

Oil is the Gasket

BY LAKE SPEED JR. AND KEITH JONES

No experienced engine builder would intentionally bolt a cylinder head to a block without installing a gasket between the block and cylinder head.

Why? Because the gasket seals the block deck surface to the cylinder head surface. As we all know, a piece of metal that looks smooth is actually rougher and wavier than it appears. That microscopic surface roughness and waviness create leak paths, especially under high cylinder pressures.

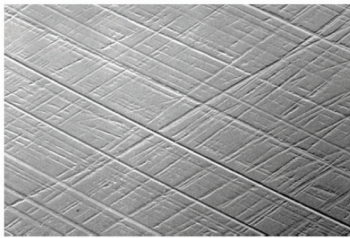
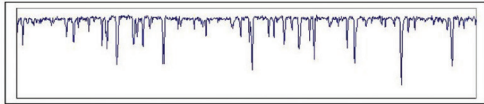
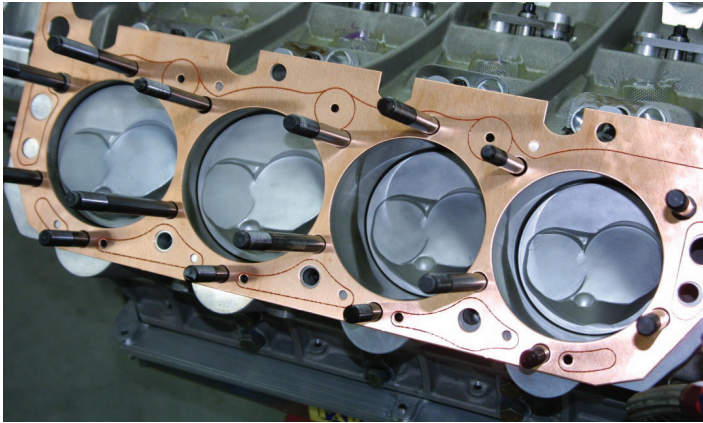


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Head gaskets are used to seal the cylinder head to the engine block. Regardless of gasket material, it is the job of the gasket to seal the head to the block. The motor oil does the same thing between the piston ring and cylinder wall.

Gaskets are used to fill the voids and contain those high pressures. That's why really high horsepower engines O-ring the blocks and heads!

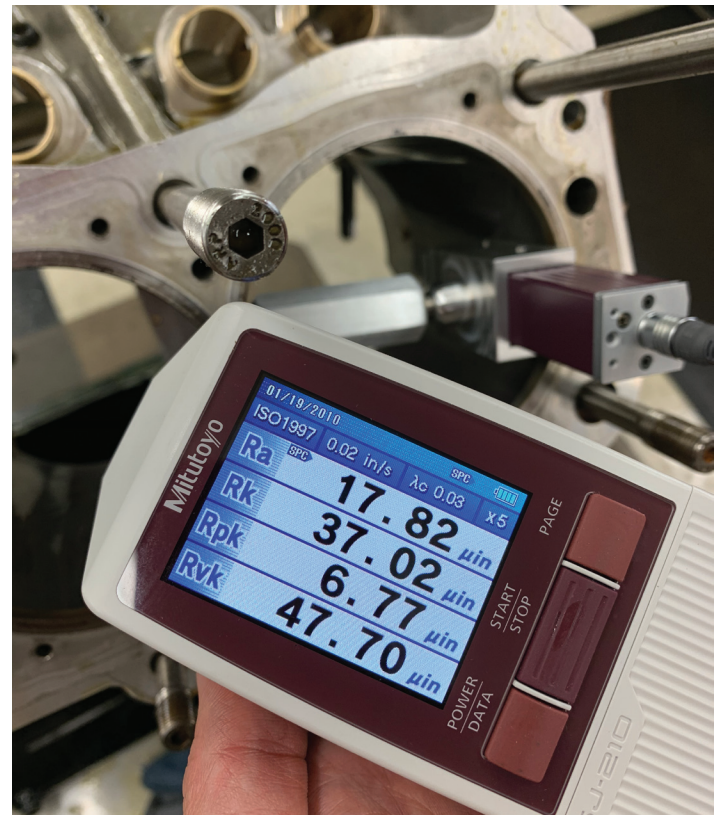
So, what does this have to do with motor oil? Well, those same microscopic peaks and valleys also exist on the cylinder walls, piston rings and piston ring grooves. (Profilometer measurement photo). What fills in those valleys and covers those peaks? Motor oil, which acts like a gasket to seal those components together.

If you've ever leaked down an engine both hot and cold, you've probably seen a difference in the readings. Part of that difference is thermal expansion of the parts, but part of the difference is also the amount of oil on the cylinder wall and piston rings. A dry cylinder wall and piston rings will leak more than when wetted with motor oil.

Now you might be thinking that smoother surface finishes on the cylinder wall must be the answer, but a certain amount of roughness is needed.



A profilometer provides surface roughness measurements. The results are reported in both numerical and graphical forms. With the complexities of modern block and piston ring materials, a profilometer is a must.



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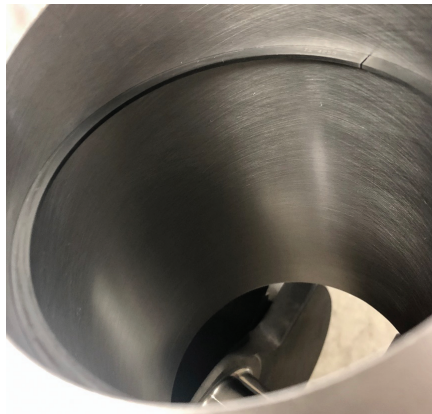
Just like the deck on the block, the cylinder walls need roughness to hold the oil. Because the oil is fluid and not a stationary gasket, the roughness on the cylinder wall retains the oil so it can function as that gasket to assist with ring seal.

I experienced this firsthand, back when the NASCAR and NHRA Pro Stock teams began to experiment with mirror smooth bore finishes. The idea was to reduce friction, but these super smooth bores did not retain enough oil. As a result, blow-by increased and crankcase vacuum decreased. In an effort to fix the problem, higher viscosity oils were employed, but the increased fluid drag off-set any reduced friction due to the smoother cylinder wall finish.

In the end, getting the correct plateau finish was the correct answer. Smooth on top, but with deep valleys to hold the oil.

Now you might think to yourself, I've never had any problems getting my engines to seal up, so why even worry with plateau finishing.

Well, the traditional honing and finishing techniques tend to leave a



Plateau finish

rougher surface, which is good for retaining oil. However, the peaks from those rougher surfaces can wear the face of the ring faster, especially with the softer molybdenum face coatings.

While Moly is great at holding oil - it has more porosity than PVD coatings - it is softer, so it will wear faster than a PVD coating. When combined with a rougher cylinder wall finish, a Moly faced ring will break-in quicker, but it will also wear out

faster, especially with low lubricity fuels like Methanol and E85.

Alternatively, a PVD coated piston ring with a plateau bore finish will provide a lower amount of friction, the highest crankcase vacuum, and the longest ring/bore life.

Using modern honing machines, surface finishes, ring materials and coatings all combine to create a more efficient engine, and part of that efficiency is the "gasket" formed by the motor oil, so the next time you are building an engine, think about the "gasket" that you pour into the engine. ■



Lake Speed Jr. (above left) and Keith Jones (above right) from Total Seal Piston Rings. For more information, please email lake@totalseal.com or keithj@totalseal.com.

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