



Installation Instructions: S&S® Three Piece Flywheel Assemblies for 1999-Up Harley-Davidson® big twin engines and S&S T-Series engines

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.

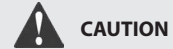
IMPORTANT NOTICE:

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.

SPECIAL TOOL REQUIREMENTS

- Harley-Davidson® service manual or S&S® service manual for the specific model or engine you are working on
- Timken® bearing install tool - for engines with Timken sprocket shaft bearings
- Feeler gauge
- Dial indicator
- Torque wrench

GENERAL INFORMATION

- Thoroughly read and understand the section that pertains to the flywheels you are installing.
- If you don't have the required tools or knowledge for installing these flywheels you should have a qualified shop install them.
- It is the engine builder's responsibility to confirm proper clearances when assembling an engine.
- S&S produces flywheel assemblies with connecting rods of three different lengths. Make sure the connecting rods are correct for your application: **(See Picture 1, below)**
 - 1999-'06 — 7.667" length - marked with one dot
 - 2007-up — 7.659" length - not marked (no dot) Tapered wristpin end for stock pistons - straight wristpin end for performance pistons
 - 120R Engines — 7.575" length - marked with two dots
 - If using stock pistons for 2007 and later engines, connecting rods must have tapered wristpin bosses to fit the internal profile of the pistons. These rods are not rebuildable.

DISASSEMBLY

1. Refer to the Harley-Davidson service manual or S&S service manual for the specific model or engine you are working on for the correct disassembly procedure.
2. The engine will need to be removed from the frame of the motorcycle and completely disassembled.

INSTALLATION

Preparation for Installation

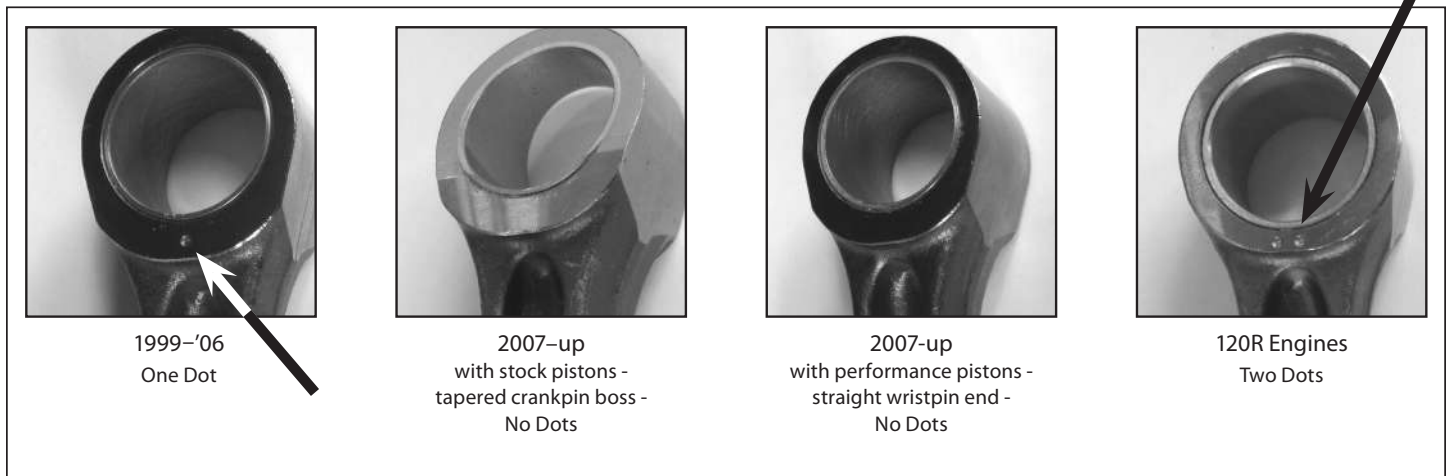
1. Remove flywheel assembly from packaging material. Handle with care to avoid dropping and potentially cutting your hands on sharp edges.
2. Using a lint free cloth and lacquer thinner, thoroughly clean flywheel assembly to remove rust preventative oil.
3. Do not immerse or wash the flywheel in a solvent tank. Connecting rod bearings are coated in grease which may become contaminated by dirt and debris if put in a solvent tank.

STROKE CODES	
CODE	STROKE
-	3.600"
21	3 ³ / ₈ "
17	4"
19	4 ¹ / ₈ "
9	4 ³ / ₁₆ "
5	4 ¹ / ₄ "
1	4 ³ / ₈ "
2	4 ¹ / ₂ "
6	4 ⁵ / ₈ "
3	4 ³ / ₄ "
7	4 ¹³ / ₁₆ "
4	5"
ENGINE STYLE	
CODE	ENGINE STYLE
SF3	1999-UP BT
FLYWHEEL DIAMETER	
CODE	DIAMETER
X	8 ¹ / ₄ "

