HONDA

Press Information

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2020 HONDA CBR1000RR-R FIREBLADE SP

The CBR1000RR-R SP is a brand-new motorcycle, built with an unwavering focus on circuit riding, with unprecedented levels of performance and control. Its inline four-cylinder engine draws heavily on the RC213V-S's combustion efficiency and low-friction technologies – while also sharing its bore and stroke; it also features titanium con-rods and forged aluminium pistons. Honda Selectable Torque Control (HSTC) has been optimised and adjustable Start Mode added to Power, Engine Brake and Wheelie Control; a quick shifter is standard. An aluminium diamond frame features a longer RCV213V-S-style swingarm, with six-axis Inertial Measurement Unit (IMU), 3-level Honda Electronic Steering Damper (HESD) and second-generation Öhlins Smart Electronic Control (S-EC) suspension and user interface. New Brembo Stylema brake calipers bite 330mm discs

through 2-level ABS. The bodywork and riding position have an uncompromising focus on aerodynamic performance, and the fairing features MotoGP-derived winglets to generate downforce. A full-colour TFT screen and Honda Smart Key are the finishing touches.

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1. Introduction

Since its original 1992 introduction Honda's iconic Fireblade has evolved into an incredible 1000cc sports motorcycle. And it's also been the base of a competitive race machine, on short circuits around the world and the roads of the Isle of Man TT.

But time - and competition - marches on, and for 2020 Honda is drawing a line under where the CBR1000RR Fireblade has been, and looking forward to where it's going. Two brand-new motorcycles – the CBR1000RR-R Fireblade* and CBR1000RR-R SP Fireblade – have been created, with heavy involvement from Honda Racing Corporation, to carry the legend forward.

Leaning heavily on the engine and chassis technology of the RC213V-S 'street-legal MotoGP machine', with aerodynamics drawn from the RC213V MotoGP bike, both versions of the new Fireblade have been designed from the ground up - in terms of engine, handling and aerodynamics - for outright track performance.

**See separate CBR1000RR-R Fireblade press kit for information.

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2. Model Overview

From a clean sheet Honda and HRC's development engineers set to work creating a new inline four-cylinder engine for the both the CBR1000RR-R and CBR1000RR-R SP. It's a compact, short-stroke layout – sharing the bore and stroke of the RC213V – and features a semi-cam gear train, finger-follower rocker arms, titanium con-rods, RC213V-S internal friction reduction technologies, piston jets with check ball system and a built-in bottom bypass passage for the cylinder water jacket.

A ram-air duct in the front fairing tip feeds through the headstock directly into the airbox. The 4-2-1 exhaust downpipes are ovalized and the end-can has been developed in conjunction with Akrapovic.

The result? The CBR1000RR-R SP engine delivers 113Nm @ 12,500rpm and makes peak power of 160Kw @ 14,500rpm.

Throttle By Wire has been enhanced for improved feel and three default riding modes feature options to change Power, Engine Brake, Wheelie Control and the optimised Honda Selectable Torque Control (HSTC). The electronics package also now includes adjustable Start Mode.

A totally new aluminium diamond frame uses the rear of the engine as the upper shock mount; the swingarm is longer and based on the RC213V-S design. The rigidity balance, weight distribution and steering geometry have been carefully adjusted for the increased engine output, in terms of front and rear grip levels, and feel for both.

A new 43mm Öhlins NPX front fork replaces the NIX fork of the previous model and second-generation Öhlins Object Based Tuning interface (OBTi) offers finer control of settings front and rear. The front discs are larger in diameter and worked by new Brembo Stylema four-piston calipers while the ABS is adjustable for track riding. The rear tyre is now sized 200/55-ZR17.

A six-axis Inertial Measurement Unit (IMU) provides accurate 3D estimation of riding dynamics and provides input to manage all of the electronic systems. It also controls the new rod-type 3-level Honda Electronic Steering Damper (HESD).

Honda's RC213V MotoGP machine has leant some of its slippery aerodynamics to the CBR1000RR-R Fireblade SP, including winglets to increase downforce and improve braking stability. The riding position is also much more compact.

The fully customisable 5-inch TFT display offers intuitive control operated via a simplified four-way switch on the left handlebar. Honda's Smart Key system adds convenience.

