

Gsxr 750 Gsxr 1100: 1992 - 1995



SUZUKI MOTORCYCLES GSX R 750, GSX R 1100 Generation 3: 1992 - 1995

Gsxr 750 and Gsxr 1100: facing the inevitable: liquid cooling



Suzuki's management and engineers stood at a crossroads with the **Gsxr** in the early 1990s. After seven years of racing success—well-deserved wins in AMA Superbike and world Endurance—and strong street bike sales, the direction for the next generation **Gsxr** was hotly debated.

One thing not up for debate was the switch to a liquid-cooled engine. The engineering team anticipated the inexorable march of horsepower—from the original goal of 100 PS (approximately 100 horsepower) up to 110, 120, or even 130 possible from a **Gsxr 750** in the none-too-distant future.



Development continued at a vigorous pace, with new computer technologies meshing with the engineer's better understanding of how the **Gsxr** engine responded to tuning changes. It was an all-out effort to find more power, that's true, but the desire was also to find additional midrange power and, where possible, improve durability without sacrificing performance.



These goals were a big jump from the original **Gsxr**'s horsepower mandate, around which the first oil-cooling scheme was designed. New thinking in combustion chamber shapes and manufacturing technologies that allowed for more precision at lower cost were working along with racing experience to push horsepower up and up. There were two possible avenues to follow. One: join the majority of the manufacturers who were producing sportbikes in what is, today, a familiar idiom—a narrow inline-four-cylinder engine stuffed into a beam frame whose main members curved around the outside of the cylinder head.

This form was used by all of the **Suzuki Gsxr** major competitors and, indeed, by **Suzuki**'s own race team on the **RG 500** GP bike. This direction in frame design would signal a major shift for the appearance and technology of the **Gsxr**.

Option two was to continue to develop the **Gsxr** with an over-the-top frame and finally acquiesce to liquid cooling. "It was decided to stay with main elements of the **Gsxr**. It was believed that that

was what riders wanted, that the identity of the **Gsxr** was wrapped up in the styling and frame design," says Masami Haga, general manager of the motorcycle planning department and a man deeply involved in a lot of the directions **Suzuki moto** takes.

The product planners' desire to retain **Suzuki Gsxr** legacy appearances was in part a way to help smooth the shift away from the bike's signature oil cooling. But it pushed the engineers into design decisions they would not have made given a clean sheet of paper.

For a company that traditionally had let engineers choose the directions they thought best-to, in essence, dictate what the product would be based on the need to have the lightest, fastest, most potent **motorcycle** in the class-these were tough times.

Still, the engineers' solutions were often inspired, despite the bike's general move away from what are considered to be the **Gsxr**'s major tenets: lightness, simplicity, compactness. Power is fine if you have it, but Mr. Yokouchi was clearly right that you could do more with less if the overall **motorcycle** was very light. Times were changing rapidly by the early 1990s, with massive improvements in tires, suspension, and brakes. Speeds were climbing-not just at the racetrack but also for everyday riders on the street-thereby putting greater strain on the chassis.

Engine power was always expected to increase, and it flat-out had to in order to keep up with the inevitable weight gain of improved suspension and larger wheels and tires.

For **1992**, then, **Suzuki moto** unleashed the **Gsxr 750 WN** in most markets except the U.S. (Sales of the old bike were still strong in the States, and a slightly weak economy meant that it would be hard to press any price increases on the new model). America would keep the oil-cooled **Gsxr** another year with minimal changes and receive the **Gsxr 750 W** in 1993.

Practically everything about the liquid-cooled **Gsxr** was new. The chassis had begun to morph from the original extruded-tube alloy design to something on the way to a true spar design.

The extruded upper tubes were now five sided, with a noticeable chamfer along the upper edge. Still, the frame was considered a double-cradle design, with the main tubes arching up and over the engine and making clearance for the cheeks of the airbox on the noisy side of four 38 mm Mikuni carburetors.

Suzuki moto took the opportunity to push the **Gsxr 750** along the path that defines sportbike chassis geometry. From the early bikes' "lazy" steering geometry and, for the most part, long wheelbases, the **Gsxr** first was made shorter and then gradually received ever more aggressive steering-head geometry.

