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## S&S Super Stock<sup>™</sup> Cylinder Head Kit Installation Instructions for 1984 & Later Evolution<sup>®</sup> Big Twin<sup>®</sup> and Sportster<sup>®</sup> Engines



S&S Super Stock Cylinder Head Kit contains all parts needed for complete installation. Special S&S pistons shown should be used on conjunction with S&S heads for maximum performance. S&S cylinder head kits are available for 3½" and 3⅝" bore engines.

## Safe Installation and Operation Rules:

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

- 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.
- 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 while working on electrical components.
- 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 by 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. Never direct compressed air toward other people.
- 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/or 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.
- 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.

**The words Harley, Harley-Davidson, H-D, Big Twin, 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.**

## 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 engine 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 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 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.

**Introduction**

S&S Super Stock™ cylinder heads are designed to fit all Harley-Davidson Evolution Big Twins and Sportsters. The exterior dimensions of these heads are stock-like and require no additional clearancing when replacing stock heads on engines installed in stock chassis. All the parts needed for installation are included. Stock parts not supplied such as rocker arms, rocker cover assemblies and some mounting hardware should be reused when reassembling the engine.

*NOTE - S&S cylinder heads are designed to work with all aftermarket roller rocker arm assemblies also.*

**Special Features of the Major Kit Components:**

The shapes of the S&S cylinder head combustion chamber and piston dome are identically matched to create a high quench, closed combustion chamber designed to improve mixture turbulence and flow. For optimum performance it is recommended that these parts be used together.

The intake and exhaust ports are a "cast to shape" design that yields approximately 25% more flow than stock heads.

The special intake manifold included for improved flow has larger runners, 1.780", to match the larger intake ports on the heads and a directional vane to help split the incoming mixture as it passes the valve guide.

The valve train components are designed to improve flow and work with any present day fuel. Clearances are set for any S&S camshaft with a lift of up to .560" without modification. If cams of higher lift are to be used, head kit may be ordered with special high lift, racing spring kit which allows the use of cams of up to .780" lift.

**Kit Contents:**

- One set of S&S Super Stock cylinder head assemblies complete with valves, valve springs, valve guide seals and keepers installed.
- One set of S&S pistons complete with rings, wristpins and wristpin keepers.
- One S&S intake manifold with o-ring seals and mounting flanges.

- Rocker cover gaskets, cylinder head and base gaskets, exhaust pipe gaskets and pushrod tube and alignment dowel o-rings.
- Hardware which includes cylinder head alignment dowels, exhaust port stud lockwashers and nuts, cylinder head mounting bracket bolts and washers, and manifold mounting screws and washers.
- Installation instructions.

*Note - Other S&S products such as adjustable chrome moly pushrods, cam, Hydraulic Lifter Limited Travel kit, and Super carburetor which may enhance the operation of S&S Super Stock cylinder heads may be purchased separately. In some instances many of these parts are sold with S&S heads as part of a stroker or Sidewinder big bore kit or one of our popular "Hot Set Up" packages.*

**Installation Steps**

1. **Strip Motorcycle and Inspect Parts**
2. **Check Piston Alignment in Cylinder Bore**
3. **Piston and Cylinder Fitting**
4. **Rebalance Flywheels (883 & 1100 Sportsters only)**
5. **Install Pistons, Cylinders and Heads**
6. **Finish Assemble Top End, Install Carburetor and Replace Gas Tanks**
7. **Engine Break-In Procedure**
8. **Performance Notes**

**Installation Instructions**

Installation of an S&S Super Stock cylinder head kit is comparatively easy and can be performed by any Harley-Davidson repair shop equipped to do engine overhauls. No special tools other than those used in normal overhaul repair work are required.

Read instructions thoroughly before starting work. When they are completely understood proceed with installation.

**1. Strip Motorcycle and Inspect Parts**

Follow H-D factory procedures outlined in H-D service manual for stripping motorcycle for top end service.

*NOTE - Disconnect battery and drain all gasoline from gas tanks before doing any work.*

**WARNING - 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.**

- A. Remove gas tanks and all other parts required to perform top end service.
- B. Remove carburetor, rocker covers, pushrods and pushrod tube assemblies, cylinder heads and cylinders. Also remove piston rings from piston. Do not remove pistons.

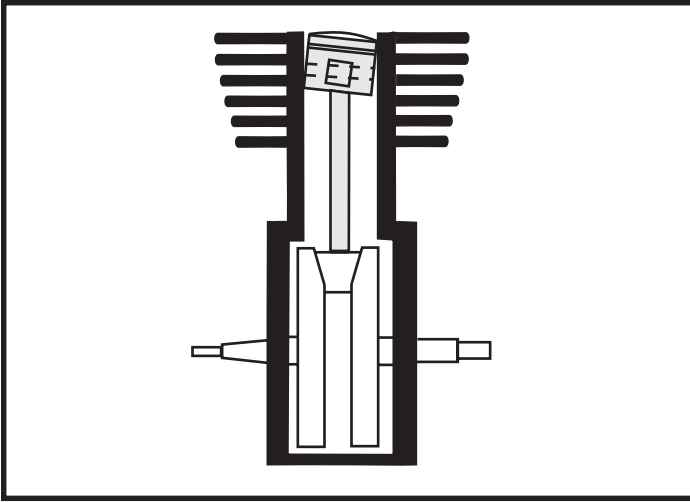


Figure 1



Picture 1

**NOTE** - Be careful not to introduce any dirt or other foreign material into crankcase during disassembly of engine.

**CAUTION** - Metal filings, dirt and any other foreign contamination in engine may cause premature wear and/or irreversible damage to bearings and other internal engine components.