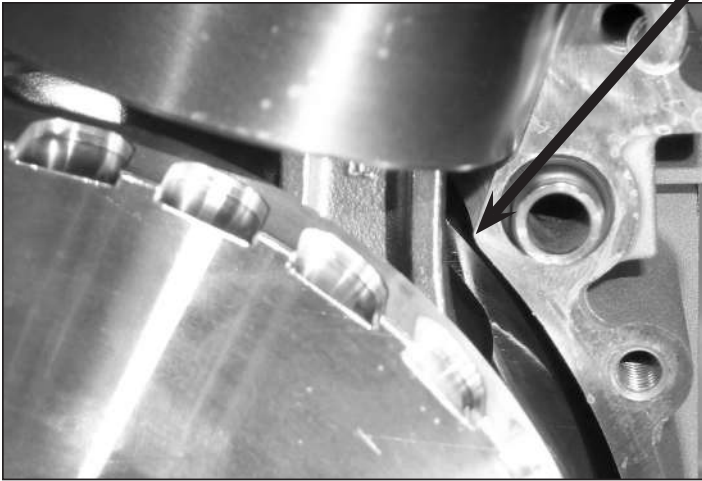
4. If flywheel is checked for runout, measurements should be checked at the bearing surfaces while fixtured on the mainshaft centers in a truing stand. The total indicated runout (TIR) for new S&S flywheels should be less than .0005".
5. Inspect flywheel assembly to make sure you have the correct style, diameter, stroke, and mainshafts are correct for your application. See identification chart above.

Flywheel Installation

1. Replace the pinion shaft bearing in the right side crankcase with a new bearing. Follow factory procedures.
2. Check flywheel and connecting rod to crankcase clearances. This is of particular importance with longer than stock strokes.
 - a. Install flywheel assembly in right crankcase only.
 - b. Assemble pistons without rings on their proper connecting rods. Installation of wristpin clips is not necessary.



Picture 1



Picture 2



Picture 3

NOTE - Rear piston has piston to piston clearance notch machined in piston skirt, place notch toward center of engine.

- c. Install both cylinders and temporarily secure each cylinder with one nut.
- d. Rotate flywheel to positions where connecting rods are closest to crankcase and cylinder spigots in front and rear. There must be a minimum of .060" clearance between connecting rods and crankcases or cylinder spigots. **See Picture 2, above.**
- e. Clearance crankcases or cylinder spigots if needed by grinding or machining material from areas of contact or insufficient clearance. Connecting rod to crankcase clearance is usually not a problem with S&S Stroker kits, but if engines are built with longer strokes or heavier connecting rods a potential for contact exists.
- f. If the right crankcase half requires clearancing, the left crankcase half will also require clearancing. Clearance as needed.

NOTE - If clearancing is required, tape off the bearings to prevent chips from getting into bearings.

- g. Disassemble cylinders and pistons. Remove flywheel assembly from right crankcase.
3. Clean all lower end parts for final assembly.
 4. Thoroughly clean crankcase mating surfaces with solvent and a shop-quality scrubbing pad to remove any residual gasket material from the sealing surfaces.
 5. Wash the cases in warm soapy water, rinse and blow dry. Wipe them one last time with a clean, dry cloth.

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.

6. If flywheel assembly is to be installed in 2003-later stock Harley-Davidson® crankcases with straight roller sprocket shaft bearing, follow installation procedure and specifications in Harley-Davidson service manual.

NOTES

- 1999-'02 Harley-Davidson® big twin engines have Timken® sprocket shaft bearings. Stock 2003 and later engines use the same roller type bearing for the sprocket shaft that is used on the pinion shaft.
- S&S offers two styles of flywheel assemblies to accommodate both styles of crankcases. One style is designed for use with Timken® sprocket shaft bearings. They will fit directly in stock 1999-'02 Harley-Davidson® crankcases, all S&S crankcases for 1999-later big twin engines, and 2003 and later Harley-Davidson cases which have been updated to accept Timken® sprocket shaft bearings. These flywheels may be used in 2003 and later engines if Harley-Davidson® bearing kit #24004-03B is installed.
- If installing #24004-03B bearing kit, verify that it contains 24604-00D or 24607-07 sprocket shaft bearing. Do not use a 24604-00, 24604-00A, 24604-00B or 24604-00C bearing.
- S&S also produces flywheel assemblies that are a direct replacement for 2003 and later big twin engines and includes a bearing race for the stock roller bearings installed on the sprocket shaft.

7. If flywheel is to be installed in stock 1999-'02 crankcases, S&S crankcases, or 2003-later stock crankcase which have been converted to Timken® sprocket shaft bearings, follow steps 8 through 30.

NOTE - S&S recommends that Timken® bearing end play be checked before final assembly of the flywheels in the crankcases. The simplest way to do this is to make a "slip-fit" test sprocket shaft. Turn the diameter of a used sprocket shaft down about .002" so that the Timken bearing will slide easily over it for this test. Weld a vise tab on the flywheel end of the shaft so it can be held securely in a large vise. **SEE PICTURE 3, ABOVE**

8. Clamp the test shaft in a vise with the shaft pointing straight up.
9. Slide the inner bearing over the test sprocket shaft.
10. Put the left crankcase half over the inner bearing. Do not oil the bearings for this test.
11. Slide the Timken bearing spacer over the test shaft followed by the outer bearing.
12. Load the bearing with either a sprocket shaft nut and spacer or a bearing installer tool.
13. Attach a dial indicator to the work bench or the sprocket shaft, and place the probe on the crankcase near the sprocket shaft. Check the amount of endplay in the bearing by moving the crankcase up and down, noting the readings on the dial indicator.



