



## Running in procedure

I am asked by almost all my engine build customers "how do I run the engine in" ?

I can only go by my experience to date, and put down how I feel it should be done.

A newly rebuilt engine will be running tight tolerances, when things run tight they get hot, even with lubrication. The trick in all the aspects of running in a newly rebuilt engine is to be aware of the damage that can be caused by excessive heat and avoid it.

It is absolutely imperative that your engine have appropriate timing and fuelling failure to endure this can result in piston damage really quite quickly. You need to put a safe tune into it initially, and then after break-in you can fine tune it for maximum performance. On engines I have built the timing will be set as close to 35 degrees as I can do, it will still need accurately adjusting upon completion of running in, carburetion is the sole responsibility of the owner, failure to ensure the fuelling is correct could make your engine run lean and possibly damage the pistons.

The stock timing advance on all XS650 models is too aggressive for petrol that is available today, additionally the increased compression that typically comes with a performance engine build requires less advance. Higher compression speeds the burn and timing advance must be reduced from the factory level of 38 degrees.

One of the biggest tuning mistakes we run into is people who move their ignition timing up (i.e. more advanced), mistakenly believing this enhances power. Nothing could be further from the truth! We have dynamometer tuned quite a few bikes, and the typical street XS650 with 9.0:1 compression makes maximum power at about 35/36 degrees total advance. Furthermore, they like the timing brought in relatively slowly, a worn advance and retard in the case of mechanical points allows the engine to reach full advance too early, too much timing too early can make this engine run hotter, lose power, and puts the engine kit at risk, so please pay particular attention to this!

Never, ever, ever attempt to adjust the timing by listening for rattle/ping, many engines have been destroyed by using this method, and max power typically occurs well below the threshold of ping.

**Proper break-in is critical to realizing maximum life and performance of your engine.** We can't stress this enough. Follow these steps to the letter. Ignore any alternative methods you may read about on the internet/listened to in a pub!

Minimizing heat is absolutely essential to successful break-in, and excessive heat will damage your pistons and forever condemn your engine to be a mediocre performer. The reason for this is that neither your rings nor your cylinder bores are perfectly round on initial assembly. Therefore, the rings are actually only making contact with the cylinder walls in a few places. The tension of the rings is concentrated in these places, increasing friction and heat. This condition exists until the rings have a chance to polish the cylinders into their shape. While that process is taking place, however, the rings and the pistons are very vulnerable to damage from excess heat. You can learn Google more about this phenomenon by researching "ring micro-welding". It's a very real risk to your engine!

The assembly lube put on the rings and pistons is to help combat ring micro-welding. Yes, there are some individuals that claim "run it in hard" using no lubrication, and thrashing it from new, We don't subscribe to that theory. Your rings are at much greater risk of micro-welding than they are of failing to seat. They will seat just fine. You need to pay attention to the possibility of damaging them.

On your initial start-up, run the engine no longer than 10 seconds. Use a clock with a second hand or a stop watch. Don't guess! Shut it off and allow it to cool completely to room temperature. A little bit of patience now will go a long way to providing you with a strong engine that lasts a long time.

For your second heat cycle, run the engine no longer than 20 seconds. Again, time it properly, don't guess. Allow it to cool completely.

Repeat this heat and cool cycles with run times of 30 and 40 seconds.

You're now ready for your first ride. Keep the rpm's down as much as possible and keep air flowing across the cylinders. Ride it no more than a mile, shut it down, and let it cool completely.

For your second ride, treat it similarly gently. Keep your rpm's below 3500 and keep air moving across the cylinders. Ride it a couple miles and let it cool completely.

For the next 50 miles, do not exceed 3500rpm and avoid using full throttle. Vary your speeds, allowing the engine to pull and then decelerate gradually. This reversal on the rings, from pressure to vacuum, assists in the seating process.

For the next 500 miles, stay below 4000rpm, avoid using full throttle, and keep the heat down.

Once you're past the 500 mile break-in period, change your oil. During break-in, the rings have carved the cylinders into their shape and the shavings have been captured in the oil, so you want to change the oil to get that stuff out. Use any reasonable quality oil initially, Yamaha suggest 20W-50 oil formulated for air-cooled engines.

Have your bike professionally dyno tuned. Proper tuning is critical to maximum power, long life, and good gas mileage. It makes no sense at all to spend thousands

on motor work and then leave power on the table, and put it all at risk, because you didn't spend a few pounds on a proper dyno tune.

You are now ready to enjoy the full power of your new engine.