- C. Thoroughly clean and inspect all parts that are to be reused. Any parts that show signs of wear or damage should be replaced.

## 2. Check Piston Alignment in Cylinder Bore

The purpose of this procedure is to check for and correct possible piston misalignment in the cylinder bore. During normal manufacturing, engine components such as crankcases, cylinders, and connecting rods can be machined to dimensions within factory specifications but on the extreme ends of the tolerance range. Sometimes these components when combined together form an assembly that is borderline or actually "out of print". The worst result is that the pistons can run cocked in the cylinder bores causing the connecting rods to thrust to the sides exerting unnecessary stress on the pistons, rings, rod bearings and other related parts. This procedure is not the same as "blue printing", but it provides almost the same result. We feel that not enough emphasis is given to checking the piston alignment in the cylinder bore.

**NOTE** - All engines should be checked upon disassembly. This applies to any engine receiving new pistons which includes those being completely overhauled.

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

## Visual Procedure

- Reinstall cylinders on old pistons without rings. Hold cylinders securely in place.
- Move piston tight toward camside of engine.
- Turn engine over in normal direction of travel 2 or 3 revolutions and observe piston during process.
- Move piston toward driveside of engine and repeat Step C. If misalignment exists, piston will appear closer to cylinder wall at one point around circumference. Condition can be corrected by bending rod in opposite direction. Figure 1 shows an exaggerated side view.
- Repeat Steps B to D for other cylinder.
- Remove pistons and cylinders. Observe pistons for wear spots on sides above top compression ring. If either side near wristpin is worn clean while side opposite is carboned up, then piston was not running straight and true in cylinder bore. Piston will also generally show diagonal wear pattern on thrust faces of skirts and possibly signs of connecting rod to wristpin boss contact inside piston.

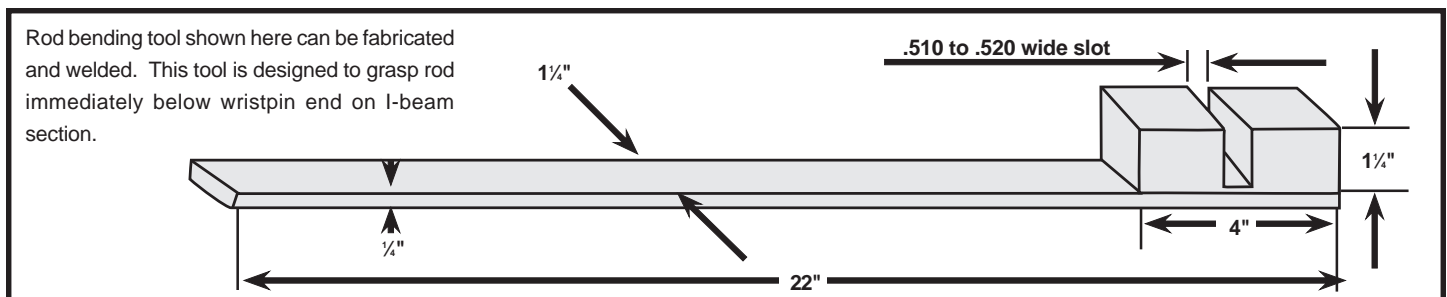


Figure 2

## Checking Pin Procedure

*NOTE - S&S rod checking pin, part #53-0002, is designed to help perform this procedure. It may also be necessary to fabricate a rod bending tool as illustrated in Figure 2.*

- 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.
- 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 1.**

*NOTE - 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.*

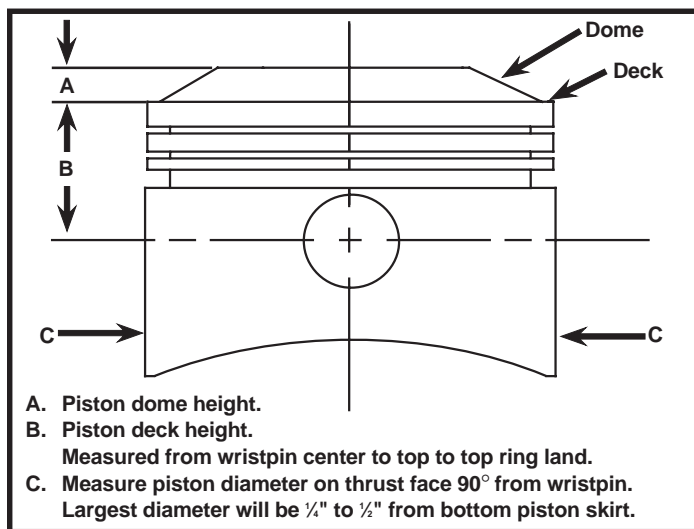
- Repeat checking and bending procedure for other rod.