Picture 4

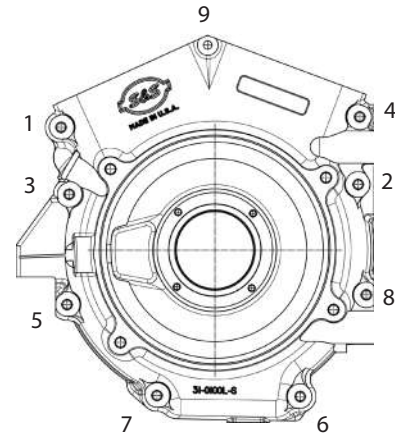
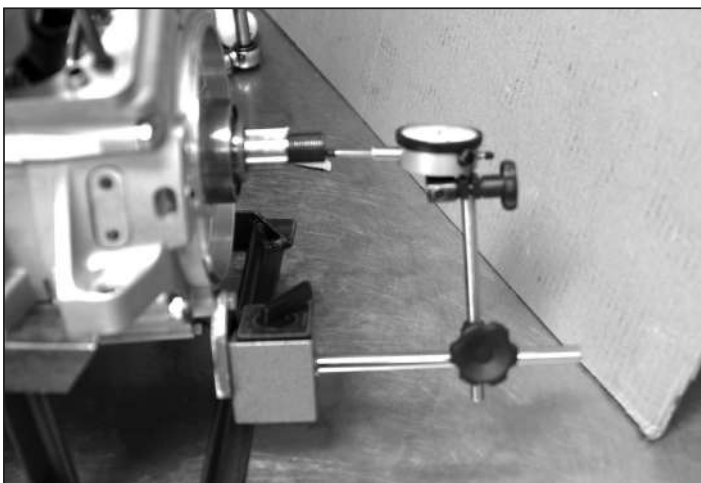


Fig. 1

14. Endplay should be between .001" and .005". If endplay is less than .001" a thicker spacer must be used. If endplay is greater than .005" a thinner spacer must be used. When the bearing end play is within specification, the flywheels can be installed in the crankcases.
15. Support the flywheel assembly in a stand with the sprocket shaft straight up. A coffee can or small bucket works well for this.
16. Use a sprocket shaft bearing installation tool (such as S&S PN 53-0060) to press the inner bearing onto the sprocket shaft against the flywheel.
17. Place the left crankcase half over the sprocket shaft.
18. Install the Timken bearing spacer and position the outer Timken bearing on the shaft.
19. Use the sprocket shaft bearing installation tool to press the bearing, shaft and case together.
20. Turn the left crankcase and flywheel assembly over so the pinion shaft is straight up. Support the crankcase half so it is stable.
21. S&S® uses and recommends Threebond® 1184 to seal the joint between left and right crankcases. Apply a consistent thin coat to both cases, taking care not to get any material in a place where it could get inside the engine. Take special care not to block oil return passages.
22. Allow sealant to cure per the manufacturer's instructions and install the right crankcase half.
23. In order to assemble the right side case half S&S recommends the use of a pinion shaft guide (Jims® #1288 or similar). The guide fits over the pinion shaft **as shown in Picture 4, above**. The shaft guide positions the rollers in the right crankcase bearing so the shaft can slip through as the right case is lowered into place.
24. Install the case bolts and tighten the 5/16" fasteners to 18 ft-lbs. The center case bolt in S&S crankcases in a 1/4" bolt and should be tightened to 120 in-lbs. Use the sequence in Fig. 1, above.
25. When the crankcase has been assembled, confirm that the flywheel endplay specification is within .001"-.005".
26. Load the bearing with either a sprocket shaft nut and spacer or a bearing installer tool.
27. Mount a dial indicator on the right side of the lower end assembly. Put the indicator on the pinion shaft so it measures in and out horizontal shaft movement. **See Picture 5, below left.**
28. Rotate the shaft and push in on it, noting the indicator reading. Rotate the shaft and pull on it, noting the dial indicator reading. The difference between the two readings is the endplay—it should be between .001" and .005".
29. If endplay is not within this range, the main bearing spacer must be changed. Remember a thinner spacer will produce less endplay.
30. With the flywheel assembly installed in the crankcases, the rest of the engine may be assembled. Follow steps outlined in stock or S&S service manual. In addition, follow any special steps required for any aftermarket or high performance components used in the engine.



Picture 5

CLEARANCE SPECIFICATIONS S&S® THREE PIECE FLYWHEEL ASSEMBLY		
COMPONENT	FACTORY SPECIFICATION	SERVICE WEAR LIMIT
CONNECTING ROD SIDEPLAY	.005"-.035"	.040"
WRISTPIN CLEARANCE	.0007"-.0013"	.002"
PINION SHAFT RUNOUT*	.003" MAX	-

*w/o compensator or charging system installed



Installation Instructions: 106" S&S® Stroker Kits for Harley-Davidson® Twin Cam 88® Engines

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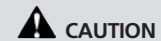
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- Before performing any installation steps disconnect battery to eliminate potential sparks and inadvertent engagement of starter while working on electrical components.
- Read instructions thoroughly and carefully so all procedures are completely 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 judgement when performing installation and operating motorcycle. Good judgement begins with a clear head. Don't let alcohol, drugs or fatigue impair your judgement. 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 inhaled. Run motorcycle in a well ventilated area where fumes can dissipate.

