‘**Race**’) or racetrack with racing slicks (‘**Slicks**’), selected by the rider in the framework of the engine characteristics by a push of a button. These characteristics are combined with the respective ride modes and comprehensively adapted to one another for maximum safety.

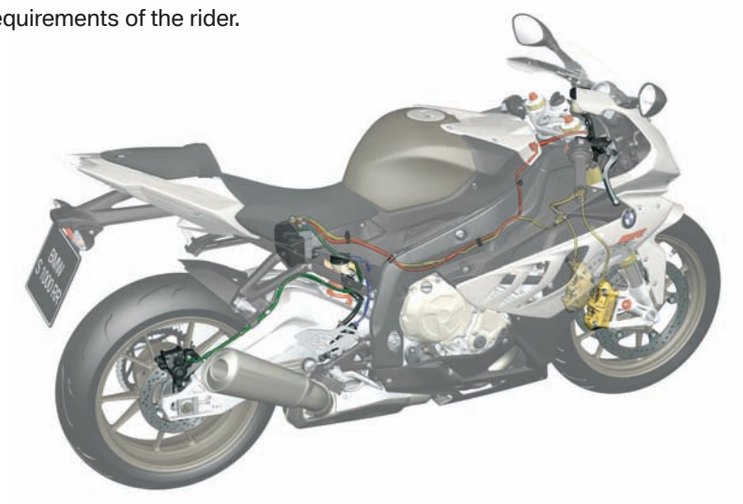
Whenever the hand brake lever is actuated in the ’**Rain**’ or ‘**Sport**’ mode, the front double disc brakes are activated, with only slight braking pressure built up in the rear wheel brake. The foot brake lever activates the rear wheel brake only.

In the ‘**Race**’ and ‘**Slick**’ modes, the rear wheel lift-off detection does not intervene with the rider’s request for deceleration. This means that the rider may decelerate even stronger on minor road bumps and with sufficient traction of the bike.

In the ‘**Slick**’ mode, the rider still has an ABS system for both wheels at his disposal whenever the hand brake lever is actuated. Actuating the foot brake lever puts skilled riders in a position to ‘brake drift’ without having to refrain from the benefits of a front wheel ABS.

The pressure sensor integrated into the front wheel control circuit will activate the stop lamp and the pump whenever the hand brake lever is actuated. The latter will then pump brake fluid through the open valve into the rear wheel circuit. The pressure set in the rear wheel circuit is monitored by a second pressure sensor and set in accordance with the desired brake force distribution defined by the rider. The third pressure sensor in the rear control circuit monitors the brake pressure applied by the rider’s foot.

The utilisation of a fourth pressure sensor in the front wheel circuit allows for a control of the front wheel brake pressure that was further enhanced and is more sensitive than that of the previously used BMW Integral ABS II. This is achieved by comparing the actual pressure values in the control and wheel brake circuits with one another. This also makes the omission of pressure release bores possible, which results in an optimal action point and perfect modulation.
All pressure sensors are integrated into the pressure modulator. The system layout with integrated pressure sensors makes a separate stop lamp switch unnecessary. The Race ABS may also be deactivated separately in all ride modes to cater for specific requirements of the rider.



Dynamic Traction Control "DTC" (optionally available only in conjunction with Race ABS)

A Dynamic Traction Control system is available as an option in conjunction with the Race ABS. In view of the enormous power potential of the **S 1000 RR**, the DTC system contributes impressively to overall performance and safety.

It is specifically under varying conditions, tracks with low traction and sudden changes of the coefficient of friction that the new DTC system provides valuable support for the rider. It prevents undesirable spinning of the rear wheel during acceleration and thus the loss of straight-line stability, which may result in the rear wheel breaking away and – in the worst case – in a crash. A comparison of the speed values of front and rear wheel via the ABS sensors and the data provided by the banking angle sensor allow the system electronics to detect a spinning rear wheel and to trigger the respective reduction of the engine power by backing off the ignition angle and intervening with the throttle position. Different from the previously used BMW Motorrad ASC systems, the DTC also monitors the motorcycle's banking angle via a complex cluster of sensors and takes it into account for its control behaviour.

