

Breaking in a New or Rebuilt Engine

When you turn the ignition key for the first time on a new or rebuilt engine, you have a window of opportunity to assure that the engine makes the best power it can in the future. Paradoxically, the method you use to increase your bike's horsepower output can also improve your engine's

longevity. The approaches to breaking in engines are as varied as the owners of the bikes. However, the two extremes of the break-in continuum are represented by the "factory knows best" adherents and the "run it like you're going to race it" supporters. Neither of these approaches is certain to give you maximum horsepower, and one may actually damage your engine. As with many things in life, taking a more middle-of-the-road approach can deliver the power motorcycle riders crave while not prematurely aging the engine.

So, what exactly occurs during engine break-in? The metal parts that must work directly with each other soften their hard edges until they mesh more easily. Also, break-in performs a vital heat-treating process. Heat cycling the parts in the confines of the engine - particularly round parts like pistons and cylinders - relieves residual internal manufacturing stresses. Most importantly, proper break-in will give the piston rings optimal seal in the cylinders.

Piston rings seal the gap between the piston and the cylinder by using the build-up of pressure in the compression and expansion strokes of the piston. This pressure travels through the space between the cylinder wall and the piston to the ring which holds itself in place due to its natural springiness. When the gas hits the ring, it presses it down into the bottom of the piston's groove, opening a slight gap between the top of the ring and the groove. The pressurized gasses force their way between the top of the groove and the ring and ultimately work their way behind the ring on the innermost point of the groove. Here, as Kevin Cameron puts it in his book Sportbike Performance Handbook, "the gas pressure 'inflates' the ring by...pressing outward against the cylinder wall."

New or freshened cylinder walls have a crosshatch pattern honed into them which serves two purposes. The pattern retains oil to help lubricate the rings. When the crosshatches are fresh they have sharp peaks and valleys that need to be worn down - as does the surface of the rings. In order to get the rings to seat against the cylinder wall, you need to run the engine hard enough to utilize the gas pressure forcing the rings against the walls. If you don't use enough force, the rings don't get worn in well enough to form a tight seal against the crosshatch. Use too much force and heat builds up on the cylinder walls and rings, preventing a good seal. Cylinders with poor ring sealing will never produce the power they are capable of since the explosive charge "blows by" the rings reducing combustion pressure.

Racers and engine builders will often break in engines on a dyno so that they have complete control over the process, but street riders can do a good job of breaking in a new engine if they follow a couple of simple rules. Fill the engine up to the top of its capacity with cheap, non-synthetic, name-brand motor oil. You want the oil to be of a high quality so go with the big names. However, you're going to dump it really soon, so find it on sale. Next, heat cycle your engine prior to riding it. Start the engine and vary the engine speed to between 750 and 1500 rpm so that the engine spins fast enough to pump lots of oil through. If you're breaking in a rebuilt engine, check for oil leaks while it warms up. As soon as the engine hits operating temperature shut it down and let it return to ambient temperature. Repeat this process once more. The bike is now ready to be ridden.

Warm the engine before you begin riding it. Avoid riding in a time of day where you will spend excessive time idling or riding at extremely low speeds. You want to be able to accelerate and decelerate without having to worry about other vehicles. Stay out of top gear for now. Out on the road you want to vary your engine speeds, not holding any one rpm for too long. (One of the worse things you could do is go drone on the interstate at the same rpm for an hour.) Do not lug your engine at any time during the break-in process. This is actually more damaging than excessive throttle at this stage!

When road conditions allow, do some half to three-quarter throttle acceleration from 3000 rpm up to about 5000 rpm. (Note: All of these rpms assume a redline of 7500. If your bike's limit is lower, then reduce the rpms accordingly.) When you shut the throttle, let the engine decelerate for at least the same amount of time that it was on the gas. This allows the cylinder walls and rings to cool. If you notice smoke in your exhaust during deceleration, don't worry. Smoking on deceleration is common with a new engine. After riding at varied throttle settings for a couple of miles, repeat the acceleration up to ten grand. Repeat the process one more time. As you're riding, you may notice that the engine's idle speed has begun to climb with the loosening of its internals. Adjust it to keep it in the 750 to 1,000 rpm range for now. Now, your engine is ready for some runs to higher rpm. Keep the throttle at about three-fourths for now. (You'll get to go WFO before too long.) Run the rpms up a couple thousand higher than before and start from about 2500 rpm. Still follow with that extended cooling deceleration. Continue to vary rpm and speed while avoiding top gear. After three or four runs up to 6000 rpm, you're ready for some full throttle fun. Beginning at 2500 rpm, crank the throttle all the way to the stop, letting the engine run up to redline. Close the throttle and let engine braking slow the bike down. Since you're running the engine up to the limit, you can generate some serious speed. Be smart about where and when you do this. Also, do it in lower gears, say second or third. Again, you'll want to repeat these acceleration runs three or four times with extended cooling in between.

If you follow these steps, your engine should now be broken-in. Adjust the idle speed to the factory specification. Dump your oil and replace it with more inexpensive, name-brand motor oil. You can switch to synthetic motorcycle oil after 1,500 miles. Some things to remember: Keep varying the engine speed for a few hundred miles and continue to avoid lugging the motor.

There are many, many ways to break in an engine. The information presented here is adapted from Evans Brasfield's 101 Sportbike Performance Projects. The book is written from the perspective of a sport bike rider, but the information can easily be applied to any modern motorcycle. When in doubt, use your best judgment and go with sources you trust.

Pat Hahn

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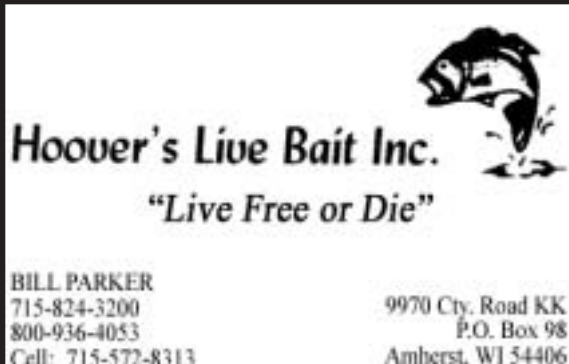
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JEREMIAH 29:11 NIV
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