



## Installation Instructions for S&S<sup>®</sup> Pistons

### DISCLAIMER:

S&S parts are designed for high performance, closed course, racing applications and are intended for the very experienced rider only. The installation of S&S parts may void or adversely affect your factory warranty. In addition such installation and use may violate certain federal, state, and local laws, rules and ordinances as well as other laws when used on motor vehicles used on public highways, especially in states where pollution laws may apply. Always check federal, state, and local laws before modifying your motorcycle. It is the sole and exclusive responsibility of the user to determine the suitability of the product for his or her use, and the user shall assume all legal, personal injury risk and liability and all other obligations, duties, and risks associated therewith.

The words Harley<sup>®</sup>, Harley-Davidson<sup>®</sup>, H-D<sup>®</sup>, Sportster<sup>®</sup>, Evolution<sup>®</sup>, and all H-D part numbers and model designations are used in reference only. S&S Cycle is not associated with Harley-Davidson, Inc.

### SAFE INSTALLATION AND OPERATION RULES:

Before installing your new S&S part it is your responsibility to read and follow the installation and maintenance procedures in these instructions and follow the basic rules below for your personal safety.

- Gasoline is extremely flammable and explosive under certain conditions and toxic when breathed. Do not smoke. Perform installation in a well ventilated area away from open flames or sparks.
- If motorcycle has been running, wait until engine and exhaust pipes have cooled down to avoid getting burned before performing any installation steps.
- Before performing any installation steps disconnect battery to eliminate potential sparks and inadvertent engagement of starter while working on electrical components.
- Read instructions thoroughly and carefully so all procedures are completely understood before performing any installation steps. Contact S&S with any questions you may have if any steps are unclear or any abnormalities occur during installation or operation of motorcycle with a S&S part on it.
- Consult an appropriate service manual for your motorcycle for correct disassembly and reassembly procedures for any parts that need to be removed to facilitate installation.
- Use good judgment when performing installation and operating motorcycle. Good judgment begins with a clear head. Don't let alcohol, drugs or fatigue impair your judgment. Start installation when you are fresh.
- Be sure all federal, state and local laws are obeyed with the installation.
- For optimum performance and safety and to minimize potential damage to carb or other components, use all mounting hardware that is provided and follow all installation instructions.
- Motorcycle exhaust fumes are toxic and poisonous and must not be breathed. Run motorcycle in a well ventilated area where fumes can dissipate.

### IMPORTANT NOTICE:

Statements in this instruction sheet preceded by the following words are of special significance.



**WARNING**

Means there is the possibility of injury to yourself or others.



**CAUTION**

Means there is the possibility of damage to the part or motorcycle.

**NOTE**

Other information of particular importance has been placed in italic type.

S&S recommends you take special notice of these items.

## GENERAL INFORMATION

- 1- For maximum piston and ring life, fit pistons using close fit dimensions. Close fit requires absolute adherence to new engine break-in as described on page 7.
- 2- For immediate drag strip use, fit pistons using loose fit dimensions. Break in rings and pistons with 50 easy miles if possible. Piston and ring life will be reduced with loose fit dimensions.
- 3- Measure all pistons at widest point across thrust face, perpendicular to wristpin hole. Several measurements should be taken to locate widest point. Typically, this will be at bottom of piston skirt for pre-1984 big twins, and approximately 1/2" below level of wristpin hole in pistons for Harley-Davidson® Evolution® and Twin Cam 88® engines. If pre-1984 piston is notched for placement in rear cylinder, use measurement directly above notch for skirt measurement.
- 4- S&S® recommends #220-#280 grit stone for final honing of stock bore and Sidewinder®, S&S T124 and S&S big bore cylinders. #320 grit stone is recommended for engines using S&S 92-4500, 92-4510, or 92-4520 pistons.
- 5- Follow procedure recommended in Harley-Davidson® service manual for boring and honing stock bore big twin and Twin Cam 88® cylinders. Follow instructions included with S&S Cylinder Torque Plate Kit when boring and honing S&S 3 3/8" or 4", 4 1/8" bore cylinders. Torque plates must be used to simulate compressive stress in an assembled engine. Cylinders will distort if torque plates are not used.