## 3. Piston and Cylinder Fitting

### NOTES

- For maximum piston and ring life, fit pistons using appropriate close fit dimensions. Close fit requires strict adherence to new engine break-in procedures.
- For immediate drag strip use, fit pistons using appropriate loose fit dimensions. Attempt to break in rings and pistons with 50 easy miles if possible. Piston and ring life will be reduced when using loose fit dimensions.

**CAUTION - Failure to follow instructions and perform required clearancing, installation and/or break-in procedures correctly may result in damage to pistons and/**



Picture 1

**or other engine components. S&S voids its guarantee if pistons are not installed and/or broken in properly.**

- Measure piston across thrust face 90° to wristpin hole. Make a series of measurements starting directly below oil ring groove and ending at extreme bottom of skirt. Use widest measurement to represent size of piston. **See Figure 3.**

*NOTE - All 31/2" and 35/8" bore pistons for S&S Super Stock cylinder heads have barrel shaped skirts. As a result, largest diameter is located 1/4" to 1/2" above extreme bottom of skirt. See Figure 3.*

- Determine size of cylinder. Refer to S&S piston fitting instructions #2500 for clearance specifications.
- Bore and hone cylinder to size required for piston plus proper desired running clearance. Use torque plates torqued to 50 ft. lb. to simulate stresses in an assembled engine.

*NOTE - S&S recommends using a 220 grit stone during final honing process. Using finer than 220 grit stones will result in smoother cylinder wall finishes which do not provide sufficient abrasion between cylinder wall, piston and rings nor sufficient oil retention for proper lubrication required for break-in.*

**CAUTION - Insufficient cylinder wall lubrication during break-in process may result in piston scuffing and damage to pistons, rings and/or cylinders.**

- Thoroughly clean cylinders, pistons and all parts required to reassemble engine. Use high grade lacquer thinner on gasket surfaces.

### WARNINGS

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

## 4. Rebalance Flywheels (883 & 1100 Sportsters only)

This step applies to all Super Stock cylinder head installations on Sportster 883 and 1100 engines.

*NOTE - S&S Super Stock 31/2" and 35/8" bore matching pistons are designed to replace stock 1200cc and 1340cc pistons and S&S #92-2420 and #92-1900 series pistons without requiring flywheel rebalancing. This also means that engines presently equipped with 31/2" bore can be converted to 35/8" bore without rebalancing. Rebalancing is required only when converting 883cc and 1100cc stock bore Sportster engines to 31/2" or 35/8" bore.*

**CAUTION - Failure to rebalance engine will cause engine vibrations possibly resulting in damage to engine components.**

- A. Follow H-D factory procedures outlined in H-D service manual for removing and disassembling engine.
- B. Rebalance flywheels.

*NOTE - If engine is expected to be used under extreme conditions, it is recommended that the connecting rods in engines prior to 1989 be changed to H-D part #24275-86A or S&S #34-7800 as either of these assemblies is stronger than early stock H-D connecting rods.*

**CAUTION - Under extreme conditions that exist in racing, early stock connecting rods may fail causing damage to the engine.**

**WARNING - Under extreme conditions as in a racing application, early stock connecting rods may fail causing the engine to inadvertently seize possibly causing loss of control of the motorcycle.**

- C. Reassemble bottom end using H-D factory service procedures.

## 5. Install Pistons, Cylinders and Heads

- A. Install cylinder base gaskets provided dry. Be sure gaskets match cylinder base line-up dowels and oil return passageways.
- B. Install pistons on rods without rings and wristpin clips.
- C. Slip cylinders in place over cylinder studs and pistons.
- D. While applying pressure to cylinders, rotate flywheels in normal direction of travel for at least one complete revolution. Note if there is any resistance or contact between pistons at any point in rotation. If contact or resistance occurs, it must be diagnosed and corrected.

*NOTE - Since it is nearly impossible to anticipate every possible engine combination, it is the engine builder's responsibility to check for proper running clearances. S&S considers checking and establishing all running clearances as standard engine building practice that must be performed during engine assembly. Engine failure due to improper clearances between moving parts is not covered under warranty.*

**CAUTION - Contact between moving engine components may cause damage or destruction of the parts involved and produce abrasive particles which may cause damage or premature wear to other engine components.**

- E. While applying pressure to cylinders, rotate flywheels so front piston is positioned at top dead center. Note where piston deck (See Figure 3) is positioned in relationship to head gasket surface. Piston deck (flat located just above top compression ring groove), not dome, must be flush with or slightly below gasket surface. If piston deck is higher than cylinder at top dead center, something is wrong and S&S should be notified.

*NOTE - Most stock V2 and S&S V2 style engines are designed with .045" to .0625" piston to head clearance when piston is flush with or slightly below gasket surface with a .020" thick base gasket in place. This clearance is provided by thickness of head gasket. Therefore, in most cases at top dead center piston deck should be flush with or slightly below head gasket surface of cylinder.*

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

- F. Repeat procedure to check rear piston to cylinder gasket surface relationship.
- G. Install piston rings and wristpin clips per S&S piston instruction sheet #2500.
- H. Coat piston skirts with engine oil and install cylinders.
- I. Spin each head bolt down on its respective stud to be sure threads are clean and free of contamination.
- J. Insert cylinder/head alignment dowels provided and place o-ring seals over dowels. Install head gaskets provided in kit dry.

