

Gsxr 750 Gsxr 1100: 1988 - 1991



SUZUKI MOTORCYCLES Gsxr 750, Gsxr 1100  
Generation 2: 1988 - 1991



Without question the first generation **Suzuki Gsxr** was an out-of-the-ballpark success. The model turned the sportbiking world upside down. With one deadly accurate slash of the knife, it caused every other sportbike manufacturer to bleed sales and, once through triage, to rethink its evolutionary product-development process.

But even though the **Suzuki Gsxr** - due credit to the **Gsxr 1100**, but the **Gsxr 750** in particular - was doing extremely well in showrooms, it wasn't winning everything in sight on the racetrack.



Kevin Schwantz's first season aboard the **Gsxr 1986**, netted a single win in AMA Superbike. Honda's first aluminum-frame VFR **750** arrived that year, and Fred Merkel put the company's substantial (some said "enormous") race budget to good use, winning his third title in a row by '86.

The next year Schwantz took five wins and came home second in the championship. But it wasn't enough for **Suzuki moto**, whose corporate pride was hanging way over the line. The **Suzuki Gsxr** was conceived to win, and win it would.



In the U.S. and abroad, the competition had stepped up to **Suzuki's** challenge with the **Gsxr**, but plans were in place to advance the state of the art.

The result, which debuted as the **1988 Gsxr 750** model, represented a wholesale revision of the bike, with every part of its design-engine, frame, suspension, bodywork-dramatically revised.

In modern **motorcycle** product-development cycles, everything is carefully considered and planned well in advance. By the time a model is introduced, the development engineers have long been hard at work on the next model, seeking to institute changes they could not make in the previous iteration and, perhaps, stamping their name on the bike itself through pet



technologies.

This well-ordered world had, up until the mid-1980s, worked mainly on four-year cycles. Introduce a new model, and make few changes in year two. Perhaps make small updates in year three, with cosmetics the main focus of year four.

Then introduce a new model **Gsxr** and start the process over again. But **Suzuki moto** had reset the standards with the first **Gsxr** and had only heightened competition.

Every **Suzuki** engineer knows the phrase "To stand still is to fall behind." And for 1988 - a year earlier than **motorcycle** enthusiasts and the press expected - **Suzuki moto** launched a new **Gsxr 750**.

Although it followed in the footsteps of the first version, emphasizing low weight and "hypersports" handling, it was as much a change from the first generation **Gsxr** as the **Gsxr** itself was from the **GS 750** that had come before.

In short, **Suzuki moto** left no dyno unoccupied in the search for race-winning performance. What's more, the '88 debut of the J model **Gsxr750** also predicted a further shortening of the development cycles. By the time this second generation **Gsxr** was done, it had seen four major revisions in as many years.

Central to the new bike was a radically short-stroke version of the oil-cooled engine.

There are many ways to make more power for a given design; one is to increase the potency of the combustion event by flowing more air through the head or raising the compression ratio. But engines are a careful balance of conflicting design requirements.

Raise the compression ratio and you erode detonation margins, which are thinnest when the engine is running at its hottest. Increase engine power, and it will run hotter. At some point, you reach the limit of the cooling system.

Other methods have to be considered.

For **Suzuki moto**, that alternative was more rpm. With that goal in mind, the engineering staff shortened the **750**'s stroke by 4 mm and increased the bore by 3mm. A shorter stroke results in lower piston speeds so that a higher rev ceiling can be considered; for the **750** it rose to an absolutely giddy 13,000 rpm. All else being equal, if you can maintain torque output at the top of the rev band and increase the maximum, horsepower will go up.

Juggling the bore/stroke relationship sets off a series of other changes, so although the J model's engine outwardly resembles the first generation **Gsxr**'s, it shares remarkably few parts.

The new pistons are slightly heavier than the long-stroke engine's but result in a higher compression ratio, now 10.9:1, which is fairly high for an engine of that period. They are mated to connecting rods 3.5 mm shorter than the previous iteration's that, in turn, hook to a crankshaft with 2 mm larger journals.