Dynamic Traction Control is also available with the different ride modes of the engine management system.

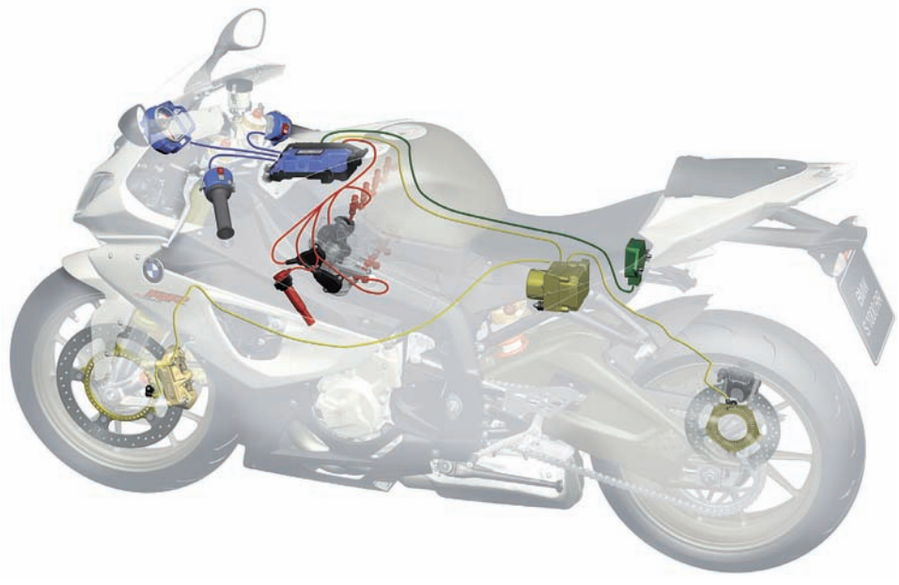
In the '**Rain**' mode for riding on wet tarmac, the traction control will intervene quite early before the friction limit is reached in order to provide maximum safety to the rider without sacrificing riding pleasure, even under the most difficult road conditions.

In the '**Sport**' mode, for example, when riding on dry roads, the traction control will intervene considerably later and in line with the distinctly higher friction values. In this specific mode it allows for a safe and at the same time sporty acceleration out of bends to provide maximum riding pleasure on public roads.

In the '**Race**' mode, the DTC is tuned more to approach the limit, taking into account a distinctly sporty riding style on the racetrack with street legal sports tyres.

In the '**Slick**' mode, the DTC is equally tuned to cater for racetrack applications, but takes into account the distinctly higher adhesion values of treadless racing slicks as well as an accordingly more racing oriented riding style.

The DTC as well as the Race ABS my be deactivated in all ride modes.



The S 1000 RR offers innovative suspension technology on the highest of levels for a supersports performance. It's not only maximum engine power that defines a supersports bike, it also has to have a chassis and suspension that is advanced enough to allow the rider to utilise the machine's awesome power. The slim design of the motorcycle in conjunction with its optimal ergonomic features are equally convincing, resulting in a particularly positive and safe ride combined with excellent handling properties. Computing models, simulations, CAD technology and countless road tests were employed to determine the ideal stiffness of the frame combined with minimum weight. The outstanding riding properties primarily result from the optimal position of the overall centre of gravity, a relatively steep steering angle of 66.1 degrees, and a short wheel castor of only 95.5 mm. The application of consistent lightweight design thus helped to create the lightest 1000 cc supersports bike with ABS. Including ABS, the S 1000 RR weighs only 206.5 kgs with a full tank of fuel.