### CAUTION

**Failure to follow instructions and perform required clearancing, installation and/or break-in procedures may result in damage to pistons and/or other engine components not covered under warranty.**

Piston Fitment Chart

Piston Series	Close Fit	Loose Fit	Piston Series	Close Fit	Loose Fit
92-1060	.0023" to .0025"	.0035" to .0045"	92-1900	.002" to .0025"	.003" to .004"
92-1080	.0023" to .0025"	.0035" to .0045"	92-1910	.002" to .0025"	.003" to .004"
92-1100	.0023" to .0025"	.0035" to .0045"	92-1930	.002" to .0025"	.003" to .004"
92-1110	.0023" to .0025"	.0035" to .0045"	92-1940	.002" to .0025"	.003" to .004"
92-1120	.0023" to .0025"	.0035" to .0045"	92-2000	.002" to .0025"	.003" to .004"
92-1130	.0023" to .0025"	.0035" to .0045"	92-2010	.002" to .0025"	.003" to .004"
92-1200	.002" to .0025"	.0032" to .0045"	92-2020	.002" to .0025"	.003" to .004"
92-1210	.002" to .0025"	.0032" to .0045"	92-2030	.002" to .0025"	.003" to .004"
92-1400	.002" to .0025"	.0032" to .0045"	92-2040	.002" to .0025"	.003" to .004"
92-1410	.002" to .0025"	.0032" to .0045"	92-2050	.002" to .0025"	.003" to .004"
92-1420	.002" to .0025"	.0032" to .0045"	92-2420	.0008" to .0013"	.002" to .0025"
92-1430	.002" to .0025"	.0032" to .0045"	92-2440	.0008" to .0013"	.002" to .0025"
92-1436	.002" to .0025"	.0032" to .0045"	92-2460	.0008" to .0013"	.002" to .0025"
92-1550	.002" to .0025"	.0032" to .0045"	92-2500	.002" to .0025"	.003" to .0035"
92-1556	.002" to .0025"	.0032" to .0045"	92-2510	.002" to .0025"	.003" to .0035"
92-1560	.002" to .0025"	.0032" to .0045"	92-2600	.002" to .0025"	.003" to .0035"
92-1620*	.002" to .003"	.0035" to .004"	92-2610	.002" to .0025"	.003" to .0035"
92-1630***	.0015" to .002"	.0025" to .0035"	92-2700***	.0015" to .002"	.0025" to .0035"
92-1630*	.002" to .003"	.0035" to .004"	92-2720*	.002" to .003"	.0035" to .004"
92-1640***	.0015" to .002"	.0025" to .0035"	92-2730*	.002" to .003"	.0035" to .004"
92-1640*	.002" to .003"	.0035" to .004"	92-2800***	.0025" to .003"	.0045" to .0055"
92-1800***	.0025" to .003"	.0045" to .0055"	92-2800*	.0035" to .004"	.005" to .006"
92-1800*	.0035" to .004"	.005" to .006"	92-2900*	.0035" to .004"	.0035" to .004"
92-1830*	.0035" to .004"	.005" to .006"	92-3700	.003" to .0035"	.0045" to .0055"
92-1840*	.0035" to .004"	.005" to .006"			

\*\*\* - With Slotted Oil Ring Groove

\* - With holed Oil Ring Groove

## PISTON INSTALLATION

- 1- Piston Series 92-1600, 92-1620, 92-1630, 92-1640, 92-2400, 92-2420, 92-2440, 92-2460, 92-2700, 92-2720 and 92-2730 have offset wristpins and must be installed with dimple in piston dome toward right or cam side of engine. Piston Series 92-1060, 92-1070 and 92-1080, 92-1210, 92-1550, 92-1556, 92-1560 also have offset wristpins and must be installed with symbol fCAM toward right or cam side of engine.
- 2- Piston Series 92-3500, and 92-3700 have larger intake valve reliefs which must be installed toward intake valves or middle of engine.
- 3- Most other pistons have no special features. They can be installed as desired unless piston skirt has piston-to-piston clearance bevel on one side. In such case, bevel must face center of engine. If only one piston has bevel, it will be for rear cylinder. See #4 immediately below.
- 4- Some piston sets have all piston-to-piston clearance machined into rear piston. In such cases rear piston must be installed with bevel or notch toward front. If dimple is present, piston must be installed with dimple in correct position. The dimple in the ring should face down and be installed in the gap above the wrist pin. This dimple keeps the support rail from rotating.
- 5- Check all installations for minimum of .060" clearance between pistons at closest point near bottom of stroke.
- 6- Check all installations for minimum of .060" clearance between pistons and flywheels at bottom of stroke. Replacement pistons may or may not have adequate clearance. Compare replacement pistons with ones being replaced and make corrections accordingly.

**NOTE:** In all cases it is the engine builder's responsibility to confirm proper clearances when assembling an engine. This is especially critical with performance components such as higher compression pistons and high lift camshafts. In addition to clearances mentioned, .060" valve-to-piston clearance must be confirmed.

