HONDA
The Power of Dreams

PRESS INFORMATION
June 2011

NSF 250R

Honda R&D Co., Ltd. Motorcycle R&D Center

NSF250R | Introduction （1）

From the “MT125R” of 1976 to the “RS125R”, which ceased production with the 2009 model, Honda has produced 15,000 market racing machines. Over 34 years, Honda has broadened the base of two-wheel motorsports in Japan and worldwide with these market racing machines and nurtnred a number of racing riders.
During this time, Honda has won 29 All-Japan 125 cc Championship, a grand total of 131 Road Racing World Championship Grand Prix (WGP) victories, 11 manufacturer’s championships-nine of which were with the RS125R.
Dani Pedrosa and Andrea Dovizioso, currently active in riding the RC212V in MotoGP, have both won World Championships with the RS125R while building their racing experience. Without racing with 125 cc works machines, Honda Racing Corporation (HRC) has supported users by selling kit parts to boost performance while continuing with sales of base vehicles, thereby expanding aftermarket business opportunities.
Later, environmental challenges for mass-production models were pushed to a global level, accompanied by a similar shift to 4-strokes for motorcycle racing machines. The shift came from the pinnacle of World Championship Grand Prix racing, moving in 2002 from GP500 (2-stroke, 500 cc) to the MotoGP (initially 4-stroke, 990 cc, currently 800 cc and from next year 1000 cc) and in 2010 frome GP250 (2-stroke, 250 cc) to Moto2 (one-make 4-stroke, 600 cc Honda engine).

■1976 MT125R

■1987 RS125R

■1996 RS125R

NSF250R | Introduction（2）

Replacing the current 2-stroke, 125 cc machines currently used in the GP125 class, Honda developed the new “NSF250R” machine for entry riders to compete with, seizing the opportunity provided by the commencement of new 4-stroke, 250 cc Moto3 category, which starts in 2012.
With a mission of broadening the base for motorcycle motorsports cultivated by the RS125R, Honda aimed for a high-performance, lightweight, and compact racing machine that allows users to ride with the same sense of comfort as they did on the RS125R and this new machin inherits important elements from its predecesor, offering a good base to learn the basics in order to progres to the MotoGP class.

As a leader of the “NSF250R” development, on top of seeing the NSF250R expand the base for 2-wheel motorsports, as the RS125R did, and sharing dreams and excitement with our customers by revitalizing the Moto3 class, our greatest joy would be for the machine to serve as a springboard in creating future MotoGP champion riders.
We really look forward to this new “NSF250R” being loved by more people around the world and helping them to realize their dreams in the world of motorsports, all the while being charmed by the machine.

■NEW NSF250R

Honda R&D Co., Ltd. Motorcycle R&D Center
NSF250R Large Project Leader
HIKARU TSUKAMOTO

NSF250R | Development Concept （1）

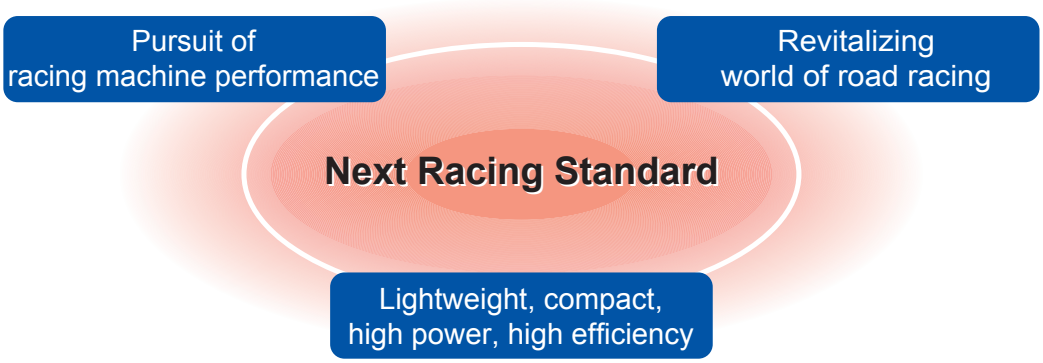
Currently, the 2-stroke GP125 class is a gateway to success in road racing around the world, supporting young riders to experienced riders, and from local races to the MotoGP. The characteristic of the GP125-class machine is a body size allowing young entry riders to control the machine with relative ease. The machine is very responsive and offers direct feel for the engine and contact with the frame, it is also equipped with a wide range of adjustable functions that boasts maximum machine performance.
Honda believes these are important elements in helping riders reach the next level.
Adopting the basic concept of inheriting these elements, the development objective for the NSF250R was to achieve the high performance and the easy handling of a 4-stroke engine, in a racing machie. In other words: lightweight, compact, high power and high efficiency.

Setting

“Next Racing Standard”

as the development keywords, the development team insisted this machine with its sincere desire for the pursuit of performance on the circuit and the revitalization of the world of road racing through the birth of a new 4-stroke machine suitable for moving up from entry level to the MotoGP.

■NSF250R development concept



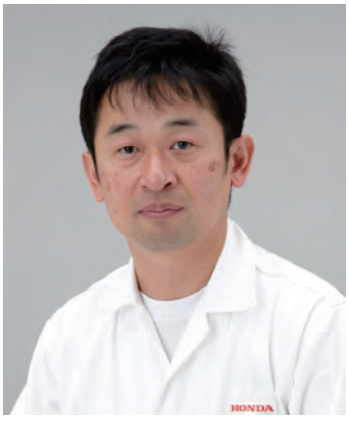
NSF250R | Development Concept （2）

NSF250R development concept: “Next Racing Standard”

To pursue performance for a racing machine, Honda developed the “NSF250R” in an effort to realize a new machine-lightweight, compact, with high power and high efficiency that inherits elements of the RS125R with the goal of revitalizing the world of road racing through the performance of a new 4-stroke engine.

To this end, we judged that we needed to opt for the engine exclusively designed for a racing machine and the compact body inherited the RS125R.

■NEW NSF250R



Honda R&D Co., Ltd. Motorcycle R&D Center
NSF250R Development Project Leader
YOSHIYUKI KURAYOSHI

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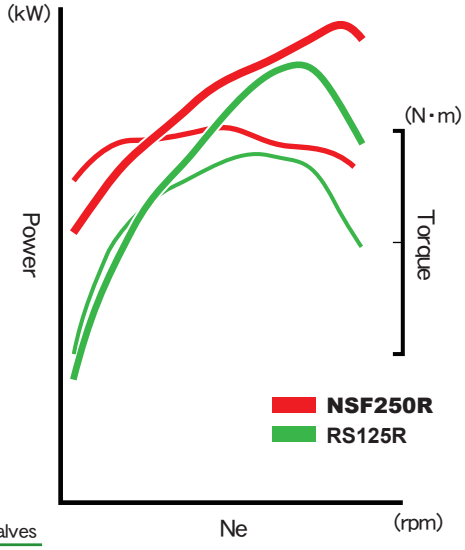
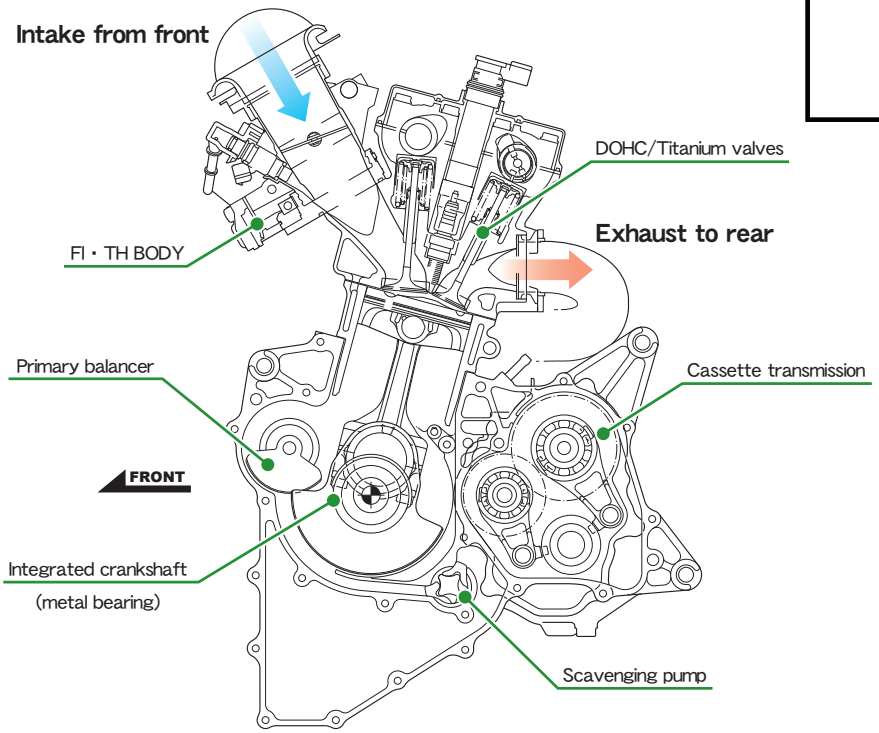
NSF250R | Power Unit （1）

