

## Instruction Sheet 51-1108

Revised 03-10-03

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Because every industry has a leader

## Installation Instructions for S&S Twin Cam Style Cylinder Heads

### 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 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.

**Introduction**

S&S Super Stock™ cylinder heads are designed to fit all Twin Cam style engines. S&S heads can be used on stock 88", 3 $\frac{3}{4}$ " bore engines as well as 95", 3 $\frac{7}{8}$ " bore engines and all S&S 4" bore Twin Cam style engines. The exterior dimensions of these heads are stock-like and require no additional clearancing when replacing stock heads on engines installed in stock chassis. The combustion chambers are compatible with stock style flat topped pistons and S&S Twin Cam style pistons. Some S&S pistons are flat topped and some have a "pop up" dome to increase compression. Spark plug holes are in the stock location and machined to accept stock spark plugs.

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

- The intake and exhaust ports are a "cast to shape" design that yields approximately 30% more flow than stock heads.
- The special intake manifold required for S&S Twin Cam style cylinder heads has larger 1.780" I.D. runners to match the larger intake ports on the heads.
- 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 .640" without modification. S&S cylinder heads are designed to work with stock or S&S rocker covers, and are compatible with stock rocker arms or aftermarket roller rocker arm assemblies.
- All S&S Twin Cam style cylinder heads with 89cc combustion chambers are machined to accept the S&S compression release. Compression release machining is optional on heads with the 79cc combustion chamber. Installation of S&S electric compression releases requires the use of S&S die-cast rocker covers or similar rocker covers with a central hole or chimney. If heads are machined for compression release, but compression release is not used, a special plug #90-4916 must be installed in compression release hole in each head.
- The S&S Twin Cam style cylinder heads have been strengthened with additional material in key areas. One such area is around the head bolt holes on the spark plug side. The head bolt washer pads for the two "outboard" head bolts is at the same level as the head bolt pads under the rocker cover. As a result, S&S Twin Cam style heads use four identical long head bolts in each head instead of two long and two short head bolts.

**Kit Contents:**

- One set of S&S Super Stock cylinder head assemblies complete with valves, valve springs, valve guide seals and keepers installed.
- Hardware which includes head bolts, exhaust port stud flanged nuts, manifold mounting screws and washers, intake manifold o-ring seals, and exhaust pipe gaskets.
- Installation instructions.

**Additional items required for installation. Some of these items are included S&S Hot Set Up or Super Sidewinder packages. If the below items are not listed in the kit contents, they must be purchased separately.**

- S&S Twin Cam style rocker covers.
- S&S intake manifold.
- Rocker cover gaskets, cylinder head and base o-rings, exhaust pipe gaskets and pushrod tube and alignment dowel o-rings.
- Head gaskets.

**NOTES**

- *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.*
- *Valve pocket reliefs in stock H-D pistons are smaller than those in S&S pistons. Valve to piston clearance should be checked if S&S heads are used with OEM H-D pistons and high lift cams. If S&S heads have not been decked, valve to piston clearance is normally adequate with cams such as the S&S 585G, with TDC lifts of up to .186"/.179". If cams with higher TDC lifts are used, clearance must be checked.*
- *If S&S heads are used with S&S pistons no valve to piston clearancing is normally required.*
- *If S&S 79cc heads are decked, valve to piston clearance should be checked. If Stock H-D pistons are used with S&S heads that have been decked, valve pockets must be modified in nearly all cases.*
- *S&S cylinder heads with 79cc combustion chambers have smaller valves than the heads with 89cc chambers. Heads with 79cc chambers have 1.940" intake and 1.575" exhaust valves. Heads with 89cc chambers have 2.000" intake valves and 1.605" exhaust valves.*
- *Due to the larger valve sizes in S&S cylinder heads with 89cc chambers, the 89cc heads, will nearly always require valve to piston clearancing if used with stock H-D pistons. No clearancing will be required if used with S&S pistons.*
- *Other S&S products such as adjustable chrome moly pushrods, cams, Hydraulic Lifter Limited Travel kit, and Super E and G carburetors 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 Super Sidewinder™ big bore kit or one of our popular "Hot Set Up" packages.*

## Installation Steps

1. Strip Motorcycle, Disassemble, and Inspect Parts
2. Check Clearances and Install S&S Cylinder Heads
3. Finish Assembly of Top End, Install Carburetor and Replace Gas Tanks
4. Engine Break-In Procedure (For installations that include new pistons.)
5. 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, Disassemble, 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, pushrod tube assemblies, and cylinder heads.

