

Instruction sheet No. 2002
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General Flywheel Instructions

SAFE INSTALLATION AND OPERATION RULES:

Before installing your new S&S flywheels 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 compressed air is used during installation, be particularly careful. Compressed air and particles dislodged using compressed air are harmful to eyes and body. Wear protective goggles, and always direct air stream away from body parts such as hands and eyes and other people near you.
- When using solvents, degreasers and other chemicals during cleaning and installation, read manufacturer's instruction label for proper use. Exposure of some chemicals to skin, eyes and other body parts may be harmful. Many items are flammable and present a fire hazard. Use in well ventilated area and wear protective clothing when using them to avoid personal injury.
- 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.
- Consult an appropriate authorized H-D service manual for correct disassembly and reassembly procedures for any parts other than those outlined in these instructions.
- 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.
- To prevent possible engine flooding and overspill of gasoline on surrounding area which is a fire hazard, make sure float settings are correct and carburetor needle and seat assembly works freely and shuts off supply of gasoline after installation is completed. Always shut off fuel petcock when engine is not running.
- Be sure all fuel lines, supply and overflow, are routed correctly and fuel line clamps are in place and tightened. Lines must not contact exhaust pipes or other extremely hot surfaces where they could melt or leak and catch fire.
- Before starting engine and riding motorcycle, be sure throttle opens and closes smoothly. Turn handlebars to left and test throttle. Then, turn bars to right and test throttle. To avoid possible loss of control of motorcycle and potential personal injury to yourself or others due to throttle sticking in open position, throttle must work smoothly and return to a fully closed position when hand is removed from throttle grip.
- Motorcycle exhaust fumes are toxic and poisonous and must not be breathed. Run motorcycle in a well ventilated area where fumes can dissipate.

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 six (6) 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 6 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 motorcycles. S&S shall have no warranty or liability obligation if an S&S part is used in any other application.

DISCLAIMER:

S&S parts are designed for high performance, off road, racing applications and are intended for the very experienced rider only. The installation of S&S parts may void or adversely effect 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.

**PRESENT S&S CRANKCASES AND FLYWHEELS
ARE NOT COMPATIBLE WITH HARLEY-DAVIDSON
ELECTRONIC FUEL INJECTION (EFI) MODELS.**

IMPORTANT NOTICE:

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

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

WARNING

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

CAUTION

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

NOTE

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

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

NOTES

● All current production S&S flywheels are made from closed die, heat treated, steel forgings. They do not have connecting rod thrust washers like earlier S&S or stock flywheels, because present flywheel material is harder than thrust washers previously used.

● S&S Big Twin flywheels have three timing marks, "F", "R" and "TF". The "F" mark stands for front cylinder 35° before top dead center (TDC). The "R" mark is rear cylinder 35° before TDC. The "TF" mark is TDC front cylinder.

● S&S Ironhead Sportster style flywheels have three timing marks, "F", "R" and "TF". The "F" mark stands for front cylinder 40° before top dead center (TDC). The "R" mark is rear cylinder 40° before TDC. The "TF" mark is TDC front cylinder.

● S&S V2 Sportster style flywheels have three timing marks, "F", "R" and "TF". The "F" mark stands for front cylinder 30° before top dead center (TDC). The "R" mark is rear cylinder 30° before TDC. The "TF" mark is TDC front cylinder. S&S V2 Sportster style flywheels have timing marks on both flywheels to accommodate four speed and five speed engines.

● We recommend that "big inch" Evolution style engines be timed at 30-32° before TDC rather than the stock 35° for Big Twins or 40° for Sportsters. When "F" timing mark is located in the center of the timing hole, the crankshaft is positioned 30° before TDC for Sportsters or 35° before TDC for Big Twins for the front cylinder. When "R" timing mark is located in the center of the timing hole, the crankshaft is positioned 30° before TDC for Sportsters or 35° before TDC for Big Twins for the rear cylinder. Placing the mark to the rear of the hole, or just entering the hole, advances timing almost 5°. Conversely, if the mark is just leaving the hole, timing is retarded almost 5°.