Introduction

Installation of the S&S® 3 $\frac{1}{8}$ " bore Stroker kit for Harley-Davidson® Twin Cam 88® engines is relatively straight forward. Assembly Procedures for the S&S Stroker kit are essentially the same as for assembly of a stock engine. In addition, a torque plate kit, S&S Part #53-0048 is available, for fitting the S&S 3 $\frac{1}{8}$ " bore pistons to stock Twin Cam 88 cylinders.

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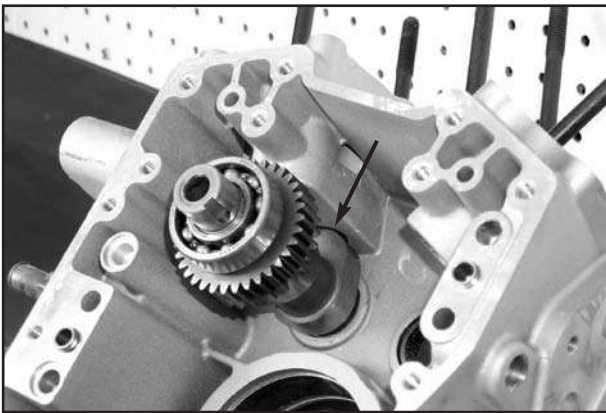
NOTE- The 106" kit requires stroker flywheels which are included with the kit. S&S® flywheels for Twin Cam 88® engines are supplied assembled and balanced. The procedure for installing an S&S flywheel assembly is the same as for stock flywheels.

Installation Steps

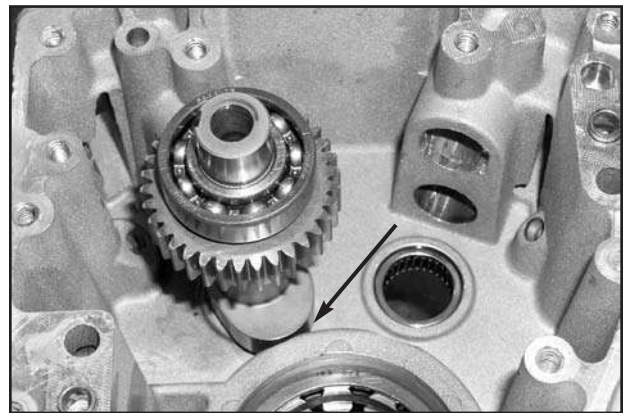
1. Prepare camside crankcase.
2. Check internal engine clearances and assemble crankcases.
3. Final assembly.
4. Engine break-in procedure.

Installation

1. Prepare Camside Crankcase
 - A. Refer to appropriate service manual. Remove engine from frame. Disassemble engine and split crankcases.
 - B. Temporarily install cams to be used in camside crankcase. Refer to S&S cam installation instructions. Turn cams at least one full rotation, and note any clearance problems between the cam lobes and the crankcase. Pay particular attention to pinion bearing boss and tappet guide boss areas.
 - C. Machine material from crankcase to achieve .030" clearance between cam lobes and crankcase. See **Picture 1 & 2.**



Picture 1



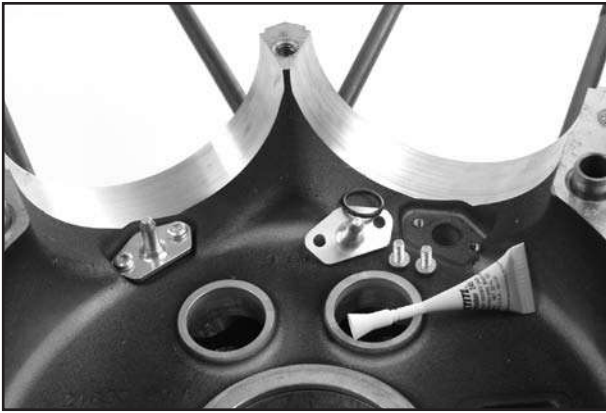
Picture 2

Clearance between cam lobes and crankcase must be checked at pinion bearing boss and tappet guide boss. Grind or machine case to achieve .030" minimum clearance.

CAUTION

Clearance between cam lobes and crankcase must be checked at pinion bearing boss and tappet guide boss. Machine case to achieve .030" minimum clearance.

- D. Install piston oiler kit, S&S Part #31-2026. Lubricate o-ring with engine oil. Apply Loctite® 243 to threads of machine screws. Install and torque to 25 in-lbs. See **Picture 3.**
2. **Check internal engine clearances and assemble crankcases.** Many clearance checks can be made at the same time that some assembly steps are performed. This can save time for the engine builder.
 - A. Cylinder to piston fitment.
 1. The 106" Stroker 3 $\frac{1}{8}$ " bore pistons, S&S piston series 92-1210, require a clearance of .002"-.0025" to cylinder bore. S&S recommends that torque plates be installed on cylinders when boring and honing to achieve proper fitment tolerance.
 2. Identify front and rear pistons. The rear piston will have a notch machined into the piston skirt for clearance with the front piston. This notch must face the center of the engine, towards the front of the motorcycle.
 3. Check piston ring gap. Install piston ring into finished cylinder and square-up ring to bore using the piston. The required ring gaps are as follows:
Top two compression rings .016" - .022"
Oil control rings (rails) .015" - .035"
File or grind ring ends as necessary to establish proper end-gap.
 4. Wash finished cylinder in hot, soapy water to remove honing abrasive from cylinder bore. Rinse with clean water and apply a light oil to the bore to prevent rust.