For the '92 **Gsxr750 WN** model, rake was reduced yet again (from 25.3 degrees to 24.5), as was trail (3.9 inches down to 3.7). Sportbike steering heads were getting steeper, but wheelbases were growing again: the **Gsxr750**'s increased 0.8 inch to 55.7. As the engineers continued to develop the **Gsxr**, they found (as did engineers at other factories) that the steeper head helped reduce steering effort and improve maneuverability, and the longer wheelbase helped add back some stability.

In place of the previous-generation bike's extruded, square-section swingarm came a fabricated affair of aluminum starn pings and castings. Feedback from racing also shaped the bike's rear subframe, which, for the first time, was a bolt-on affair.

This method, as opposed to the welded-on subframe of the previous generation, made for easier modification for the race bikes and simplified repair procedures for both racers and street riders. It was less likely that a mild get-off would bend the main frame or break off the subframe in such a way that the entire frame would have to be replaced.

This bike was recognizable as a **Suzuki Gsxr**, even if you didn't immediately figure out the reason for the curious wedge of bodywork covering the rearmost part of the main frame. It was put there "because riders complained about coming in contact with the frame and scratching it," says designer Takahiko Kawaguchi.

The upper fairing was largely a carryover from the '91 model except for repositioned air intakes, but the lower fairing clearly revealed the massive new water radiator in front of the engine and the large air exhausts along the flank.

The engine requiring all this new plumbing was essentially new, even though it used the old **Suzuki Gsxr 750**'s 70.0 mm by 48.7 mm bore and stroke. A completely redesigned cylinder head carried valves the same size as the previous engine's but with thinner stems and set at an included angle of 32 degrees. That's a reduction of 8 degrees from the oil-cooled motor but hardly cutting-edge. In fact, by '94, the **Suzuki Gsxr 750** engine seemed to embrace conservative values all around.

"Actually, we were ready to make this change in the previous engine," says Kunio Arase, now part of the racing group in charge of the MotoGP and Superbike engines. "But we had a production hang-up.

The factory could not produce a direct-acting system before **1992**."

Along with the shallower included valve angle for a more efficient combustion chamber came higher compression, now 11.8: 1 compared to the 10.9:1 of the last oil-cooled engine. **Suzuki moto** could get a lot more heat out of the engine with liquid swirling around the head and upper cylinders, so it could raise the compression ratio without fear of detonation or heat saturation.

Curiously, the **Gsxr** retained vestigial cylinder finning. "The engine didn't need it, of course," says Mr. Arase. "But it was felt that the fins were needed to preserve the family resemblance." In other words, no "naked" engine could be a **Gsxr**'s prime mover. Mr. Arase's comment tells you a lot about his engineering mind.

Although he's clearly loath to say so directly, you sense his dissatisfaction with the compromise. Unnecessary finning adds weight and casting complexity, not performance.

Substituting water jackets for full finning allowed **Suzuki**'s engineers to close up the bore spacing, which narrowed the engine by nearly 3 inches. The combination of a more compact head and a thinner bottom end allowed the chassis guys to move the engine forward and down in the frame-almost always a good thing for handling.

Suzuki moto had yet to reach for end-driven cams, preferring to retain the central cam tunnel. (Yamaha did the same during this period, so end drive was hardly expected from anybody.)

Suzuki moto did not abandon oil cooling altogether. The piston squirts remained, and just to make sure the oil remained cool, an oil-to-water cooler was placed at the base of the oil filter.

Because **Suzuki moto** stayed with an over-the-top, double-cradle frame, the engine did not have the fashionable downdraft carburetion. Instead, the quartet of Mikunis sat upright, just as the carbs had since the days of the **Gs 750**. Although revised for the new **Gsxr 750 WN** model, the airbox could not take up as much space as one designed to feed downdraft carburetors.

Ultimately, the new liquid-cooled **Gsxr 750**'s engine punched out nearly the same peak power as the previous engine but with a commendably broader torque curve, one that started its hike up the mountain at lower revs. Even when reverted to the long-stroke configuration, the oil-cooled engine made its best power above 9,000 rpm.

The new engine was described in contemporary press as coming alive by 7,500 rpm, even if it still packed the most fun from 10,000 rpm to the 13,500 rpm redline.