*NOTE - Care must be taken to use correct alignment dowel o-rings with V2 head gaskets. Head gaskets supplied with S&S cylinder heads compress to about .045" thick and require .070" diameter o-rings. Gaskets supplied with SIDEWINDERS for stock heads compress to about .0625" and require .0825" diameter o-rings.*

**CAUTION - Using thin o-rings with thick gaskets or thick o-rings with thin gaskets may cause oil leaks or possible ruptured head gaskets around line-up dowels due to incorrect o-ring compression.**

*NOTE - All S&S cylinder head kits are supplied with .045" thick head gaskets, because this clearance promotes better combustion chamber turbulence and flame travel. When other cylinder heads are used S&S supplies .0625" thick gaskets. Using thicker head gaskets with S&S heads reduces design efficiency and performance. If thinner head gaskets are used with other cylinder heads, piston to head and valve to piston clearances must be checked during assembly.*

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

- K. Bolt heads on cylinders. Clean threads of head bolts and cylinder studs. Place one or two drops of oil on threads of each head bolt just prior to final assembly to reduce friction and insure accurate torque readings. Tighten bolts in stages using crossing pattern. **See Figure 4.** If using S&S crankcases, torque bolts to 45-47 ft. lbs. in four stages. If using stock crankcases, follow the same bolt tightening sequence, but use stock three stage procedure and torque values shown below. If using other aftermarket crankcases, contact the manufacturer for recommended head bolt torque specifications.

	S&S Crankcases	Stock Crankcases
Stage 1	8 ft-lbs.	7-9 ft-lb
Stage 2	18 ft-lbs.	12-14 ft-lbs.
Stage 3	Turn additional 90°	Turn additional 90°

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

**CAUTION - Improper torquing sequence and head bolt torque values may cause head gasket failure. Excessive torque values may cause studs to pull out of crankcase.**

## 6. Finish Assemble Top End, Install Carburetor and Replace Gas Tanks

Follow H-D factory procedures outlined in H-D service manual to assemble rocker cover components and other parts that were removed for top end service.

- Install rocker arm bases per H-D specs.
- Assemble rocker arms, pushrods and pushrod tube assemblies and adjust pushrods.
- Install rocker covers using gaskets provided.
- Install intake manifold, mounting flanges and o-ring seals provided. Be sure o-rings and flanges are assembled in correct sequence. See Figure 5. Use flange marked "F" on front head and flange marked "R" on rear. Slotted end of mounting flange goes toward lower manifold mounting hole. Flat washer provided is used on slotted end of flange. Do not tighten mounting flange screws.

*NOTE - Special S&S manifold must be used with S&S heads because intake port diameters of S&S heads are larger than stock. Special S&S manifold requires o-ring seals which also have larger than stock diameter to fit O.D. of manifold runners. These o-rings, S&S part #16-0235, are included and cannot be used in stock applications.*

- Bolt carburetor and air cleaner assembly in place using carburetor instructions supplied from manufacturer.

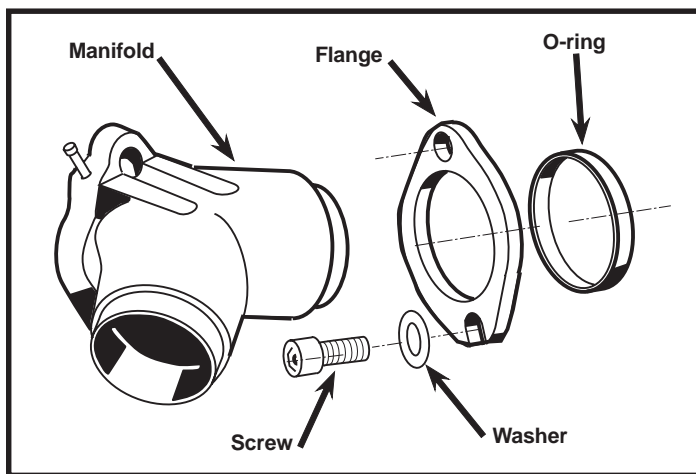


Figure 5

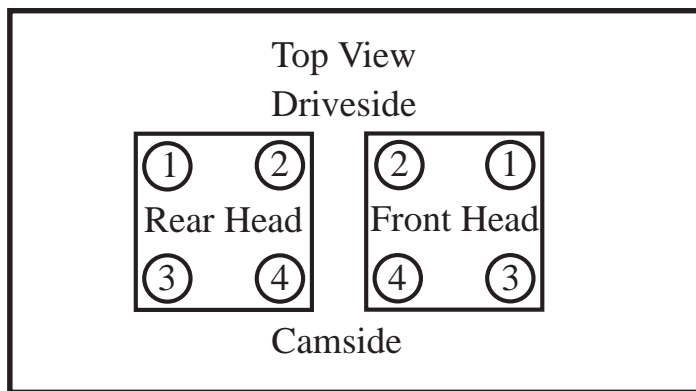
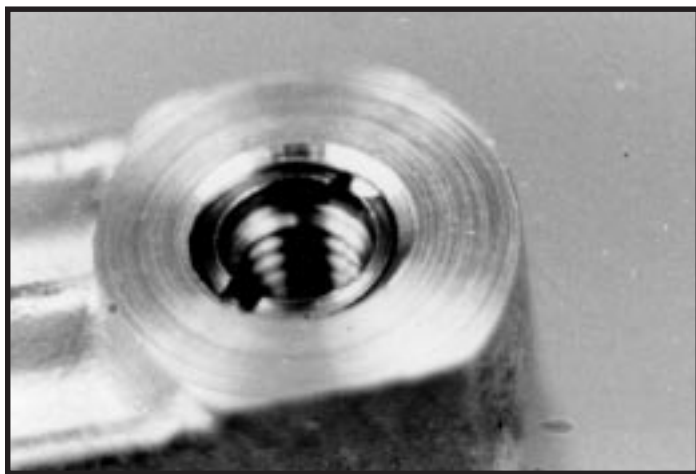