### CAUTION

**Failure to establish proper clearances can result in severe engine damage not covered under warranty.**

## WRISTPIN RETAINER INSTALLATION

**NOTE:** Thoroughly clean wristpin before installation, paying particular attention to bore. Pass clean, lint-free cloth back and forth through wristpin bore several times to insure removal of contaminants.

- 1- If wristpin clips are used, insure that groove in piston is free of burrs and foreign matter.
- 2- Round "wire" style clips identical to and interchangeable with stock Harley-Davidson® Evolution® clips require wristpins with specially chamfered ends. Install wire clips using procedure recommended in a Harley-Davidson® service manual. End of clip must rest over notch in piston below wristpin hole to allow removal of clip in future. Be sure clip is fully seated in groove.

**NOTE:** Round "wire" style clip ends must be deburred before installation.

- 3- "Tru-Arc" style clips should be installed with proper tool. Clips should not be used with wristpins having chamfer on end greater than  $\frac{1}{64}$ ". Install clip with open side facing downward and sharp edge of clip to outside of wristpin hole away from wristpin. Be sure clip is fully seated in groove.
- 4- "Spiral-Loc" style clips are installed by slowly working clip into wristpin hole using thumb nail, small screwdriver or awl in circular turning motion. Once entire clip is in hole, push end of clip into groove, followed by rest of clip. Be sure clip is fully seated in groove.
- 5- PTFE wristpin buttons must be used only in pistons where buttons are fully supported in wristpin hole. Buttons are used in place of and not in conjunction with conventional wristpin clips. Recommended wristpin endplay is .010" to .060" and is determined by subtracting length of wristpin with button on each end from finished cylinder bore.  
To make fitting easier, S&S® buttons come in four widths. "A" buttons are thinnest and "D" buttons are thickest. Use two A buttons, Part 94-9251, for bore sizes  $3\frac{7}{16}$ " std. to  $3\frac{7}{16}$ " +.040, two B buttons, Part 94-9252, for bore sizes  $3\frac{7}{16}$ " +.050 to  $3\frac{7}{16}$ " + .090, two C buttons, Part #94-9258, for bore sizes  $3\frac{5}{8}$ " std. to  $3\frac{5}{8}$ " +.030, and two D buttons, Part 94-9259, for bore sizes  $3\frac{5}{8}$ " +.040 to  $3\frac{5}{8}$ " +.070.
- 6- Special notched aluminum buttons are supplied with Piston Series 92-3500 and #92-3700. When installed, notch simulates oil ring groove and helps support oil ring. Buttons should not protrude beyond ring land diameter when in place.

## RING INSTALLATION

- 1- Ring widths on some piston series have changed from time to time. Part numbers of rings originally supplied with pistons should be recorded for future reference in the event replacement rings are required.
- 2- The majority of ring kits presently supplied by S&S® contain a moly faced top ring, a cast, reverse torsion second ring, and a three piece oil ring. This may be confirmed as follows:
  - A- Top compression ring has a gray finish that is relatively light in color, and may or may not have a slight bevel along the inner edge. It has no dot or other identifying mark. The light color can best be recognized by comparing compression rings to each other beneath a good light. Install light colored ring without dot in top groove, bevel up. If there is no bevel, ring can be installed either side up.
  - B- Second compression ring has a darker, charcoal gray finish and slight bevel along inner surface. This ring has a dot. **See Figure 1.** Install in second or middle groove with dot up.
  - C- Oil rings are three piece type with two rails and one expander. Do not shorten expander for any reason! Installation is straightforward with one rail placed above expander, other rail below expander. Rails may be shortened to correct gap, but burrs must be carefully removed.

**NOTE:** In some cases, same expander is used for several bore sizes. Oversize rings will not necessarily have a larger expander

