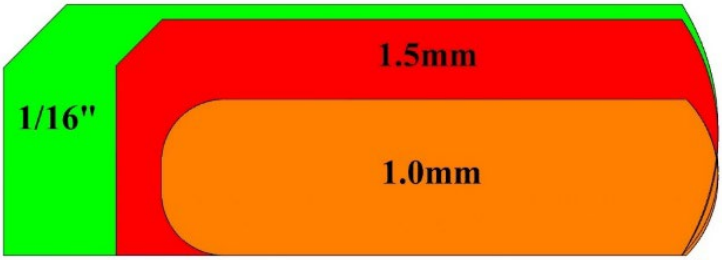
MAHLE
Motorsport

How Modern Piston Rings Increase Performance

There are still strong beliefs in the engine building world that a 1/16, 1/16, 3/16" ring pack is better than MAHLE's 1.0, 1.0, 2.0mm "thin" rings. Few would argue against the ability of thinner rings to free up horsepower in the right application, but the concern is usually: will they last? or are they worth it? We asked our engineering team this very question and here's what they had to say:

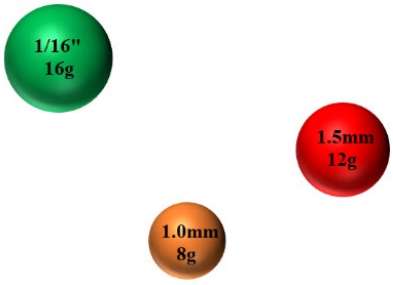
Durability

The modern ring pack is much more than just "thin". The advancement of material and coating technology, particularly the widespread use of high strength steel, creates a ring far more durable than any cast or ductile option. Granted, you can apply these better materials to any size rings, but that won't overcome the differences in cross-sectional area that allows the smaller rings to be lighter and more conformable. This means you can design for less radial tension to achieve the same or better sealing of combustion gases. Furthermore, less tension throughout all four strokes of the engine results in less wear on the face of the rings and less wear of the cylinder walls. Steel is also a better conductor of heat and can withstand longer durations of high temperature operation without concern for the rings "losing tension".



Lighter & Efficient

The performance industry is driven by the continued evolution towards lighter, faster, and stronger components. Piston rings are no exception. A 1.0mm compression ring can be up to 50% less mass vs a 1/16" ring, and even 25% less compared to 1.5mm rings. Simply stated a 50% a reduction in ring mass equals a 50% reduction in the inertia force on that ring. In addition to the reduced reciprocating mass, the inertia reduction from lighter rings allows for operation at higher RPMs with less ring flutter, further increasing the ring to piston groove seal.



Optimizing Seal

What is often overlooked, is that the engine bore will never be perfectly cylindrical while in operation. Diagram A illustrates how a bore can be distorted simply from operating temperatures (shown at 100°C/ 212°F). The magnitude of this distortion may be difficult to perceive and is often measured in microns, but it is well within the range of allowing a pathway for cylinder pressure to escape the combustion space. When we add in distortion from mechanical loading and deformation, the conditions are only worsened. Older ring designs simply rely on brute force (tension) to overcome these challenges.

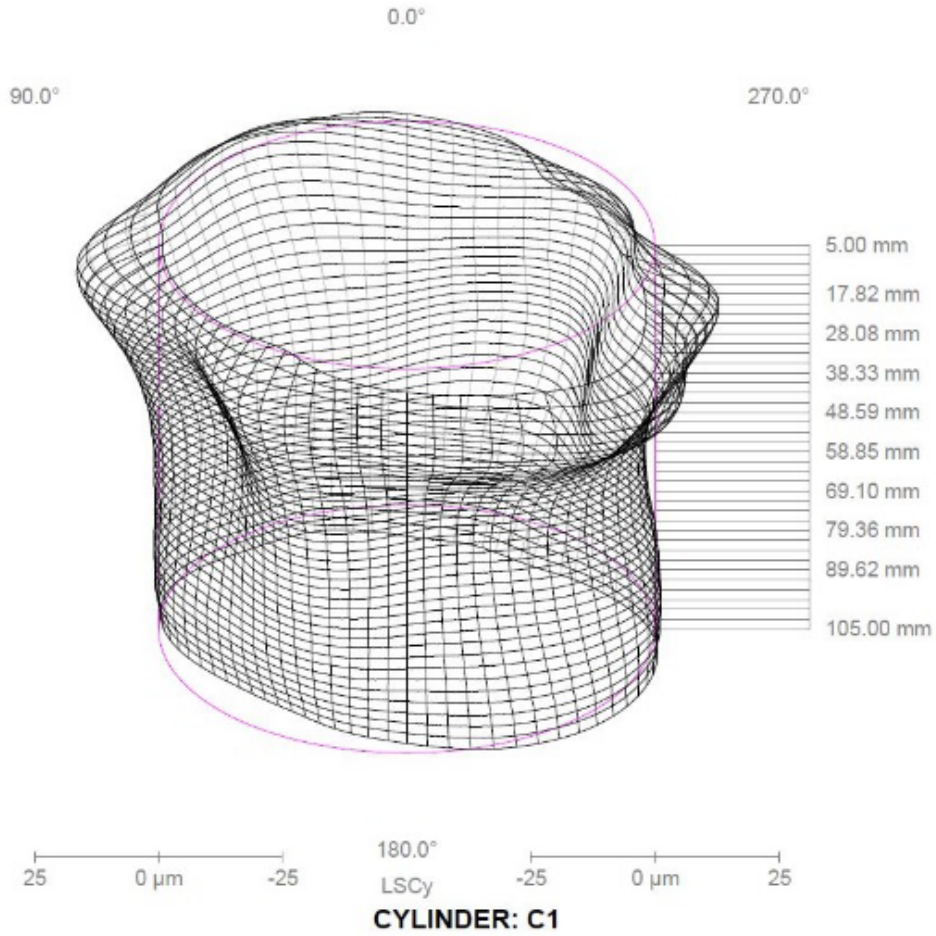


Diagram A.

The modern, more conformable rings are a cost effective to way to increase sealing, reduce friction, and ultimately provide a durable increase in horsepower and torque that engine builders and racers alike will agree is a win-win combination.