Picture 3



Picture 4

⚠ CAUTION

Cylinders that have not been cleaned with soap and hot water will release abrasive into the oil as the engine reaches operating temperature, resulting in accelerated wear of internal engine components, greatly reducing engine life.

B. Piston to head clearance,

1. Install flywheel assembly in right crankcase only.
2. Assemble pistons without rings on their proper connecting rods. Installation of wristpin clips is not necessary.

NOTE - Rear piston has piston to piston clearance notch machined in piston skirt, place notch toward center of engine.

3. Install both cylinders and temporarily secure each with one nut.
4. Rotate flywheel to position where pistons are at TDC. Piston deck should be flush with cylinder head gasket surface.

NOTE - The stroker engine is designed with .045" piston to head clearance (squish), which is provided by thickness of head gasket. Therefore, pistons at TDC should be flush with head gasket surface of cylinders. If pistons are higher than cylinders at TDC, then something is wrong and S&S® should be notified.

⚠ CAUTION

Insufficient clearance between piston domes and cylinder heads will damage pistons, heads and/or other engine components.

C. Connecting rod to crankcase clearance.

1. Rotate flywheel to positions where connecting rods are closest to crankcase and cylinder spigots in front and rear. There must be a minimum of .060" clearance between connecting rods and crankcases or cylinder spigots. **See Picture 4.**
2. Clearance crankcases or cylinder spigots if needed. Connecting rod to crankcase clearance is usually not a problem with S&S Stroker kits, but if engines are built with longer strokes or heavier connecting rods a potential for contact exists.

NOTE - If clearancing is required. Tape off the pinion and cam bearings to prevent chips from getting into bearings.

D. Piston to piston clearance.

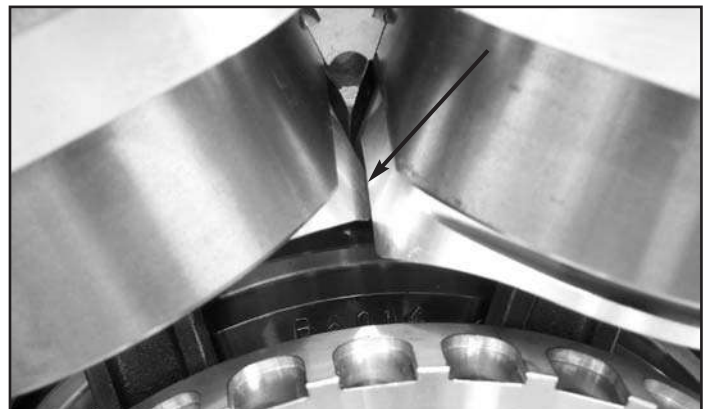
1. Rotate flywheel to position where pistons are closest to each other. **See Picture 5.** Check clearance between pistons.

NOTE - A minimum of .060" clearance is required between pistons at the closest point.

2. If additional clearancing is needed, disassemble cylinders and pistons and carefully file edge of piston skirts until clearance is obtained. Clean all parts.

E. Piston to piston oiler clearance. This step can be done at the same time as Step C above.

1. Rotate flywheel to position where rear piston is at bottom of travel.
2. Check clearance between piston skirt and piston oiler. **See picture 6.**
3. Repeat for front piston.
4. If clearance between piston skirts and piston oilers is less than .060", install S&S Piston Oilers (PN 31-2026).
5. Recheck clearance before final assembly.



Picture 5



Picture 6

F. Assemble lower end - final assembly.

1. Disassemble cylinders and pistons. Remove flywheel assembly from right crankcase.
2. Clean all lower end parts for final assembly.

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.

3. Install flywheel assembly. Follow factory procedure.
4. Bolt crankcases together. Use S&S® torque specs for crankcase bolts. Torque case bolts in two stages to 10 ft-lb. and finally 15 ft-lb. in the sequence shown in **Figure 1**.
5. Assemble gear case components. Follow S&S instructions if installing S&S gear drive cams. Follow factory procedures for all other components.

G. Check valve pocket fit.

1. Install pistons without piston rings on correct connecting rods. Install cylinders.
2. Turn engine over until piston in front cylinder is at top dead center. Paint area around valve pockets on pistons with machinist's blue.
3. Place valves in cylinder head leaving off springs and retainers. Place head on cylinder and secure with one bolt.
4. Lower valves until they contact piston. Rotate valve, marking painted area.
5. Remove head and check points of contact. Valve should fit in valve pocket machined in piston dome.
6. If insufficient clearance exists, remove piston and machine valve pocket until head of valve fits flush.
7. Repeat procedure for other cylinder head.