Continuous improvement in suspension and brake design helped push up the gizmo quotient in every sportbike of the period, and the inevitable result of the **Gsxr** gaining both a stiffer frame and a liquid-cooled engine was weight gain.

The **Gsxr 750 WN** was some 60 pounds heavier than the original **Gsxr**. The bike fought back with much improved handling and better power particularly for the race teams able to harness the benefits of liquid cooling-but the media continued to point out that the **Gsxr** had drifted away from the original's focus on low weight and utter simplicity.

The **Gsxr 750** had matured-and no one doubts that it had to-but enthusiasts wondered just where **Suzuki moto** had put its priorities.

Suzuki moto, once again, worked fast to counter the complaints. The '94 **Gsxr 750** received a host of improvements, most of them aiming to reduce overall weight.

Using a revised frame, with the wall thicknesses reduced in strategic locations to prevent a loss of rigidity, and costly magnesium covers on the engine along with hollow transmission shafts,

Suzuki moto was able to pull some 30 pounds off the **Gsxr 750**'s hide. That's an impressive number, and along with slightly increased power from detail improvements inside the engine, it helped

redress the performance gap with the burgeoning 900 cc class. For '95, the **Gsxr 750** was left pretty much alone. **Suzuki moto** did not at the time drop the hint-though it did little to stem rumors-but big things were in the works for '96.

Suzuki moto is among the smartest players in the parts-commonality scheme, wherein a manufacturer leverages one set of chassis designs, bodywork, engine cases, and running gear for multiple models, but it set new standards in 1992 with the introduction of the **Gsxr 600** and, a year later, with the revised **Gsxr 1100**. The benefits of parts sharing are compelling, especially for **Suzuki moto**, which is well versed in stretching its engineering resources to the fullest. **Suzuki moto** was a fraction the size of Honda and Yamaha, yet it still managed to maintain a stranglehold on the ultra-sport class. In 1992, U.S. sales of the **Gsxr 750** were better than 4,000 units.

In that same year, Honda sold just fewer than 1,100 **750** class machines (the VFR 750), and Kawasaki pushed out 2,225 ZX 7s and ZX 7Rs. From this vantage point, it's easy to see how sharing parts among three models - the new **600**, introduced to the world in 1992; the **750**; and an updated **1100**, debuting in 1993 - would improve profitability and, if done properly, not endanger the sales of any category.

The **600** was a controversial program. Without the resources to develop a **600** class machine from scratch, the decision was made to adapt the **750** chassis and new liquid-cooled engine to the task. As a result, the **600**s shared the **750**'s frame (with minor modifications) as well as the larger bike's bodywork, wheels, brakes, and basic suspension.

In the early 1990s, the traditional displacement classes were starting to morph. Most manufacturers fielded middleweight machines - 500 s first, then 550 s, and then **600**s - as well as **750**s and open-class bikes at and above **1000** cc.

But the market was beginning to stratify in the early 1990s, with ever more powerful and sophisticated **600**s taking sales from the **750**s left and right. Partly, this phenomenon stemmed from the rising cost of street bikes and ever-increasing insurance requirements.

Suddenly, a **600** class machine looked considerably cheaper to buy and own than a **750**, while the liter bikes were still an atmosphere away. By 1993, the **Gsxr 750**'s only competition was the Kawasaki ZX 7.

The Honda VFR 750 had changed into a sport-tourer with the arrival of the lighter, very fast CBR 900 RR. Yamaha's FZR 750 had been gone from the U.S. market since the end of 1988. (Its replacement, the YZF 750 R, would return for 1994, miss 1995, and be gone again by 1998.)

The market was quickly changing, with **600**s a required component of any sportbike line, 900 s taking over for **750**s (the theory was to have more power in a **750**-size package), and the big bikes turning into quasi G Ts with thrilling top-speed performance.

When **Suzuki moto** tackled the **600** class in the U.S. by basing its machine off the **750**, the resulting bike was larger and heavier than the other **600**s, albeit with higher-specification brakes and suspension. (Now that all the top-line **600**s wear inverted forks, it's easy to forget that **Suzuki** was there first.) Adding to the perception of heft, the **600** had slightly more conservative chassis numbers, with 1 degree more rake, 0.2 inch more trail, and 0.2 inch more wheelbase.

