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Piston Ring Gaps, Oil Consumption and Blow-by.

It is common to refer to the top two rings on a three ring piston as the compression control rings and the bottom ring as the oil control ring. While the top ring is dedicated to compression control and the lower ring to oil control, the second ring has shared roles of compression and oil control. The second ring's workload is typically 80% oil control and 20% compression control and so should more correctly be called an oil ring and not a compression ring.

It is not uncommon to receive complaints that the piston ring gaps on new compression rings are too big, with the fear that the engine will experience increased oil consumption. In practice, there is no evidence to support this. It can however result in slightly increased blow-by rates. The typical compression ring gap specifications range from 0.3 to 0.7 mm, but may be larger than this in application and in some cases can be in excess on 1.0 mm for second rings. Up to 90% of ring tension on compresson rings is actually the result of combustion gas pressures during the combustion cycle. The combustion gases enter the ring groove and travel to the back of the ring forcing it out onto the cylinder wall (Figure 1.). This force is largest on the top ring and less on the second ring.

When an engine is idling or in part-load operation, the combustion forces are reduced as are the compression ring forces on the cylinder walls. In particular, the oil scraping efficiency of the second ring is reduced and can result in increased oil consumption. Some manufacturers increase the ring gaps for the express purpose of allowing the combustion gas pressure behind the rings to increase more rapidly and increase the sealing function of the top compression ring and the second ring oil scraping efficiency (Figure 2.).

So, while increased ring gaps do not cause increased oil consumption, increased radial ring wear does result in increased ring gaps, and oil consumption as the second ring oil scraping abilities become less efficient. Standard ring gap specifications are for rings at the nominal or smallest standard bore size. For every 0.025 mm increase in bore diameter, the ring gap increases by 0.079 mm. A standard bore tolerance is typically 0.030 mm (eg. 100.000 - 100.030 mm), but it is not uncommon for some engine reconditioners to increase the bore by a further 0.025 mm to allow for safe operation in elevated temperature conditions. This could result in a ring gap increase of 0.173 mm.

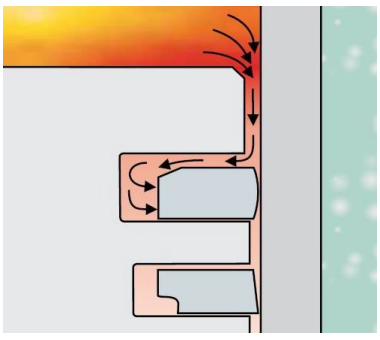

Figure 1.

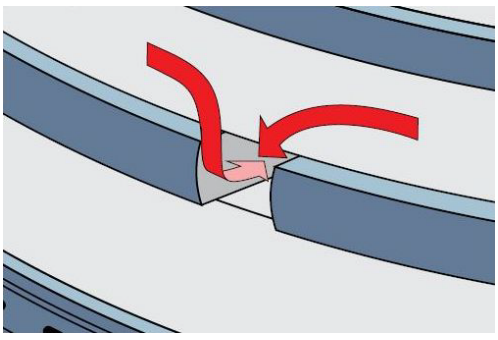

Figure 2.

(Graphics by MS Motor Service International)