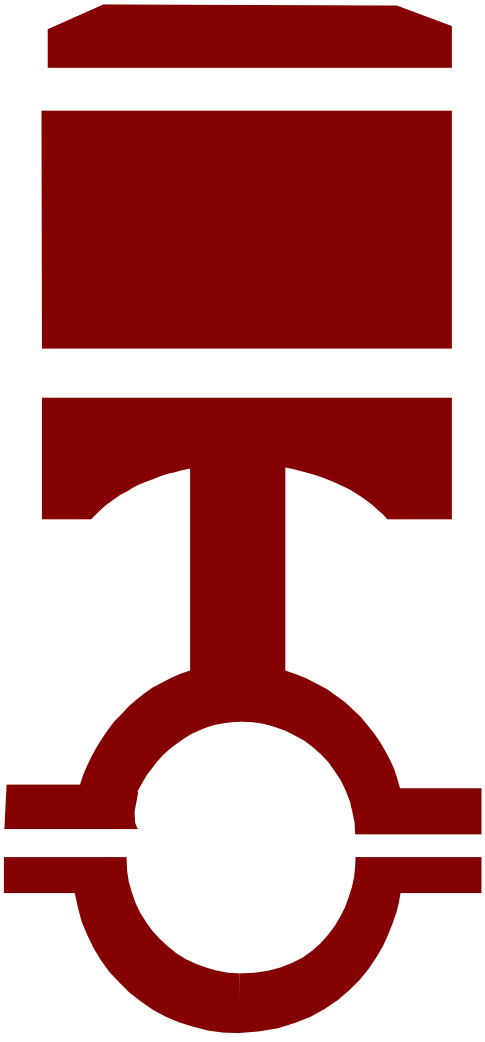
HOW DO RINGS WORK?



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This guide can help you understand piston rings functionality and proper handling that will maximize your engine life.

Ring Functions: It's a tough job but somebody has to do it!

The selection of piston rings for an engine is fundamentally related to the engine application. Various vehicles have varying requirements to satisfy which determine the ring materials and designs. Street engines, competitive racing engines, sport engines, and specifically fueled engines such as alcohols and nitrous oxides or even compressed natural gases all may require specific differences in materials and design.

Piston rings serve more than one purpose: to contain and maintain cylinder and combustion pressure, to prevent oil from getting into the combustion chamber with the help of the valve guides and seals, and to aid in the control of thermal changes in the engine.

Top Ring

The top ring or fire ring is known as the compression ring and is expected to seal against pressure losses from the combustion process. The compression ring is also expected to maintain a high build up of pressure as the piston arrives at the top of the stroke when at a predetermined location the combustible mixture is ignited building up pressure to force the piston downward. The ability of the piston ring to maintain this pressure is contingent on a couple of important items.
The ring gap is critical to this event and obviously burning gases do flow through this gap. The ring gap is also critical to the function of the top ring as it is related to its stability. In addition to this the fire ring is a barrier and transfers a large portion of the heat through its contact with the cylinder wall.

Conventional Second Ring or Secondary Compression Ring

The second ring is probably the most misunderstood ring application of all the rings used on a piston. With a conventional piston ring the ring design is similar to the top ring. It also has a ring gap which allows hot gases to further penetrate down the cylinder wall into the crankcase oil. This is known as blow-by and has deleterious effects on the engine.
Blow-by getting into the oil contaminates the oil with carbon particles from the combustion process, raises the acid level, heats up the oil and speeds up the oxidation process. This effectively begins the process of slowly diminishing the lubrication ability of the oil and allows the carbon particles to wear out all the parts which it is expected to lubricate. The second ring also serves as an oil scraper ring to help minimize the oil above the second ring and as such compliments both the compression ring and the oil ring.

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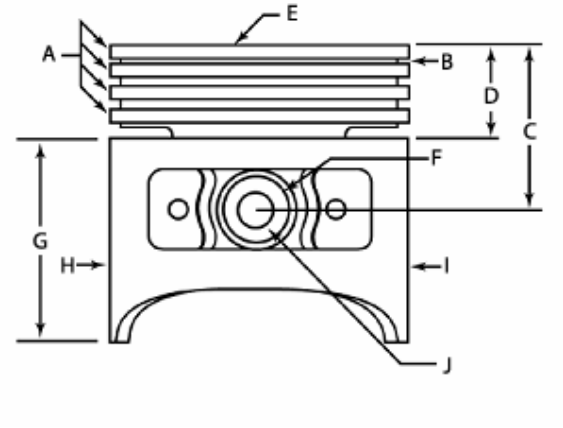
Oil Control Rings

Oil control rings are designed along with the piston to effectively permit lubrication of the rings, pistons, wrist pins and cylinder walls without oil migrating into the combustion process. Oil Rings also assist the thermal control of the piston by directing oil into the inside of the piston to help cool the piston dome. Total Seal provides several types of oil rings as may be required including the popular three piece ring consisting of an expander and two rails. The expander provides the tension for the rails and are sold in more than one tension depending on the application. When installing an expander, the expander joint is to be 90 degrees to the wrist pin and the rails should be 1" apart centered on each side of the wrist pin end.

Ring Terminology



(A) Ring Land: The part of the piston between the ring grooves and above the top ring that confines and supports the piston rings.

(B) Heat Dam: A narrow groove in the top land used in some pistons to help control heat getting to the top ring. It actually fills with carbon in normal operation and limits heat flow to the ring.

(C) Compression Height: The distance from the pin centerline to the top of the piston.