The NSF250 engine was developed exclusively for road racing, to ensure superior quality and greater potential for commercial racing machine.
With a development concept of “lightweight, compact, high output and efficiency,” numerous technological advances were introduced to create an engine befitting a racing machine.
The DOHC single-cylinder 249cc engine demonstrates a racing machine’ s power delivery and response, with intake from front and exhaust to rear to improve air charging efficiency, and a cylinder tilted back 15 degrees to concentrate the engine’ s mass, primarily to improve its stability.
In order to deliver ample power into the high rpm range, the DOHC system incorporates titanium valves for both intake and exhaust (Honda patented).
The new design also offers improved air charging efficiency along with ram-air intake, thanks to the straight intake port and throttle body with 50-mm diameter bore. In shaft layout, the balancer shaft is placed above the crankshaft to make the engine shorter and concentrate the mass.

■Engine Power Curve



■Engine layout



Thinner lightweight piston (patent pending by Honda):

A thinner piston with an overall height of only 31.5 mm has been adopted, with a bore diameter of 78 mm.

With improved combustion efficiency through a bulging shape side squish of the piston head, the engine inherits MotoGP technologies, such as two forged piston rings.

On the back, higher rigidity for the two pin-boss connection ribs was achieved through Computer Aided Engineering or CAE analysis, allowing the engine to handle higher rpm and higher output.

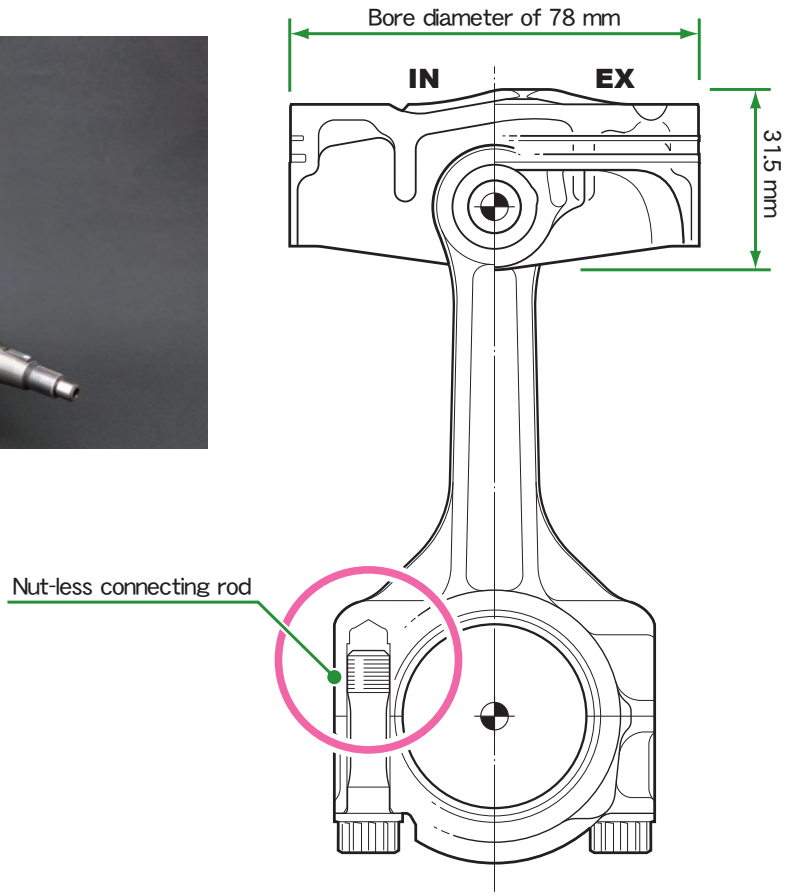
Nut-less connecting rod:

A light nut-less type was chosen for the connecting rod. While a conventional connecting rod damps the big end with a nut and bolt, the nut-less connecting rod uses only a bolt to clamp the tapped hole cut directly into the rod.

As a result, connecting rod weight is reduced, and the engine achieves increased revs and nimble responsiveness during powerful acceleration.

Plain bearings are also adopted to handle higher output.

■Piston&connecting rod



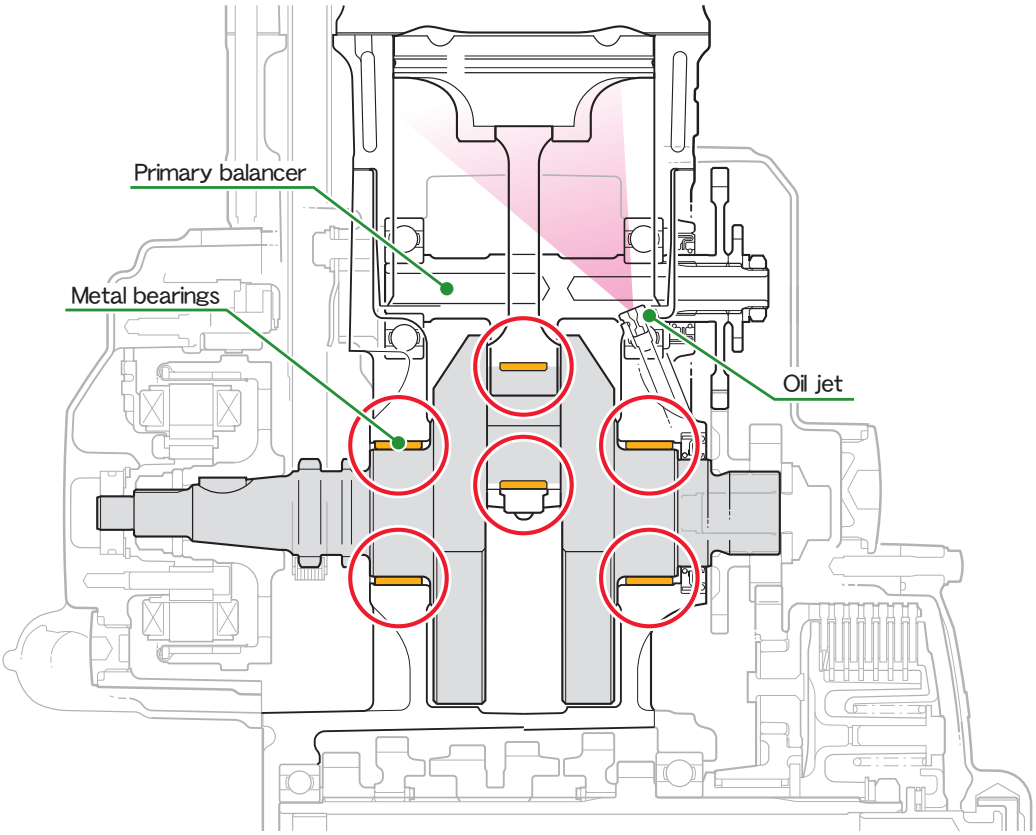
Crankshaft:

The NSF250R crankshaft realizes both high rigidity and precision required for a high-rpm, output racing engine, through a forged, integrated structure.

