IMPORTANT NOTICE:

- If using Hypereutectic Pistons, follow piston manufacturers ring end gap specifications.
- **Quickseat®** is the recommended cylinder wall lubricant for ring installation. If unavailable lightly lubricate with WD-40® or similar. Piston skirts should be lightly lubricated with engine oil. Remember excessive or improper lubricating of the rings may prevent them from sealing.
- **During engine break-in, use petroleum based motor oils only.** Synthetic oils may be used after break-in cycle is complete.
- **Do not** install these ring in chrome plated cylinders. Special non-chrome rings must be used.
- **Do not intermix gapless ring rails with oil ring rails or try to substitute rails from any other ring set.** Total Seal Gapless® rings and rails are carefully machined to fit together and are not interchangeable with other Total Seal rings or with any other rings not from this set.
- **Excessive oil volume can lead to oil consumption.** This can be caused by high volume oil pumps, excessive bearing clearance, modified oil systems, etc. It is the end user's responsibility to make sure this system is functioning properly for the given application.

Total Seal Piston Ring Division
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-Corporate Offices-
Manufacturing Plant
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Installation Sheet

TOTAL SEAL®
PISTON RINGS
Total Seal, Inc.
Phoenix, Arizona

Thank you for choosing Total Seal® Piston Rings—the longest lasting piston rings available for your engine.

We are confident you will enjoy the Total Seal benefits of:

- low blowby
- increased horsepower
- improved fuel economy
- cooler and cleaner oil
- longer engine life

Please spend a few minutes and read through this entire instruction sheet before you begin installation.

Proper installation will assure that you receive all the benefits of this fine ring set.

If you have questions, please call our technical service line for additional information at (623) 587-7400.

Engine Preparation - Iron Cylinders

Finish hone cylinder walls with torque plates installed if available. Recommended hone grit specification: moly-face or cast iron top ring 280-320 grit. Chrome face top ring: 220-280 grit. Finished hone with a 22 to 24 degree cross-hatch pattern off horizontal axis.

Plateau Honing - call

Nikasil® or Coated Cylinders - call

All cylinder heads (new, used or rebuilt) must have valve stem to guide clearance checked. Excessive clearances may lead to oil consumption. Valve to guide clearance must be fitted to the minimum end of manufacturers specification. All applications must use a positive type viton valve guide seal on intake and exhaust valves.

Total Seal Gapless® rings seal so well that increase manifold vacuum and decreased crankcase pressures may lead to excessive flow in the PCV system if the engine is so equipped. In some cases it may be necessary to reduce the amount of flow to prevent oil from bring pulled through the PCV system. In most cases, a restrictor with a 1/16" orifice placed in the fresh air inlet breather hose is sufficient to remove all pressure from the crankcase without pulling oil into the induction system.

RING INSTALLATION

Total Seal Gapless® Top Ring

1) Install machined ring first with groove side down and gap 180° from 2nd ring end gap (see fig. 1).

2) Install rail into groove machined in ring with gaps opposed 180°.

Top Rings (Conventional)

1) If ring has a dot, install dot side up.

2) Unmarked rings with inner bevel are installed bevel side up.

3) Rings without dot or inner bevel install either side up (see fig 3).

Total Seal Gapless® 2nd Ring

1) Install machined ring first with groove side down and gap 180° from top ring end gap (see fig 1).

2) Install rail into groove machined in ring with gaps oppose 180°.

Non Gapless (Conventional) 2nd and 3rd Rings

1) If ring has a dot install side up.

2) Unmarked rings with an inner bevel install bevel side down.

3) Rings without a dot or inner bevel install either side up (see fig. 3).

Oil Control Ring

1) Three piece type - install as shown in figure 1.

2) **Do not attempt to modify expander in any way.**

Oil Rings with Nylon Buttons

These buttons are installed as an Anti-Overlap feature. They may be removed is desired. If removed, caution should be taken to insure the expander ends are not overlapped upon installation.

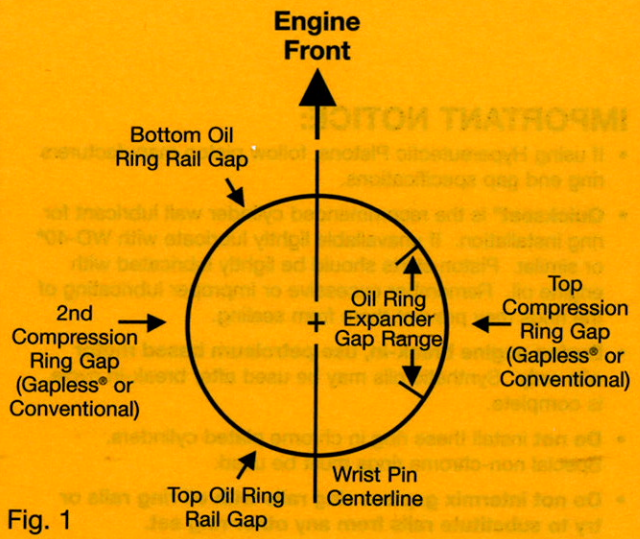


Fig. 1

* If piston has more than 2 compression grooves, subsequent rings should be positioned 180° apart in descending order.

Helpful Tips for Ring Fitting and Seating

All pistons (including new ones) should be checked for proper ring to groove clearances.

Ring to piston groove back clearance should be a MINIMUM of .005" deeper than radial wall dimension of piston ring. If piston ring sticks out of groove by any amount, you have the wrong rings (see fig. 2).

