New Model with a Four-Cylinder Engine: Ninja ZX-4R

Targeting the increasingly competitive 400-cm³ class supersport motorcycle market, we have introduced a totally new four-cylinder model, the first since the ZXR400 debuted in 1989. Our new model comes with an engine that delivers a whopping 57 kW/14,500 min⁻¹, compared with a maximum output of 35 kW by our competitor's models.

Introduction

Although 400-cm³ class sport motorcycles were originally developed in line with the Japanese licensing system, because our Ninja 400 has sold well in the U.S., Europe, and China, the number of sales in the global market is expected to be large.

1 Background

Although the Ninja 400 is still a popular bike, many competing models have appeared over the years which is stiffening the competition. However, most of these models come with a one- or two-cylinder engine. To cement out position as the leader in this class, we developed the new four-cylinder Ninja ZX-4R as the model that sets the standard for others to follow.

This is our first 400-cm³ class four-cylinder model since the 2008 Zephyr400, and the first completely new design of a four-cylinder 400-cm³ engine for supersport motorcycles since the 1989 ZXR400 over 30 years ago.

2 Specifications

Table 1 compares the main specifications of the new Ninja ZX-4R and those of the Ninja 400 and ZXR400. The table shows that the Ninja ZX-4R outperforms the latest two-cylinder model Ninja 400 by more than 60% and the previous four-cylinder model ZXR400 by more than 30%.

Table 1 Main specifications of the ZX-4R, Ninja400, and ZXR400

	ZX-4R	Ninja 400	ZXR400
Engine type	In-line 4-cylinder	In-line 2-cylinder	In-line 4-cylinder
Displacement [cm³]	399	399	398
Bore stroke	57×39. 1	70×51. 8	57×39. 0
Max. power [kW]	57 / 14, 500 min⁻¹	35 / 10, 000 min⁻¹	43 / 12, 000 min⁻¹
Max. torque [N·m]	39 / 13, 000 min⁻¹	37 / 8, 000 min⁻¹	39 / 10, 000 min⁻¹
Compression ratio	12. 3	11. 5	12. 1

3 Features

The Ninja ZX-4R's four-cylinder engine offers a major advantage over competing models owing to its maximum engine speed equal to or higher than 15,000 min^{-1}, producing an exhilarating exhaust note inherent in four-cylinder motors. The new model also features the ram-air intake system (**Fig. 1**) similar to that on the higher-end ZX-6R and ZX-10R models, outputting 59 kW (80 hp) thanks to the ram pressure that improves charging efficiency.

(1) Engine

Figure 2 compares the performance curves of the Ninja ZX-4R and Ninja 400. Using four cylinders has reduced the weight of each piston and connecting rod, achieving higher revolutions. The performance is especially higher in the high-revolution range of 10,000 min^{-1} or above. Moreover, the Ninja ZX-4R delivers high output by increasing the compression ratio via reducing the clearance with the pistons, This is achieved by improving the precision in the shape of the combustion chamber squish area shown in **Fig. 3** through machining, and by adopting large-diameter throttle valves (ϕ34), which reduce the inhalation resistance, and by employing the same valve-seat section processing as for the ZX-10R.

(2) Frame

Based on the frame of the 250 cm^3 model ZX-25R, we applied FEM analysis to narrow down the sections related to improving the output, so the increase in the mass of the frame is within 1 kg. Other major changes were