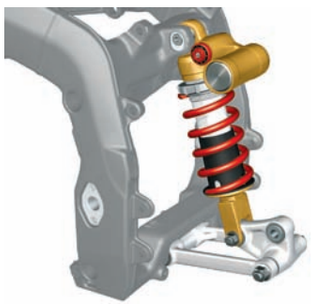
Frame

The aluminium bridge-type tubular frame weighs 11.98 kgs and utilises the powerplant as a load-bearing element. The frame is a welded design that is composed of four individual castings. This design helped to succeed with the enormous challenge encountered, when trying to realise a slim waistline as well as a large intake plenum. The steering head and the two lateral parts with integrated engine mounts are tilt castings, whilst the rear frame section that incorporates the rear engine mounts, swinging arm bearings and brackets for footrests and kinematics is a low-pressure die-casting. The frame elements are welded together in the BMW aluminium competence centre of the Berlin plant by a high-precision robot. The rear frame section is a welded design made of square aluminium sections, bolted to the main frame in four positions. This in turn allows for optimal accessibility of the centrally mounted rear suspension strut.

Swinging arm

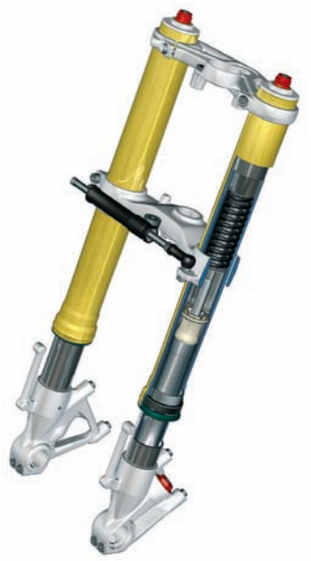
The swinging arm has a total length of 593 mm and is one of the decisive design factors when trying to deliver traction and grip from a bike with high engine power. Because of the short length of the engine, the **S 1000 RR** features one of the longest swing arms in the segment of supersports bikes. Three individual elements made of deep-drawn sheet aluminium with a wall thickness of 2.5 mm together with the lower cast shell create a torsionally rigid swinging arm body with a weight of as little as 6.22 kgs. A shaft in the left side of the swinging arm routes the drive chain to the sprocket. The lower cast shell integrates all auxiliaries that are subject to high mechanical loads, such as the pivot point of the kinematics system, swinging arm bearings and rear wheel mounts. The broad adjustment range of the rear axle of 45 mm allows for changing the position of the rear axle by 17.5 mm towards the front and by 27.5 mm towards the rear.

Suspension Strut



The S 1000 RR sports a central suspension strut with adjustable compression and rebound damping and spring pre-load. It additionally allows for an adjustment of the low speed damping (e.g. for extended road bumps) and high speed damping (e.g. in case of short jolts) of the compression. The suspension strut is mounted in a compact and lightweight kinematic system with an overall suspension travel of 130 mm, 90 mm of which are positive and 40 mm negative travel. Eccentric inserts in the upper strut mounts make it possible to lift the rear end of the S 1000 RR by 10 mm at the strut mount in order to adjust it to the individual requirements of the rider.

Telescopic Fork



The S 1000 RR comfortably meets the extremely high requirements on ride dynamics when it comes to front wheel guidance. An upside-down fork with a generous stanchion diameter of 46 mm provides exceptional torsional rigidity. In comparison to the conventional 43 mm units, this larger diameter ensures distinctly higher braking stability and greater feedback to the rider. The forks are accommodated in the steering head by two forged aluminium fork bridges. The steering shaft of the bottom bridge is supported in two large roller bearings. The installed length of the sliders may be used to adapt the ride height of the front end to the requirements of the rider. The total length of 15 mm allows for lowering the front end up to 5 mm and raising it by as much as 10 mm. The inside of the upside-down fork sports so-called cartridge inserts, i.e. a separate hydraulic piston-cylinder system, and features adjustments for the spring preload as well as compression and rebound. The overall suspension travel is 120 mm, 75 mm of which are positive and 45 mm negative travel. Settings from 1 to 10 are available for a simple adjustment of spring preload, compression and rebound. This makes the counting of ‘clicks’ as is otherwise required unnecessary and the current setting may immediately be verified. The compression and rebound adjustment are additionally colour-coded.