● Usually S&S flywheels are balanced before leaving our facility. Some customers prefer to do their own balancing or to have another balancing shop do the work for them. This is acceptable in most cases.

CAUTION - Flywheels assembled improperly prior to being dynamically balanced may sustain irreversible damage to mainshaft and crankpin tapers during actual balancing. S&S voids its guarantee if flywheels have been balanced in this fashion.

● Many problems in assembling and truing flywheels can be prevented by careful inspection of all parts used in the assembly.

● 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 drills and compressed air to clean all oil passageways of dirt, filings, etc. whenever possible. During actual final assembly, recoat all internal parts with high quality engine oil or assembly lube.

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

WARNINGS

● Some solvents, degreasers, gasoline and other chemicals are harmful to skin, eyes and other

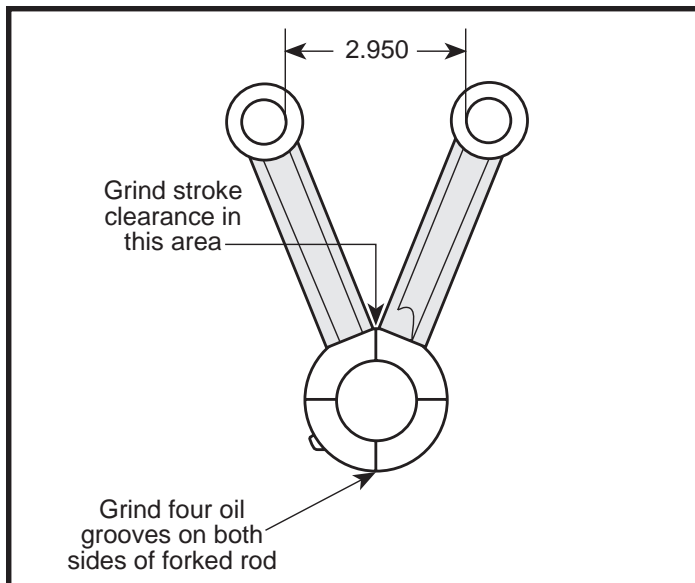


Figure 1

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 body parts such as hands and eyes. Never direct compressed air toward other people.

- S&S pinion shafts for Evolution Sportsters are the 1987 style splined shaft because this design is stronger than the later style stock straight shaft and key. As a result, the engine builder must use a 1986-1987 style pinion gear (HD #24055-86 through #24061-86) and oil pump drive gear (HD #26318-75). Stock Torrington style pinion main bearing in 1986 crankcases must be replaced with 1987 and later style race and steel caged roller bearing.

Assembly Instructions

1. Connecting Rod Preparation (All)

NOTE - If S&S connecting rods are used, follow instructions that accompany rods since rod preparation below has already been done.

If S&S rods are not used, perform following steps:

- To insure adequate oil on sides of rods and matching thrust surfaces of flywheels, S&S

recommends that four grooves be ground on each side of both front and rear connecting rods. **See Figure 1.** Make these grooves .020" to .030" deep and .030" to .040" wide and should be ground 90° from each other. After making grooves, remove all sharp edges and burrs with emery cloth.

- With rods assembled on crankpin and bearings, measure distance between rods at closest points in wristpin holes. If measurement as shown in **Figure 1** exceeds 2.950" for rods with .792" wrist pins or 2.850" for rods with .892" wrist pins, grind female rod at points where male rod makes contact to achieve sufficient clearance.

NOTES

- Rods clearanced to this dimension provide adequate clearance for strokes up to and including 5". Do not remove any more material than is necessary to obtain required clearance.
- Use of .892" diameter wrist pins with stock connecting rods is not recommended.