*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.
- D. If S&S compression releases are to be used, they should be installed in the new S&S cylinder heads at this time. Compression releases can be installed with the engine in the frame, but the procedure is much easier before the heads are installed. If cylinder heads are machined for compression releases, but compression releases are not going to be used, #90-4916 threaded plug and #50-7094 washer must be installed in the compression release hole of each head. Torque to 30 ft. lbs. **See Picture 1.** Install compression releases per S&S instruction sheets #51-1065 (manual) or #51-1109 (electric).

## NOTES

● S&S compression releases can only be used on S&S cylinder heads which are specially machined for them. They can not be used on stock OEM H-D heads.

**Important:** S&S Twin Cam style heads must use S&S Twin Cam style rocker covers, and S&S rocker cover gaskets. S&S Twin Cam style heads do not have the OEM style crankcase breather groove machined into the top surface of the head. If Harley-Davidson rocker covers, or any aftermarket rocker covers are installed that use the OEM style breathing, excessive oil consumption and damage to engine oil seals will result.

● S&S compression releases must be used with S&S rocker covers

### 2. Check Clearances and Install S&S Cylinder Heads

*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.*

*NOTE - These instructions are for cylinder head removal and replacement only. If replacing pistons and/or cylinders, refer to the OEM or S&S Instructions for those components.*

**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.**



Picture 1

- A. While applying pressure to hold cylinders in position, rotate flywheels so front piston is positioned at top dead center. Note where piston deck (**See Figure 1**) 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 - Stock and S&S Twin Cam style engines are designed so that at top dead center, piston deck should be flush with or slightly below head gasket surface of cylinder. Piston to head clearance is provided by thickness of head gasket (.045" for S&S engines).*

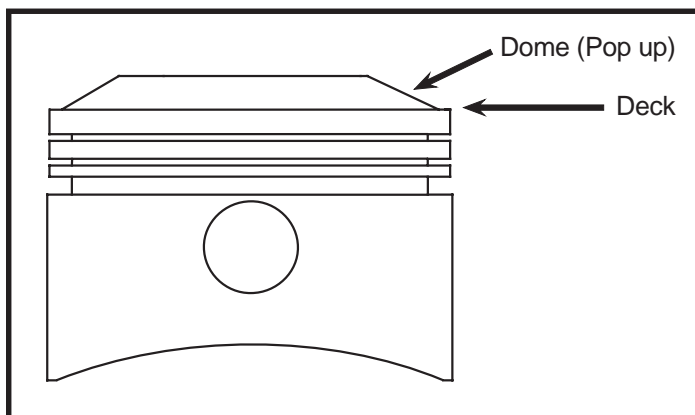
**CAUTION - Insufficient clearance between piston domes and cylinder heads or piston domes and valves will cause damage to pistons and cylinder head components.**

- B. Repeat procedure to check rear piston to cylinder gasket surface relationship.
- C. Check valve pocket fit.

#### NOTES

- *Valve pocket reliefs in stock H-D pistons are smaller than those in S&S pistons. Valve to piston clearance should be checked if S&S heads are used with OEM H-D pistons and high lift cams. If S&S 79cc heads have not been decked, valve to piston clearance is normally adequate with cams such as the S&S 585G, with TDC lifts of up to .186"/.179". If cams with higher TDC lifts are used, clearance must be checked.*
- *If S&S heads are used with S&S pistons no valve to piston clearancing is normally required.*
- *If S&S heads are decked, valve to piston clearance should be checked. If Stock H-D pistons are used with decked S&S heads, valve pockets must be modified in nearly all cases.*

1. With cylinders and pistons installed, turn engine over until piston in front cylinder is at top dead center.
2. Paint area around valve pockets on pistons with machinist's blue.



**Figure 1**

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.

#### NOTES

- *S&S recommends a minimum of .060" clearance between intake valve and piston valve pocket recess, and .080" between exhaust valve and piston valve pocket recess at piston TDC.*
- *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 HL<sub>2</sub>T 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, remove piston and machine or grind valve pocket until head of valve fits flush with proper clearance.
  6. Repeat procedure for other cylinder head.
- D. 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 HL<sub>2</sub>T washer, if used. This insures that tappets can not bleed down, so that valve position will be accurate for clearance check.
  3. Turn engine over in normal direction of travel two complete revolutions.
  4. Disassemble engine and check thickness of putty in valve pockets.
  5. If insufficient clearance exists, machine or grind piston until proper clearance is achieved.
  6. Disassemble top end and clean all parts for final assembly.
- E. Remove cylinders and install piston rings and wristpin clips per S&S piston instruction sheet #2500.
- F. Coat piston skirts with engine oil and install cylinders.