Wheels and Brakes – front

The die-cast aluminium wheels with ten intricate spokes emphasise the dynamic overall impression of the S 1000 RR. Maximum strength combined with the lowest possible weight were the design priorities. This is the reason why the area of the rim hub was designed to directly accommodate the brake discs. The front brake comprises two floating 320 mm stainless steel brake discs with a thickness of 5 mm. The brake system is actuated via a radial master brake cylinder with a diameter of 19.05 mm located on the handlebar. The two radial Brembo brake callipers each sport four 34 mm diameter pistons as well as four symmetric sintered metal brake pads. A 120/70 ZR 17 tyre is mounted on the 3.50"x17" rim.

Wheels and Brakes – rear

The 6.00"x17" rear rim features the same design and sports a 190/55 ZR 17 tyre. The rear brake system consists of a 220 mm fixed brake disc with sintered metal brake pads and single-piston floating calliper. The brake lines for the front and rear are made of braided steel to provide a consistent lever pressure. The sprocket transmits the drive forces to the rim via an integrated torque cushion.

Design and Ergonomics

The **S 1000 RR** shares the unmistakable design philosophy of BMW Motorrad. Asymmetric sections, employed for the design of the front end, giving it two 'split faces' are typical design elements of BMW Motorrad and used to give the S 1000 RR a prominent and unmistakable character. This asymmetric design not only pursues mere design aspects, at the same time it meets functional requirements. Whilst a large outlet opening for the outflowing cooling air was achieved on the left side, a very dynamic 'gill' look was created on the other. Guide surfaces are equally integrated into the engine spoiler, which optimise the airflow to the radiator and oil cooler.

The transparent windshield is another functional design component, with a patented shape specifically arranged in the windshield to prevent undesirable turbulence. The pressure that reaches the helmet and upper body of the rider is thus pleasantly low even at high speeds, resulting in the best wind protection that is available in this segment.

When it comes to the colour scheme, painted elements alternate with dark vehicle components in a very harmonious interplay. The painted aluminium fuel tank is ergonomically integrated into the overall concept and allows for excellent knee contact and thus a perfect integration of the rider. Considerable focus was put on balanced ergonomics, which equally cater for the needs of short and tall riders.

These asymmetric elements and technical details distinctly set the S 1000 RR apart from its competitors and give it an extremely sporty appearance. The low contour front fairing together with the upswept angular tail section as well as the slender and dynamic proportions of the bike create the impression of a muscular supersports motorcycle.

The S 1000 RR certainly sets new benchmarks in the supersports segment regarding design and performance. A comprehensive range of available options and accessories provides the possibility to personalise the motorcycle according to the individual requirements of its rider.

Handlebar and Cockpit

The rider's cockpit is designed without compromise to provide a clear and functional arrangement. All functions required for the operation of the electrical and electronic components are clearly arranged and easily accessible. The operation of ABS, DTC, high-beam, horn, and turn signals is exclusively performed by the left hand. The right side sports the start/stop switch as well as the mode button for the selection of the ride modes. Clutch and brake lever are adjustable and clamped to the clip-on handlebars with a split bracket, which makes them individually adjustable and easy to replace. The I-cluster displays the engine speed via a digitally controlled rev counter. The central display shows the road speed and the gear engaged in large numbers together with the ride mode selected / currently active. The right-hand part of the display provides information on trip mileage, includes a lap timer function with data recording for the last 10 laps, and a menu for various settings of the I-cluster.

The lap timer is triggered via the high-beam switch or the optional infrared lap trigger. Only 2 screws need to be loosened to remove the rear view mirrors for the racetrack. The full aluminium tank with a capacity of 17.5 litres makes a valuable contribution to save weight, since it weighs approx. 1.5 kgs less than those of the competition.

