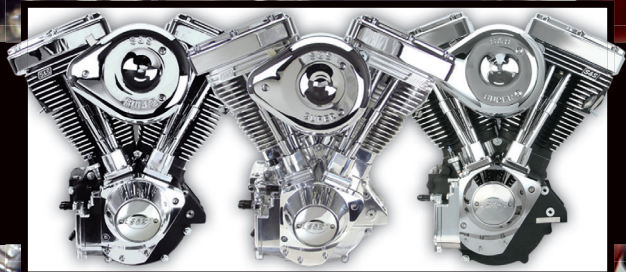




Owners Manual

S&S® V-Series Engines



DISCLAIMER:

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

The words Harley®, Harley-Davidson®, H-D®, Sportster®, Evolution®, and all H-D part numbers and model designations are used in reference only. S&S Cycle is not associated with Harley-Davidson, Inc.

SAFE INSTALLATION AND OPERATION RULES:

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

- Gasoline is extremely flammable and explosive under certain conditions and toxic when breathed. Do not smoke. Perform installation in a well ventilated area away from open flames or sparks.
- If motorcycle has been running, wait until engine and exhaust pipes have cooled down to avoid getting burned before performing any installation steps.
- Before performing any installation steps disconnect battery to eliminate potential sparks and inadvertent engagement of starter while working on electrical components.
- Read instructions thoroughly and carefully so all procedures are completely understood before performing any installation steps. Contact S&S with any questions you may have if any steps are unclear or any abnormalities occur during installation or operation of motorcycle with a S&S part on it.

- Consult an appropriate service manual for your motorcycle for correct disassembly and reassembly procedures for any parts that need to be removed to facilitate installation.
- Use good judgment when performing installation and operating motorcycle. Good judgment begins with a clear head. Don't let alcohol, drugs or fatigue impair your judgment. Start installation when you are fresh.
- Be sure all federal, state and local laws are obeyed with the installation.
- For optimum performance and safety and to minimize potential damage to carb or other components, use all mounting hardware that is provided and follow all installation instructions.

Motorcycle exhaust fumes are toxic and poisonous and must not be breathed. Run motorcycle in a well ventilated area where fumes can dissipate.

WARRANTY:

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

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

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

ADDITIONAL WARRANTY PROVISIONS:

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

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INTRODUCTION

The S&S® engine you have purchased is an air-cooled, v-twin. It is designed to offer Proven Performance® and reliability. Specifications for the 3½", 3⅞", 4", and 4⅞" bore engines are found in this manual. We have covered the most popular configurations, 80ci, 96ci, 111ci, and 124ci, based on their original S&S production designs. Some changes may have been made over time as these engines have been in production for a number of years. The specifications in this manual are based on the most recent production specifications.

ENGINE INSTALLATION

The procedure for installing an S&S engine is basically the same as outlined in the factory service manual for the model of motorcycle the engine is being installed in. However, S&S engines are sometimes taller than a stock engine so the installer must check to make sure there is adequate clearance between the engine and all chassis components including the frame and fuel tanks. An upgraded clutch should also be considered, since the S&S engine will produce more power than the stock engine it is replacing.

OIL LINE HOOK-UP

The following diagrams show how the crankcase breather and oil lines should be hooked up for S&S V-Series engines. Note most 4⅞" bore engines have a use a vacuum breather system

Viscosity	Ambient Temperature (°F)
SAE 20W50	Above 30°–100°
SAE 50	Above 60°–100°
SAE 25W60	Above 80°
SAE 60	Above 80°