*NOTE – Stock H-D Twin cam style cylinder heads require two long and two short head bolts per cylinder. Stock short head bolts can not be used with S&S Twin Cam style cylinder heads. The design of the S&S cylinder heads requires the use of four long head bolts per cylinder. All head bolts are the same length. Stock long head bolts can be used with stock length motors, but*

the short head bolts must be replaced with long head bolts. Engines with longer than stock cylinders require four special length, long head bolts per cylinder. **See Picture 2.**

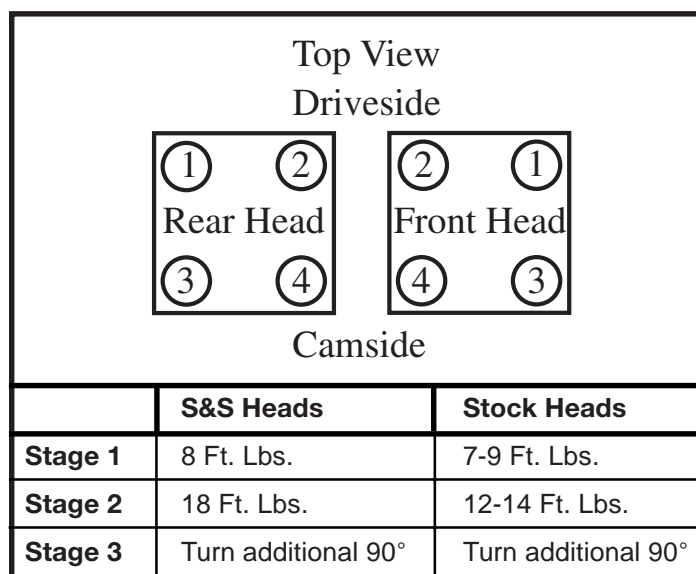
- G. Spin each head bolt down on its respective stud to be sure threads are clean and free of contamination.
- H. Install head gaskets dry. S&S 3 $\frac{3}{4}$ " bore heads gaskets require o-rings around the cylinder head locating dowels similar to stock head gaskets. S&S 3 $\frac{3}{4}$ " and 4" bore head gaskets do not use o-rings around cylinder head locating dowels.
- I. Bolt heads on cylinders. Clean threads of head bolts and cylinder studs. Place one or two drops of oil on threads and under the head 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 2.**

*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.**

### 3. Finish Assembly of Top End, Install Carburetor and Replace Gas Tanks

- A. 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. If S&S rocker covers are used, follow S&S instruction sheet #51-1054.
- B. Assemble rocker arms, pushrods and pushrod tube assemblies and adjust pushrods.



**Figure 2**



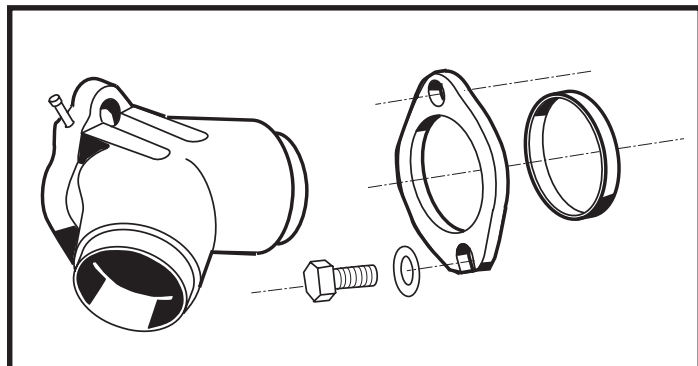
**Picture 2**

S&S Twin Cam style cylinder heads use four long head bolts per head instead of the usual two long/two short H-D design because the head bolt washer pads on the spark plug side of the S&S heads are on the same level as the pads for the other head bolts. Stock H-D heads shown for comparison with S&S heads.

- C. Install intake manifold using provided mounting flanges and o-ring seals. Be sure o-rings and flanges are assembled in correct sequence. **See Figure 3.** 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.