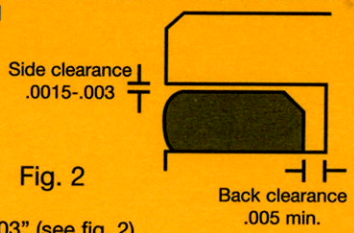


Fig. 2

Ring to groove side clearance should be a minimum of .0015 to a maximum of .003" (see fig. 2).

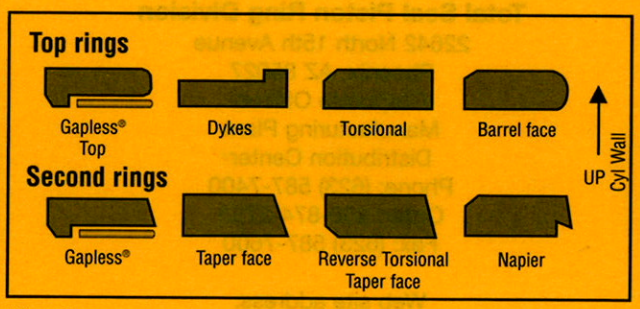


Fig. 3

Gapless® 2nd or Conventional Ring Sets

(Gapless Top Ring sets refer to green installation sheet.)

NON FILE-TO-FIT
Ring End Gap Supplement

The specifications listed in the table are based on normal operating conditions. The ideal ring end gap varies and is dependent upon many factors. Additional clearance may be required on Nitrous, Forced Induction and Endurance applications due to increased combustion temperatures. Extra ring gap may be required in Marine, Solid and Filled block applications because of decreased block expansion and increased ring expansion.

For ring installation and placement, follow the instructions found on the installation sheet included with this ring set.

Due to the nature of performance applications and the many variables involved, this information should not be considered absolute. The decision and ultimate responsibility rests entirely with the customer.

IF YOU ARE NOT SURE, ASK!!! Tech line: (623) 587-7400

SAE Recommended Ring Gap Clearances

Cylinder Diameter	Ring End Gap Clearances
1.0000 - 2.3624	.006 - .014
2.3625 - 2.9524	.008 - .016
2.9525 - 3.5424	.010 - .020
3.5425 - 4.3299	.012 - .022
4.3300 - 5.1174	.014 - .026
5.1175 - 5.9049	.016 - .030
5.9050 - 6.8899	.020 - .035
6.8900 - 8.9999	.024 - .041

TSS/91 Series and Classic Series Rings are Non File-To-Fit ring sets. End gaps are designed to fall within SAE specs.

Note: If the end gap is less than the minimum specified for your bore size, it may be necessary to increase the end gap by filing the ring ends. Follow the method described below.

Proper Ring Gap Measuring Procedure

- Torque plate should be attached to engine block and torqued to specifications (if available).
- Piston ring should be square in the bore 1" down from the deck.
- Measure ring end gap with feeler gauge or equivalent measuring device.

Proper Ring Filing

- Ring gap should be filed using proper ring gap filing tool.
- Ring gap should only be filed in an inward direction and square to the sides.

Hyperecutectic Piston Use

- Follow the piston manufacturers ring end gap recommendations.

An Important Fact

Ring sets are manufactured to fit a specific bore size. Every .001" that the bore is larger than the specified bore size causes ring end gap to increase by .0035".

Gapless® 2nd or Conventional Ring Sets

(Gapless Top Ring sets refer to green installation sheet.)

FILE-TO-FIT
Ring End Gap Supplement

TOTAL SEAL
PISTON RINGS
Total Seal, Inc.
Phoenix, Arizona

The specifications listed in the table are based on normal operating conditions. The ideal ring end gap varies and is dependent upon many factors. Additional clearance may be required on Nitrous, Forced Induction and Endurance applications due to increased combustion temperatures. Extra ring gap may be required in Marine, Solid and Filled block applications because of decreased block expansion and increased ring expansion.

Remember, your experience with your specific application may exceed ours. If our recommendations vary from what you've previously used, play it safe and use the larger of the two end gap sizes.

For ring installation and placement, follow the instructions found on the installation sheet included with this ring set.

Due to the nature of performance applications and the many variables involved, this information should not be considered absolute. The decision and ultimate responsibility rests entirely with the customer.

IF YOU ARE NOT SURE, ASK!!! Tech line: (623) 587-7400

CAUTION... THESE ARE FILE-TO-FIT RINGS!!!

Proper Ring Gap Measuring Procedure

- Torque plate should be attached to engine block and torqued to specifications.
- Piston ring should be square in the bore 1" down from the deck.
- Measure ring end gap with feeler gauge or equivalent measuring device.

Proper Ring Filing

- Ring gap should be filed using proper ring gap filing tool.
- Ring gap should only be filed in an inward direction and square to the sides.

Application	Top Ring	Second Ring	Oil Ring Rail
Street, Strip, Circle	Bore x .0045"	Bore x .0035"	Min. .015"
Nitrous up to 150hp	Bore x .006"	Bore x .0045"	Min. .015"
Nitrous over 150hp	Bore x .008"	Bore x .0055"	Min. .015"
Blown Gas*	Bore x .0055"	Bore x .0035"	Min. .015"
Blown Alcohol*	Bore x .0045"	Bore x .0035"	Min. .015"
Blown Nitro*	Bore x .0055"	Bore x .0035"	Min. .015"

**Indicates any type of forced induction system.*

Hyperecutectic Piston Use

- Follow the piston manufacturers ring end gap recommendations.

An Important Fact

Ring sets are manufactured to fit a specific bore size. Every .001" that the bore is larger than the specified bore size causes ring end gap to increase by .0035".