H. Check Valve to piston clearance at TDC.

1. Spread layer of putty into valve pockets in both pistons.
2. Assemble cylinder heads and bolt on cylinders with head gaskets in place. Install rocker covers and pushrods. Adjust pushrods so the hydraulic piston in tappet is bottomed in the tappet bore or on the HL₂T washer if used. This insures that tappets can not bleed down so valve position will be accurate for clearance check.

*NOTE- The earlier Harley-Davidson® Twin Cam 88® lifters, H-D® part numbers 18538-99 & 99A, require the S&S HL₂T kit number 33-5339. Later lifters, H-D® part number 18538-99B, require the S&S HL₂T kit number 33-5338. Both kits are included with the stroker engine kits, and either kit is installed & adjusted the same way - remove the retaining clip from the top of the lifter, and remove the piston assembly and spring from lifter body. Place the appropriate HL₂T travel limiter into the bore of the lifter and replace removed components in the order that they were removed. **See Picture 7.***

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3. Turn engine over in normal direction of travel two complete revolutions.
4. Disassemble engine and check thickness of putty in valve pockets.

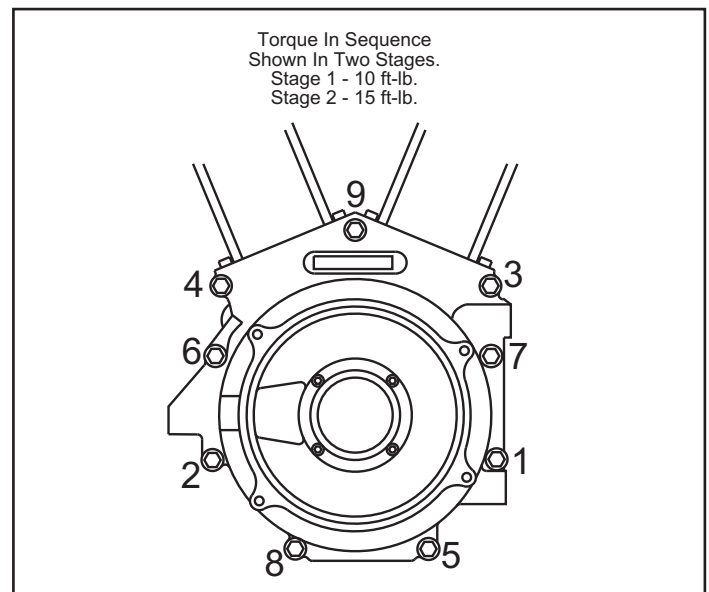


Figure 1

NOTES:

- S&S® recommends at least .060" clearance around periphery of valve.
- S&S recommends at least .060" clearance between intake valve and piston valve pocket recess, and .080" between exhaust valve and piston valve pocket recess.
- When checking valve to piston clearance pushrods must be adjusted so the hydraulic piston in tappet is bottomed in the tappet bore or on the HL₂T washer if used. This insures that tappets can not bleed down so valve position will be accurate for clearance check.

⚠ CAUTION

Insufficient clearance between piston and valves may cause them to contact each other during operation resulting in damage to piston and valve train components.

5. If insufficient clearance exists, machine piston until proper clearance is achieved.
6. Disassemble top end and clean all parts for final assembly.

3. Final assembly.

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 drill bits and compressed air to clean all oil passageways of dirt, filings, etc. whenever possible. All iron or steel parts should be coated with engine oil immediately after cleaning to prevent rust. During actual final assembly, recoat all internal parts with high quality engine oil.

⚠ CAUTION

Manufacturing chips, dirt and/or other contaminants circulating in engine oil may possibly damage engine components resulting in shorter engine life and possible engine failure.

⚠ WARNING

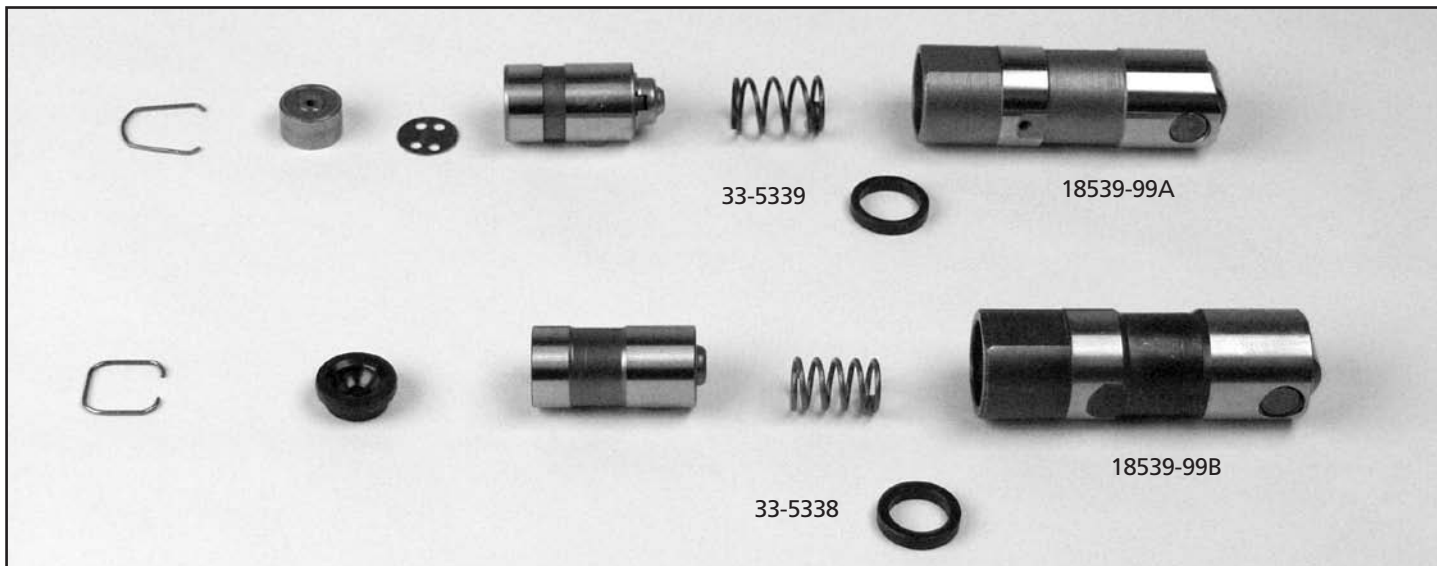
- Some solvents, degreasers and other chemicals are harmful to skin, eyes and other body parts. Many items are flammable and present a fire hazard. Read manufacturer's instruction label for proper use. Use in well ventilated area and wear protective clothing when using them to avoid personal injury.
- 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 yourself and other people near you.