CAUTION - Inadequate clearance between rods or too much clearancing on rods will cause unwarranted stress on connecting rods, rod bearings, pistons, etc. resulting in possible failure of one or all aforementioned parts.

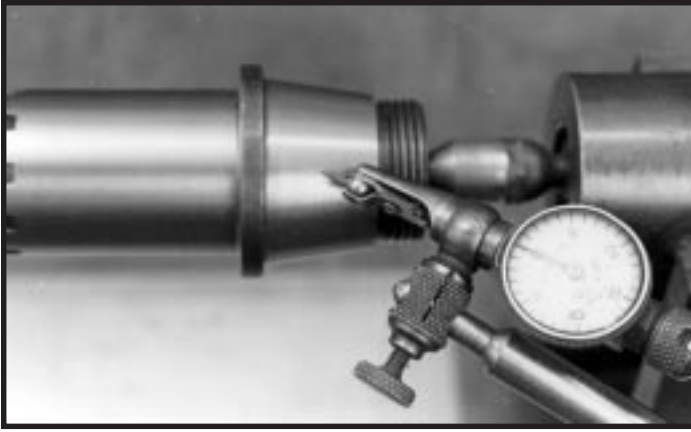
- Thoroughly clean all parts to remove dirt, filings, etc.

CAUTION - Burrs, dirt, filings, etc. left on connecting rod components may circulate in oil damaging other parts possibly causing engine failure.

2. Inspect and Clean All Parts

- Flywheel type and style can be determined from coded information in serial number. Check serial number of flywheels to insure that flywheels are the correct type and stroke for application. Refer to flywheel identification information on **Page 7**.
- Thoroughly clean all parts to be used. This includes mainshafts, main bearings, connecting rods, rod bearings, keys and flywheels including tapers and key ways.

CAUTION - Burrs, dirt, filings, etc. left on flywheel assembly parts may circulate in oil damaging other parts possibly causing engine failure.



Picture 1

C. Check both mainshafts between centers for taper surface to bearing surface concentricity. Make sure centers on shafts are clean beforehand. If tapers and bearing surfaces are concentric with each other and with center, then truing will be easier. **See Picture 1.**

NOTE - S&S shafts should not require checking as runout on ground taper and bearing surfaces on S&S shafts is .0003" or less.

D. Inspect key ways and oil holes in flywheels for burrs. Remove burrs if necessary.

NOTE - S&S does not recommend lapping tapers to remove burrs. This practice tends to distort the taper by removing material unevenly around the circumference. This makes flywheels difficult if not impossible to true. In addition the lapping process work hardens the surface of the taper. The resultant hard surface makes it very difficult to pull shaft or crankpin into taper. If crankpin and shafts are not pulled fully into flywheel tapers, excessive rod side play and assembly width may result. Lapped flywheel

tapers are also very difficult to resurface if repairs are ever needed.

CAUTION - S&S warranty is void if flywheel tapers are lapped.

E. Check keys in groove of shafts. Keys should be light hand press fit in grooves. If key is too tight in groove, sand side key with fine sand paper on a metal plate or other flat surface. Do not hammer key into groove.

CAUTION - Hammering tight key into groove may result in irreparable damage to shaft.

F. With key in shaft, insert into respective tapered hole in flywheel and check to see that key does not bottom in groove. If key bottoms out, file flat side of key, not rounded side, until shaft with key in place fits in flywheel without bottoming out. Check crankpin and crankpin key also.

3. Lower End Assembly

A. Reclean mainshaft tapers, crankpin and flywheel tapers with lacquer thinner.

B. Assemble mainshafts in respective flywheels. Lightly coat taper and threads of each shaft with green Loctite during assembly. Install crankpin in camside flywheel using Loctite also. Refer to table below for torque specifications.

CAUTION - If stock torque specs are exceeded with stock mainshafts damage to the mainshaft may result.

C After camside flywheel, pinion shaft and crankpin are assembled, blow air through pinion shaft oil feed hole to check for blockage or misalignment of oil feed passages.