Crankshaft bearings:

Plain bearings, which are effective for high output/low friction, smaller and more space savings than ball bearings, are used to realize a lighter and compact engine.

■Cross-sectional view of crankshaft unit



Cylinder:

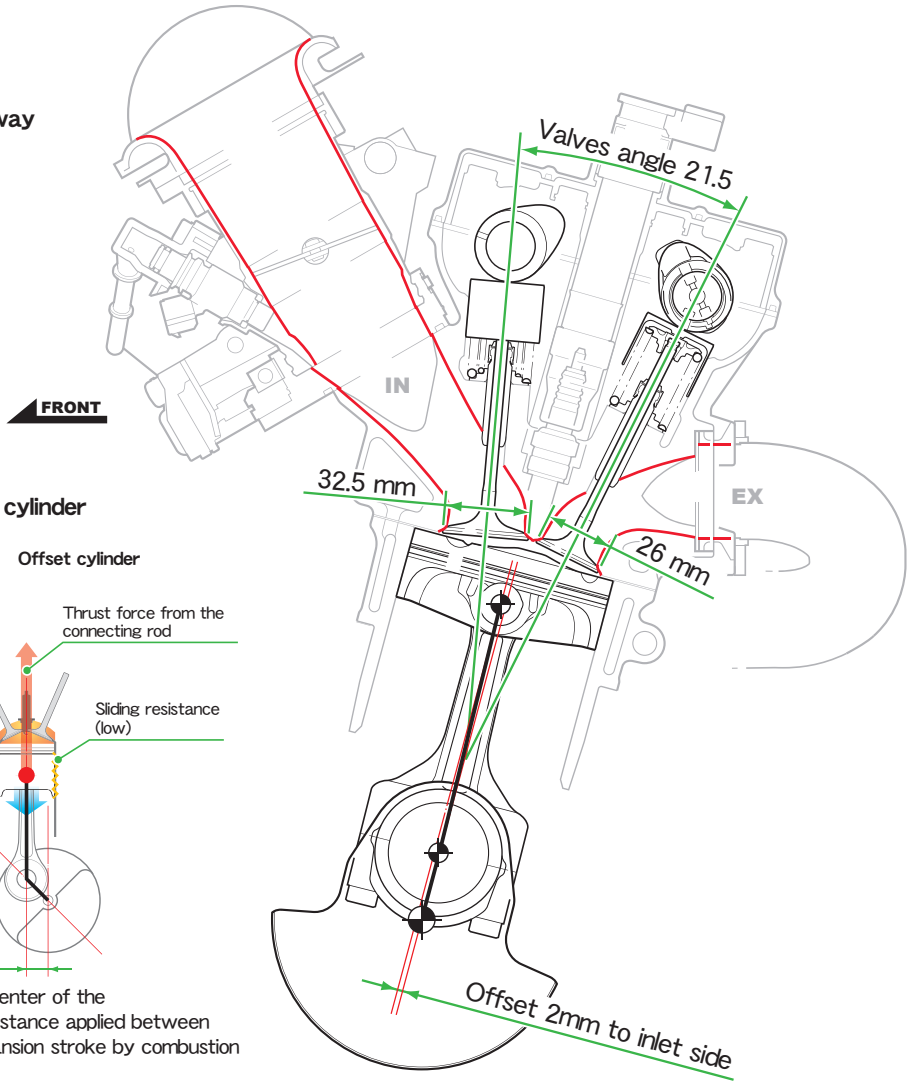
Reduced piston/cylinder friction for improved durability has been achieved by surface treating the cylinder with nickel silicon carbide (Ni-SiC) and an by using an offset cylinder shaft.

Titanium valves (Honda patented)

DOHC configuration, plus light and highly rigid titanium inlet and exhaust valves*1, allows the valves to function more precisely in the high rpm range.

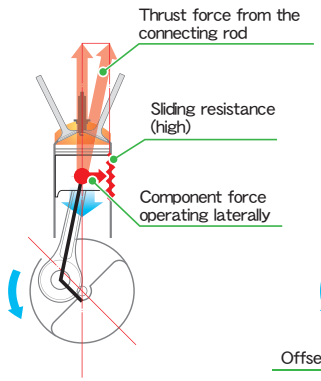
(*1. This is the first time titanium has been used for exhaust valves in a Honda mass-production mortorcycle.)

■Intake/exhaust channel cutaway



■Conceptual diagram of offset cylinder

Conventional cylinder



Offset cylinder

Cylinder centerline is offset from the center of the crankshaft.This offset reduces the resistance applied between the piston and the cylinder during expansion stroke by combustion pressure.

Sealed crankcase, dual-channel lubrication system:

Oil seal is set on each end of the crankshaft to seal the crankcase, and a dual-channel lubrication system is used, one on the crankshaft/piston side and the other on the transmission/clutch side.

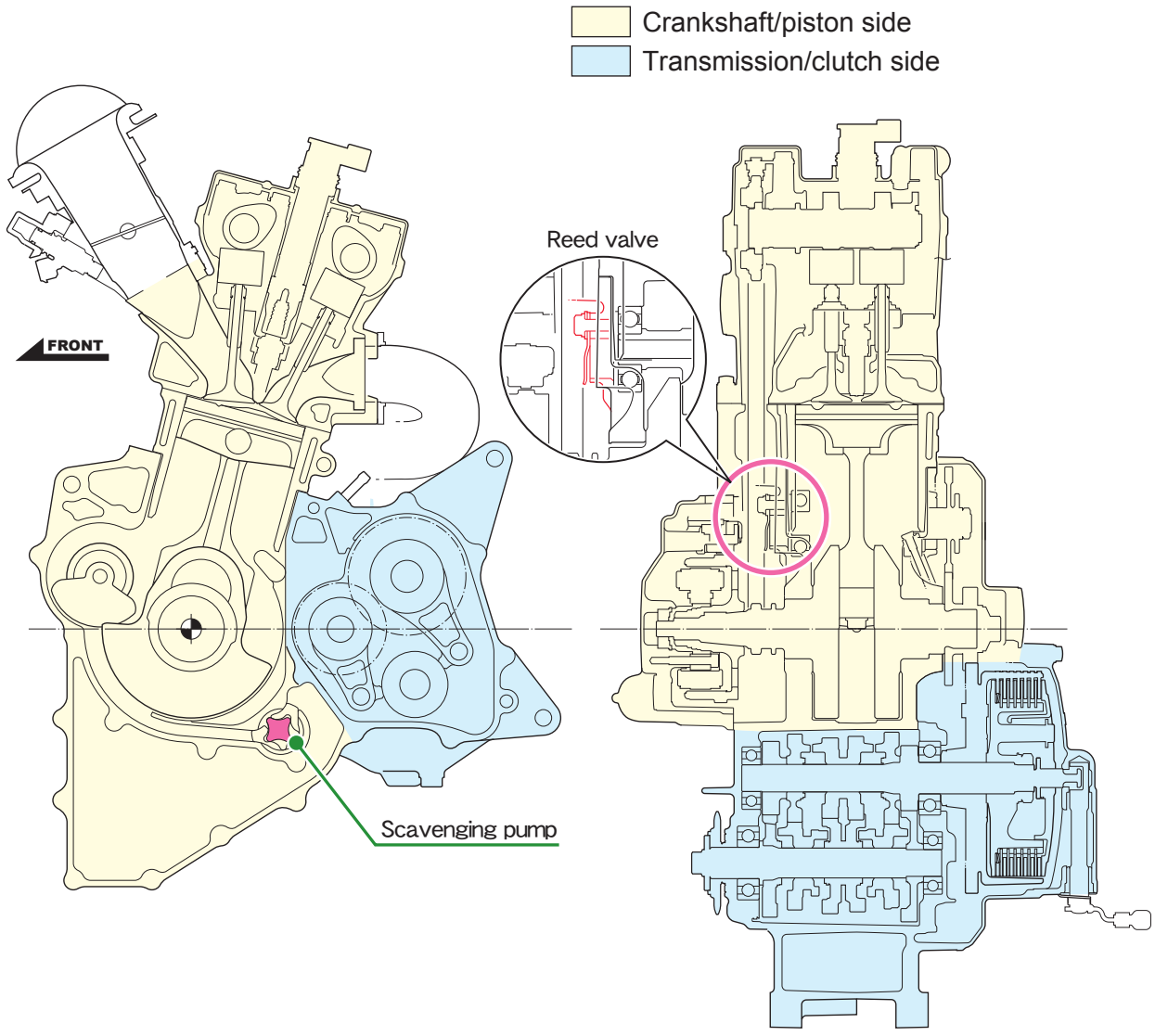
On the crankcase side, a force-feed system with trochoid pump is adopted, while an oil bath system used for 2-stroke engines is adopted for the transmission side.