- A. Head gasket surface flatness check. Before top end is assembled, head gasket to cylinder mating surfaces should be checked.

⚠ CAUTION

Incomplete contact between gasket surfaces of cylinders and cylinder heads may cause combustion leakage possibly resulting in damage to cylinders and/or other engine components.

1. Thoroughly clean head and cylinder gasket surfaces.
2. Place straight edge across head gasket surface at different places around diameter to determine flatness.
3. If unevenness is revealed, machine head gasket surface just enough to make complete contact.



Picture 7



Picture 8

- B. Top end assembly procedure.
1. Thoroughly clean all top end parts and blow dry with compressed air. Use high grade lacquer thinner on gasket surfaces.
 2. Apply an assembly lube to the wristpin and wristpin bushing in the connecting rod. Install pistons on connecting rods, keeping note of proper placement and orientation. Install piston rings.
 - a. Install oil ring support rail in the bottom of the oil ring groove. **See Picture 8.**
 - b. Install oil ring separator and the oil control rings.
 - c. The plain cast ring is to be installed in the second ring groove, dot facing up.
 - d. The chrome-faced ring is to be installed in the top ring groove, either side up.
- Install wristpin retaining clips.

NOTE - S&S® recommends the use of clip installer, part number H-D® 42317, available from Kent-Moore, through Harley-Davidson®, or similar tool, for clip installation.

All reference to Harley-Davidson® part numbers is for identification purposes only. We in no way are implying that any of S&S® Cycle's products are original equipment parts or that they are equivalent to the corresponding Harley-Davidson® part number shown.

3. Coat piston skirts with engine oil and install cylinders.
4. Install head gaskets dry. Be sure head gaskets are properly positioned.
5. Before installing heads spin each head bolt down on its respective stud to be sure threads are clean and free of contamination. Place a drop or two of oil on threads and under head 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 that these steps must be done carefully. Maintaining a good head gasket seal depends on it.

CAUTION

Improper torquing sequence and head bolt torque values may cause head gasket failure.

6. Bolt heads on cylinders. Follow the stock bolt tightening sequence, and use stock three stage procedure and torque values shown in Figure 2. **See Figure 2.**

IMPORTANT NOTE - Proper first time engine start-up and break-in is critical to achieve permanent and lasting head gasket seal. Follow "Engine Break-In" procedures at end of section.

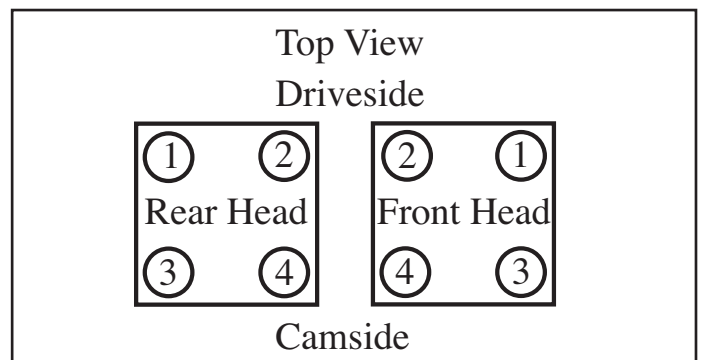
CAUTION

Improper first time engine start-up and break-in procedure may cause head gasket failure.

7. Finish assembling top end per Harley-Davidson® specs. Install pushrods and adjust.

NOTE - The earlier Harley-Davidson Twin Cam 88® lifters, H-D® part numbers 18538-99 & 99A, require the S&S HL₂T kit number 33-5339. The later lifters, H-D® part number 18538-99B, require the S&S HL₂T kit number 33-5338. Both kits are included with the Stroker engine kits, and either kit is installed & adjusted the same way - remove the retaining clip from the top of the lifter, and remove the piston assembly and spring from lifter body. Place the appropriate HL₂T travel limiter into the bore of the lifter and replace removed components in the order that they were removed. To adjust pushrod, rotate engine until the lifter is at its lowest point, collapse the lifter with the pushrod until it bottoms against the travel limiter, and then shorten the pushrod one complete turn (6 flats of the adjuster). Tighten the locknut of the pushrod adjuster. Repeat for remaining pushrods.