S&S FLYWHEEL ASSEMBLY TORQUE SPECIFICATIONS			
BIG TWIN			
	Stock H-D Shafts	S&S Shafts (Street)	S&S Shafts (Racing)
Sprocket Shaft	290 - 320	400 - 450	450 - 500
Pinion Shaft	140 - 170	275 - 300	275 - 300
Crankpin Nut	180 - 210	350 - 400	450 - 500
SPORTSTER			
	Stock H-D Shafts	S&S Shafts (Street)	S&S Shafts (Racing)
Sprocket Shaft	100 - 120	340 - 360	350 - 400
Pinion Shaft - IH XL	100 - 120	180 - 200	200 - 250
Pinion Shaft - V2 XL	100 - 120	340 - 360	350 - 400
Crankpin Nut	150 - 075	290 - 310	350 - 400 *

* Using S&S sprocket shaft on crankpin.



Picture 2



Picture 3

CAUTION - Partially or completely blocked oil feed passageways may cause irreversible damage to connecting rod bearings and other engine components. Flywheels or connecting rod bearings damaged as a result of blocked oil passageways that were not checked during assembly are not covered under warranty.

D. Measure width of female rod on crankpin end.

See Picture 2. Measurement should be 1.743"-1.745" for Big Twins, and 1.481"-1.483" for Sportsters.

E. A pre-assembly connecting rod side play check should be done before final assembly to determine if connecting rod side play will fall within the specified .015"-.035" range when crankpin nuts are final tightened. Assemble left and right flywheels on crankpin without rods. Moderately snug crankpin nuts. Do not worry about flywheels being true. Measure distance between connecting rod thrust pads on flywheels. **See Picture 3.** Rod side play will be reduced by about .015" when crankpin nut is final tightened. Therefore, distance between flywheel thrust pads as measured in this check must be .030"-.050" greater than female rod width measured in **Step D**. For example, if a Big Twin female rod measures 1.744", the distance between flywheel pads must be 1.774"-1.794". If difference between pad to pad distance and female rod width is less than .030", female rod must be surface ground on sides to provide more clearance. Take equal amounts off each side if more than .010" is to be removed. If more than

.050" must be removed from female rod width or if difference between pad to pad distance and female rod width is greater than .050" a different crankpin should be tried. If side play is incorrect and different crankpins do not correct problem, contact S&S.

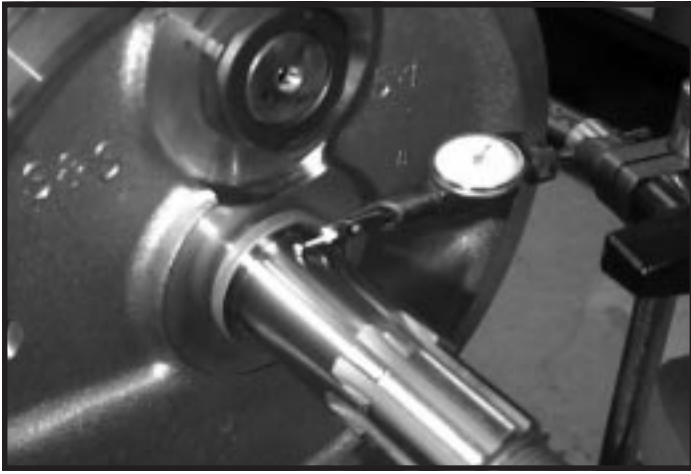
NOTE - S&S recommended rod side play is .015" to .035". If material is removed from sides of female rod, overall width of bearing cages must be reduced so bearings and cages are free to float with rods without contacting flywheel thrust pads. Bearing cage side clearance of .008 to .020 less than rod width is recommended.