Scavenging pump and reed valve:

To reduce friction, a scavenging pump is used to create negative pressure inside the crankcase.

Through the use of a reed valve with optimized placement, pressure fluctuations inside the crankcase are constantly controlled, achieving friction reductions even during heavy loads on the engine (patent pending by Honda).

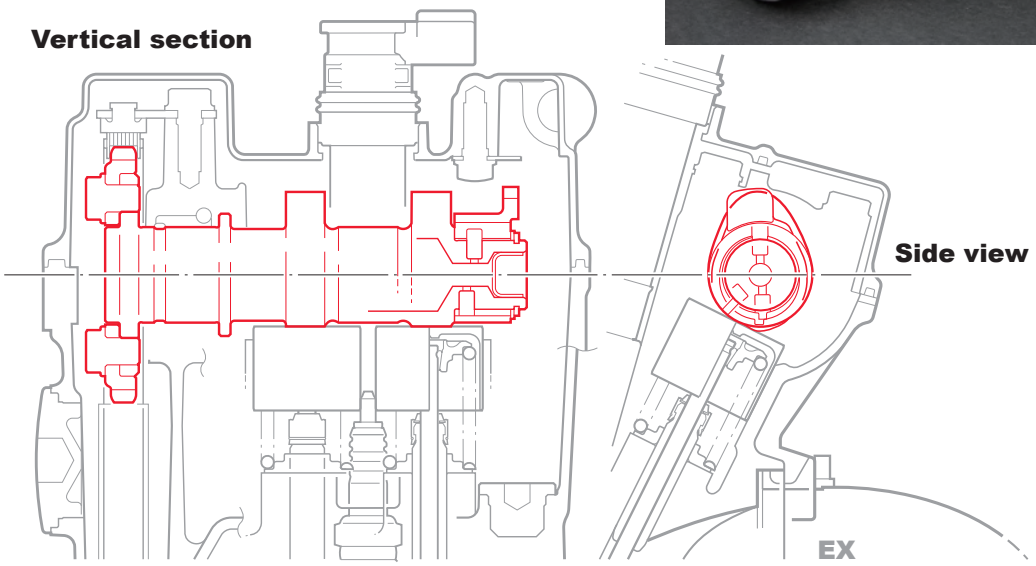
■Sealed crankcase



Auto-decompression:

Auto-decompression is used to allow easy push-starting even in harsh conditions.

■Camshaft cross sections



Cassette transmission:

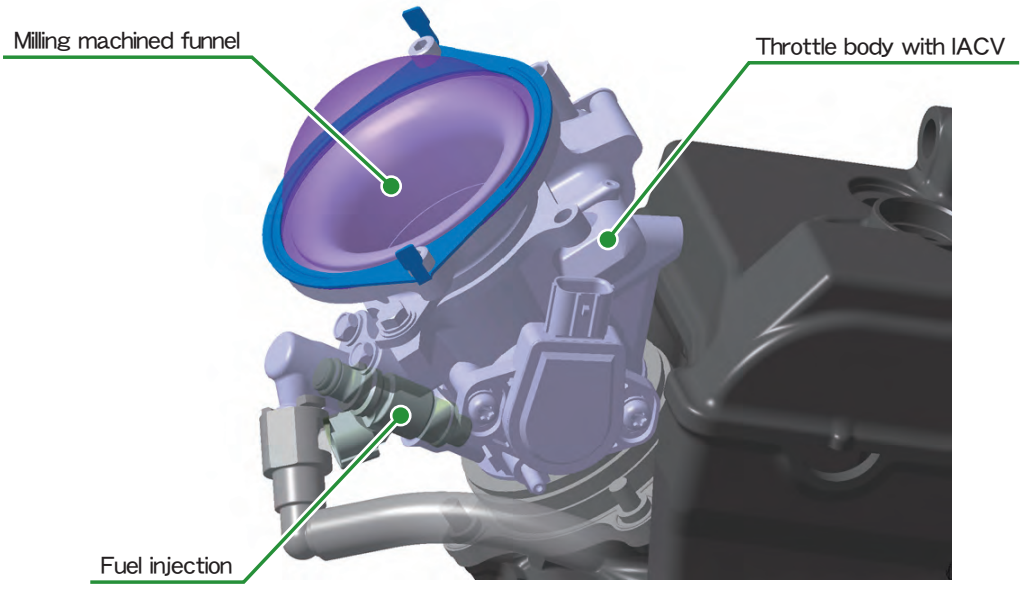
A cassette-type transmission is allows easy replacement of gear ratio for optimum performance at each racing circuit.

The cassette-type design means that the gear cluseer can be removed and replaced without removing the engine or disassembling the crankcase. And by making the close-ratio transmission of the RS125R available, the transmission provides convenience for RS125R users.

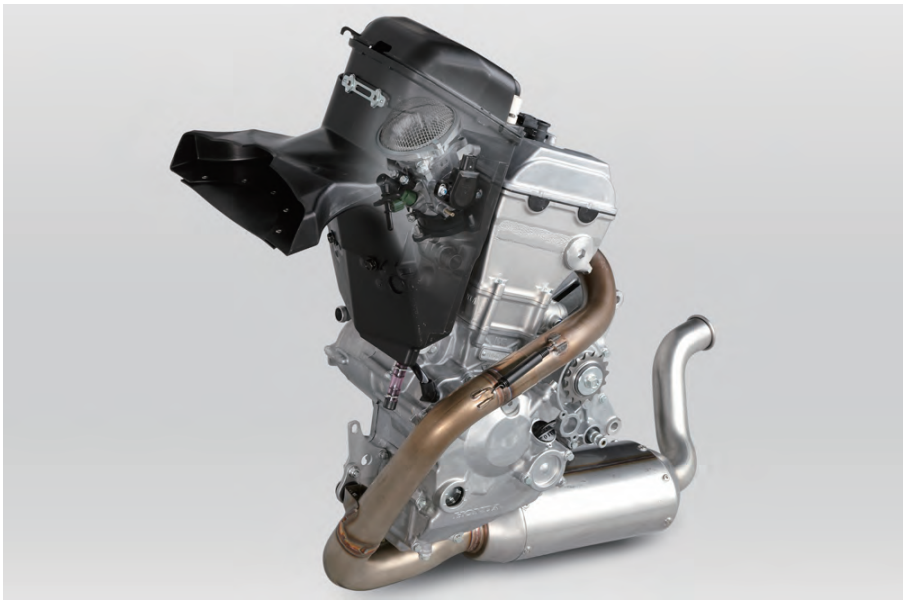
Fuel supply system:

Throttle body is equipped with IACV (Intake Air Control Valve).
The IACV opening control and optimized intake air effectively control the engine-braking force of the 4-stroke single-cylinder engine, and provide the feeling of deceleration matching each rider' s preference.
Air funnel precision has been enhanced through the adoption of a short aluminum intake funnel, which maximizes output characteristics and response.

