RING INSTALLATION GUIDELINES

IMPORTANT: BEFORE FILING RINGS – Check each individual ring in its corresponding piston ring groove, to ensure proper ring groove depth (radial back clearance) and side clearance (thickness)(fig. 2). Proper cylinder finish (honing), ring end-gap, and lubrication are critical to achieving optimum ring seal.

Radial Thickness

The domestic industry standard for piston ring radial width is referred to as "D-Wall". The Society of Automotive Engineers (SAE) has established this standard as bore size divided by 22. (fig. 1) For example, a D-Wall piston ring for a 4.00" bore would have a radial thickness of 4.00/22 = .182". In other applications, such as import and racing, reduced radial thickness (back cut) rings, Dykes, and gas ported pistons can provide greater radial pressures and better sealing characteristics under high cylinder pressures. However, these ring types have lower radial tension in the unloaded position, which reduces friction and drag.

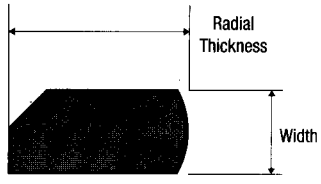


Figure 1

Side (Lateral) Clearance

Side (Lateral) Clearance – Side, or lateral, clearance is the difference between the width of the ring groove and the width of the ring itself. SAE standards recommend .002"-.004", however many engine builders in the racing and high performance industries use clearances tighter than this. (fig. 2) Piston ring side clearances less than .001" will result in damage to pistons and rings as well as loss of compression and performance.

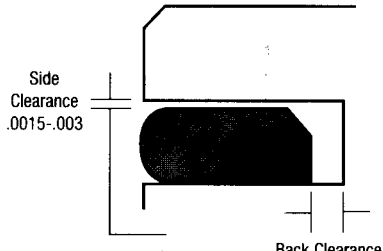


Figure 2

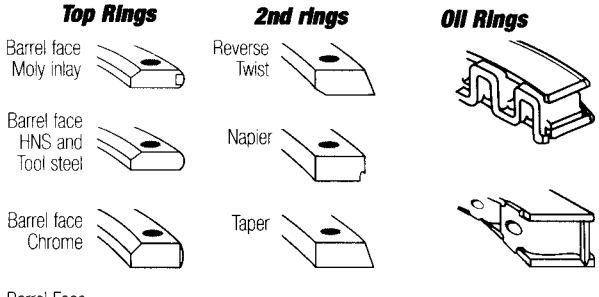
Back Clearance

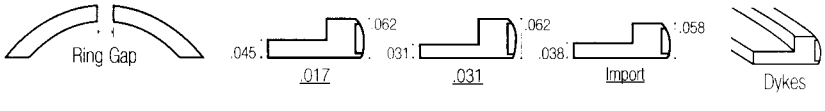
Back clearance is the difference between the depth of the ring groove and the radial thickness of the ring. Ring groove depths are typically made greater than the radial widths of the rings themselves in order to compensate for varying coefficients of thermal expansion. Theoretical optimum back clearance is zero, however this is not practical under actual operating conditions as the rings would likely bottom-out within the grooves and result in engine damage. (fig. 2)

Table 1

	Top Ring	2nd Ring	Oil Ring Rail
Application	Min. Gap Per Inch of Bore		Minimum Gap
High-Perf. Street-Strip	Bore x .0045"	Bore x .0050"	min .015"
Street Moderate Turbo/Nitrous	Bore x .0050"	Bore x .0055"	min .015"
Late Model Stock	Bore x .0050"	Bore x .0053"	min .015"
Circle Track / Drag Race	Bore x .0055"	Bore x .0057"	min .015"
Nitrous Race Only	Bore x .0070"	Bore x .0065"	min .015"
Blown Race Only	Bore x .0060"	Bore x .0060"	min .015"

Ring Types





Additional Ring Installation Guidelines

- Rings with a marking - Install with marking facing up.
- Rings with no marking and bevel - Install with bevel facing up.
- Rings with no marking and no bevel - Install either side up.
- **CAUTION! Chrome Rings must not be used on chrome cylinders.**

End Gap

End gap is the clearance between the two ends of a piston ring as it is installed in a cylinder. Most high performance and racing engine builders purchase piston rings slightly oversized in order to file fit them to very precise end gaps. Testing has shown measurable increases in horsepower and decreases in blow-by as a result of properly fitting the ring end gap to the operating conditions. Factors such as supercharging, turbocharging, nitrous oxide, endurance racing and different fuels determine proper ring end gap. Proper ring end gap can be more than double from one engine to the next depending upon the above factors.

At operating temperature, the top ring end gap should be as small as possible. Precise machining of the cylinder bores is critical, and is the reason why rings should be fitted to the cylinder in which they are to be installed. A diameter variance from one cylinder to the next changes the end gap of the rings in that cylinder by a factor of pi (3.1416). For example, a cylinder .001" larger in diameter will increase the ring end gap by .001 x 3.1416 = .003", rounding off, which could increase cylinder leakage in that cylinder and decrease performance.