Despite reduced counterweight size, the whole crank is slightly heavier than before but considerably stronger. All of these changes were made to improve the engine for racing.



Indeed, **Suzuki moto** personnel admit that they might have been sacrificing roadability for racetrack success. "We wanted more high-rpm power.

That was the main goal," says Chiaki Hirata, a member of the engineering team for the first generation of **Suzuki Gsxr** engine.

To fully capitalize on the increased rpm ceiling, the new **Gsxr** received camshafts with more overlap and duration that open larger valves.

In fact, the J model's valves are the same size as the **Suzuki Gsxr 1100**'s. Feeding this reworked cylinder head were four 36mm Mikuni carburetors that introduced a new semiflat slide arrangement.

To make sure they were up to the short-stroke engine's airflow requirements, they were 2mm larger than the mixer on the previous engine. Because a dense air charge helps power, too, **Suzuki moto** ducted cool air from the front fairing to the airbox area; some of that air also went to the back of the engine to help keep it cool. This could be considered a nascent form of ram air, although the primary benefit was lower intake-air temperatures.

On the other end of the system, the **Gsxr** gained a new four-into-two exhaust system.

The original **Gsxr** proudly wore a race-like four-into-one system with a massive muffler, but increasing noise regulations, along with the desire to increase exhaust volume, led **Suzuki moto** to go with paired mufflers. A slight weight penalty was considered worthwhile against the power increase.

Without question there was more power-contemporary magazine reports had the J model at just over 90 hp to the rear wheel, an 11 hp jump from the long-stroke **Gsxr 750**. In fact, the **Gsxr 750** now made close to the same power as the **Gsxr 1100** (albeit without the meaty midrange torque) and vanquished everything else in the **750** class of '88, which was clustered in the 82 to 85 hp range. Most of the power advantage came at high rpm; from 9,000 rpm to the redline, the new short-stroke engine positively killed the old engine.

More power means more heat, and **Suzuki moto** continued to work the oil-cooling angle for all it was worth. (With the benefit of two decades' hindsight, we know that oil cooling would eventually reach its limit.

Even the engineers admit they knew as much at the time.) The new bike carried 15 percent more oil that circulated through an oil cooler said to be 48 percent more heat efficient, and a higher-capacity pump, allied to new fittings and lines, increased overall oil flow by 20 percent.

That's straightforward engineering stuff, but Mr. Yokouchi's team looked into a few other tricks to help get the heat out of the cylinder head and into the airstream. Primary among these are new baffles that fit into the recesses in the head intended to carry a large volume of oil. By adding baffle plates, the oil flow in that area must accelerate.

A careful balance is at work here. Move the oil too slowly and it will readily absorb so much heat that it boils. Move it too quickly and it does not have time to absorb all the heat the cylinder head is trying to reject.

In the early **Gsxr** s, it was enough to let the oil do its natural thing in this area; with more power and more heat to reject, these new baffles were deemed critical. **Suzuki moto** enveloped this

thoroughly revised engine in an entirely new frame that borrowed liberally from the company's racers of the previous year. Moreover, the new frame was designed to be strong and easier to produce.

It didn't seem terribly important at the time, but the '88 **Gsxr**'s frame was constructed in a way that the company would maintain until the 2005 models (and, probably, beyond.) where the previous **Gsxr** frame was built of aluminum tubes and extrusions welded together, the new frame incorporated cast-aluminum sections at the steering head and swingarm pivot. These complicated shapes are much easier to create in a casting than they are with welded members.

In order to create as compact a bike as possible, the new **Gsxr 750** had a shorter wheelbase (by some 2 inches) at 55.1 inches, less rake (24.8 degrees vs. 26.0), and less trail (3.9 inches vs. 4.2).