Figure 4

*NOTE - S&S cylinder heads are machined for use on all V2 engines. Heads are drilled and tapped to accept 1/2 -13 air cleaner mounting bolts used on 1992 Big Twin heads or 1/2-13 threaded cylinder head vent fittings used on 1991 and later Sportsters and 1993-up Big Twins. For installation on '84 to '91 Big Twins and '86 to '90 Sportsters, screw thread reducing inserts, part #90-4026, in carburetor backplate mounting holes in cylinder heads. Surface of insert should be just slightly below machined surface of head so backplate rests against head and not insert. **See Picture 2.** Insert (threadsert) will reduce hole to 5/16-18 threads to accept stock '84 to '91 air cleaner mounting bolts. Threadserts may be supplied with or without a thread locking compound already applied to threads. Loctite or equivalent thread locking compound should be applied sparingly to threads of those not pre-coated during installation. Threadserts with preapplied thread locking compound should be installed in desired position and left in place. **IMPORTANT - Screwing threadsert in hole activates compound and locks it in position making it difficult to change after compound has "set up"***

**CAUTION - Installation of threadsert where it protrudes above air cleaner backplate mounting boss surface may damage air cleaner backplate.**

- Reassemble gas tanks and all other parts that were disassembled during preparation for top end service. Be sure there are no gasoline leaks and that throttle opens and closes smoothly and snaps shut when released.



Picture 2

*NOTE - Throttle must not bind and must snap shut to fully closed position when released.*

**WARNING - If throttle does not return to fully closed position when released, it may inadvertently stick open possibly causing loss of control of motorcycle and personal injury to you or others.**

*NOTE - Fuel needle and seat assembly must completely shut off fuel supply entering bowl. Fuel line connections must not leak.*

**CAUTION - Unwarranted gasoline leaking by fuel inlet needle may flood engine causing damage to components.**

**WARNING - Unwarranted gasoline leaks at fuel line connections and/or past inlet needle may flood engine and overflow on surrounding area creating fire hazard.**

## 7. Engine Break-In Procedure

- A. Upon initial start-up, quickly check to make sure oil pressure is normal and no leaks exist. With minimal load on engine, ride motorcycle at low speeds until cylinder head temperature reaches about 250°. Do not crack throttle or subject engine to any heavy load during this period as V2 head gaskets are susceptible to failure until heat build-up is completed. Heat build-up is necessary to cause heads and cylinders to expand and seal. Improper initial engine start-up and break-in procedure may cause head gasket failure.

*NOTE - Proper first time engine start-up and break-in is critical to achieve permanent and lasting head gasket seal. Prior to initial start-up, a .001" to .005" feeler gauge will fit between head gasket and head and cylinder gasket surfaces stopping at fire ring on head gasket. Warming engine as instructed will tightly close this gap producing a good, lasting seal.*

**CAUTION - Do not allow engine temperature to become excessive as permanent engine damage may result.**

- B. First 50 miles are most critical for new rings and piston break-in. Most engine damage will initially occur during this period. Keep heat down by not exceeding 2500 rpm. Vary speed. Do not lug engine.
- C. Next 500 miles should be spent running engine no faster than 3500 rpm or about 50-55 mph. Do not lug engine and continue to vary speed.

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

- D. For balance of first 1000 miles, speed can be run up to 60 to 70. Continue to run engine at all different speeds including lower 40-45 mph ranges.
- E. 1000 to 2000 miles—basically same procedures as before. You can be a little more liberal with rpm range.

Avoid overheating engine and putting any hard strain on engine (drag racing, trailer towing, sidecar operation).

- G. 2000 miles and up—have fun!