Fig. 1 Ram-air system

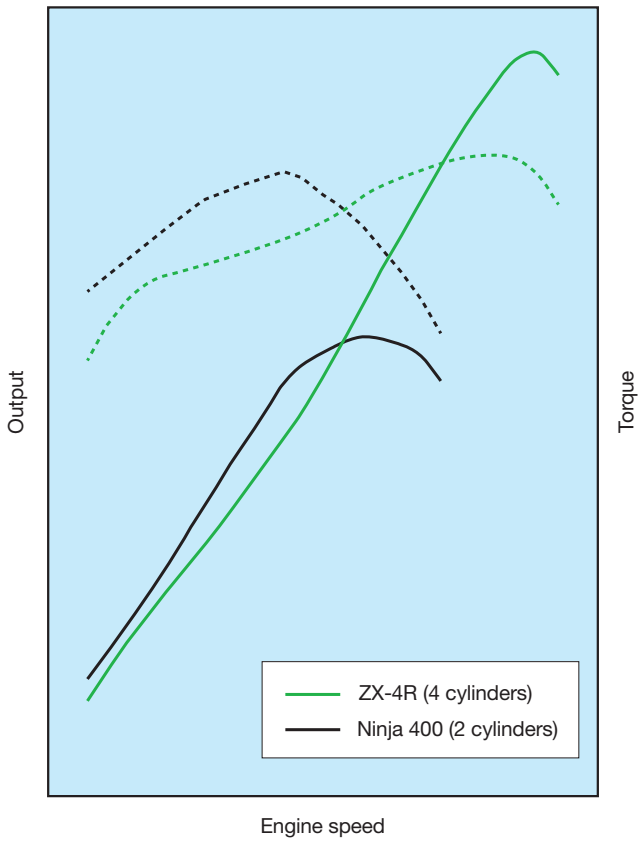

Fig. 2 Performance curves for the ZX-4R and Ninja400

confined to using double front brakes to enhance engine performance in place of the single brakes, and to changing the tire size from 110/70/17 to 120/70/17 for the front and from 150/60/17 to 160/60/17 for the rear to enhance stability at high speed. Keeping the changes minimal worked to suppress the increase of the bike's weight to 6 kg compared with the ZX-25R.

(3) Electronic accessories

For the ZX-4R we have adopted an electronic throttle for the first time in a four-cylinder 400-cm^3 model, giving it power mode and a quick up/down shifter. In addition, the full-color TFT meter display that supports Connected provides convenience to riders and can show information in a mode that makes riding circuit racecourses even more fun.

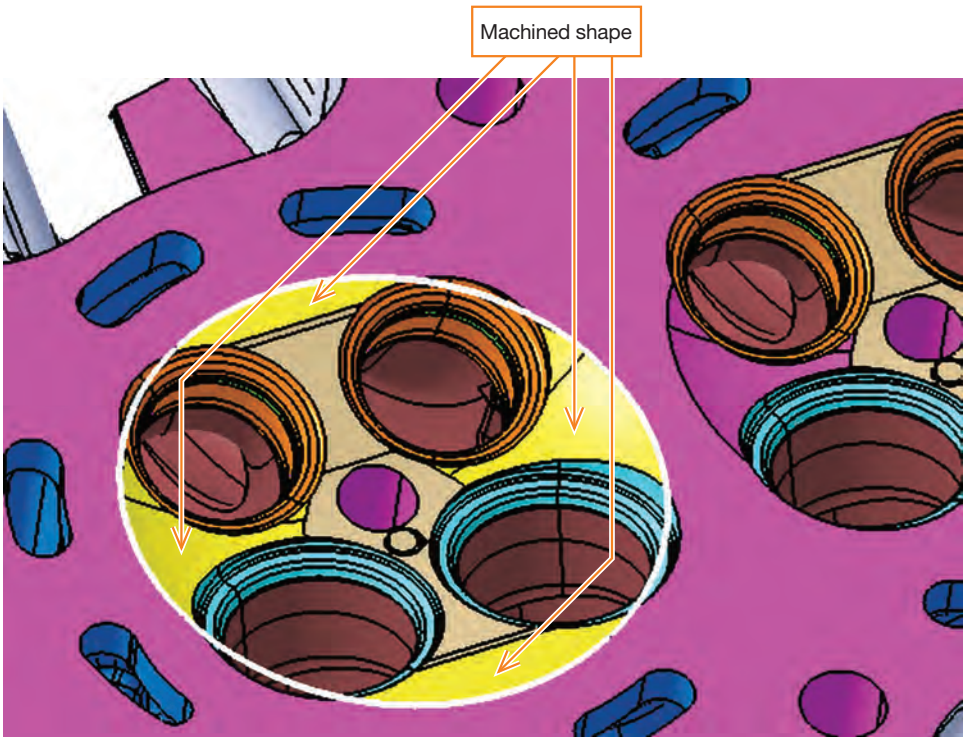

Fig. 3 Combustion chamber configuration

Conclusion

Motorcycles can be sold right around the world as long as they satisfy emission control standards EURO 5 and noise control standard R41-05. Our models satisfy the regulations of various countries and regions, such as China, Japan, the U.S., and Europe.

The release of this new model means a comeback for our 400-cm^3 four-cylinder model, which had been absent from our lineup for a long time. And as of 2024, the ZX-4R is the world's only mass-produced four-cylinder 400-cm^3 model. In addition, we have achieved a major increase in the ZX-4R's power output as various countries tighten their regulations, so this model is a showcase for our technical prowess as well.

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