For the engine, **Suzuki**'s engineers specified smaller, 65.0 mm pistons (down from the **750**'s 70.0 mm units) and a short-stroke crank, giving a total stroke of 45.2 mm, 3.5 mm less than the **Gsxr 750**.

They didn't have enough development time to extract the most from this configuration, so the **600** arrived larger than its competition and slightly down on power. It should be no surprise that the proud parents were loath to watch their offspring take such a drubbing, and **Suzuki** stopped production of the **600** after the '93 model year.

The revised **Gsxr 1100** fared much better. As before, it lagged one year behind the big changes brought to the **750**. The '93 received the liquid-cooled configuration from an engine that shared a great many parts with the **Gsxr 750**. Acknowledging that the **Gsxr 1100** would be plenty powerful in a **750**-size frame, **Suzuki**'s engineers worked on maximizing torque. The new engine's bore and stroke dimensions-75.5 mm by 60.0 mm - were considerably less oversquare than the **750**'s or **600**'s.

Both of the smaller engines' bore to stroke ratios were 1.45:1; the **Gsxr 1100**'s was a considerably more conservative 1.25:1. What's more, by using carburetors the same size as the **Gsxr 750**'s and comparatively small valves, the **Gsxr 1100** engine made prodigious torque.

Cycle World described the revised **Gsxr 1100**'s engine as having "excellent manners": "Around town, the engine is a docile partner, and offers the rider a plentiful supply of smooth, torquey, low-vibration power."

The magazine went on to say, "Forceful acceleration begins as low as 4,000 rpm, and builds in a linear fashion to the bike's 11,500 rpm redline. The 8,500 rpm burst of last year's model is missing."

In keeping with the established philosophy that the **Gsxr 1100** wasn't as deadly serious as the **Gsxr 750** and therefore should be slightly more comfortable, the **Gsxr 1100** once again came with clip-on handlebars above the top triple clamp. The new frame pushed back the rider slightly to make room for the larger main members and an enlarged airbox, but the change was largely mitigated by the taller bars.



Suzuki moto continued to develop the **Gsxr** line aggressively, of course. But in retrospect, the third generation **Gsxr** can be seen as a side trip away from the bike's principal intentions as a race-ready Superbike. With this iteration, it had grown large and soft, and the competition's performance crowded it more than ever before.

The **Suzuki Gsxr** had been a tremendous success for the company, a massive seller, and a gold-clad marketing tool. The product-planning and marketing staffs had the advantage in product development, and they were rightly concerned that a move too far away from what a **Gsxr** looked like might jeopardize its success.



And even in a softening U.S. economy and with amazing new sportbikes stealing some of the **Gsxr**'s thunder, the line continued to sell extremely well for **Suzuki moto**. Such reliable income was important to maintain the **Gsxr**'s place in racing as well as to support the Grand Prix team. Kevin Schwantz, now considered legend in Japan, won the top crown for **Suzuki moto** in 1993, eleven years after the last 500GP title with Franco Uncini.

But what the marketing types had failed to realize was that Mr. Yokouchi and the engineers even the engineers working on this generation-were right: performance mattered most.

Above and beyond all: performance. A decade on, the engineers responsible for this generation of **Gsxr** squirm in their chairs slightly, tacitly acknowledging that maintaining **Gsxr** appearances had trumped maintaining the **Gsxr**'s original performance brief.

All that was about to change.



Suzuki Gsrx 750-Gsrx
1100: 1985 - 1987



Suzuki Gsrx 750-Gsrx
1100: 1988 - 1991



Suzuki Gsrx 750-Gsrx
1100: 1992 - 1995



Suzuki Gsrx 600-Gsrx 750-
Gsrx 1100: 1996 - 1999



Suzuki Gsrx 600-Gsrx 750-
Gsrx 1000: 2000 - k1 - k2
- k3



Suzuki Gsrx 600-Gsrx 750-
Gsrx 1000: k3 - k4 - k5



Suzuki Gsx R 600-Gsrx
750-Gsrx 1000: k5 - k6 -
k7