## 8. Performance Notes

### Ignition

- Ignition system type - Most S&S engines initially tested on our dyno are equipped with a point type ignition system or some aftermarket high performance electronic unit. These systems allow us to bypass the performance parameters (such as the rpm limiter) designed for stock parts and built in to the stock ignition system. We use an other than stock system to establish some baseline comparisons and determine the maximum horsepower potential a given engine combination possesses. For "real world" evaluations and comparisons with stock combinations we will often use a stock electronic system with an H-D accessory performance ignition module, because more often than not this is what is already installed. Besides, since you already own it, the stock system is free and, under normal operating conditions, works very well with little or no maintenance - two requirements for satisfactory riding. We recommend a stock ignition system for most applications and the other systems for maximum efforts where getting every ounce of horsepower is more important than economizing. If the stock electronic system is retained, contact your local H-D dealer for the part number of an ignition module with specifications that coincide with your high performance requirements.
- Spark plugs - Use spark plugs that are compatible with the ignition system. If you are in doubt, most manufacturers can recommend which plugs they prefer you use with their system. Dual plug installations in S&S Super Stock heads are not necessary.
- Flywheels - S&S flywheels have timing marks that when located in the center of the timing hole position the pistons in the same location before top center as stock H-D flywheels. Placing the mark to the right side of the hole or just entering the hole advances timing almost 5°. Vice versa, if the mark is just leaving the hole, timing is retarded almost 5°.
- Timing - Tests conducted using S&S Super Stock heads on Big Twins and Sportsters showed that best performance was achieved with the ignition timing set at 32°. We attribute this to the higher compression ratios generally used, improved flow characteristics and overall efficiency of the S&S design.

Once the engine is timed and operating, monitor it for excessive heat. Too much heat can mean that timing is set incorrectly and should be adjusted to prevent engine damage.

**CAUTION - Improper ignition timing may cause excessive engine heat which may damage pistons and/or other engine components.**



## Carburetion

- 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.
- 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 proven spark plug combinations and to consult the spark plug manufacturer if you have questions. If one desires to become more proficient at plug reading, Champion Racing Division has a very informative booklet which may be helpful. For details, write:

Champion Spark Plug Co.  
PO Box 910  
Toledo, OH 43601

- Cams and exhaust systems can make some engines difficult to carburate. We have found that certain cams and exhaust systems will cause poor performance at a specific rpm, and attempts to correct jetting for that specific level usually destroys carburetion over the balance of the range. A combination of cam overlap, reversion, and back pressure, or even lack of back pressure can cause mixture dilution at certain engine rpms. This dilution will cause engine roughness or misfiring when engine is held in this range.

## Exhaust Systems

- Drag pipes - While drag pipes can be used with good results to establish performance guidelines on pre-Evolution engines, they are generally not recommended for Evolution motors in street applications. Evolution

engines are easier to carburate with muffled 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 for V2 engines consists of the stock header pipes with the crossover tube and a set of low restriction mufflers. Harley-Davidson offers a series of mufflers that can be used with stock header pipes that work very well in most situations and offer an inexpensive alternative to a new exhaust system. We prefer their tapered and baloney cut styles. This combination will typically produce 10 hp more than drag pipes in the midrange. Since the midrange is where the vast majority of normal driving occurs, it makes this system ideal for the street.

## Gearing

- Gearing depends on the total weight of the machine and rider/s, the size of the engine, cam/s, 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:

$$\text{Engine Revolutions Per One Revolution of Rear Wheel} = \frac{(\text{Clutch Sprocket}^*) \times (\text{Rear Wheel Sprocket}^*)}{(\text{Motor Sprocket}^*) \times (\text{Transmission Sprocket}^*)}$$

\*Number of teeth on each sprocket

## Compression

- Generally speaking, Evolution engines with the proper camshaft selection can operate using higher compression ratios with fewer problems than their earlier counterparts. Keep in mind, though, that while engines with higher compression ratios make more horsepower and perform better, they also tend to lose that performance edge faster, require more maintenance and start harder. As a rule, we prefer to limit the compression ratio to no greater than 11 to 1 for engine combinations used in normal street operation. A word of caution is in order. Before building an engine you may regret later on, carefully consider your riding needs, riding style and overall performance objectives.