OIL RECOMMENDATIONS

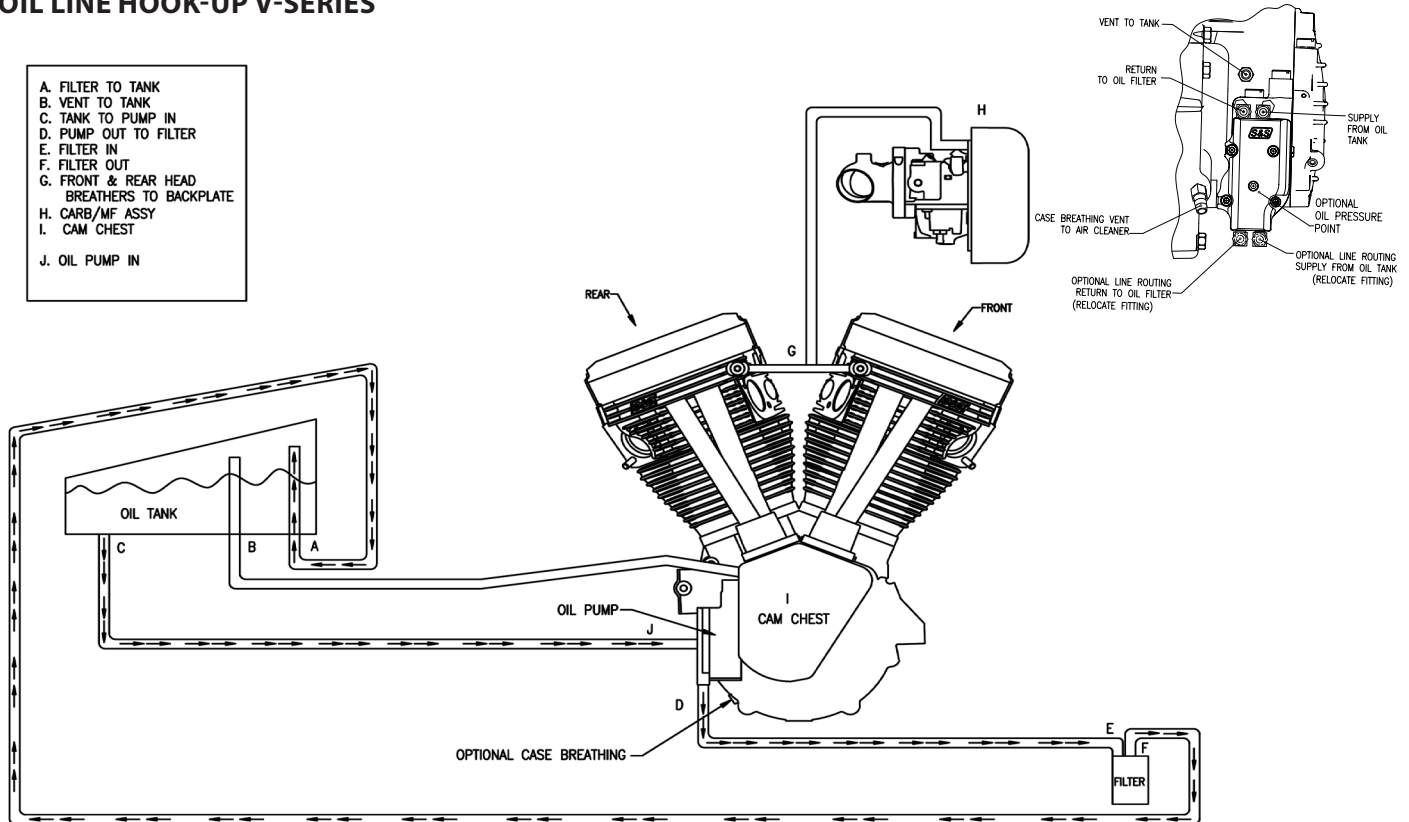
S&S recommends synthetic engine oil such as S&S Premium Synthetic 20W50. However a premium petroleum based engine oil such as S&S Heavy Duty 20W50 or 25W60 is acceptable.

Regardless of what type of oil you select, be sure to use only oil specifically designated for use in an air-cooled motorcycle, and select the viscosity suggested for the temperature range you will be operating your motorcycle in.