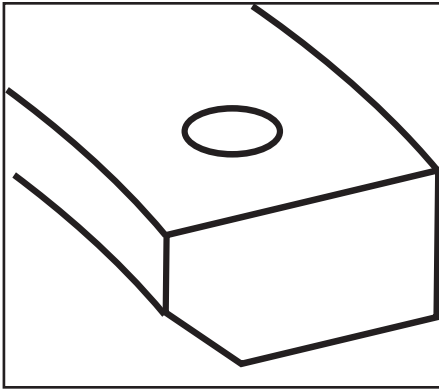


Figure 1

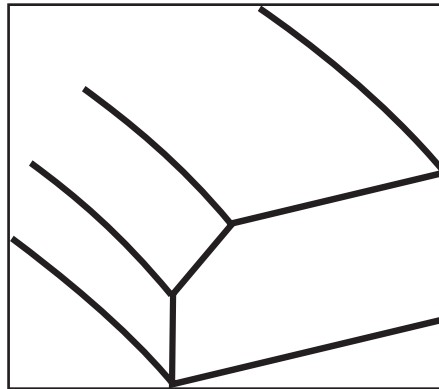


Figure 2

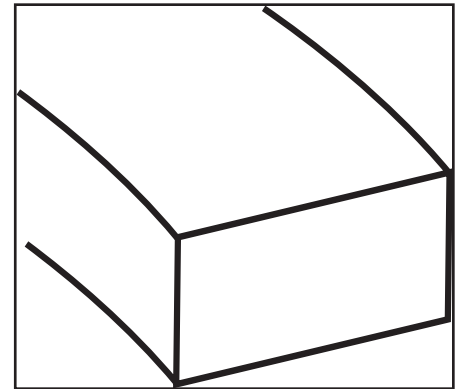


Figure 3

 CAUTION

**Failure to remove burrs may cause engine damage.**

**Incorrect installation of rings may result in poor performance, excessive oil consumption or engine damage.**

3- For ring kits in which section #2 above does not apply, compression rings may be of plain cast iron type, chrome faced cast iron type, moly faced cast type or chrome type.

A- The most common combinations are:

- 1- Two chrome faced cast rings
- 2- One chrome faced cast ring & one plain cast ring.
- 3- One moly faced cast ring & one plain cast ring.

B- Install as follows:

- 1- Chrome faced or moly faced ring always goes in top groove
- 2- Plain cast ring usually goes in second groove. Plain cast type is usually a reverse torsion ring distinguished by an inside diameter bevel on one side of ring and a "dot" or oversize mark on other side. **See Figure 1** above. If two cast iron compression rings are supplied in a set, check to see if one is reverse torsion style ring with dot and bevel. Reverse torsion style ring always goes in second groove with dot up if present.

C- The following rules apply to compression ring identification and placement. Rules are listed in order of priority. In other words, if both Rule #2 and Rule #4 apply, for example, Rule #2 will be followed and Rule #4 ignored.

- 1- Chrome or moly ring goes in top groove.
- 2- Cast iron regular or reverse torsion ring goes in second groove.
- 3- Any identifying "pip" marks, dots or oversize marks go to top of piston.
- 4- Ring with one dot goes in top groove, ring with two dots goes in second groove.
- 5- If both rings are identical and have one dot or two dots, either ring can go in either groove.
- 6- If ring has dot and inside diameter bevel, dot goes to top of piston. **See Figure 1** above.
- 7- If ring has no dot but does have inside diameter bevel, bevel goes to top of piston. **See Figure 2** above.
- 8- If ring has no dots and no bevel, it can go either way. **See Figure 3** above.

4- Ring Gap Measurements

- A- Compression ring end gap on big twins with 3½" bore is .014" to .022".
- B- End gap on all other compression rings is .016" to .024".
- C- Oil ring rail end gap on big twins with 3½" bore is .015" to .035".
- D- Oil ring rail end gap on all others is .015" to .035".
- E- Compression ring end gap on big twins with 4½" bore is .017" to .025".
- F- Oil ring rail end gap on big twins with 4½" bore is .015" to .035".

**NOTE:** In certain instances, the next oversize ring set may be supplied with pistons, for example +.060" oversize rings with +.050" pistons. In this case end gaps must be measured and rings filed as necessary. Ends must then be carefully deburred.

 CAUTION

**Failure to deburr rings may result in engine damage.**

**Piston Series 92-1210, 92-1550, 92-1556, and 92-1560 have a ring support rail that needs to be installed before any other rings are installed.**

- 5- If your piston application uses oil ring support rails, install ring support rail in front piston so that the end gap is toward the rear of the cylinder (90° from wristpin). Install ring support rail on rear piston so that the end gap is toward front of the cylinder (90° from wristpin). The dimple in the ring must face down and be installed in the gap above the wrist pin on both pistons. **See picture below.**



#### 6- Ring Gap Placement

##### A- Oil ring

- 1- Expander gap must be in center of thrust face (rear of piston), or 90° from wristpin.
- 2- Bottom rail gap should be approximately 1.5" or 45° to right of expander gap.
- 3- Top rail gap should be approximately 1.5" or 45° to left of expander gap.

**NOTE:** Confirm that ends of expander do not overlap during installation. Properly installed expander will appear larger than piston but will compress when cylinder installed.