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Installation Guidelines

- Always Install Pro Seal rings with marks (top of ring indicators) toward the top of the piston.
- Always stagger end gaps on each of the ring grooves, oil rails and expander (See ring orientation diagram below).
- Always use a ring expander when installing rings.
- Always lubricate new rings with clean engine oil - no dry starts!
- Do not "spiral" the rings into the pistons. This will result in ring deformation after installation, causing poor sealing.
- Do not over-expand the rings. Over-expansion can lead to ring breakage opposite the gap or ring distortion.

Hints for Filing Ring Gaps

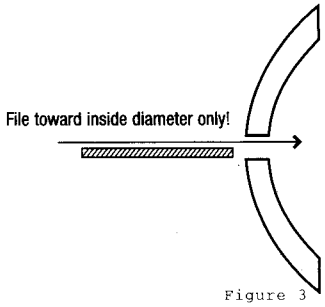

Figure 3

- JE strongly recommends using a professional quality ring grinder
- If a ring grinder is not available, file from outside face toward inside diameter to avoid chipping the face coating (fig. 3)
- Filing only one end of the ring allows you to use the other end as a reference - to verify that the gap remains straight and parallel.
- Remove sharp corners by hand stoning / deburring all gapped edges.

* NOTE: There is some controversy as to the effect of coolant temperatures on ring end gaps. Some engine builders feel that if coolant temperature is low, they can narrow up on ring gaps - Not true! Piston and ring temperatures remain approximately the same whether the coolant temperature is high or low. If you consider thermal growth or expansion, the engine with a higher coolant temperature would have larger bores than the engine with lower temperature.

Oil Ring and Rail Support

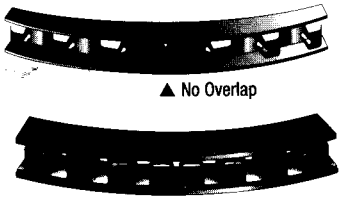

Figure 4 ▲ No Overlap

Oil Ring Diagrams/Installation

1. Make sure oil ring expander ends are butted properly and do not overlap. (fig. 4)
2. Install top oil ring rail in a counter-clockwise direction and the bottom rail in a clockwise direction with gaps positioned as in the ring installation diagram. (fig. 5)

Ring Orientation Diagram

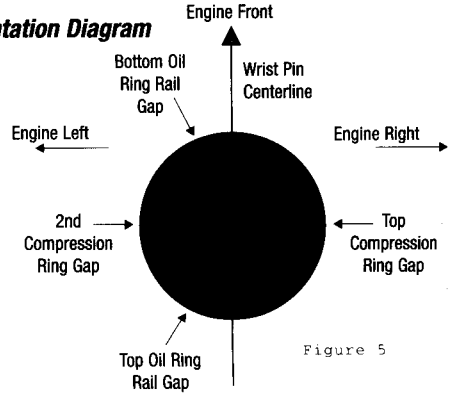

Figure 5

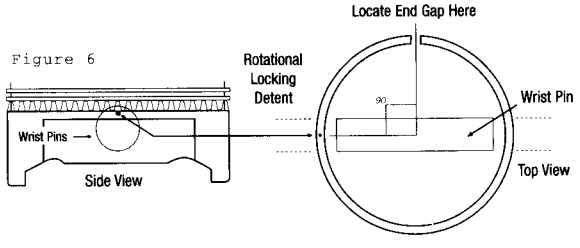

Figure 6

Oil Ring Support Rails Installation

1. Install oil ring support rails on the bottom of the oil ring groove with the antirotational locking detent facing downward.
2. Rotate the oil ring support rail until antirotational locking detent falls between opening at intersection of ring groove and wrist pin hole. (fig. 6)
3. Install oil ring assembly as usual.

Sets Containing Rail with a Tab

For sets containing one regular rail and one tab rail per cylinder. Tab rail can be installed above or below oil ring expander with tab pointing toward expander (fig. 7). If installed in horizontally opposed engine, rail gaps should be installed as shown at right.

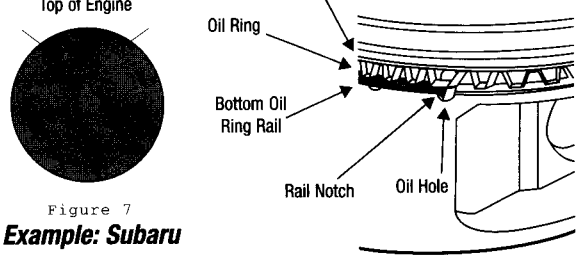

Figure 7

Example: Subaru

Boring and Honing

Boring and honing is becoming a very complicated subject as cylinder finishes become more refined and oils become more slippery. There are a number of different honing procedures depending upon ring material, ring tension, block material and application. If you have any questions about how your cylinder should be honed, please contact your honing representative or professional engine building machine shop.

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