CAUTIONS

- **Incorrect connecting rod side play may cause excessive rod side thrusting and potential damage to rods, flywheels and other engine components.**
- **Connecting rod bearing and cage assemblies that are wider than female rod may become damaged upon contact with flywheel thrust pads. Abrasive particles from damaged rod bearings may circulate in oil and cause damage to other engine parts.**

J. Finish assembling flywheels and rods. See S&S Flywheel Assembly Torque Specification table. Check final connecting rod side play with feeler gauge.

K. Check flywheel assembly for run out by placing ends of mainshafts between centers. Place dial indicators on bearing surfaces of mainshafts. True wheels as needed. Although H-D factory specs allow .001" runout which is acceptable, S&S trues



Picture 4

flywheel assemblies to .0005" or less runout on either mainshaft bearing surface. **See Picture 4.**

NOTE - When truing flywheels, runout measurements must be taken on mainshaft bearing surfaces. Do not take measurements on flywheel rims. Flywheel rim will show runout that is not a valid indication of mainshaft concentricity.

CAUTION - If it is necessary to strike the rim of the flywheels during the truing procedure, a lead hammer should be used to avoid damaging the flywheel rim. If rim is dented it may be impossible to recondition mainshaft tapers due to difficulties indicating center of taper.

4. Installation

A. For engines of 4½" or longer stroke, the oil return holes in the stock location must be plugged, and the crankcase must be modified to use the lowered oil return holes. This modification is necessary due to

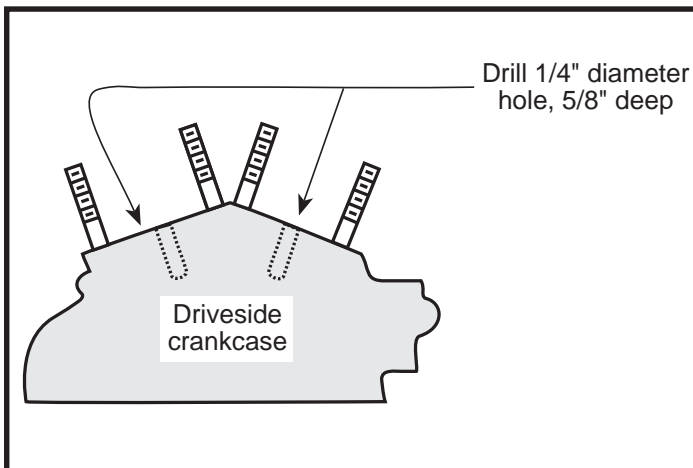


Figure 2



Picture 5

increased piston travel in longer stroke engines. Oil control ring position will be below stock cylinder oil return hole at the bottom of the stroke. If modification is not done, oil will be carried to the combustion chamber by piston rings causing engine to smoke.

NOTE - Engines with strokes shorter than 4½" stroke or shorter do not require this step.

1. If using stock cylinder base gaskets, place base gasket on cylinder base gasket surface, and punch ¼" hole in gasket directly in center of oil return hole in base gasket surface of cylinder. S&S gaskets are pre-punched.
2. Place gasket on driveside crankcase half in its respective position. Mark crankcase gasket surface through ¼" diameter hole in gasket.
3. Drill ¼" diameter hole perpendicular into crankcase gasket surface ⅝" deep. **See Figure 2.**
4. Perform **Steps 1 through 3** on other cylinder.
5. Bolt front and rear cylinders on drive side crankcase half.
6. Using lower oil return hole in cylinder spigots as a guide, drill ¼" diameter connecting holes in crankcase to intercept holes drilled ⅝" deep in **Step 3**. **See Figure 2 and Picture 5.**

NOTES

- If base plates are to be used, be sure they are in place.
- Lower oil return hole in current production S&S cylinders is ½" on center below base gasket surface of cylinder. This dimension allows the use of up to 5" stroke using a ⅛" thick base plate. Some early

production cylinders have lower oil hole located about $\frac{5}{16}$ " on center below gasket surface. These early production cylinders can be used with strokes up to $4\frac{3}{4}$ " where base plates are not used.