Rear View

The rear LED light combines the tail and stop lamp functions and is integrated neatly into the tail section. The appearance is as if the S 1000 RR wants to show it's 'horns' to the traffic following. The license plate carrier accommodates turn signals, reflector and license plate illumination. The removal of 3 screws and the separation of a connector is all it takes to remove the carrier for the racetrack. The turn signals may also be retrofitted in an LED variant as an accessory.

Colours and Equipment

Colours

Mineral silver metallic in combination with ostra grey swinging arm and rims create a highly technical and clear contrast, making the **S 1000 RR** appear extremely light, compact and dynamic without being obtrusive.

The thunder grey metallic variant pursues a different intention. It deliberately refrains from strong contrasts and ensures a compact and stocky appearance in combination with swinging arm and rims in ostra grey.

The S 1000 RR makes an unambiguous statement of its sporty nature in striking acid green metallic. Here, the contrast is again very pronounced to impressively emphasise the dynamic and sporty character of the bike. With this colour variant, the swinging arm is anodised in noble silver with the rims painted in high-gloss black.

Available at an extra charge: The S 1000 RR in a colour scheme that is based on that of a superbike racer. The bike is finished in modern solid alpine white, solid magma red and lupin blue metallic. The swinging arm is equally anodised in silver and the rims are painted in high-gloss black.

Options (SA) available ex factory

- BMW Motorrad Race ABS
- Race ABS with Dynamic Traction Control (DTC)
- HP shift assistant
- Vehicle Theft Alarm system incl. remote control

Accessories (SZ) range

- HP pillion passenger footrests
- HP clutch lever, folding
- HP brake lever, folding
- HP carbon badge carrier left
- HP carbon badge carrier right
- HP carbon fuel tank trim left
- HP carbon fuel tank trim right
- HP carbon chain guard
- HP carbon mudguard front
- HP carbon mudguard rear
- HP carbon pillion seat cover
- HP carbon engine spoiler
- HP carbon heel protector
- HP lap trigger
- LU infrared receiver 2D
- Infrared transmitter 2D
- Tank bag
- Rear bag
- Pillion seat cover in body colour
- Akrapovic® sports silencer
- Sports assembly stand
- Sports assembly stand, front
- Fork adapter front for assembly stand
- Swinging arm adapter for sports assembly stand
- Windshield tinted
- Windshield high
- Windshield tinted high
- Crash sensor
- Retrofit VTA
- LED turn signals

Specifications

Engine: Type	Water/oil-cooled four-stroke in-line four-cylinder with four valves per cylinder actuated via cam followers, two overhead camshafts and four titanium valves per cylinder
Horsepower output	142 kW @ 13,000 rpm
max. torque rating	112 Nm @ 9,750 rpm
Bore	80 mm
Stroke	49.7 mm
Effective displacement	999 cc
Bore/stroke ratio	0.621
Compression ratio	13 : 1
Fuel type	premium plus unleaded (95 – 98 octane incl. knock control)
Valve angle to cylinder axis	Intake: 11.2° Exhaust: 13.3°
dia. intake valve	33.5 mm
dia. exhaust valve	27.2 mm
Cam spread	IN: 106° / EX: 105°
Valve timing, measured at 3 mm valve lift	IN opens 2° BTDC IN closes 34° ABDC EX opens 22.5° BBDC EX closes 10.5° BTDC
Valve lift (zero valve lash)	IN 9.67 mm EX 8.54 mm
Engine oil capacity	3.9 l
Oil filter	external filter cartridge
Oil pumps	1 Eaton pump
Oil circuit operating pressure	3.5 – 5.5 bar
Engine cooling system:	Oil/water cooling
Capacity	2.9 l
Thermostat opens at	85° C
Clutch:	oil-immersed multi-plate anti-locking clutch, mechanical actuation
Clutch plate dia.	132.4 mm
Drive discs	10
Actuation	cable actuation, adjustable
Gearbox:	sequential 6-speed gearbox with straight-cut gears
Primary transmission ratio	1 : 1.652
Gear ratios	1st gear 1 : 2.6471 2nd gear 1 : 2.091 3rd gear 1 : 1.727 4th gear 1 : 1.500 5th gear 1 : 1.0360 6th gear 1 : 0.261

