

Instruction 51-1016

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Installation Instructions: S&S® Non-Copper Head Gaskets for Harley-Davidson® Evolution® & Twin Cam 88® Engines

NOTE: *Cleaning parts prior to and during assembly and keeping parts clean after final assembly are imperative to minimize contaminants that may circulate in oil and shorten engine life. Many parts can be cleaned with soap and water first. Then, reclean all internal parts and gasket mating surfaces using high quality solvent that does not leave any harmful residues. Be sure to read and follow manufacturer's instruction label before use. Use brushes and compressed air to clean all oil passageways of dirt, filings, etc. whenever possible. During final assembly, recoat all internal parts with clean motor oil.*



CAUTION



Installer is responsible for ensuring parts are clean at assembly. Damage caused by manufacturing chips, dirt and/or other contaminants is not covered under warranty.



WARNING



- **Some solvents, degreasers and other chemicals are harmful. Many items are flammable and present a fire hazard. Read the manufacturer's instruction label for proper use. Use in well ventilated area and wear protective clothing to avoid injury.**
- **Compressed air and particles dislodged by compressed air are harmful to eyes and body. Wear protective goggles when using compressed air and always direct air stream away from body parts such as hands and eyes. Never direct compressed air toward other people.**

Top End Assembly Procedure

- A. Thoroughly clean all top end parts and blow dry with compressed air. Use high grade lacquer thinner on gasket surfaces.
- B. Install base gaskets dry. Be sure gaskets match cylinder base line up dowels and oil return passageways.
- C. Install pistons and rings per instructions, or S&S® piston instruction sheet 51-1028.
- D. Coat piston skirts with engine oil and install cylinders.
- E. Install head gaskets dry with widest side of metal fire ring against cylinder.

NOTE: *S&S 3¾" bore head gaskets for 1999-up big twins require o-rings around the cylinder head locating dowels similar to stock head gaskets. S&S 3⅞", 4" and 4⅛" bore head gaskets do not use o-rings around cylinder head locating dowels.*

NOTE: *All S&S cylinder head kits are supplied with .045" thick head gaskets. This clearance promotes better combustion chamber turbulence and flame travel.*



CAUTION

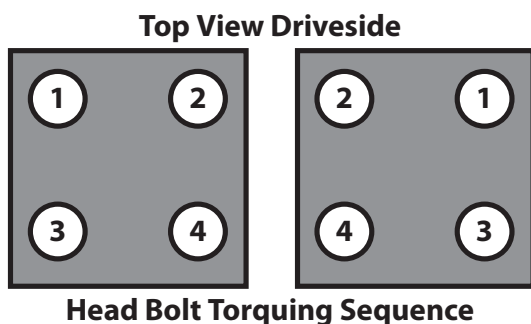


Insufficient clearance between piston domes and cylinder heads or piston domes and valves will cause damage to pistons, heads and/or valves.

- F. Before installing heads, check the threads of cylinder studs and head bolts by spinning each head bolt down on its respective stud to be sure threads are clean and undamaged. If binding is encountered, correct before proceeding. Place a drop or two of oil on threads of each head bolt just prior to final assembly.

NOTE: Light coating of oil on head bolt threads minimizes friction so torque values will not be distorted. It cannot be emphasized enough how important it is to do these steps carefully. Maintaining a good head gasket seal depends on it.

G. Bolt heads on cylinders using stock washers and head bolts or S&S® washers and head bolts when provided. Tighten head bolts in stages using crossing pattern shown below. Use torque specifications appropriate for crankcase type. Do not exceed specified torque values.



	S&S® Case	Stock Case
Stage 1	8 ft-lbs	7–9 ft-lbs
Stage 2	18 ft-lbs	12–14 ft-lbs
Stage 3	Turn 90° more	Turn 90° more

NOTE: Stock head bolt torque specifications must be used with stock crankcases. Stronger material used in S&S crankcases allow the use of higher torque values.

CAUTION

Improper torquing sequence and head bolt torque values may cause head gasket failure. Exceeding specified torque values may cause cylinder studs to pull out of crankcases, resulting in damage to crankcases and loss of head gasket seal.

H. Finish assembling top end per OEM instructions. Install and adjust pushrods per factory specifications, or manufacturers pushrod instructions.