The oil filter used on an S&S® V-Series engine should be rated at 24 microns. Spin-on filters should not have an anti-drain back valve. S&S filters are available to replace Harley-Davidson® #63805-80A and 63796-77A. The S&S part numbers are 31-4101 and 31-4102.

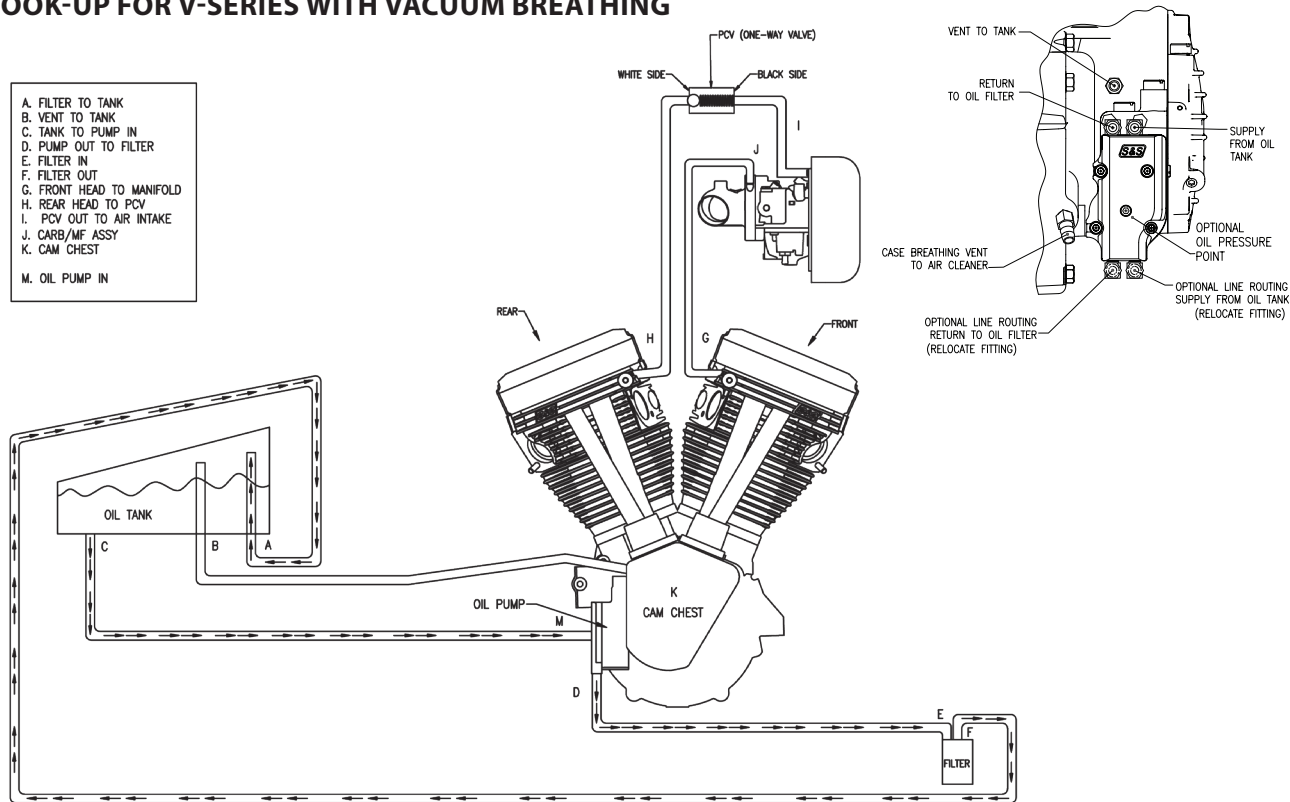
OIL LINE HOOK-UP V-SERIES

- A. FILTER TO TANK
- B. VENT TO TANK
- C. TANK TO PUMP IN
- D. PUMP OUT TO FILTER
- E. FILTER IN
- F. FILTER OUT
- G. FRONT & REAR HEAD BREATHERS TO BACKPLATE
- H. CARB/MF ASSY
- I. CAM CHEST
- J. OIL PUMP IN