- B- Top compression ring gap should be 135° or approximately 4½" to left of oil expander gap.  
C- Second compression ring gap should be 135° or approximately 4½" to right of oil expander gap.

**\*NOTE:** Fit wristpins at .0007" to .001".

#### ENGINE BREAK-IN PROCEDURE

##### NOTES:

- S&S® engines are designed for high performance and as such are not as tolerant of inadequate break-in. Correct break-in will assure longer engine life and will prevent unnecessary engine damage. Engine damage caused by improper break-in is not covered under the S&S warranty.
- If new pistons have not been installed, only steps A, B, and C are required.
- If new pistons have been installed, all break in steps are required.

- A- Initial start up. Run engine approximately one minute at 1250-1750 rpm. DO NOT crack throttle or subject to any loads during this period as head gaskets are susceptible to failure at this time. During this time check to see that oil pressure is normal, that oil is returning to the oil tank, and that no leaks exist.
- B- Shut off engine and thoroughly check for any leaks or other problems. Let engine cool to the touch
- C- After engine has cooled, start up again and allow the motor to build some heat. Engine should be run no longer than three to four minutes. When the cylinders become warm/hot to the touch (approximately 150°) shut the motor down and let it cool to room temp. Follow the same cautions as for the initial start-up, and continue to watch for problems.
- D- Repeat this procedure 3 or 4 times. Each successive time it should take slightly longer to warm up and you can increase the temp slightly each time (+10°). You can be more liberal each time with the rpm, gently vary rpm continuously from idle up to 2500 rpm in the final cycle. Don't be too concerned with final carb settings at this time because idle speed and mixture cannot be correctly set until the motor reaches full operating temperature. The motor should not reach that temperature during these cycles. Do not allow engine temperature to become excessive. After the motor has cooled to room temperature for the final time you are ready to start the 500 mile engine break-in process.
- E- The first 50 miles are most critical for new rings and piston break-in. Engine damage is most likely to occur during this period. Keep heat down by not exceeding 2500 rpm. Avoid lugging the motor, riding in hot weather or in traffic. Vary the engine speed. Do not lug the engine. We recommend changing the oil at 50 miles.
- F- The next 500 miles should be spent running engine no faster than 3500 rpm or 60 mph. Avoid continuous steady speeds, and do not lug the engine. Vary engine rpm. We recommend changing the oil again at 500 miles.

#### CAUTION

**Lugging or running engine prematurely at sustained high rpm may result in damage to pistons and other engine components. S&S® voids its guarantee if engine is not broken in properly.**

- G- For the balance of the first 1000 miles the motor can be run in a normal but conservative manner. You can be more liberal with the rpm range and motorcycle can be operated at normal highway speeds. Avoid overheating or putting any hard strain on the engine: no drag racing, dyno runs, excessive speed, trailer towing or sidecar operation.
- H- After 1000 miles, verify carburetor jetting and adjustment. Change the engine oil. Motorcycle can now be operated normally.



## Installation Instructions for S&S<sup>®</sup> Piston Rings

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- If motorcycle has been running, wait until engine and exhaust pipes have cooled down to avoid getting burned before performing any installation steps.
- Before performing any installation steps disconnect battery to eliminate potential sparks and inadvertent engagement of starter while working on electrical components.
- Read instructions thoroughly and carefully so all procedures are completely understood before performing any installation steps. Contact S&S with any questions you may have if any steps are unclear or any abnormalities occur during installation or operation of motorcycle with a S&S part on it.
- Consult an appropriate service manual for your motorcycle for correct disassembly and reassembly procedures for any parts that need to be removed to facilitate installation.
- Use good judgment when performing installation and operating motorcycle. Good judgment begins with a clear head. Don't let alcohol, drugs or fatigue impair your judgment. Start installation when you are fresh.
- Be sure all federal, state and local laws are obeyed with the installation.
- For optimum performance and safety and to minimize potential damage to carb or other components, use all mounting hardware that is provided and follow all installation instructions.
- Motorcycle exhaust fumes are toxic and poisonous and must not be breathed. Run motorcycle in a well ventilated area where fumes can dissipate.

## Ring Identification

'Ring widths on S&S® pistons may change from time to time. Part numbers of rings originally supplied with pistons should be recorded for future reference in the event replacement rings are required.