■Throttle body



■Newly-developed liquid-cooled 4-stroke DOHC single-cylinder engine



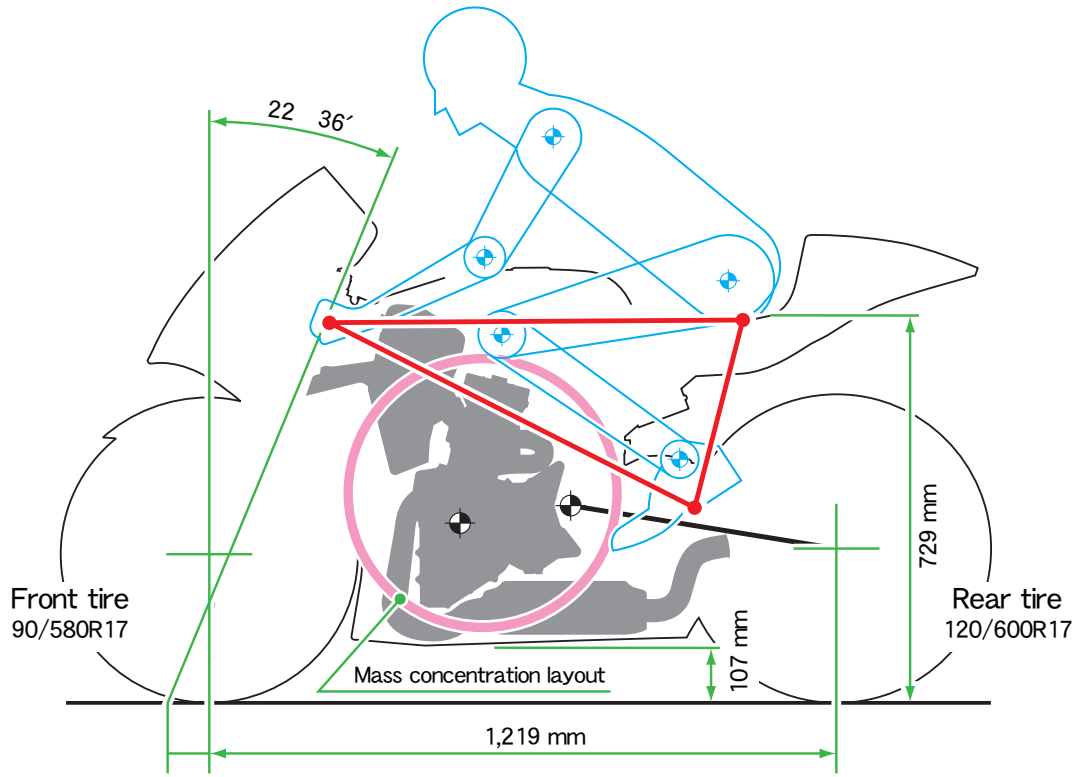
〈Frame Layout〉

Inheriting the RS125R’ s compact frame, following technological advances were adopted to perfectly match the 250 cc, 4-stroke engine.

1) Cylinder engine tilted back, with intake from the front and exhaust to the rear
2) Throttle body inside the air box
3) Exhaust pipe in the reversed S (patent pending by Honda)
4) Midship muffler

This Complete Built Up or CBU packaging allows mass concentration while achieving an inertial yaw moment on par with the RS125R. At the same time, a high level of both maneuverability and stability were realized by optimizing weight distribution and the position of the center of gravity, for the excellent cornering performance required by lightweight class racing motorcycles.

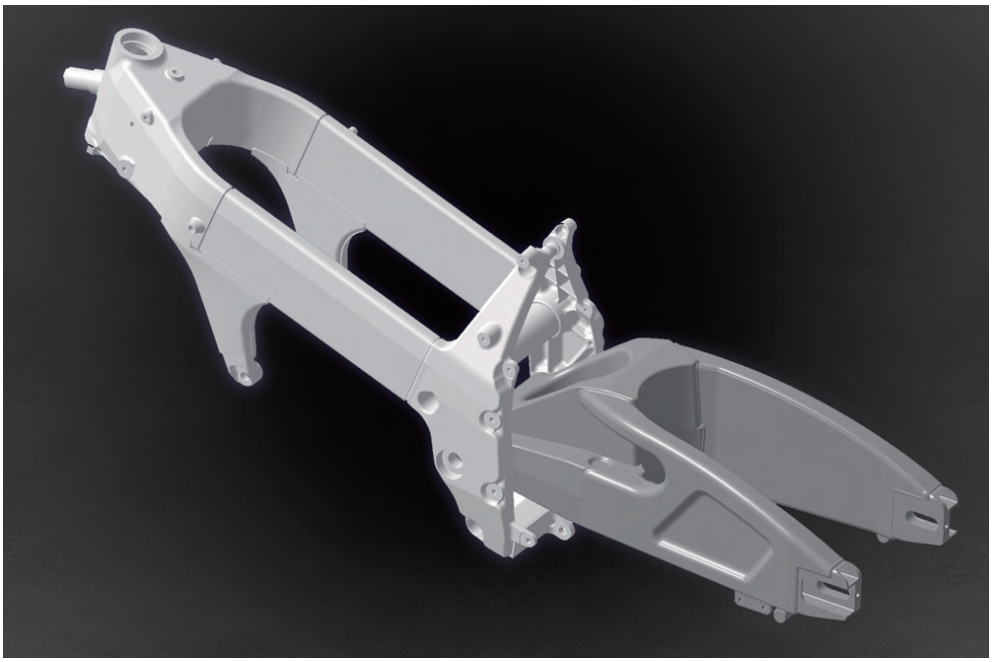
■Riding position and dimensions



NSF250R | Frame （2）

The NSF250R' frame is based on the RS125R's proven unit. To optimize the rigidity in balance and torsion of a 4-stroke engine, frame specifications were determined from actual riding tests and CAE analysis.
For the front engine hanger and the main pipe section, optimum balance was achieved mainly by enhancing torsional rigidity. A newly configured swing-arm and frame body also resulted in a structure allowing smooth torsional characteristics.
On the whole, stability during braking is improved, and a leeway and nimbleness during cornering exceeding those of the RS125R is ensured. The frame offers superb handling so that riders will not feel the weight increase of a 4-stroke engine, even when approaching corners.

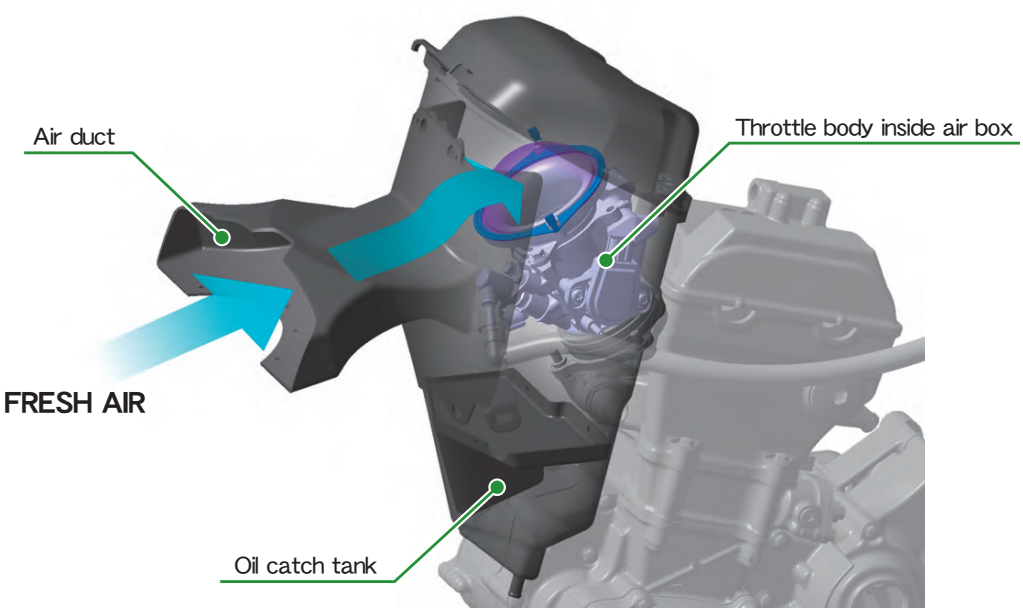
■Newly designed Frame body and Swing arms