3. Key Features

3.1 Engine

- ***Short-stroke, inline four-cylinder engine produces high output at high rpm***
- ***Ultra-compact design due to semi-cam gear train and starter motor driving through clutch main shaft***
- ***Internal friction reduced by Diamond Like Carbon (DLC) cam lobes and bottom-bypass water jacket***
- ***Finger-follower rocker arms, titanium con-rods and forged aluminium pistons reduce inertial weight***
- ***Airbox fed by ram-air duct tunnel through the steering stem***
- ***Titanium end-can developed in conjunction with Akrapovic***

The CBR1000RR-R Fireblade SP's 1000cc inline four-cylinder engine is completely new and designed with heavy input from the HRC MotoGP development program. It now generates peak power of 160Kw @ 14,500rpm, with peak torque 113Nm @ 12,500rpm.

To achieve the required valve size, combustion efficiency and friction reduction to generate these numbers, the RR-R engine shares the same ‘over square’ 81mm bore and 48.5mm stroke as the RC213V – a radical change from the 76 x 55.1mm of the previous design, and the largest bore size among inline four-cylinder 1000cc machines.

Compression ratio is set at 13.0:1. The inlet valves are 32.5mm diameter, with 28.5mm exhaust; they’re also now operated by finger-follower rocker arms (as opposed to bucket valve drive) which reduces inertial weight by approximately 75%. Friction is further reduced by the use of Diamond Like Carbon (DLC) on the cam lobes – just like the RC213V-S. This is the first time this process has been used on a mass-produced motorcycle and sees a reduction in valve train frictional loss of 35% compared to non DLC-coated lobes. To reduce crankshaft deflection (due to inertia and combustion energy) the crank journals are larger and the crankcase wall thickness has been optimised.

The valve train is driven by a new (patent pending) semi-cam gear train system. To drive such high-rpm/high-cam lift performance the chain is driven from the timing gear located on the crank shaft via the cam idle gear – this makes it shorter in length.

Forged, lightweight TI-64A Titanium (a material developed by Honda) con-rods and con-rod caps save 50% in weight compared to Chromium Molybdenum steel versions; they also employ HB 149 Chromium Molybdenum Vanadium (Cr-Mo-V, again a Honda development) steel bolts and do without fastening nuts.

To ensure durability the same configuration as the RC213V-S is applied to the sliding surfaces – the small-end bushings are made of shaved C1720-HT Beryllium copper (because of its high-rpm reliability) while the surfaces of the big-ends are treated with DLC.

The pistons are forged from A2618 aluminium (the same as the RC213V-S) for lightweight strength and durability and each piston is 5% lighter than before. To guarantee high-rpm wear resistance the piston skirts now feature an Ober coating (Teflon and Molybdenum base) and nickel-phosphorous plating for the piston-pin clip-groove.

To manage temperature increase the pistons use a multi-point piston jet which sprays cooling oil in multiple directions through each cycle. At low rpm – when not needed – check balls within the jets shut off the flow of oil in order to limit oil pressure loss and reduce friction.

Air is fed into the engine via a ram-air duct located at the high-surface pressure tip of the front fairing; the size of its aperture is equivalent to that of the RC213V MotoGP machine. A ribbed ‘turbulator’ to the right, left and above the duct entrance ensures maximum induction of moving air with minimal impact on handling. The draft angle of the aperture’s interior wall maintains flow under high-speed and acceleration.

To maintain stable performance across a wide speed range, pressurised air takes a straight shot through the headstock, around the steering stem and into the airbox. This smooth path is made possible by the application of Honda’s Smart Key system (dispensing with a traditionally-mounted ignition barrel) and steering angle of 25°.

The ‘dirty’ side of the air filter has been enlarged to lower airflow speed and it’s also 25% bigger than the previous design and angled for an even flow. On the ‘clean’ side, filtered air

changes direction into the largest volume of the airbox and - along with fuel from the upper injector - feeds to an eccentric bell-mouth funnel. The result is reduced drop in intake air pressure – and more efficient breathing for more performance.

To draw the volume of air needed the throttle body diameters have been enlarged from 48 to 52mm. An oval internal cross-section makes for smooth flow – and further reduces intake pressure drop – from the throttle butterfly valves to the inlet valves.

The valve angle on the intake side has been reduced from 11° to 9°. This change improves combustion efficiency by reducing the surface area of the combustion chamber, and gas flow efficiency of the intake ports is increased by approximately 2%.

The port volume (the capacity between throttle butterfly valves and intake valve seat) has been reduced 13% to improve throttle response. And the throttle shaft is now constructed from highly rigid stainless steel (as opposed to brass) reducing deflection and operational friction, putting a much more direct connection into the rider's right hand.

Mirroring the intake side, the four exhaust downpipes have optimised diameters and an oval cross section to improve gas flow. The catalyser unit is 10mm larger in diameter to reduce exhaust pressure drop, and careful adjustment of wall thickness has minimised any weight increase.