G. Clean dirt, filings, etc. out of passageways.

H. Press a piece of $\frac{3}{4}$ " long x $\frac{3}{8}$ " O.D. steel tubing (Part #93-1032) provided in kit into oil return hole in base gasket surface until tubing is flush with surface. "Ream" hole slightly with drill to remove any burrs that may exist.

NOTE - A very tight press fit with 100% seal is not critical as tube will sufficiently divert oil flow to new hole. Loctite may be applied to tube if fit seems too loose.

NOTES

- When pressing Timken bearings on sprocket shaft, be sure to lubricate the shaft. If this is not done the bearing may gall on the shaft and become stuck.
- Big Twin engines using 1958 and later style pinon shafts may be assembled with any of the different styles of pinon main bearing sets for 1958 and later engines. If necessary, bearings can be spaced with thrust washers to control end play and to insure that rollers run fully within the bearing race.
- S&S Big Twin flywheels can be ordered machined to stock $8\frac{1}{2}$ " diameter or to small diameter (typically $8\frac{1}{4}$ "). Small diameter flywheels are used mainly to provide extra piston to flywheel clearance thus allowing the use of longer skirted pistons in long stroke engines. There is also about a 2 pound

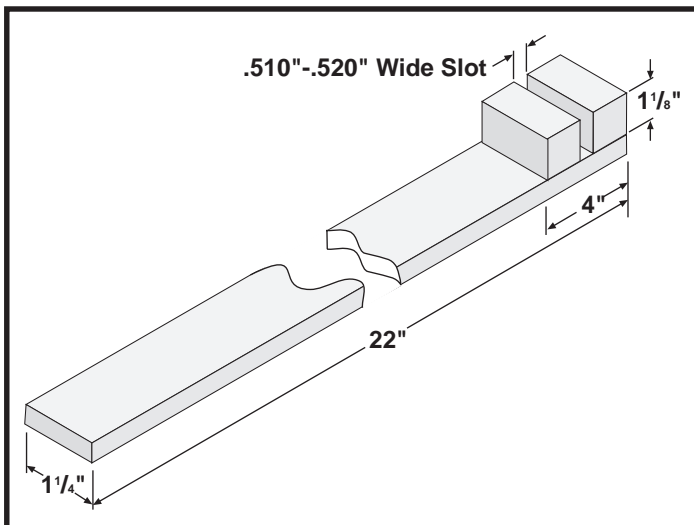
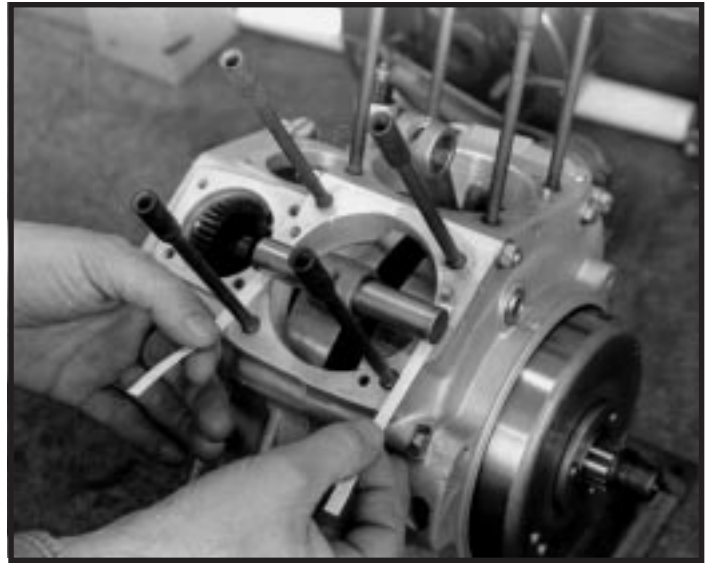


Figure 3



Picture 6

difference in weight between stock and small diameter flywheels. It is important to modify crankcases to accept flywheels to be used. Flywheels that are too small will leave a large gap between flywheels and oil scraper resulting in poor oil scavenging and possible oil consumption problems. If flywheel diameter is smaller than diameter crankcases were machined to accept, scraper should be built up to rim of flywheels. Recommended clearance between flywheels and scraper is .008" - .010".