NSF250R | Frame （3）

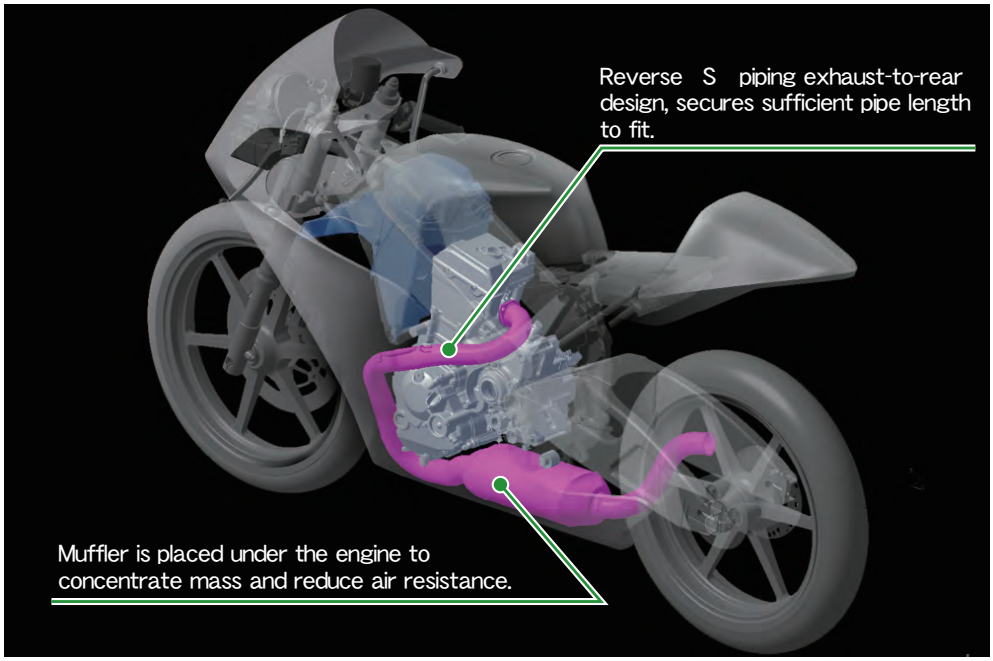
As with MotoGP machines, the NSF250R's throttle body is housed in the air box, and the air cleaner is placed between cylinder and radiator (patent pending by Honda).
This layout allows a large 5-liter capacity air box, in the limited frame space while concentrating mass (oil catch tank capacity not included).
For air intake, a ram-air intake system is standard equipment. Air passing under the bottom bridge goes through the large air duct and is channeled straight to air box. This arrangement improves output by actively using the ram-air intake system.
The oil catch tank is also cast-integrated into the bottom of the airbox, resulting in effective use of space and reduced weight.

■Structure in the air box



The exhaust pipe is laid out in a large, reversed “S” from behind the back-tilthing cylinder, and is connected with muffler beneath the engine (patent pending by Honda). This reverse-S piping ensures the correct pipe length to achieve higher output and superior drivability.
The muffler, one of the heavier components, is placed adjacent to the frame’ s center of gravity to concentrate mass, so as not to affect the handling. Placing the large-capacity muffler inside the cowling also contributes to reduced air resistance.

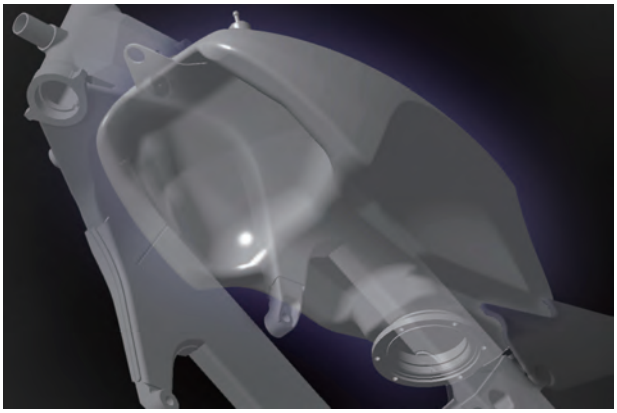
■Layout of the Exhaust muffler

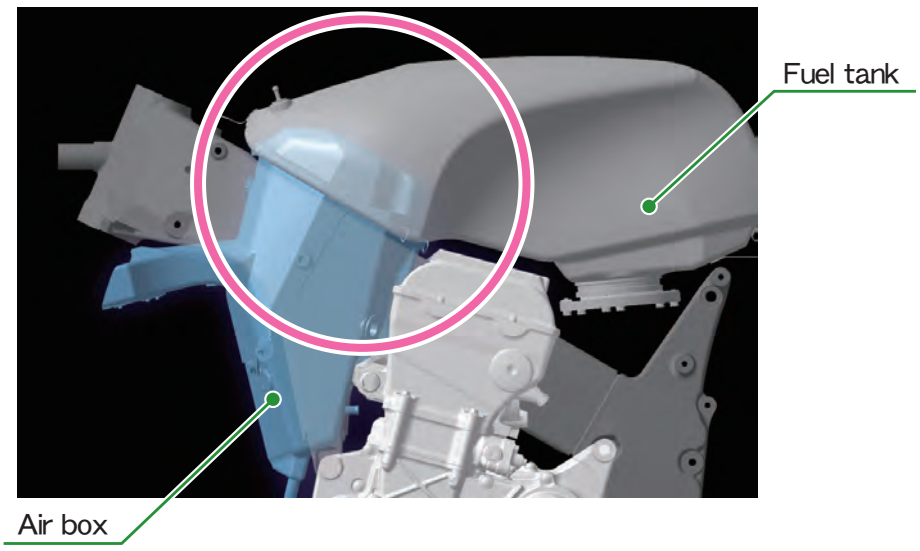


NSF250R | Frame （5）

The thin aluminum fuel tank provides a better knee-grip, and free riding position, inheriting the same design from the RS125RW, ridden by racers including Dani Pedrosa and Andrea Dovizioso.
The shape also allows the rider to lean far forward without interfering with the chin of the rider' s helmet.
The tank capacity is 11 liters, in spite of the indented underside required to secure sufficient air box capacity.