1. The majority of ring kits presently supplied by S&S® contain a moly faced top ring, a cast, reverse torsion second ring, and a three piece oil ring. This may be confirmed as follows:
2. Top compression ring has a gray finish that is relatively light in color, and may or may not have a slight bevel along the inner edge. **See Figure 1.** It generally has no dot or other identifying mark. The light color can best be recognized by comparing compression rings to each other beneath a good light. Install light colored ring in top groove, bevel up. If there is no bevel, ring can be installed either side up.
3. Second compression ring has a darker, charcoal gray finish and may have slight bevel along inner surface, or a hook-like relief machined on the bottom of the outer diameter. **See Figures 2 and 3.** This ring may have a dot or letter on the top side. Install in second or middle groove with dot or letter up. Bevel on the inner surface or groove on outer diameter will face down.
4. Oil rings are three piece type with two rails and one expander. Do not shorten expander for any reason! Installation is straightforward with one rail placed above expander, other rail below expander. Rails may be shortened to correct gap, but burrs must be carefully removed.

*NOTE: In some cases, same expander is used for several bore sizes. Oversize rings will not necessarily have a larger expander*



**Failure to remove burrs may cause engine damage.  
Incorrect installation of rings may result in poor performance,  
excessive oil consumption or engine damage.**

5. Rings supplied in some ring kits may differ from those described in point #1 above. Compression rings may be of plain cast iron type, chrome, or moly faced cast iron.
6. The most common combinations are:
  - a. Two chrome faced cast rings
  - b. One chrome faced cast ring & one plain cast ring.
  - c. One moly faced cast ring & one plain cast ring.
  - d. Some S&S Pistons have a ring support rail that must installed after the piston and wrist pin are installed on the connecting rod and before any other rings are installed. Install ring support rail in front piston so that the end gap is toward the rear of the cylinder (90° from wristpin). Install ring support rail on rear piston so that the end gap is toward front of the cylinder (90° from wristpin). The dimple in the ring must face down and be lined up with the wrist pin on both pistons.
7. Install as follows:
  - a. Chrome faced or moly faced ring always goes in top groove
  - b. Plain cast ring usually goes in second groove. Plain cast type is usually a reverse torsion ring. distinguished by an inside diameter bevel on one side of ring, and a dot, letter, or oversize

mark on other side. **See Figure 2.** Some second rings may have a hook shaped groove machined around the bottom of the the outer diameter. If two cast iron compression rings are supplied in a set, check to see if one has mark and bevel or hook shaped groove. These rings always go in second groove with marking up if present and bevel or groove facing down.

8. The following general rules apply to compression ring identification and placement. Rules are listed in order of priority. In other words, if both Rule b and Rule d apply, for example, Rule b will be followed and Rule d is ignored.
  - a. Chrome or moly ring goes in top groove.
  - b. Cast iron regular or reverse torsion ring goes in second groove.
  - c. Any identifying pip marks, dots, letters, or oversize marks go to top of piston.
  - d. Ring with one dot goes in top groove, ring with two dots goes in second groove.
  - e. If both rings are identical and have one dot or two dots, either ring can go in either groove.
  - f. If ring has dot or letter and inside diameter bevel, dot or letter goes to top of piston. **See Figure 2 and 3.**
  - g. If ring has no dot but does have inside diameter bevel, bevel goes to top of piston. **See Figure 1** below.
  - h. If ring has no dots and no bevel, it can go either way. **See Figure 4** below.

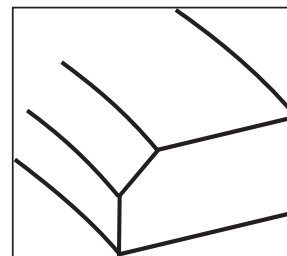


Figure 1

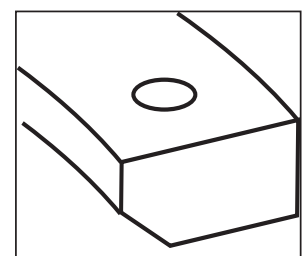


Figure 2

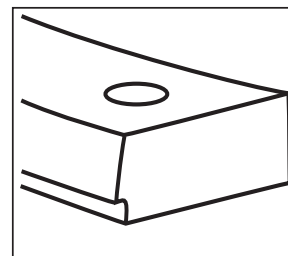


Figure 3

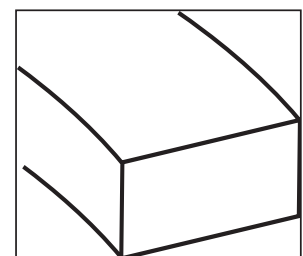
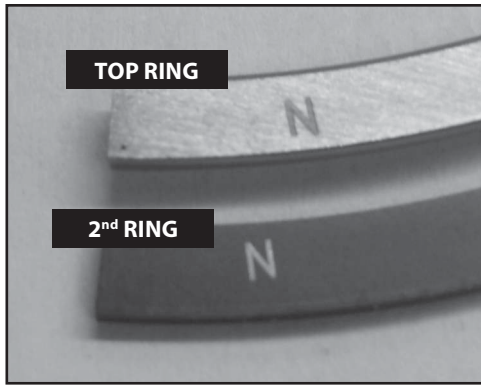