NOTE - If S&S compression releases are to be installed, it is much easier to install them before rocker covers are installed and the engine is installed in the frame. S&S die-cast rocker covers for Harley-Davidson Twin Cam 88 or similar rocker covers with a center hole must be used if S&S electric compression releases are to be installed.



	S&S® Heads or Stock Heads
Stage 1	7 Ft.-Lbs.
Stage 2	14 Ft.-Lbs.
Stage 3	Turn additional 90°

Figure 2

8. Clean oil tank and oil cooler, if applicable, and flush or replace oil lines before installing engine in frame.

CAUTION

If engine is run with foreign material in the oil tank, engine damage will occur. Engine damage caused by foreign material in the oil tank is not covered under the S&S® warranty.

4. Engine break-in procedure.

NOTE - S&S engines are designed for high performance and as such are not 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.

- 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 1000 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.
- I. Have Fun!

Performance Notes:

- *Ignition system - S&S engine kits for Harley-Davidson® Twin Cam 88®, we recommend that an aftermarket or high performance ignition module be used. Engines built with S&S kits have higher than stock compression ratios, performance cams, and in some cases cylinder heads with combustion characteristics that are different from stock. These and other factors effect the ignition requirements of the engine. Programmable ignition systems allow ignition maps to be optimized for a specific application, but should be programmed by a qualified technician. Consult the ignition manufacturer for recommendations regarding use of a specific ignition system with large displacement high compression engines.*
- *Spark plugs - Use spark plugs and wires that are compatible with the ignition system. Dual plug installations in S&S Super Stock® heads are not generally necessary.*
- *All S&S test engines are run using S&S carburetors. S&S Super E and G carburetors are recommended for most applications with the Super G being used more often on larger displacement, freer breathing engines with higher compression ratios. Typically, engines equipped with S&S heads require the same or slightly leaner jetting than those engines fitted with stock heads. Consult the carburetor jetting instructions for specific jetting recommendations.*
- *If another type carburetor is used, it must be made to run rich enough to operate properly and to prevent engine damage. If you have a problem with another carburetor, S&S cannot help you and recommends you call the carb manufacturer with any questions you may have.*
- *If the motorcycle is used exclusively on a drag strip where engine temperatures vary, slightly richer jets may be necessary for best performance. Larger jets/richer mixtures will enable one to run a colder engine which is sometimes desirable. This is best determined by experimentation.*

Performance notes, continued

- Carburetor jetting and spark plug color - While spark plug color may be used to help determine carburetor jetting, S&S® recommends that our instructions be used as primary jetting guide and that plug color indications be used only as secondary aid. We have found that different brands of gasoline, gasoline additives, engine heat (due to ignition timing), and brands of plugs and heat range used distort plug color drastically making plug reading difficult for the average tuner. Also, new plugs usually require a road test of 10 miles or more to properly develop the color which means that quarter mile tests may not be long enough and hence, not always a good indication of carb jetting. It is best to use recommended spark plug type and to consult the spark plug manufacturer if you have questions.

Exhaust Systems

- Drag pipes - While drag pipes can be used with good results to achieve top end horsepower, they are generally not recommended for street applications. Carburetor adjustment and jetting is generally easier for engines with muffled exhaust systems.
- Muffler systems: Most stock and many aftermarket exhaust systems are too restrictive and made exclusively for looks with little consideration given to performance. A very good, economical street system consists of the stock header pipes with the crossover tube and a set of low restriction S&S mufflers. These mufflers work very well in most situations and offer an inexpensive alternative to a whole new exhaust system. Low restriction S&S mufflers and stock header pipes will typically produce 10 hp more than drag pipes in the midrange. Since the midrange is where the vast majority of normal riding occurs, it makes this system ideal for the street.

Gearing

- Gearing depends on the total weight of the machine and rider, the size of the engine, cam, exhaust system and type of riding to be done. Most high performance engines, and particularly those with larger displacements, are capable of pulling more gear. We suggest you break the engine in with stock gearing to minimize the load on the engine. After the engine is broken in, you will have a better feel of its potential and can change gearing accordingly.
- For those who wish to determine their final drive gear ratio the formula is as follows:

Engine Revolutions per One Revolution of Rear Wheel=

$$\frac{(\text{Clutch Sprocket}^*) \times (\text{Rear Wheel Sprocket}^*)}{(\text{Motor Sprocket}^*) \times (\text{Transmission Sprocket}^*)}$$

* Number of teeth on each sprocket.

Compression

- Generally speaking, while engines with higher compression ratios make more horsepower and perform better, they also tend to lose that performance edge faster, require more maintenance, are harder to start, and require better gasoline. As a rule, we recommend a compression ratio of no greater than 11:1 for engines used in normal street operation. A word of caution is in order. Before building an engine that may be unsuitable for your application, carefully consider your riding needs, riding style and overall performance objectives.