*NOTE - The intake port diameters of S&S Evolution style and Twin Cam style heads are larger than stock. S&S Evolution style and Twin Cam style heads must be used with an S&S intake manifold and manifold seals. When used together, the S&S intake manifold and manifold seals still allow use of stock manifold mounting flanges. S&S manifold seal (16-0235) fits all S&S Evolution style and Twin Cam style intake manifolds, but does not interchange with stock.*

- D. Install carburetor and air cleaner assembly using appropriate carburetor instructions.
- E. 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.



**Figure 3**

*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.**

#### 4. Engine Break-In Procedure

##### NOTES:

● *S&S engines are designed for high performance and as such are not as tolerant of inadequate break-in as stock or lower performance engines. Correct break-in will assure longer engine life and will prevent unnecessary engine damage. Engine damage caused by improper break-in is not covered under the S&S warranty.*

● *If new pistons have not been installed, only steps A,B, and C are required.*

● *If new pistons have been installed, all break in steps are required.*

- A Initial start up. Run engine approximately one minute at 1250-1750 rpm. DO NOT crack throttle or subject to any loads during this period as head gaskets are susceptible to failure at this time. During this time check to see that oil pressure is normal, that oil is returning to the oil tank, and that no leaks exist.
- B. Shut off engine and thoroughly check for any leaks or other problems. Let engine cool to the touch
- C. After engine has cooled, start up again and allow the motor to build some heat. Engine should be run no longer than three to four minutes. When the cylinders become warm/hot to the touch (approximately 150°) shut the motor down and let it cool to room temp. Follow the same cautions as for the initial start-up, and continue to watch for problems.

- D. Repeat this procedure 3 or 4 times. Each successive time it should take slightly longer to warm up and you can increase the temp slightly each time (+10°). You can be more liberal each time with the rpm, gently vary rpm continuously from idle up to 2500 rpm in the final cycle. Don't be too concerned with final carb settings at this time because idle speed and mixture cannot be correctly set until the motor reaches full operating temperature. The motor should not reach that temperature during these cycles. Do not allow engine temperature to become excessive. After the motor has cooled to room temperature for the final time you are ready to start the 500 mile engine break-in process.
- E. The first 50 miles are most critical for new rings and piston break-in. Engine damage is most likely to occur during this period. Keep heat down by not exceeding 2500 rpm. Avoid lugging the motor, riding in hot weather or in traffic. Vary the engine speed. Do not lug the engine. We recommend changing the oil at 50 miles.
- F. The next 500 miles should be spent running engine no faster than 3500 rpm or 60 mph. Avoid continuous steady speeds, and do not lug the engine. Vary engine rpm. We recommend changing the oil again at 500 miles.

**CAUTION – Lugging or running engine prematurely at sustained high rpm may result in damage to pistons and other engine components. S&S voids it's 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.

## 5. Performance Notes

● *Ignition system* – For S&S Twin Cam style engine kits, 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 a brand of carburetor other than S&S is used, it must be made to run rich enough to operate properly and to prevent engine damage.* Any technical questions regarding use and adjustment of carburetors other than S&S should be directed to the manufacturer. This includes S&S carburetors that have been modified by a third party.

● *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 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 mufflers. Several aftermarket manufacturers offer high performance mufflers that can be used with stock header pipes. These mufflers work very well in most situations and offer an inexpensive alternative to a whole new exhaust system. Low restriction 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 driving 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:*

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

\*Number of teeth on each sprocket

## Compression

● *Generally speaking, 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.

## Replacement Parts For S&S Twin Cam Style Cylinder Heads

Use this line drawing to identify the replacement part required. Parts interchangeable with stock H-D parts are listed with the H-D number of the parts they replace. If no H-D number is provided, the S&S part cannot be used as a direct replacement for the H-D part and vice versa. Year groups listed apply to S&S parts only; do not attempt to identify stock H-D parts by these groups. Abbreviation "NS" means part is not shown in diagram..