Where the first generation **Gsxr** eschewed the trendy 16-inch front wheel, the '88 bike took a gamble with new, wider 17-inch rims, front and rear, intended to carry Michelin's just-designed low-profile radial sport tire in sizes 120/70 and 160/60. (Yes, that rear seems awfully small nearly twenty years later.)

Suspension, too, came in for a major overhaul, and it now featured a new cartridge-type fork with preload, rebound, and compression adjustments. A new, nonreservoir shock worked through a revised linkage rear suspension.

In this respect, **Suzuki moto** was leading the pack by not just putting highend technology on the street-this was among the first applications of the dirt-derived cartridge fork-but by giving the rider an unprecedented range of adjustments.

Up to this point most sportbikes had suspension adjustments for spring preload in the front and preload plus rebound damping in the rear, often just four to six "clicks" of adjustment. In fact, the first road tests of the new **Gsxr** pointed out that it was easy to get lost in the suspension adjustments and that it was easy to make the bike handle strangely by going off on the setup.

Contemporary reviews rated the short-stroke **Gsxr 750** high for pure performance but noted that the high-rpm-biased engine power required the utmost commitment from the rider.

The exhaust system could drag in corners, but some of that might have been due to the new generation of stickier tires.

No question: the **Suzuki Gsxr** had grown and become far more tightly focused as a result of breeding for the track. The magazines were full of praise. Cycle's test resulted in this statement, "But let's get one thing straight: Serious, complex and demanding as the **Gsxr** is, it's best understood as a road-legal racer-a 'street bike' that's as far removed from the street as Laguna's corkscrew is from Sunset Boulevard.

On this **Gsxr 750**, straight pavement becomes almost a perversity." Once more, **Suzuki moto** took the **Gsxr** to the brink of what is acceptable performance for an everyday bike, But, as Sadayuki Inobe, **Suzuki**'s current executive general manager, says, "The **Gsxr** has always been about 'born on the track.' That is what is important."

At the outset, the J model was intended to be a better racer, and it was. Kevin Schwantz won the AMA Superbike round at the famed Daytona 200 and Doug Polen finished second in the series to Bubba Shobert's Honda.

That same year, **Suzuki moto** won the World Endurance championship with a bike based on the **Gsxr 1100**.

Still, the new short-stroke engine wasn't easy for the smaller teams to tune.

It would take the combined talents of Yoshimura's U.S. engineers and tuners working closely with their counterparts in Japan to make the top-line bikes competitive. The smaller teams struggled as they discovered that hard-won tuning techniques from the previous engine didn't work on the revver. **Suzuki moto**, very much engineering driven and surprisingly light on hubris, immediately put together a special double-R model for 1989 that reverted to the previous "long-stroke" configuration but also came with special race bodywork and significant revisions to make the bike a true "out of the crate" racer.

Just five hundred were made.

Takahiko Kawaguchi was the designer in charge of the '89 double-R model. "There are a lot of differences that aren't easy to see," he says. "For example, the fairing had to be changed to allow making it from fiberglass.

The forward part was slightly longer than the regular **Gsxr**'s for aerodynamics." And although much of what was done under the skin was dictated by engineering, there was still some leeway.

"The riders wanted to be more comfortable for the track," he continues, "so we changed the shape of the side fairings and lowered the windscreen for better aerodynamics when the rider is tucked in. We also made the front fender smaller to allow more air to the engine, and the top of the aluminum fuel tank is sloped down."

This last change helped keep the rider's elbows from catching on the sharp edges of the tank cheeks.

Although only five hundred were minted, the double-R model had persuasive influence on the **Suzuki Gsxr** line. The next year, **Suzuki moto** debuted the **Gsxr 750 L**. If you thought even a medium-size **motorcycle** company like **Suzuki** couldn't react quickly, then you would have been set straight by the '90 bike. Although it reverted to the bodywork of the standard '89 bike, the L model kept the longerstroke version of the engine that debuted with the double-R. Mr. Hirata explains the decision, "We had tried a short-stroke **750** with the **GS 700 E** for the American market and it worked well."