Akrapovic partnered in development of the exhaust end-can. Constructed from titanium, its small physical size and light weight contribute to mass centralisation and right-side lean angle. The exhaust valve was also designed with Akrapovic to deliver both low-rpm torque and high-rpm power; a valve stopper (patent-pending) stops exhaust-gas leak when closed while also reducing noise, allowing total end-can internal volume to reduce by 38% compared to the outgoing design.

Minimising friction elsewhere in the RR-R engine was a key focus in obtaining the increase in rev-range. To reduce bore distortion (and thus friction), the cylinder features a patent-pending built-in bottom bypass. This system circulates cool water from the radiator into the main water jacket, while the area below uses non-cooled water. The net effect is a lower, and more even temperature at all points across the bores compared to the previous engine. An external hose is also eliminated.

To reduce width the engine is started by rotation of the clutch main shaft rather than the crankshaft. Patent-pending, this design allows for a more compact crankshaft while double use of the primary driven gear (which itself is smaller, with fewer teeth) to also transmit rotation from the starter motor saves space; the engine is shorter in length thanks to reduction in distance between the crankshaft, counter shaft and main shafts. The rear of the engine block also now serves as the upper shock mount.

3.2 Engine/Electronics

- ***Throttle By Wire optimised for faster response and improved feel***
- ***Three default riding modes plus options to customise Power, Engine Brake and Wheelie control***

- ***Honda Selectable Torque Control (HSTC) gains slip rate control for smooth torque management over 9 levels***
- ***Start Mode and quickshifter standard fitment***

Alongside the 17YM CBR1000RR, the 17YM CBR1000RR was the first in-line four-cylinder engine from Honda to use Throttle by Wire (TBW). Derived and developed from the system used by the RC213V-S, it controls the throttle butterfly valve angle (relative to input from the throttle) to provide a linear delivery and puts precise throttle control – and a natural feel – in the rider's right hand.

For the CBR1000RR-R SP, TBW has been improved for faster response through a range of part throttle applications – such as gradual opening on corner exit – to minimise any delay in torque delivery.

There are three default riding modes, with options to change engine output and character (see diagram). Power (P) operates through levels 1-5 with 1 giving ultimate outright power. Engine Brake (EB) manages performance on a closed throttle through levels 1-3, with 1 being the strongest engine braking and Wheelie (W) through levels 1-3 (plus off) with 1 giving the weakest intervention.

Wheelie control uses information gathered by the IMU on pitch angle, along with front and rear wheel speed sensors to maintain torque and deal with the wheelie without sacrificing forward drive.

Honda Selectable Torque Control (HSTC) adjusts through 9 levels (plus off) with 1 giving weakest intervention. It has been optimised for the 2020 machine and now adds slip rate control (when the slip *change* rate based on ratio of front/rear wheel speeds exceeds predetermined values) to moderate rapid wheel spin (see diagram). In conjunction with the existing outright slip control, HSTC is smooth in operation while delivering maximum confidence for the rider.

The CBR1000RR-R SP is also equipped with Start Mode for race starts. It limits engine rpm at 6,000, 7,000, 8,000 and 9,000rpm set-points, even with a wide-open throttle, letting the rider focus on clutch release (and lights) alone. A quickshifter is also fitted as standard, with performance optimised for racetrack performance and reliability.

3.3 Chassis

- ***New aluminium frame and swingarm change weight distribution, centre of gravity and rigidity balance for improved handling and traction***
- ***Bosch six-axis Inertial Measurement Unit (IMU) for accurate calculation of machine dynamic behaviour and precise control***
- ***Second-generation Öhlins Smart Electronic Control (S-EC) offers finer choice of settings. A new Öhlins NPX fork features pressurised damping for improved bump absorption and feel***
- ***New dual Brembo Stylema radial-mount four-piston calipers managed by***

ABS with switchable SPORT/TRACK modes

- ***Showa's new 3-level Honda Electronic Steering Damper (HESD) controlled by IMU for precise stability management***

The reduction in physical size of the CBR1000RR-R SP's engine opened up new packaging options around it for the new frame and swingarm – with completely revised geometry. The goals? Even more accurate high-speed steering, improved stability under acceleration and braking, and feel for front and rear grip on the limit. And at the very highest level of competition.

The diamond frame is constructed from 2mm aluminium and allows much more accurate tuning of the rigidity balance; in manufacture, after the four main frame components are welded, the engine now mounts in six locations improving machine handling. Vertical and torsional rigidity are increased by 18% and 9%, with horizontal rigidity decreased by 11% - all aimed at producing maximum levels of feel.