Figure 4

9. Rings for S&S 4 1/8" bore pistons and Pistons for CVO 110 engines
  - a. The 2nd compression ring is dark grey in color with a letter "N" on the top side. **(see Picture 1).**
  - b. The top ring compression is a light grey or silver with a letter "N" on the top side **(see Picture 1).** The top ring will have a chamfer on the inside edge, this chamfer will face up.



Picture 1

### Setting Ring End Gaps

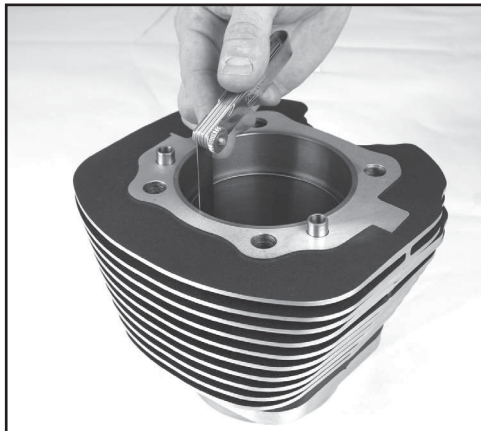
#### NOTES

1. Thoroughly wash cylinders with hot soapy water, then wash with brake cleaner and wipe with a clean white towel. Repeat until towel does not show evidence of debris and apply a light coat of oil immediately.
2. Check the ring end gap by placing the ring into the cylinder. Use a piston or caliper to ensure that the ring is placed squarely in the bore. See **Picture 2**.



Picture 2

3. Measure the ring end gap with a feeler gauge. See **Picture 3**.



Picture 3

4. See **Table 1** for proper end gap measurement. If adjustment to the gap must be made, use a proper ring end gap filing tool.

Ring End Gap			
Application	Top Ring	Second Ring	Oil Ring
Street/Hi Performance	Bore x 0.0045"	0.004"-0.008" Bigger than top ring	Minimum 0.015" Do not file
Drag Racing	Bore x 0.005"	0.004"-0.008" Bigger than top ring	Minimum 0.015" Do not file
Nitrous/Turbo Supercharged	Bore x 0.0055"	0.004"-0.008" Bigger than top ring	Minimum 0.015" Do not file

Table 1

5. Always file from the ring face towards the inside diameter to avoid damaging the face coating.
6. Remove material from only one end of the ring.
7. Ensure that ring end gaps are square.
8. Remove sharp edges and burrs.
9. Recheck gap measurement and adjust as necessary.
10. Repeat procedure with the other rings.



**Failure to deburr rings may result in engine damage.**

#### NOTES:

- In certain instances, the next oversize ring set may be supplied with pistons, for example +.060" oversize rings with +.050" pistons. In this case end gaps must be measured and rings filed as necessary. Ends must then be carefully deburred.
- Important! The gap of the second ring should be larger than the top ring; this will help keep the top ring seated for improved performance.
- All rings should be fitted to the particular cylinder in which they will be installed.
- Oil rails can normally be installed without adjusting the end gap. The minimum gap should be 0.015"
- Never alter the end gap of the oil expander ring.
- Always install the ends of the expander facing up as shown in **Figure 5**.