Still, racers, and even some street riders, were calling for more midrange torque, and **Suzuki moto** delivered.

Cycle magazine, describing the new long-stroke engine in its January 1990 issue, said: "The short-stroke engine had gone too far. With its broad, dish-shaped combustion chambers, and big inlet tracts and valves, it produced poor intake velocity and charge motion at moderate engine speeds." Some riders liked the very top-end-weighted powerband, but many found it too inaccessible for street riding. The bike that defined a race bike's personality for the street had, apparently, taken it a bit too far.

**Suzuki moto** took the opportunity to improve midrange in other ways, decreasing valve sizes slightly (by 1.3mm on the intakes and 1.0 mm on the exhausts) to improve flow velocity at lower revs.

The spark plug was also smaller, a 10mm unit in place of the previous 12 mm, which allowed for more material between the valves. Addressing cornering-clearance complaints, **Suzuki moto** switched back to a four-into-one design with a right-hand muffler, now with a bevel along the leading edge.

Numerous seemingly small changes to the engine produced impressive results.

Despite not revving as high, the **Gsxr 750 L** model produced around 88 hp to the rear wheel, still well up on the competition and with a massive increase in midrange torque, particularly around 5,000 rpm. **Suzuki moto** got what it wanted: more torque with little horsepower loss.

Another note from the looks-can-be-deceptive department: the **Gsxr 750 L** model's chassis was thoroughly revised as well. It essentially had a new frame, picking up elements of the **Gsxr 1100**'s, including upper frame tubes that were more splayed outward to improve rigidity. Rake and trail were both increased slightly-by 0.7 degree and 1mm, respectively-for improved stability. The swingarm was also based on the **Gsxr 1100**'s and stretched the wheelbase to 55.7 inches. This constant alteration of the **Gsxr**'s frame geometry serves to illustrate how closely the company

listens to the race teams, continuing the hunt for ideal handling as suspension and tire technologies evolve.

The truth is, no one perfect set of numbers can be followed as **motorcycle** technology as a whole improves. Somewhat confusing for Americans was the suspension situation. Elsewhere, the '90 J model received a male-slider fork, but the U.S. version kept the previous model's conventional fork. The U.S. market did get the first remote-reservoir shock fitted to the **Suzuki Gsxr** that year, along with the rest of the world. Slotted front brake rotors replaced drilled units, and a wider, 170 mm-wide rear tire was grafted on. That would all seem like a lot of work for a **motorcycle** ostensibly near the end of its product cycle, but such was the competition at the time that **Suzuki moto** felt the need to keep the pressure hard on development. "We have always felt the need to push chassis development," explains Hisayuki Sugita, now an assistant manager for **motorcycle** engineering. But more was to come.

For the 1991 model year, **Suzuki moto** released the **Gsxr 750 M**, which carried a new fairing and still more revisions to the engine. The fairing was a relatively easy change. "Aerodynamics was starting to become ever more important," says Mr. Kawaguchi, body designer of the '89 double-R model and the bodywork for the '91 to '95 bikes. "We wanted to keep the **Gsxr** image in the twin headlights, but a plastic cover was used to make the fairing more streamlined." The chassis carried over largely intact from the '90 model, but the **Gsxr 750 M**'s engine got a surprise makeover.

Rumors were flying in race paddocks and magazines of **Suzuki**'s imminent switch to liquid cooling. All of its major competition had joined the antifreeze league, and the race teams had to take ever more extreme measures to keep the oil-cooled engine happy in race trim. Oil coolers the size of coolant radiators sprang up. Additional tweaks inside the engine to carefully control oil flow were the norm, yet the engines were still running hotter than desired. By the end of the 1980s, it was clear that Mr. Yokouchi's great idea - so important to the success of the first **Gsxr** - was nearing the end of its useful life in high-performance and racing machines. Power had come to dominate the proceedings. No surprise to anyone who has met Mr. Yokouchi, in retrospect he is sanguine about the process of changing to liquid cooling: "It was inevitable."

