TECH

MAHLE

TECH INFORMATION FROM MAHLE CLEVITE INC.

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EVOLUTION OF FILE-TO-FIT RING END-GAP THEORY RESULTS IN CHANGES

GUIDELINES FOR RING END-GAP

Top compression rings: The minimum end-gap needed to prevent the top ring ends from butting together under the most extreme operating conditions would be considered ideal. Unfortunately it is much easier to see and know when you have too little end gap than it is to know exactly what is correct end gap. Common signs of butting end gaps are: scuffed ring faces, damaged rings and cylinders, and/or shiny areas on the butt ends of the ring. Using recommendations from ring manufacturers, engine manufacturers and your own personal experience is how most engine builders arrive at the desired end-gap.

Second rings: Current thinking regarding the end gap on most performance engines is to provide a larger gap on the second ring for best performance. Testing has shown a larger second ring gap tends to increase top ring stability allowing for a better seal. This larger "escape" path prevents inter-ring pressure from building up and lifting the top ring off the pistons allowing combustion pressure to get by. Since the primary function of the second ring is oil control, you can open the gap with no adverse effect on the compression sealing of the ring pack. (There are some applications that don't benefit from this theory because cylinder pressures are extremely high and the second ring is utilized primarily as a compression ring and not a device for oil control; these would be limited to supercharged/turbo applications.) Many engine builders have reported lower blow-by readings and horsepower gains in the upper RPM ranges with wider second ring gaps.

STEEL ALLOY RINGS

MAHLE Clevite Inc. is increasing its performance steel top compression ring offering. Steel compression rings have many advantages over ductile and cast iron rings such as: higher tensile strength, better yield strength, extended fatigue resistance, greater hardness, lower ring mass, and better cylinder wall conformability. Unfortunately a ring 35% stronger is more difficult to file the end gap compared to the ductile and cast iron rings they replace. Because of this condition we have sized our steel performance piston rings to the minimum, engineering specified, end-gap for a given bore size. For example: a 4.000" bore would be gapped at .012" out of the package. This allows the ring to fit the cylinder for measurement, right from the manufacturer. This will also allow the occasional customer desiring to run the absolute minimum end-gap to do it with not additional work. This provides the majority of steel performance ring customers to increase the end-gap to their desired specification with less work and time invested in filing of the ring.

Frequent users of our performance ring catalog will notice we have already made the transition in our "open stock" compression rings. When you see a listing, for example, for a 301-0001 which is a 4.000" bore, plasma-moly carbon steel1.2mm ring; it will have the minimum specified end gap at the nominal 4.000" bore size just like our example above.

For further information contact:

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RECOMMENDED END-GAP

TOP COMPRESSION RING		
Ductile, Grey Iron & Steel	**4.000" Bore Example**	**Recommended Min. Gap Factor**
Moderate Performance	.016 - .018	(.004 per inch of bore diameter)
Drag Racing, Oval Track	.018 - .020	(.0045 per inch of bore diameter)
Nitrous Oxide -- Street	.020 - .022	(.005 per inch of bore diameter)
Nitrous Oxide -- Drag	.028 - .030	(.007 per inch of bore diameter)
Supercharged	.024 - .026	(.006 per inch of bore diameter)
INTERMEDIATE COMPRESSION RING		
Grey Iron	**4.000" Bore Example**	**Recommended Min. Gap Factor**
Moderate Performance	.020 - .022	(.004 per inch of bore diameter)
Drag Racing, Oval Track	.022 - .024	(.0055 per inch of bore diameter)
Nitrous Oxide -- Street	.024 - .026	(.005 per inch of bore diameter)
Nitrous Oxide -- Drag	.028 - .030	(.007 per inch of bore diameter)
Supercharged	.024 - .026	(.006 per inch of bore diameter)

GUIDELINES FOR CHANGING RING END-GAP

Ring end-gap is best measured by inserting one compression ring at a time into the cylinder. Use a ring squaring tool to get the ring sitting squarely about 1" down into the cylinder bore. Using a feeler gauge, adjust the gauge thickness until you have just slight drag as it is inserted into the gap. If you desire more end-gap, remove the ring and, using a specially designed ring gapping tool, make a square cut on one end of the ring to increase the gap. Using a fine stone, gently deburr the edges of the cut before installing the ring back into the bore for measuring. Improper gapping techniques and improper deburring have ruined many compression rings, so use caution in this process!

CLEANING THE RINGS AND THE BLOCK

The process of filing ring end-gaps is a dirty one. Abrasive dust and metal shavings can contaminate your engine. Clean both the rings and the block prior to assembly.

RING NOMENCLATURE