Final drive:	O-ring chain
Transmission ratio	1 : 2.588
Number of teeth	44 : 17
Fuel preparation / Ignition system:	BMW BMS-KP EU4 engine management
max. engine speed	14,200 rpm
Idle speed	1,270 rpm
A/F control	above 9.75°
Deceleration fuel cut-off	Engine temperature above 90° Engine speed above 2,400 rpm
Fuel circuit pressure	3 to 5 bar, variable
Fuel tank capacity	17.5 l incl. approx. 4 l reserve
Ignition timing	Map
Spark plug type	NGK LMAR9D-J
Alternator:	alternator with permanent magnet
Nominal rating (max.)	434 W
Max. regulated voltage	14.4 V
Transmission ratio	1 : 1
Starter:	Electric motor with permanent excitation
Power output	0.8 kW
Battery:	maintenance free AGM battery 12 V / 10 AH; 12 V / 12 Ah; 12 V 14 Ah
Electrical system:	CAN bus electrical system, with fuses, w/o central vehicle electrical system ZFE
Front wheel suspension:	USD telescopic fork
Suspension travel at the wheel	120 mm
Stanchion diameter	46 mm
Steering head angle	66.1°
Steering angle	28° left/right
Adjustment	compression and rebound adjustment via scale from 1 to 10, spring preload and ride position (delta 15 mm)
Rear wheel suspension:	dual-lever swinging arm with central suspension strut
Swinging arm length	593 mm
Suspension travel at the wheel	130 mm
Damper system	central suspension strut
Adjustment	compression, high and low speed rebound, spring preload and ride position (delta 10 mm)

Specifications

Wheels:	cast aluminium wheel with 10-spoke design
Dimensions front	3.50" x 17"
Dimensions rear	6.00" x 17"
Tyres:	sports tyres
Dimensions front	120/70 ZR 17
Dimensions rear	190/55 ZR 17
Braking system:	hydraulic actuation
Option	Race ABS, 4 modes may be selected / deactivated DTC, 4 modes may be selected / deactivated
front	dual disc brakes, fixed radial 4-piston callipers, disc mounted acc. to BMW concept, stainless steel brake rotors
Brake disc diameter	320 mm
Brake disc thickness	5 mm
Piston diameter at brake calliper	34 / 34 mm
Piston diameter master brake cylinder (hand)	19.05 mm
Brake pad friction material	sintered metal
rear	single disc with 1-piston floating calliper
Brake disk diameter	220 mm
Brake disc thickness	5 mm
Piston diameter at brake calliper	34 mm
Piston diameter master brake cylinder (foot)	12.7 mm
Brake pad friction material	sintered metal
Dimensions:	
Overall length	2,056 mm
Overall width incl. mirrors	826 mm
Handlebar width w/o mirrors	707 mm
max. height with mirrors	1,138 mm
Wheelbase in normal position	1,432 mm
Castor in normal position	95.9 mm
Steering angle in normal position	66.1°
Seat height at dry weight	820 mm
Inside length of riders legs	1,810 mm
Weights:	
Unladen weight with full fuel tank	204 kgs (206.5 kgs with ABS)
Dry weight	183 kgs
GVWR	390 kgs
Performance data:	
Top speed	> 200 km/h
Acceleration 0 – 100 km/h	2.9 sec
Average fuel consumption @ constant 90 km/h / 120 km/h	5.7 l / 5.9 l

Printed in Germany

Responsibility for the contents: UX-VM-4, Alfred Kammerer, 10/2009