But the world would have to wait a year for **Suzuki moto** to finally make the leap. In the interim, the last gasp for the oil-cooled generation received substantial valvetrain updates. All **Gsxrs** up to this point used a form of valve actuation that was just about the industry standard. For each pair of valves in the engine-the intakes and exhausts, separately-one cam lobe pressed down on a forked rocker arm. At the free end was a pair of threaded adjusters, which in turn pushed on the valve stems. This offset system allowed the included valve angle to be smaller than would otherwise be possible if the cams were directly atop the valves. And compared to the direct-acting valve systems of the period, the forked-rocker setup provided less sliding friction.

It was useful for the air-cooled, and even the oil-cooled, engines to have some open space atop the combustion chamber for finning or for the oil chamber, so the penalty of having the cams reside ahead of and behind the valve-stem axis wasn't large. Also, by placing the cams off-axis with the valves, the head could be slightly shallower, a useful trait in a time when most engines were comparatively long stroke and fitted into frames whose main members wrapped up over the head. Later, as designers sought to make the cylinder head shorter from back to front-mainly to make room for a new breed of downdraft intake systems-the compromises started to come out in favor of direct valve actuation, which remains the standard today.

Elevated engine speeds had exposed the weight of the system and its intolerance of ultra-high revs. With this in mind, **Suzuki moto** operated each valve through an individual cam lobe and thin finger follower.

At the same time, shims for adjusting valve clearances replaced the screw/locknut setup to help reduce valvetrain weight. Otherwise, the '91 **Gsxr 750** wasn't much different from the '90, except for the American market, which finally received the Showa inverted fork that the rest of the world had enjoyed a year earlier.

**Suzuki**'s emphasis had always been on the **Gsxr 750**, but the **Gsxr 1100** received useful updates through this period and was carefully nurtured into its own niche. The **Suzuki Gsxr 1100** was intended to be slightly less purposeful and more comfortable because it was not raced, and **Suzuki moto** felt that it would be bought by "more mature" riders who could afford the higher price and increased insurance costs. But a careful balance was attempted so that an essential **Gsxr**-ness would be retained.

A company the size of **Suzuki moto** has to use its engineering talent carefully, so although this generation of **Gsxr 750** started in 1988, the **Gsxr 1100** would soldier on unchanged until 1989. At that point, the **Gsxr 1100** took a shift of sorts, pairing the **Katana 1100** engine introduced a year earlier with the frame of the just-revised **Gsxr 750**.



Created as an 1127 cc unit, the **Katana** engine was a half-generation ahead of the 1052 cc engine used in the first generation **1100s**.

Nonetheless, it received substantial revisions for use in the new **Gsxr 1100**, including beefed-up bottom-end components and different primarydrive gearing; together with reworked final-drive gearing, the **Gsxr 1100** emerged taller-g geared than the **Katana**.

The chassis used many of the same components as the **Gsxr 750**'s but was strengthened, particularly in the cast steering-head area.

A 1.3-inch-longer swingarm increased the wheelbase to 56.7 inches. Other differences from the **Gsxr 750** included taller handlebars that were mounted above the upper triple clamp and rubber-covered footpegs. (The **Gsxr 1100** engine wasn't as smooth as the **Gsxr 750**.)

As the decade opened, **Suzuki moto** knew it would have to recast the **Gsxr** into a more modern role.

The **Gsxr 750** maintained its leg lock on the dyno-no other truly mass-produced **750** of the period could touch it-but the competition was looming in the rearview. The company's decisions for the next generation of **Gsxr** would prove to be the most challenging in the model's history.



Suzuki Gsxr 750-Gsxr  
1100: 1985 - 1987



Suzuki Gsxr 750-Gsxr  
1100: 1988 - 1991



Suzuki Gsxr 750-Gsxr  
1100: 1992 - 1995



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



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



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



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