1. **Cylinder head** - All S&S Twin Cam  
(See S&S catalog for replacement cylinder heads, cylinder head sets, and kits.)
2. **Valve**  
All S&S BT, XL V<sup>2</sup> and TC w/89cc chamber  
Intake - 2.000" dia. .... **90-2000**  
Exhaust - 1.605" dia. .... **90-2001**  
Intake .085" longer - 2.000" dia. .. **90-2004**  
Exhaust .085" longer - 1.605" dia. . **90-2005**  
  
All S&S Twin Cam with 79cc chamber  
Intake - 1.940" diameter. .... **90-2025**  
Exhaust - 1.575" diameter. .... **90-2026**
3. **Valve seat**  
All S&S BT, XL V<sup>2</sup> and TC w/89cc chamber  
Intake - 2.000" diameter. .... **90-2002**  
Exhaust - 1.605" diameter. .... **90-2003**  
  
All S&S Twin Cam w/79cc chamber  
Intake - 1.940" diameter. .... 90-2027  
Exhaust - 1.575" diameter. .... 90-2028
4. **Valve guide** - Intake or Exhaust  
All S&S BT V<sup>2</sup>, XL V<sup>2</sup> and Twin Cam  
Standard (H-D#18112-92) ..... 90-2210  
+.001" (H-D#18130-83C) ..... 90-2211  
+.002" (H-D#18133-83A) ..... 90-2212  
+.003" (H-D#18131-83C) ..... 90-2213  
+.030" ..... 90-2219
5. **Valve spring shim**  
1984-up V<sup>2</sup>, all S&S BT & XL V<sup>2</sup> and TC88  
.015" ..... 90-2086  
.030" ..... 90-2087
6. **Valve guide seal** - Intake or Exhaust  
1984-up V<sup>2</sup>, all S&S BT & XL V<sup>2</sup>  
(H-D#18001-83A) ..... 90-2008
7. **Valve spring kit**  
1984-up V<sup>2</sup>, all S&S BT & XL V<sup>2</sup> and TC  
.640" lift - steel top collars ..... 90-2077  
.640" lift - titanium top collars ... 90-2078
8. **Head bolt assembly**  
All S&S TC (includes head bolt washer)  
88", 95", 100" & 107" incl. washer #50-7088  
..... 93-3030  
116" incl. washer #50-7091 ..... 93-3037
9. **Head bolt washer**  
All S&S BT & XL V<sup>2</sup> and TC  
.100" ..... 50-7088  
.250" (H-D#6016) ..... 50-7091
10. **Exhaust port stud** - (H-D#16715-83)  
All S&S BT & XL V<sup>2</sup> and TC .... 50-8082
11. **Nut**, HSFH -  $\frac{5}{16}$  -24 (H-D#7593)  
..... 50-5025
12. **Exhaust pipe gasket** (H-D#65324-83)  
All S&S BT & XL V<sup>2</sup> and TC ..... 93-1005
13. **Intake manifold** - All S&S Twin Cam  
(Refer to manifold section of S&S Catalog.)
14. **Manifold mounting screw**  
SH -  $\frac{5}{16}$  -18 x 1" (H-D#3201WA) .. 50-0101  
HH -  $\frac{5}{16}$  -18 x 1" (H-D#3987,4017)  
..... 50-0108
15. **Flat washer** -  $\frac{5}{16}$ " (H-D#6016,6702)  
..... 50-7034
16. **Manifold mounting flange**  
All S&S BT & XL V<sup>2</sup> and Twin Cam  
Front (H-D#27009-86A) ..... 16-0232  
Rear (H-D#27010-86A) ..... 16-0233
17. **Manifold o-ring seal**  
All S&S BT & XL V<sup>2</sup> and TC ..... 16-0235
18. **Head gasket - all S&S Twin Cam**  
1999-up TC, TCB  
3  $\frac{3}{4}$ " x .046" ..... 93-1045  
3  $\frac{7}{8}$ " x .046" ..... 93-1044  
1999-up TC, TCB BT, 2001-up 4" SSW  
4" x .046" ..... 93-1043
19. **Alignment dowel**, base and head  
All S&S Twin Cam ..... 50-8177
20. **O-ring**, Alignment dowel,  
Base (All bore sizes)  
Head (3/4" bore only)- all S&S Twin Cam  
..... 50-8008
21. **Plug**, HH - 14mm, ..... 90-4916
22. **Washer**, compression - 14mm  
.507" x .705" x .047" ..... 50-7094
23. **Head mount bolt**  
 $\frac{3}{8}$  -16 x 1  $\frac{1}{2}$ " - (H-D#4716W)  
All S&S BT & XL V<sup>2</sup> and TC ..... 50-0168
24. **Flat washer** -  $\frac{3}{8}$ " - (H-D#6019)  
All S&S BT & XL V<sup>2</sup> and TC .... 50-7051