#### Piston Ring installation

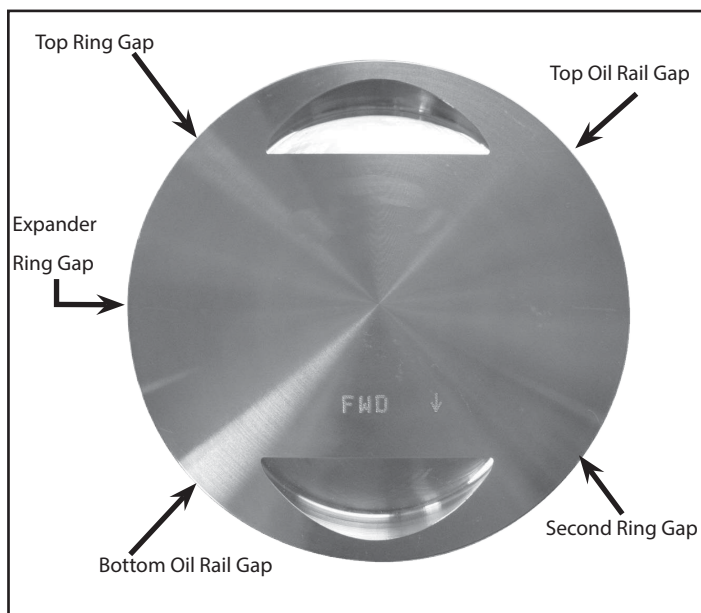
1. Piston rings may be installed either before piston is installed on connecting rod or afterward. However, if piston has a oil ring support rail, pistons must be installed on rods before support rail and rings are installed.
2. Install the oil ring expander in the bottom ring groove of the piston. The expander ring has a silver finish. Make sure the ends of the expander ring are butted together and not overlapping (**Figure 5**, below). If the tips are overlapped, excessive oil consumption will result.



Figure 5

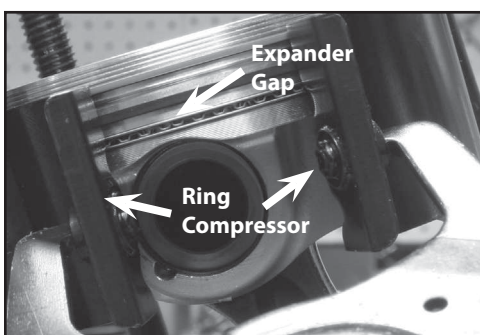


3. Install oil rails. The oil rails are the thinnest of all the rings. Either side can be placed up. Install the rails into the groove by hand. Install one rail above the expander, and one below. Orient the gaps according to **Picture 4**
4. Install the 2nd ring with the correct side facing up. Use a piston ring expander to install the ring in the 2nd groove in the piston. Orient the gap according to **Picture 4**.
5. Install the top ring with the correct side facing up. Use a ring expander tool to install the ring in the top groove. Orient the gap according to **Picture 4**.



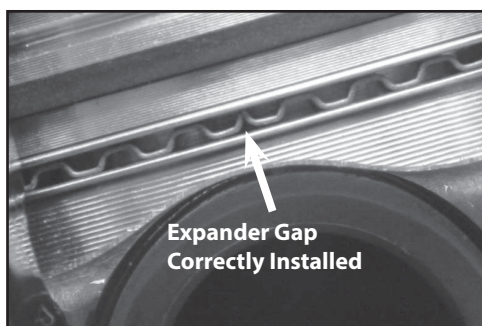
**Picture 4**

6. Compress ring pack using a suitable ring compressor. If possible, position the ring compressor so that you can see the oil expander gap during installation. See **Picture 5**.



**Picture 5**

7. Install cylinder on piston, making sure not to overlap ends of oil ring expander. See **Picture 6**.



**Picture 6**

8. Proceed with engine reassembly according to procedures described in service manual for that type of engine.

#### **Break In Procedure**

1. Initial start up. Run engine approximately one minute at 1250-1750 rpm. DO NOT crack throttle or subject to any loads during this period as head gaskets are susceptible to failure at this time. During this time, check to see that oil pressure is normal, that oil is returning the oil tank, and that no leaks exist.
2. Shut off engine and thoroughly check for any leaks or other problems. Let engine cool to the touch.
3. After engine has cooled, start up again and allow the motor to build some heat. Engine should be run no longer than three to four minutes. When the cylinders become warm/hot to the touch (approximately 150° F) shut the motor down and let it cool to room temp. Follow the same cautions as for the initial start-up, and continue to check for problems.
4. First 50 Miles -
  - a. Street - Ride normally, do not lug the engine. Avoid high heat conditions and vary the RPM while riding. No stop and go traffic, extended idle periods, or high load or high RPM conditions. Max of 3,500 rpm or 60 mph.
  - b. Dyno - A chassis dynamometer can be used to put the first 50 miles on a new engine.
5. 50-100 Miles- Ride normally, do not lug the engine. Avoid high heat conditions, no stop and go traffic or extended idle periods. Limited short bursts of throttle can aid in ring seating from this point forward during the break-in, but avoid continuous high speed or load conditions. Max of 4,250 RPM/70 mph.
6. 100-500 Miles- Avoid lugging the engine and high heat conditions. Max of 5,000 rpm. Change oil at 500 miles.
7. 500 to 1,000 miles - Ride bike normally, but avoid continuous high load operation and high heat conditions.
8. From 1,000 miles on – Break-in is complete, enjoy!