Wheelbase is now 1,455mm, with rake and trail of 24°/102mm (from 1405mm, 23°/96mm) for stability. Wet weight is 201kg. There have also been considerable changes to balance and centre of gravity; the crankshaft is 33mm further from the front wheel spindle and raised 16mm. This evens out weight distribution, while the higher c-of-g reduces pitching and improves side-to-side agility.

The swingarm – stamped out from 18 individual thicknesses of aluminium and as used by the RC213V-S – is 30.5mm longer, at 622.7mm, but weighs exactly the same as the previous design. Its horizontal rigidity is reduced by 15%, with vertical rigidity maintained to generate grip and feel.

For optimum frame rigidity (and to save weight) the top mount of the Pro-Link rear suspension attaches to the rear of the engine block via a bracket, doing away with the upper cross-member. This also isolates the rear wheel from the headstock, improving high-speed stability and feel for rear wheel traction.

Round, thin-wall aluminium tubing forms the minimal subframe. It also mounts to the frame from the top (rather than sides) to narrow the area around the rear of the fuel tank and seat, making for a compact – and aerodynamically efficient – riding position. Seat height is 830mm, with the handlebar position pushed forward (for leverage) and foot pegs moved rearward, and up.

A Bosch six-axis Inertial Measurement Unit (IMU) replaces the five-axis unit of the previous design; this allows more accurate calculation of pitch and roll for even more precise control of bike behaviour.

The CBR1000RR-R SP is also equipped with Showa's new Honda Electronic Steering Damper (HESD). A lightweight through-rod design that mounts on the bottom of the steering stem and attaches to the bottom yoke, HESD is controlled by input from the wheel speed sensors and IMU; 3 levels of control are available.

Second-generation semi-active Öhlins Electronic Control (S-EC) is featured on the RR-R SP. The 43mm Öhlins NPX fork uses a pressurised damping system to minimise

cavitation, resulting in more stable damping control and improved bump absorption at race-track speeds. Feel for front tyre grip is also enhanced. Its length also offers greater freedom for geometry changes. The shock is an Öhlins TTX36 Smart-EC unit.

In conjunction with the hardware upgrade the Öhlins Objective Based Tuning interface (OBTi) now offers much finer suspension adjustment front and rear; both can be set independently from the default settings and 3 individual modes can be set and stored allowing the rider to configure multiple settings for a track, and switch instantly while riding.

New Brembo Stylema four-piston radial mount brake calipers are operated by a Brembo master cylinder and brake lever. They now grip 10mm larger 330mm diameter discs; the 5mm disc thickness also dissipates heat more efficiently. The rear brake caliper is the same Brembo unit used by the RC213V-S.

Rear lift control and ABS-managed brake force relative to lean angle were a feature of the previous design. For the CBR1000RR-R the system gains two switchable modes; SPORTmode focuses on road-riding performance, with high brake force and less pitching, while TRACK mode offers performance in braking from much higher circuit speeds.

The rear 6-inch rim has new hub geometry, to save weight while maintaining rigidity and mounts a 200/55-ZR17 sized tyre (from 190/50-ZR17) minimising the change in chassis geometry when going from street to track rubber. The front rim mounts a 120/70-ZR17 tyre.

3.4 Aerodynamic Package & Equipment

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- ***Aerodynamic fairing, screen and mudguard minimise frontal area and reduce drag; lower fuel tank also provides more compact riding position***
- ***Inner fairing winglets drawn from the RC213V MotoGP machine reduce wheelies under acceleration and improve braking stability***
- ***5-inch colour TFT screen and simplified four-way left-hand switch offer intuitive control of riding systems***
- ***Honda Smart Key adds convenience and simplifies top-yoke design***

Alongside its new engine and chassis the CBR1000RR-R SP has an aggressive new fairing design. It’s no mere styling exercise however; the drivers in development were to create a class-leading drag coefficient (with a tucked-in rider under track conditions) and restrict lift under acceleration while improving braking stability.

The first part of the process was to lower the fuel tank cover by 45mm (compared to the previous design) decreasing the frontal area with the rider prone. At a 35° angle the screen smoothly channels airflow from the upper fairing over the rider and seat cowl, which itself presents the minimum possible drag resistance. The left and right upper fairing slits reduce yaw and roll resistance while turning.