OIL LINE HOOK-UP FOR V-SERIES WITH VACUUM BREATHING

- A. FILTER TO TANK
- B. VENT TO TANK
- C. TANK TO PUMP IN
- D. PUMP OUT TO FILTER
- E. FILTER IN
- F. FILTER OUT
- G. FRONT HEAD TO MANIFOLD
- H. REAR HEAD TO PCV
- I. PCV OUT TO AIR INTAKE
- J. CARB/MF ASSY
- K. CAM CHEST
- M. OIL PUMP IN



FUEL REQUIREMENTS

The gasoline used in your engine should have a US octane rating of 91 or higher. The United States uses the $\frac{R+M}{2}$ method of octane rating. In many countries outside the United States, the RON (Research Octane Number) is used, which will result in a higher octane requirement of about 96.

GENERAL BREAK-IN NOTES

- *Remember that these are air-cooled engines. Sufficient air movement is required to keep engine temperatures within safe operating limits.*
- *Avoid heavy traffic and congestion or extended idle periods whenever possible.*
- *S&S v-twin performance engines are designed for, and happiest when running between 2750-3500 at normal highway speeds.*
- *Today's heavier bikes and taller gearing can easily push a high performance engine into a lugging condition which increases loads on engine components, causes detonation, builds excessive heat, and increases fuel consumption. If the engine does not accelerate easily when given some throttle, downshift to a lower gear.*
- *S&S engines benefit from a warm-up period any time they are started, allow engine to reach operating temperature before being subjected to heavy loads or quick throttle revs.*

BREAK-IN OIL CONSIDERATIONS.

Either petroleum or synthetic oil designed for air-cooled v-twin engines can be used during the break-in period and during normal use. If preferred, petroleum oil can be used for the break-in period, after which, the engine can be changed over to synthetic oil.

BREAK-IN PROCEDURE

1. 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 the oil tank, and that no leaks exist.
2. Shut off engine and thoroughly check for any leaks or other problems. Let engine cool to the touch.
3. 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°F) shut the motor down and let it cool to room temp. Follow the same cautions as for the initial start-up, and continue to check for problems.
4. First 50 Miles:
 - a. Street: Ride normally, do not lug the engine. Avoid high heat conditions and vary the RPM while riding. No stop and go traffic, extended idle periods, or high load or high RPM conditions. Max of 3,500 RPM or 60 MPH.
 - b. Dyno: A chassis dynamometer can be used to put the first 50 miles on a new engine. See the notes and procedure below for chassis dyno break-in.

5. 50–100 Miles: Ride normally, do not lug the engine. Avoid high heat conditions, no stop and go traffic or extended idle periods. Limited short bursts of throttle can aid in ring seating from this point forward during the break-in, but avoid continuous high speed or load conditions. Max of 4,250 RPM/70 MPH.
6. 100–500 Miles: Avoid lugging the engine and high heat conditions. Max of 5,000 RPM. Change oil at 500 miles.
7. 500–1,000 miles: Ride bike normally, but avoid continuous high load operation and high heat conditions.
8. From 1,000 miles on: Break-in is complete, enjoy!

NOTES FOR COMPLETING INITIAL 50 MILE BREAK-IN AND INITIAL TUNING ON A CHASSIS DYNO

- *When running the bike on the dyno it is critical that engine temperatures are monitored, AFR is kept between 12.5–14.7 and the engine is not overheated. Fans must be used to keep the engine cool. When tuning under higher loads stop regularly and allow the engine to cool.*
- *A load must be placed on the engine to properly seat the rings. Running a new engine continually with no load will result in cylinder glazing and poor ring seal. The engine should be loaded to simulate close to the weight of the bike, a load of 10–15% on a Dyno jet 250i is usually sufficient. It is not recommended to use an inertia only dyno to break-in an engine as no load can be placed on the engine.*
- *Initial tuning on the engine can be completed during the initial 50 miles of dyno break-in. It is recommended the engine be run on the*

street for a minimum of 500 miles prior to completing tuning at full power. Monitor engine temperature during tuning to ensure the engine is not overheated.