Initial Start Up

- A. Run engine approximately one minute at 1250-1750 rpm. DO NOT crack throttle or subject engine to any loads 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. With a new engine, each successive time 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. Do not allow engine temperature to become excessive. After the motor has cooled to room temperature for the final time the motorcycle can be ridden normally.
- E. If the engine is new or newly rebuilt, adhere to the break-in procedure specified by the manufacturer of the components installed.

- CAUTION**
- **Improper first time engine start-up and break-in procedure may cause head gasket failure.**
 - **Do not allow engine temperature to become excessive as permanent engine damage may result.**

**Instruction 510-0005
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Installation Instructions for S&S® Piston Rings

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®, Harley-Davidson®, H-D®, Sportster®, Evolution®, 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.

WARRANTY:

All S&S parts are guaranteed to the original purchaser to be free of manufacturing defects in materials and workmanship for a period of twelve (12) months from the date of purchase. Merchandise that fails to conform to these conditions will be repaired or replaced at S&S's option if the parts are returned to us by the purchaser within the 12 month warranty period or within 10 days thereafter.

In the event warranty service is required, the original purchaser must call or write S&S immediately with the problem. Some problems can be rectified by a telephone call and need no further course of action.

A part that is suspect of being defective must not be replaced by a Dealer without prior authorization from S&S. If it is deemed necessary for S&S to make an evaluation to determine whether the part was defective, a return authorization number must be obtained from S&S. The parts must be packaged properly so as to not cause further damage and be returned prepaid to S&S with a copy of the original invoice of purchase and a detailed letter outlining the nature of the problem, how the part was used and the circumstances at the time of failure. If after an evaluation has been made by S&S and the part was found to be defective, repair, replacement or refund will be granted.

ADDITIONAL WARRANTY PROVISIONS:

- (1) S&S shall have no obligation in the event an S&S part is modified by any other person or organization.
- (2) S&S shall have no obligation if an S&S part becomes defective in whole or in part as a result of improper installation, improper maintenance, improper use, abnormal operation, or any other misuse or mistreatment of the S&S part.
- (3) S&S shall not be liable for any consequential or incidental damages resulting from the failure of an S&S part, the breach of any warranties, the failure to deliver, delay in delivery, delivery in non-conforming condition, or for any other breach of contract or duty between S&S and a customer.
- (4) S&S parts are designed exclusively for use in Harley-Davidson® and other American v-twin motorcycles. S&S shall have no warranty or liability obligation if an S&S part is used in any other application.

RING INSTALLATION

- 1- 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.
- 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. **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.
 - B- Second compression ring has a darker, charcoal gray finish and may 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.
 - 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



Failure to remove burrs may cause engine damage.

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

- 3- Rings supplied in some ring kits may differ from those described in section #2. Compression rings may be of plain cast iron type, chrome, or moly faced cast iron.
 - 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, 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.
 - 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, letters, 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 or letter and inside diameter bevel, dot or letter goes to top of piston. **See Figure 2 and 3.**
- 7- If ring has no dot but does have inside diameter bevel, bevel goes to top of piston. **See Figure 1** below.
- 8- If ring has no dots and no bevel, it can go either way. **See Figure 4** below.

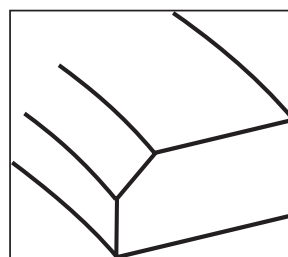


Figure 1

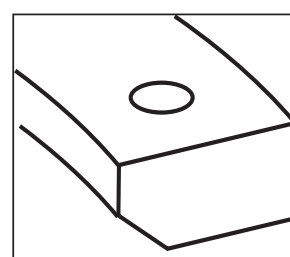


Figure 2

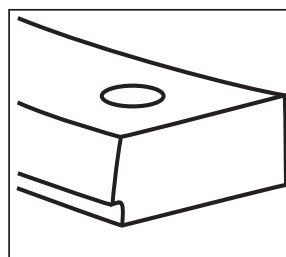


Figure 3

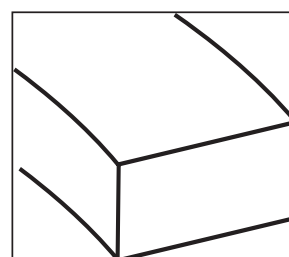


Figure 4

- 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.



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.