(D) Ring Belt: The area on the piston between the top of the pin bore and the top of the piston where the ring grooves are machined.

(E) Piston Head: The top area of the piston where combustion gas pressure is exerted.

(F) Piston Pin: Either press-fit or floating, the pin connects the rod to the piston with bearing surface.

(G) Skirt: The part of the piston below the ring belt.

(H) Major Thrust Face: The side of the piston carrying the greatest thrustload. Looking at the piston from the front in an engine rotating clockwise, this is the left side.

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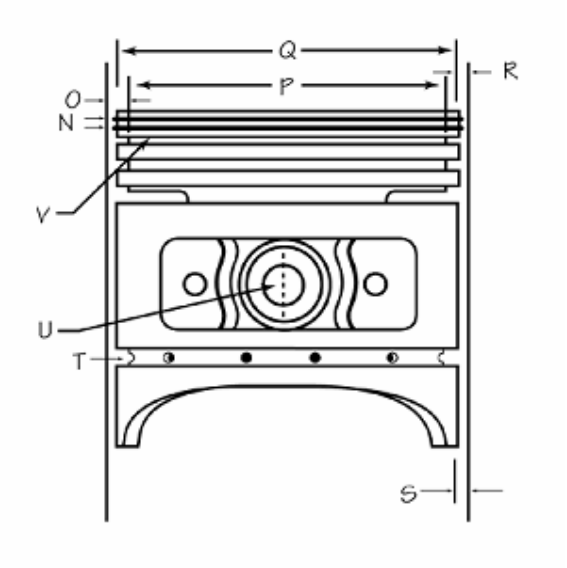

(I) Minor Thrust Face: The side of the piston opposite the major thrust face.

(J) Piston Pin Bushing: If used, the bushing between the piston pin bore and the pin.

(N) Scuff Band: One or more raised bands of piston material used in some piston designs to reduce scuffing.

(O) Groove Depth: The distance between the back of the ring groove and the cylinder wall with the piston centered.

(P) Groove Root Diameter: Piston diameter measured at the back of the groove. May vary on the same piston between ring grooves.

(Q) Land Diameter: Diameter of a given land. Can sometimes vary by design from top to bottom.

(R) Land clearance: The difference in diameter between the cylinder bore and the land diameter. "R" is 1/2 the total.

(S) Skirt Clearance: The difference in diameter between the cylinder bore and skirt diameter. "S" is 1/2 the total.

(T) Skirt Groove: A ring groove cut below the pin bore to carry an oil ring.

(U) Pin Bore Offset: The distance the pin bore is offset from center.

(V) Groove Spacer: Used on re-grooved pistons to return a ring groove to specs or in some performance applications to facilitate the use of narrower ring sets than the grooves were originally cut for.

Ring Terms And Measurements

(A) Free gap: The ring end clearance when the ring is uncompressed.

(B) Compressed gap: Also known as ring gap, it is the end gap measured when the ring is installed.

(C) Radial Wall Thickness: the distance between the inside and outside faces of the ring wall.

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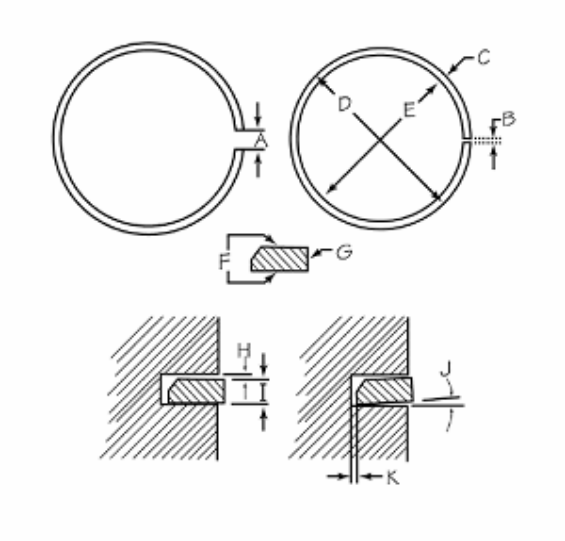


(D) Ring Diameter: Measured with the ring installed.

(E) Inside Diameter: Measured with the ring installed.

(F) Ring Sides: The top and bottom surfaces of the ring.

(G) Ring Face: The part of the ring in contact with the cylinder wall.

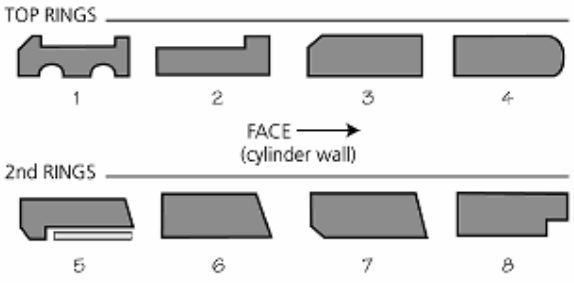
(H) Side Clearance: Clearance between the ring groove and the ring.

(I) Ring Width

(J) Torsional Twist: A built-in imbalance between the way the upper and lower sides compress that causes a twist in the ring when compressed. Used to sea both the ring in the groove and the ring to the cylinder wall.

(K) Back Clearance: Distance between the inside diameter of the ring and the bottom of the ring groove with the ring installed.

Commonly Used Ring Cross-Sections



1. Total Seal "Red Head"
2. Dykes
3. Torsional Flat Faced (square cut)
4. Barrel-Faced
5. Total Seal Gapless
6. Taper Faced
7. Reverse Torsional Taper Faced
8. Wiper