# S&S Cylinder Heads and Related Parts

## 1. Cylinder head assemblies

**Big Twin front only** includes head, seats, guides, exhaust port studs ..... **Part #90-1000F**

**Big Twin rear only** includes heads, seats, guides, exhaust port studs ..... **Part #90-1000R**

**Big Twin front complete** includes head, valves, valve springs, collars, keepers and seals ..... **Part #90-1001F**

**Big Twin rear complete** includes head, valves, valve springs, collars, keepers and seals ..... **Part #90-1001R**

**Sportster front only** includes head, seats, guides, exhaust port studs ..... **Part #90-1300F**

**Sportster rear only** includes heads, seats, guides, exhaust port studs ..... **Part #90-1300R**

**Sportster front complete** includes head, valves, valve springs, collars, keepers and seals ..... **Part #90-1301F**

**Sportster rear complete** includes head, valves, valve springs, collars, keepers and seals ..... **Part #90-1301R**

## 2. Valve FL or XL

**Intake** 2.000" dia. .... **Part #90-2000**

**Exhaust** 1.605" dia. .... **Part #90-2001**

## 3. Valve seat FL or XL

**Intake** 2.000" dia. .... **Part #90-2002**

**Exhaust** 1.605" dia. .... **Part #90-2003**

## 4. Valve guide intake or exhaust FL or XL

**Std.** replaces H-D #18112-92 ..... **Part #90-2210**

**+.001"** replaces H-D #18130-83C ..... **Part #90-2211**

**+.002"** replaces H-D #18133-83A ..... **Part #90-2212**

**+.003"** replaces H-D #18131-83C ..... **Part #90-2213**

**+.030"** ..... **Part #90-2219**

## 5. Valve spring kit FL or XL

**Steel top collars** ..... **Part #90-2074**

**Titanium top collars** ..... **Part #90-2075**

## 6. Valve spring shims

.015" thick ..... **Part #90-2086**

.030" thick ..... **Part #90-2087**

## 7. Valve spring bottom collar intake or exhaust

FL or XL ..... **Part #90-2090**

## 8. Valve guide seal intake or exhaust

FL or XL replaces H-D #18001-83A ..... **Part #90-2008**

## 9. Valve spring intake or exhaust FL or XL

**Inner** ..... **Part #90-2091**

**Outer** ..... **Part #90-2092**

**Damper** ..... **Part #90-2093**

## 10. Top collar wear plate (for titanium top collar only)

..... **Part #90-2085**

## 11. Valve spring top collar int. or exh. FL or XL

**Steel** ..... **Part #90-2088**

**Titanium** ..... **Part #90-2089**

## 12. Valve spring keeper intake or exhaust (need two per valve)

FL or XL ..... **Part #90-2094**

## 13. Head mount bolt 3/8-16 x 1-1/4" FL or XL replaces H-D #4716W

..... **Part #50-0168**

## 14. Washer 3/8" FL or XL replaces H-D #6019 ..... **Part #50-7051**

## 15. Head bolt FL or XL (includes head bolt washer #93-3022)

**Short** (stock length) replaces H-D #3500 ..... **Part #93-3028**

**Long** (stock length) replaces H-D #3501 ..... **Part #93-3029**

**Short** 5/16" longer ..... **Part #93-3036**

**Long** 5/16" longer ..... **Part #93-3037**

**Short** 7/16" longer ..... **Part #93-3038**

**Long** 7/16" longer ..... **Part #93-3039**

## 16. Head bolt washer replaces H-D #6016 ..... **Part #93-3022**

## 17. Exhaust port stud FL or XL replaces H-D #16715-83 ..... **Part #50-8082**

## 18. Lockwasher 5/16" FL or XL replaces H-D #7041 ..... **Part #50-7032**

## 19. Nut 5/16-24 FL or XL replaces H-D #7833 ..... **Part #50-5023**

## 20. Exhaust pipe gasket FL or XL replaces H-D #65324-83 ..... **Part #93-1005**

## 21. Thread insert 1/2-13 to 5/16-18 ..... **Part #50-8151**

## 22. Intake manifold FL or XL

(See "Manifold" section of catalog for part numbers and sizes available.)

## 23. Mounting flange screw 5/16-18 x 1" ..... **Part #50-0101**

FL or XL replaces H-D #3201WA ..... **Part #50-0101**

## 24. Washer 5/16" FL or XL replaces H-D #6702 .... **Part #17-0321**

## 25. Intake manifold mounting flange FL or XL

**Front** replaces H-D #27009-86B ..... **Part #16-0232**

**Rear** replaces H-D #27010-86B ..... **Part #16-0233**

## 26. Intake manifold o-ring FL or XL

(S&S cylinder heads only) ..... **Part #16-0235**

## 27. Head gasket FL or XL

**3-1/2" bore .045" thick** includes gasket & 2 ea. #93-1010 ..... **Part #93-1011**

**3-1/2" bore .0625" thick** includes gasket & 2 ea. #93-1015 ..... **Part #93-1013**

replaces H-D #16770-84B ..... **Part #93-1013**

**3-5/8" bore .045" thick** includes gasket & 2 ea. #93-1010 ..... **Part #93-1012**

**3-5/8" bore .0625" thick** includes gasket & 2 ea. #93-1015 ... **Part #93-1016**

## 28. Head gasket oil return o-ring FL or XL

.070" dia. for .045" gasket replaces H-D #26432-76 ..... **Part #50-8034**

.0825" dia. for .0625" gasket replaces H-D #26432-76A ..... **Part #50-8035**

## 29. Alignment dowel FL or XL replaces H-D #16573-83 ..... **Part #50-8023**

## 30. Piston assembly FL or XL

(See "Piston" section of catalog for part numbers and sizes available.)