■Fuel tank and Air box

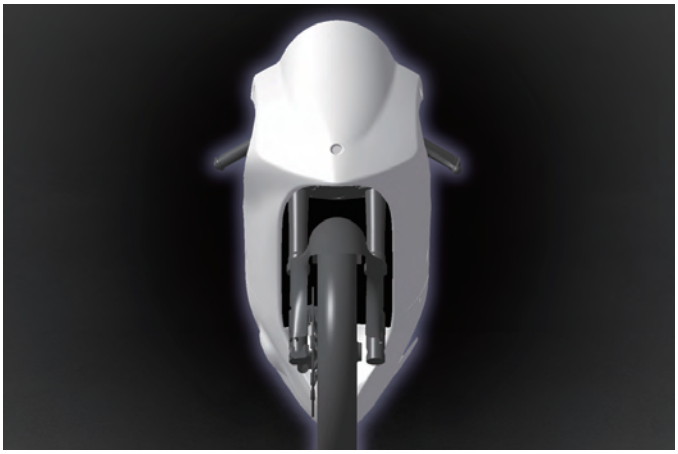




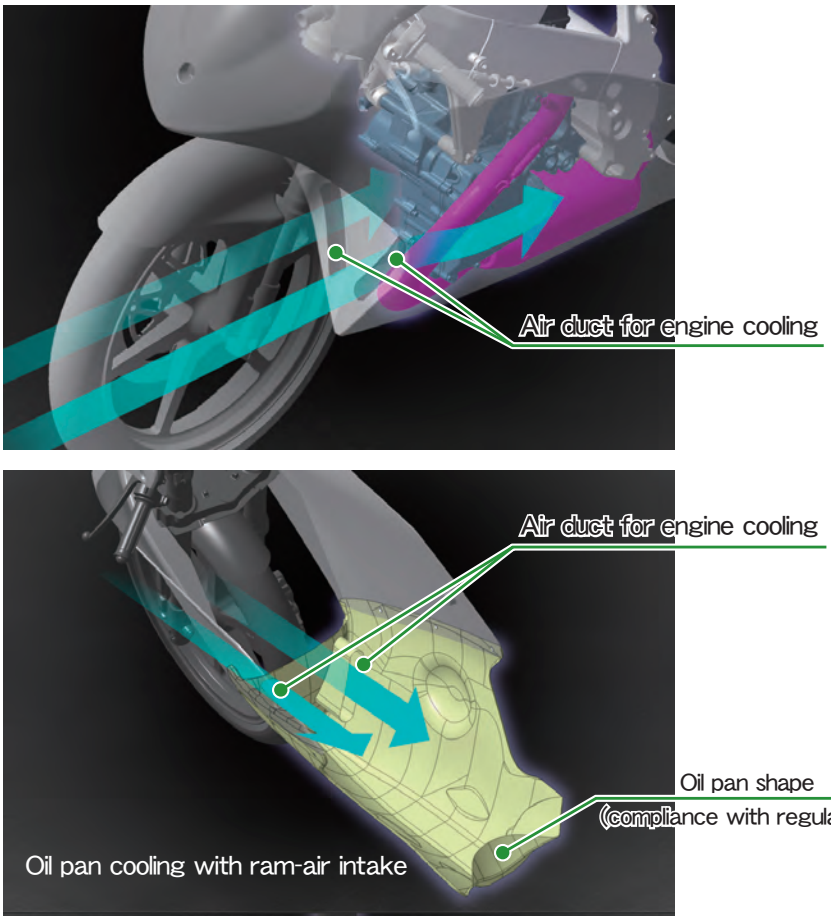
NSF250R | Frame （6）

The RS125R's cowling shape was used as a base, and despite a larger 250 cc 4-stroke engine, frontal projected area as well as air resistance is equivalent to the RS125R.
Measurements to comply with 4-stroke engine.
Regulations were also taken, including the shape of the oil pan.
Under cowling now features an extended duct to improve cooling performance.

■Frontal projected area equivalent to RS125R



■Air duct for engine cooling



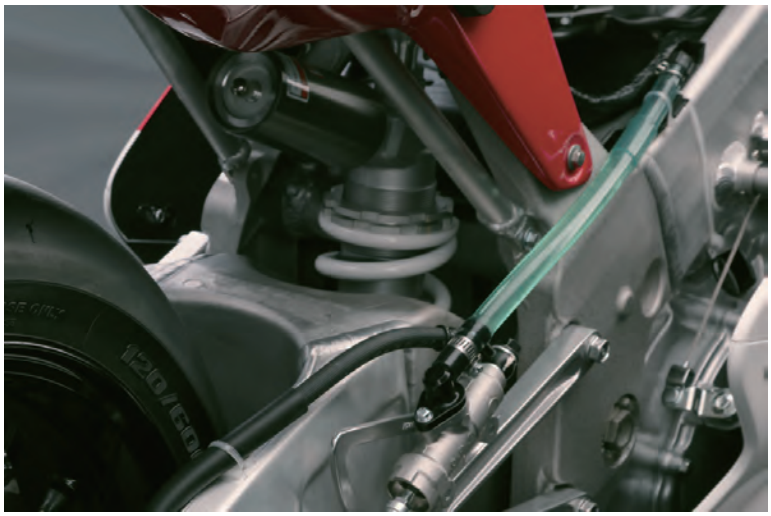
NSF250R | Suspension （1）

Front suspension:

As with the RS125R, front suspension is a 35-mm diameter inverted front fork. While the basic structure is the same as the RS125R, the front folk features an exclusive design including detailed settings high rigidity and stable performance to handle the increased vehicle weight and power output.
The damping force adjustment function for compression and rebound is designed to meet the needs of a wide variety of riders, including beginners and those stepping up to this class.

Rear suspension:

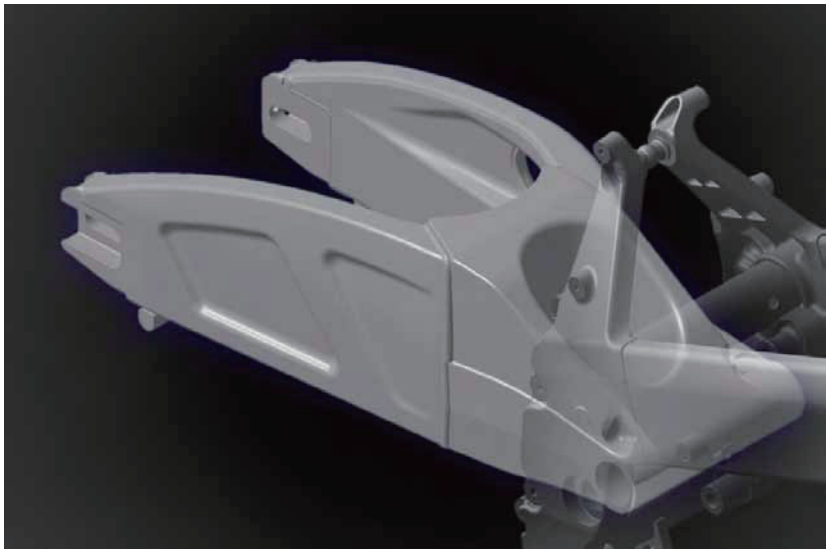
Rear suspension features the same Pro-link suspension mechanism used for the RS125R.
As the stroke increases, the cushion stroke rate grows, so the rider can easily feel the movement of the rear suspension and tyres gripping the road, allowing security when opening the throttle.
Like the front suspension, basic configuration remains the same as the RS125R, except for revised damper characteristics to match changes in vehicle weight and output.



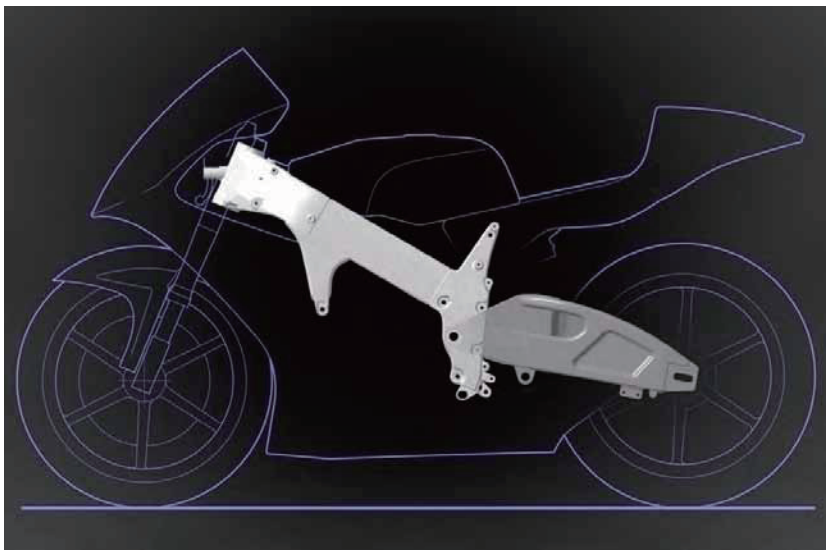
Swing arms:

This swingarm is based on the RS125RW' s swing arms, lateral and torsional rigidity were reexamined, leading to an exclusive stamped structure in high-strength, lightweight 7000-series aluminum (also used in MotoGP) to strike a high-level balance with the frame. For the swing arms moves center of gravity forward to concentrate the mass.

■Figure CG swing arm



■Frame layout



NSF250R | Suspension （3）

Brake:

A radial mount system was adopted for front brake with a 296-mm diameter floating disc. With changes in vehicle weight and top speed, disc thickness is 5 mm (up from the RS125R's 4 mm) to realize sufficient braking force.

To limit increases in unsprung weight due to the change in disc thickness, the installation hub weight was reduced.

■Rear disk brake

■Front disk brake

Wheel:

Front and rear wheel size of 2.50 x 17 and 3.50 x 17 were adopted (as featured on the RS125R) to maintain the optimum balance for a racing machine.