- When sealing crankcase halves, S&S recommends use of high temp resistant RTV premium silicone sealant or Hylomar sealant. Use any sealant sparingly to prevent particles of excess material from entering crankcase and potentially getting into engine oil.

- After flywheel assembly is installed in crankcases, rods must be checked for straightness. S&S Rod Checking Pin, Part #53-0002, was designed to help perform this procedure. It may also be necessary, to fabricate a rod bending tool as illustrated in **Figure 3**. The purpose of this procedure is to correct for machining tolerance discrepancies in components which may lead to pistons not running true in cylinder bores. While rods may be straight and true, it is sometimes necessary, to bend them to correct for these machining discrepancies. Do not bend rod by using tool in wristpin hole as this method may distort wristpin bushing. We also feel that using a piston in lieu of a checking pin may prove inaccurate due to variations in lengths of piston skirts from one side of piston to the other.

CAUTION - Pistons which do not run true in cylinder bores may cause excessive connecting rod side thrusting. This in turn may lead to premature ring, piston, connecting rod and rod bearing wear and eventual failure of these parts.

Checking Connecting Rod Straightness

A. Insert checking pin into wristpin hole. Place strips of paper between checking pin and crankcase cylinder gasket surface and apply slight downward pressure to wristpin end of rod by rotating flywheels. Pull papers out slowly. Drag on papers should be equal.

B. Rotate flywheels in opposite direction until checking pin contacts cylinder gasket surface again. Repeat procedure to rod again. If drag on papers is equal no bending is required. If one paper is loose, use rod bending tool to tweak rod in direction of loose paper and recheck. **See Picture 6.**

C. Repeat checking and bending procedure for other rod.

BIG TWIN STROKE CODES	
Code	Stroke
1	4-3/8"
2	4-1/2"
3	4-3/8"
4	5"
5	4-1/4" (Stock 80")
6	4-5/8"
12	5-1/4"
13	3-1/2" (Stock 61")
14	3-31/32" (Stock 74")
16	5-1/8"

SPORTSTER STROKE CODES	
Code	Stroke
1	4-1/16"
2	4-3/16"
3	4-5/16"
4	4-7/16"
6	4-5/8"
7	4-13/16"
8	5"
11	4-1/2"
12	5-1/4"
15	3-13/16" (Stock 61")
16	5-1/8"

BIG TWIN ENGINE STYLE CODES	
Code	Engine Style
E	1936-1954
L	1955-1971
AL	1972-Early 1981
SE*	1955-Early 1981
BL	Late 1981-Up
SL*	Late 1981-Up
J	Early Delcron 4-Cam Cases
JL	Late Delcron 4-Cam Cases
H	Early Delcron 4-Cam Cases
HL	Late Delcron 4-Cam Cases

SPORTSTER ENGINE STYLE CODES	
Code	Engine Style
None	1957-1976
B	1957-Early 1981
SB*	1957-Early 1981
BD†	1977-Early 1981
SBD*†	1977-Early 1981
C	Late 1981-1985
SC*	Late 1981-1985
SCD*†	Late 1981-1985
SCDR*†‡	Late 1981-1985
D§	1986-Up V2
DRS§†‡	1986-Up V2

* Flywheels machined for special S&S sprocket shaft and stock pinion shaft.

§ Flywheels machined for special S&S V² XL pinion and sprocket shafts.

† Flywheel machined to use either 1977 to 1986 style Torrington main bearing or 1987 and later style caged roller pinion shaft main bearing assembly.

‡ Machined for use with 1986 and later stock XL connecting rod bearings.