Why Some SV Racebikes Blow Up

By Nolan Ballew

Elastic deformation is when a material bends but returns to its original shape. Plastic deformation is when a material bends and cannot return to its original shape.

Under heavy braking or hard cornering our front fork tubes will flex a bit. They can do this hundreds of thousands of times and still return to their original shape. This is elastic deformation.

If we crash and the bike tumbles around the fork may be bent permanently. This is plastic deformation.

If we run the forks straight into a wall they may bend past the elastic point, past the plastic point, until the metal fractures and fails. You can do this with a paper clip. After so many bends back and forth, the metal fractures and breaks. Generally, this is how materials behave.

SV650s are no exception. SV cranks bend, deform and break. SV rods bend, deform and break. If we run our SV at a 6000 rpm redline the rods and the crank flex very little and would likely never fail. As we increase our redline higher and higher we ensure that our rods or crank will fail eventually. However, a stone-stock SV650 should be able to run several seasons before snapping a crank or sending a rod through the cases, yet many 2003 and newer stock SV650s have sent racers home early.

Rods and cranks fail for several reasons: Poor design, defective material, oil starvation, or abuse. If we were to disable the rev limiter and routinely rev a stock SV650 to 12,000 rpm, probably only possible in the lower three gears, we would expect things to be overstressed and to fail. Since a stock SV stops making power at 9800 rpm, there is no need to do this.

Oil starvation caused by excessive oil consumption—a problem with the early R6 Yamahas on banked tracks like Fontana or Nashville—is curable by adding extra oil during pit stops.

This leaves us with poor design or defective material. Not being an engineer or a metallurgist I have to base my design opinion on casual observation. The 2003 SV650 rods and crank look pretty much like any other set of V-Twin rods and crank. While all built Twins will break something eventually, the 2003 SV650s seemed to break things straight from the factory. If we look at what changed between 2002 and 2003 we find the same bore and stroke, and the same pistons—but a new crank and rods.

The pre-2003 cranks had 10 different thrust washers to shim between the crankshaft and the engine cases. This allowed for changing the amount of side-to-side play a crankshaft has within the cases. The 2003 and newer SV650s have no such adjustment available. This means that you either manufacture your cases and cranks to such tight tolerances that shims are no longer needed or you can mix-and-match crankshafts and cases until you find the right combination. The other option is to establish a tolerance range wide enough to accommodate your manufacturing tolerances and hope it all stays together.

If we look at the GSX-R750 from 1996 up to the present model, thrust washers are available in six or seven different thicknesses, allowing for adjustment of the side-to-side play of the crankshaft.

Suddenly in 2003 they were no longer necessary for the lowly SV650. And suddenly crankshafts started to snap at the magneto rotor.

I work in a lab with a bunch of graduate students who excel in breaking expensive machinery. It's good job security and it's usually easy to diagnose what they did wrong by asking, "What di you do differently from the las time you used it?" After lead ing them through the sam question three to 15 times the will give up what they did dif ferently and it's usually wha broke the machine.

I suspect the same is tru in the case of the snappin SV650 cranks. Some peopl get a good one; our SV65 engine ran eight of last year' WERA endurance races wit one crank. Aside from me dis abling a perfectly functionin transmission by incorrectl installing washers, our 200 SV was trouble free. Other snapped 2003 cranks after few sprint weekends. We got good one, they got a bad one, think in this case good mean the crank moves around in th crankcase the right amount, n too much, not too little. The ba ones move too little or too much

What Suzuki did differ ently is change the method b which crankshaft side play i adjusted by eliminating th adjustment. Many other man ufacturers do not have differ ent sized thrust washer available to adjust side play

Nolan Ballew on the Notorious P.I.G. Suzuki SV650 during a WERA National Endurance Series race at Talladega Gran Prix Raceway. Photo by Vicki Sulpy/MHS Photography.

Perhaps they have different methods of making cranks and cases fit together. It's possible that eliminating this tolerance control from the SV allowed some cranks to flex too much and they failed on the side of the heavy magneto rotor.

Twins break cranks far more often than Inline Fours. The reason is because of excessive flex. Any modern 600cc Inline Four will rev all day to 15,000 rpm season-after-season without breaking a crank. A Twin has no such luck. A 600 piston weighs about 140 grams, or roughly five ounces. A SV650 piston weighs about 240 grams, 8.5 ounces. The heavier the piston, the greater the strain on the crank and rods. Both pistons have to be accelerated from a dead stop at the bottom of a stroke to maximum speed and back to a dead stop at the top of the stroke, over and over again.

The longer the stroke, the farther and faster a piston has to travel at a given rpm. The SV650 has a stroke of 62.6mm. The average piston speed of a SV650 piston at 10,000 rpm is 69 feet per second. A GSX-R 600 has a stroke of 42.5mm and has an average speed of 47 feet per second at 10,000 rpm. At 11000 rpm the SV piston is traveling at an average speed of 75 feet per second while the four cylinder won't hit that speed until 15,000 rpm. When you factor in the much heavier weight of the SV piston it not hard to see why Twins are tough on cranks.

The Ducati 999R has a stroke of 58.8, shorter than the stroke of the SV650. The shorter the stroke, the lower the average piston speed, and the lower the strain on the crank and rods.

A Harley 1200 Sportster has a stroke of 97mm and a piston weight of 332 grams, or about 12 ounces. It's no wonder it has a redline of 5500 rpm.

If you race a newer SV650, install an oil-catching lower, don't rev it past 10 grand and keep your fingers crossed. ***RW***