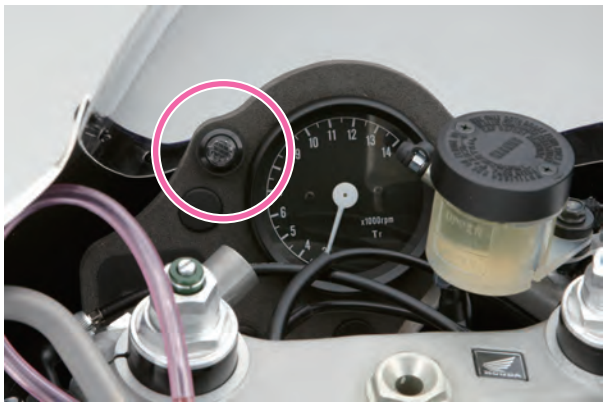
With this fully compatible specification, a major advantage is that current RS125R riders and teams have no need to purchase expensive spare wheels.

■Rear wheel size　3.50×17

■Front wheel size　2.50×17

Auto shifter switch:
Turning on auto shifter switch (ignition cut) allows the rider to shift up without operating the clutch, so the rider can concentrate on riding during acceleration.

Shift-up indicator:
An indicator shows the rider the best timing to shift up, for extra acceleration efficiently.



ECU setting tool (HRC option, price to be determined):
As a means of attaining maximum machine performance, this tool is available for improved fuel injection and ignition timing setting.
Following six features can be adjusted.
1) Fuel injection
2) Ignition timing
3) IACV
4) Auto shifter/ignition cut
5) Two different pattern data setting
6) Pit lane speed control (optional switch required)

Map mode selector switch: Two patterns (optional):
Whilst riding, the rider is able to experience the difference in settings more directly.

Pit lane speed-control switch (optional):
Switch for operating pit-lane speed set by ECU.

NSF250R | Specifications

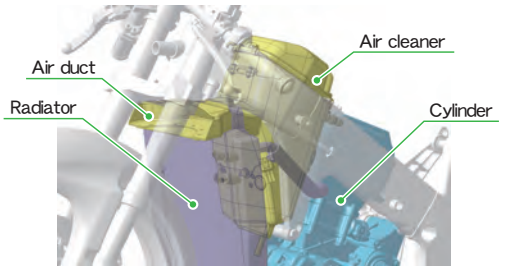
Model name			NSF250R
Model type			MR03
Overall length x Overall width x Overall height (m)			1.809×0.560×1.037
Wheelbase (m)			1.219
Ground clearance (m)			0.107
Seat height (m)			0.729
Caster angle (degree)			22° 36´
Curb weight (kg)			84
Fuel tank capacity (ℓ)			11
Engine type			liquid-cooled 4-stroke DOHC single cylinder
Displacement (cm^3)			249.3
Bore x Stroke (mm)			78.0×52.2
Maximum power (kW/rpm)			35.5/13,000
Maximum torque (N･m/rpm)			28.0/10,500
Oil Capacity (ENG OIL/T.M OIL) (ℓ)			1.27/0.55
Transmission			Constant mesh
Transmission gear ratio	1-speed		1.875
	2-speed		1.524
	3-speed		1.304
	4-speed		1.167
	5-speed		1.077
	6-speed		1.000
Reduction gear ratio	primary		2.952
	secondary		2.333
Devices (Exhaust)			IACV
Fuel supply system			PGM-FI (With throttle sensor)
Ignition type			Full-transistor
Clutch type			Wet multiplate
Lubricating type			Semi-Dry Sump
Tyre size	Front		90/580R17
	Rear		120/600R17
Rim Size	Front		2.50-17
	Rear		3.50-17
Brake type	Front	type	Hydraulic disk
		Diameter	ϕ296
	Rear	type	Hydraulic disk
		Diameter	ϕ186
Suspension type	Front		Inverted telescopic
	Rear		Pro-link suspension system
Frame type			Aluminum twin tube

NSF250R | Patents: High-Potential Machine Made Possible by Eleven Honda Patented Technologies

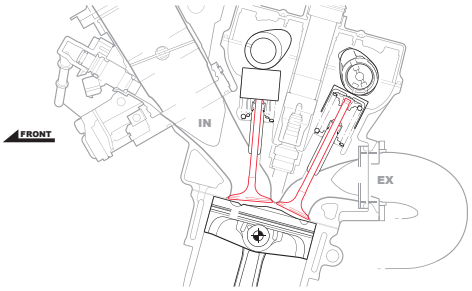
■This machine incorporates an engine that is lightweight and compact, yet offering high output, and a frame that realizes both maneuverability and stability at a high level.

Number of patents - engine related: 9, frame related: 2

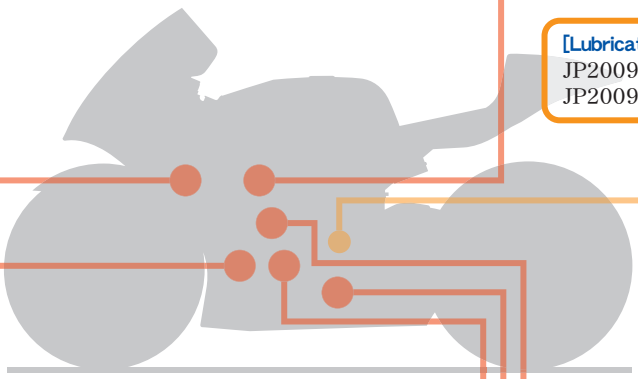
[Intake system layout realizing high output and mass concentration]
Air cleaner with throttle body inside is placed between cylinder and radiator. Air duct is placed above radiator. JP2009-162095A



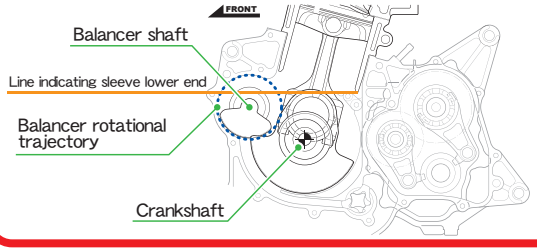
[Titanium valves, perfect for high-rpm engine]
Titanium valves were formed with appropriate Al, Mo, Si, and C compound.
JP4492959B



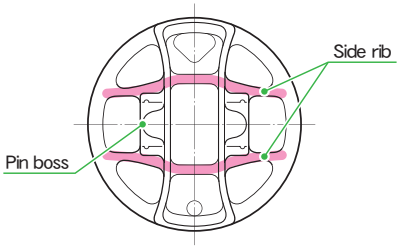
[Lubrication design allowing lightweight and compact engine]
JP2009-121325A JP2009-121326A
JP2009-162192A JP2009-162194A



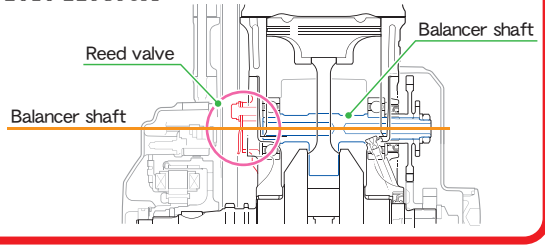
[Balancer shaft layout realizing compact engine and mass concentration]
Balancer shaft is placed a bore crankshaft. Top rotational trajectory is higher than the lower end cylinder sleeve.
JP2009-162193A



[High-rigidity, lightweight piston for high rpm and output]
Two side ribs connecting pin boss is placed diagonally on back of piston, so that the rib height gradually decreases as ribs approach the surrounding piston wall.
JP2009-121324A



[New sealed crankcase mechanism able to maintain optimum pressure]
Sealed crankcase is equipped with scavenging pump. Reed valve is installed at the same height as balancer shaft. It opens when the pressure inside the crankcase is positive.
JP2010-229893A



[Exhaust system layout realizing high output and mass concentration]
In addition to midship muffler, exhaust pipe is laid out in large reverse-S from the rear of back-tilted cylinder. JP4583439B JP2009-121327A