To make steering easier a convex surface on each side of the front mudguard moves air

flow away from the front wheel, smoothly directing it to the fairing sides. Cooling air for radiator and oil cooler has been optimised by aerodynamic management of both velocity and pressure of air flowing from the tyre.

The lower fairing has been extended close to the rear tyre, and shaped to channel air downward. This has two effects: in dry conditions, less air hits the tyre, lowering drag; in the wet, less water hits the tyre, improving grip. To let air flow around the rider's feet with minimum resistance the sides of the rear hugger are carefully shaped while its upper side is cut-out to vent air that channels up from underneath either side of the swingarm, decreasing rear lift.

The net result of all this work, with the CBR1000RR-R in stock race trim, is a best-in-class drag coefficient value of 0.270.

To generate downforce at track speeds – and maintain the smallest possible frontal area – the CBR1000RR-R employs winglet structures that effectively generate the same downforce as the 2018 RC213V MotoGP machine. The results are a reduction in wheelies under acceleration and increased stability on braking and corner entry.

Three wings are arranged in a vertical line inside both left and right fairing ducts. This arrangement (vertically deep and longitudinally shallow) has no detrimental effect on yaw and roll ability during corner entry. And the consistent distance between the trailing wing tips and the inner fairing wall limits separation of the airflow, producing maximum downforce.

The wing angle balances opposing right/left downforces from the dihedral and twist angles when yaw occurs through a corner, for stable behaviour. Flow speeds over the top and below the wings differ to prevent air getting 'trapped' on the fairing sides and affecting handling.

For full and intuitive control of the CBR1000RR-R SP's systems the full colour 5-inch TFT screen is larger and with higher resolution. It's fully customisable to show exactly what the rider wants to see. The compact left hand switchgear houses a four-way switch. Fast and easy to use, the top/bottom buttons set riding mode parameters, while the left/right buttons cycle screen display information.

Honda's Smart Key System has been added. The ignition now operates without having to insert a key, as does handlebar lock. This is both convenient in day-to-day use and has allowed use of a competition-style top yoke while freeing up optimum space for the ram air system.

4. Technical Specification

ENGINE	
Type	Liquid-cooled 4-stroke 16-valve DOHC

	Inline-4
Engine Displacement (cm³)	999.9cc
No. of Valves per Cylinder	4
Bore ´ Stroke (mm)	81mm x 48.5mm
Compression Ratio	13.0 x 1
Max. Power Output	160Kw @ 14,500rpm
Max. Torque	113Nm @ 12,500rpm
Oil Capacity	4.0L
FUEL SYSTEM	
Carburation	PGM-DSFI
Fuel Tank Capacity	16.1L
Fuel Consumption	16.0km/litre
ELECTRICAL SYSTEM	
Starter	Electric
Battery Capacity	12-2 Lithium-Ion
DRIVETRAIN	
Clutch Type	Wet, multiplate hydraulic clutch with assist slipper
Transmission Type	6-speed
Final Drive	Chain
FRAME	
Type	Aluminium composite twin spar
CHASSIS	
Dimensions (L x W x H)	2100 x 745 x 1140mm
Wheelbase	1455mm
Caster Angle	24º

Trail	102mm
Seat Height	830mm
Ground Clearance	115mm
Kerb Weight	201kg
SUSPENSION	
Type Front	Telescopic inverted fork with inner diameter of 43mm and Ohlins NPX Smart-EC with preload, compression and rebound adjustments. 125mm stroke.
Type Rear	Pro-Link with gas-charged Ohlins TTX36 Smart-EC damper featuring preload, compression and rebound damping. 143mm stroke.
WHEELS	
Rim Size Front	17 inch x 3.5
Rim Size Rear	17 inch x 6.0
Tyres Front	120/70-ZR17 Pirelli Diablo Supercorsa SP Bridgestone RS11
Tyres Rear	200/55-ZR17 Pirelli Diablo Supercorsa SP Bridgestone RS11
BRAKES	
ABS System Type	2 Channel
Front	330mm disc with 4-piston Brembo caliper
Rear	220mm disc with 2-piston Brembo caliper
INSTRUMENTS & ELECTRICS	

Instruments	TFT-LCD
Security System	HISS
Headlight	LED
Taillight	LED

All specifications are provisional and subject to change without notice.

** Please note that the figures provided are results obtained by Honda under standardised testing conditions prescribed by WMTC. Tests are conducted on a rolling road using a standard version of the vehicle with only one rider and no additional optional equipment. Actual fuel consumption may vary depending on how you ride, how you maintain your vehicle, weather, road conditions, tire pressure, installation of accessories, cargo, rider and passenger weight, and other factors.