



Engine Break In

The Proper Method to Break in your New Engine:

One of the most asked questions is how do I break in my new motor? The short answer is that no break-in is necessary. The only thing that is necessary is to seat the rings. All clearances and fitments should be perfect after blueprinting and precision assembly. So how many miles do you have to drive it to seat the rings? The cylinders are round, the rings are round, the bore is freshly honed and therefore your engine should be ready for tuning immediately. They will continue to seat better over a short period of time but you should be ready to go tune right away.

Do I need to drive it 500 miles before I tune it? Absolutely not. How about 50 miles? No. Perhaps the best thing to do is to drive it all the way to your trailer and tow it to a competent tuner. In second position on the "things NOT to do list" is trying to break in an un-tuned engine by driving it. Too lean an air/fuel will begin to heat and distort parts, too rich will wash the oil off the cylinders causing premature wear. What is in first place on the "things NOT to do list"? Rev/Load on an un-tuned motor. Within 2 to 3 seconds the pistons and cylinders can be ruined. Well I did put in a new base map or I'm just running off the stock Bikes computer. Can't I drive it like that for a few miles? Well what is the base map? Just someone's idea of what numbers will start your car. Just an educated guess by someone who does not have a clue what components you are running in your set-up. It's not intended to drive on for any extended period of time. The same with that OEM computer. It could be ok but it could also be dangerously wrong.

So what exactly do I do at the first engine start-up? Pull the spark plugs and crank the motor with your starter for a maximum of 30 seconds or until you see the oil pressure begin to register. Re-install the plugs and wires and fire up that candle. While keeping one eye on the oil pressure gauge, use your other eye to scan for fuel leaks. If there are no fuel leaks, look under the motor for any major oil or coolant/Water Wetter leaks. If that is ok, loosen the drain bolt on the water pump or system to allow any trapped air to escape. Continue to run the engine for 5 to 10 minutes or till it reaches a water temperature of 180°. Keep the rpm's between 1000-3000. Shut the engine down and double-check everything. You are now ready for tuning.

A trophy with a plaque that reads "Formula 40 Lightweight 1st Place March 2013". The plaque also features a logo with the letters "SM".

Formula 40 Lightweight
1st Place
March 2013

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But my engine was already tuned from my previous set-up. Well, what happened to your previous set-up? Did you make more changes to the build? No problem because now you have forged pistons and degreed camshaft? Wrong. Although you now have stronger/better components that will take more abuse, you are still not right on your air fuel mixture. Get that thing tuned properly ASAP.

OK, I did it my way instead of yours and now I'm burning a lot of oil. What happened? Well basically you scuffed up the skirt of the piston, messed up the surface of the cylinder wall and maybe even egg shaped the cylinder. New pistons are tapered smaller on the top to larger at the bottom of the skirt. Your piston to wall clearance is measured at the bottom of the skirt. As the engine warms up to operating temperature, the upper portion of the piston begins to expand slightly. The bottom of the skirt does not expand much. When you run in a lean condition, the upper part of the piston expands quickly. Since the ring land area is cut smaller than the tapered skirt below it, the first part of the piston that pushes into the cylinder wall is just below the oil ring. Thus you will see the worst scarring on your piston right under the ring lands where the excess heat is the highest.

The more heat that is generated, the harder the piston pushes into the cylinder wall. The uninformed would blame the piston damage on bad piston to wall clearance. Untrue If that were the problem, the damage would show up at the very bottom of the skirt. What has happened is that you have expanded your piston to the point that it has just ground itself into the cylinder wall. Keep expanding the piston by super heating it and it will push your cylinder egg shaped and maybe even balloon out the cylinder slightly. At the same time this is happening, your ring lands will begin to distort to where they will never seal properly again. Sometimes after doing this, the engine will still run but it will be a smoker. This all happens in a few seconds of lean air fuel ratio, but the end results are the same Death to your pistons and cylinder walls.

OK, I'm just going to turn run extra fat, that way I won't hurt anything. If you run too rich, you will "wash out" the rings. First, excess fuel will run down the cylinders taking the lubricating oil with it. This promotes direct metal-to-metal contact between the rings and the cylinder wall. This contact does several things. The upper ring begins to wear quickly. The middle ring is actually designed as a tapered oil scraper (it is not used for compression control at all) and the taper will begin to wear down to where it becomes flat rather than angled. When that happens, it can no longer control oil away from the combustion chamber. The last thing that happens is that pretty cross hatch design begins to wear off of the cylinder wall. While most people think that the cross hatch is there to help seat the rings, it also has a secondary purpose. That is to hold microscopic amounts of oil in the grooves to help lubricate ring to cylinder walls. With the walls smooth and no oil control help from the middle ring and a tired upper ring, oil will begin to mix with fuel in the combustion chamber. When this happens, your 93 octane fuel probably hits a value of about 80. Then detonation comes into play and begins to beat holes in the pistons, among other things.



So whom can I blame for this mess? The blind machinist that honed my piston to wall clearance? That poor quality Brand X piston manufacturer? The idiot pro engine builder that assembled my engine? My ex-friend that helped me put this all together? Those ignorant engineers that gave me a bad base map with my engine management system? The guy on the internet message board whose buddy knows that it takes at least 1000 miles of break in before you can tune an engine properly? All of the above? Probably none of the above. Go look in a mirror and ask...who started this engine and had no idea what the air fuel ratio was? Who just wanted to jump on it one time to see if it would haul? Who didn't know that their injectors were at 100% duty cycle at 4000 rpm but they wanted to see how it would run at 6000 rpm? Why it was you. Get that thing tuned right away. You will notice that the more you drive a tuned motor, the stronger it will feel. This is just the rings seating in their final 5-10% as they thank you for tuning first.



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