## 31. Piston rings (see catalog for part numbers and sizes available)

## 32. Wrist pin fits all 3-1/2" and 3-5/8" bore S&S cyl. head pistons ..... **Part #94-9256**

## 33. Wrist pin keeper fits all 3-1/2" & 3-5/8" bore S&S cyl. head pistons ..... **Part #94-9254**

## 34. Base gasket FL or XL

**3-1/2" bore** replaces H-D #16774-86B ..... **Part #93-1035**

**3-5/8" bore** ..... **Part #93-1033**

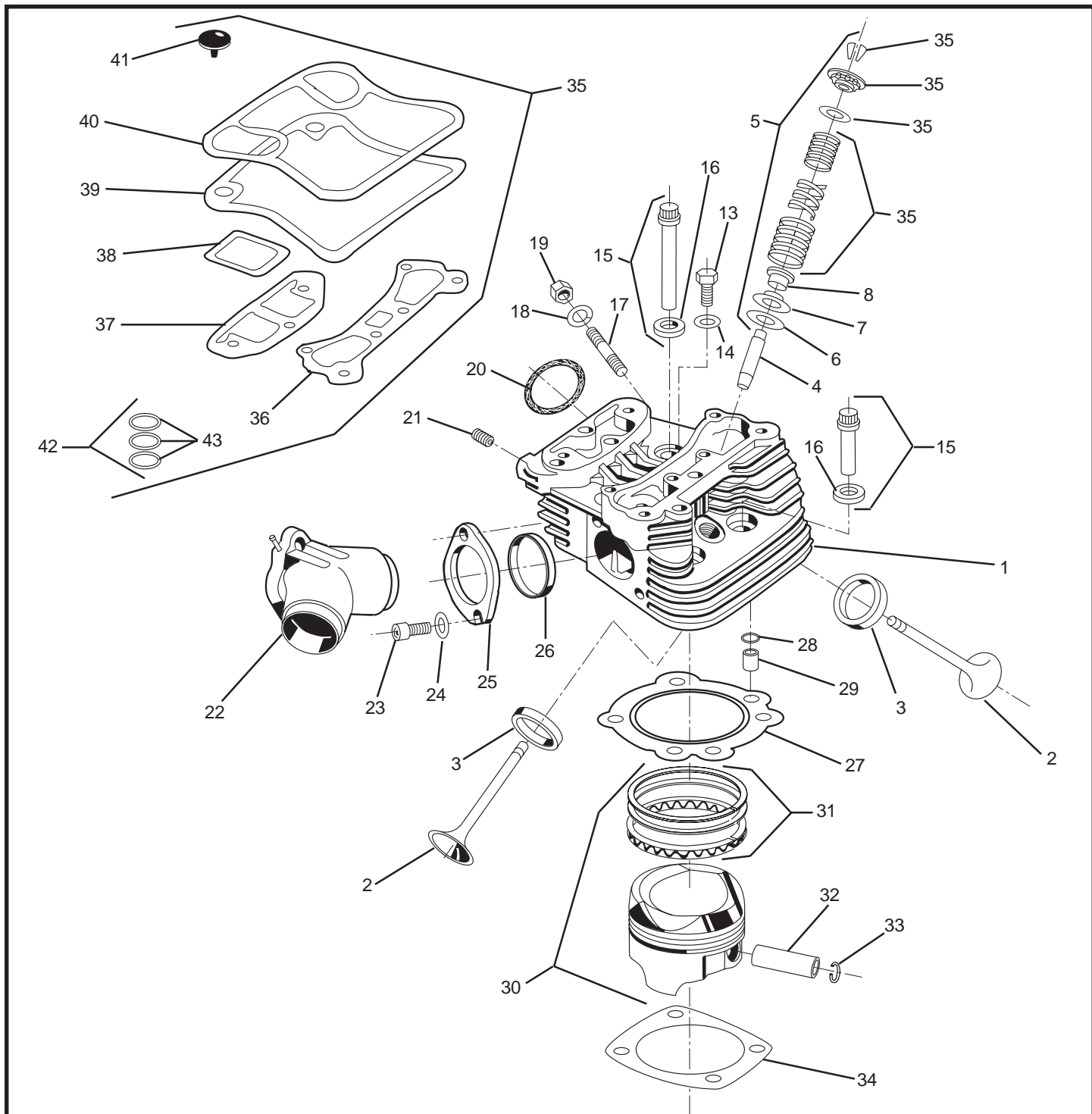
## 35. Rocker cover gasket kits

**BT '84-91** replaces H-D #17038-90 ..... **Part #90-4007**

**BT '92- up** replaces H-D #17042-92A ..... **Part #90-4027**

**XL '86-'90** ..... **Part #90-4028**

**XL '91- up** replaces H-D #17039-90A ..... **Part #90-4029**



Continued...

- 36. **Bottom right rocker cover gasket** '84-up FL or XL  
replaces H-D #16778-84A ..... **Part #90-4015**
- 37. **Bottom left rocker cover gasket**  
'84-up FL or XL replaces H-D #16779-84A ..... **Part #90-4016**
- 38. **Middle inner rocker cover gasket**  
'84-up FL or XL replaces H-D #17358-84A ..... **Part #90-4018**
- 39. **Middle outer rocker cover gasket**  
'84-91 FL replaces H-D #17355-84A ..... **Part #90-4017**  
'92-up FL replaces H-D #17355-92 ..... **Part #90-4022**  
'86-90 XL replaces H-D #17353-86A ..... **Part #90-4025**  
'91-up XL replaces H-D #17353-89 ..... **Part #90-4021**

- 40. **Top rocker cover gasket**  
'84-91 FL replaces H-D #17356-84A ..... **Part #90-4019**  
'92-up FL replaces H-D #17356-92 ..... **Part #90-4023**  
'86-90 XL replaces H-D #17354-86A ..... **Part #90-4024**  
'91-up XL replaces H-D #17354-89 ..... **Part #90-4020**
- 41. **Umbrella valve rocker cover** replaces H-D #26856-89  
..... **Part #90-4030**
- 42. **Push rod o-ring kit V2's 1884-up**  
includes 4 ea. #93-4019, #93-4023, #93-4026 . **Part #93-4022**
- 43. **Pushrod tube o-rings V2's 1884-up**  
**Top** replaces H-D #11157 or #11190 ..... **Part #50-8039**  
**Middle** replaces H-D #11132 ..... **Part #50-8038**  
**Bottom** replaces H-D #11145 ..... **Part #50-8037**