DYNO BREAK-IN PROCEDURE (FIRST 50 MILES)

1. Follow the same procedure outlined above for initial start-up and heat cycling the engine.
2. Run the bike for 25 miles on the dyno under varying speeds and loads while going up and down through the gears. Keep engine RPM below 3,500 RPM but do not lug the engine. The dyno must be operated so the engine runs under a load roughly equal to the power needed to move the bike down the road, this would be about 12 hp at 55 MPH. Keep engine head temperatures below 200°F at the temp sensor or surface of the head. Stop and cool the engine if needed.
3. Allow the engine to cool down to room temperature.
4. Run the bike for 25 more miles (50 miles total) under varying speeds, loads, and gears as before. Make sure there is some load on the engine. Keep engine speed below 4,250 RPM but do not lug the engine. Limited short bursts of throttle can aid in ring seating as long as the calibration/tune keeps the AFR in control. Keep engine head temperatures below 225°F at the temp sensor or surface of the head.
5. After the first 50 miles on the dyno, it is recommended the normal break-in schedule be followed under normal riding conditions on the street. See Step 5 under **BREAK-IN PROCEDURE**.

TUNE UP INFORMATION

S&S 4" bore and smaller V-Series engines come from the factory with Champion RN12YC 14mm long reach spark plugs (S&S PN 55-1321). 4-1/8" bore engines come from the factory with Champion RA8HC 12mm spark plugs (S&S PN 55-1320). All spark plugs should be gapped between .038- and .042-inch. If you are not using an S&S ignition system, refer to your ignition manufacturer for any additional recommendations.

IGNITION SYSTEM

Carbureted S&S V-Series engines come from the factory with either an S&S Super Stock™ or IST® ignition system installed. Fuel injected engines are equipped with an S&S VFI module.

S&S Super Stock ignition modules are factory programmed for the specific engine they are intended for. In addition the module is installed and timed to S&S specified timing. Changing the timing or removing the Super Stock ignition may void your warranty.

S&S IST ignition systems employ a knock sensor to automatically optimize ignition timing and protect your engine from damage. Removing the IST ignition may void your warranty.

Ignition timing in S&S fuel injected engines, is controlled by the S&S VFI module. The calibration file supplied by S&S for the particular engine contains ignition timing curves. If the ignition curve is modified or if another fuel injection module is used, the engine warranty may be voided.

If you choose to install another ignition system, make sure that the total ignition advance is set according to the specifications in this chart.

If the ignition system has a rev limiter, make sure it is set no higher than 6200 rpm..

Engine	Total Advance, VOES Grounded (deg BTDC)*	Max Advance, Wide Open Throttle (WOT)	RPM Max Advance @ WOT
V124	34°	29°	5000
V117	35°	30°	5000
V113	34°	29°	5000
V111	35°	31°	5000
V96	32°	27°	5000
V80	35°	33°	5000

If you choose to install another EFI module on a fuel injected V124 engine, the following ignition table should be used as a guide for ignition advance under various conditions

EFI Ignition Table - S&S V124, 10.8:1 CR, 640 Cam						
RPM	1000	2000	3000	4000	5000	6000
WOT	5.0°	15.4°	18.2°	19.5°	22.3°	26.0°
Cruise	16.0°	25.0°	34.1°	34.0°	31.7°	30.0°
Idle/Decel	15.5°	20.4°	34.4°	40.0°	42.3°	42.3°

START-UP — ENGINES EQUIPPED WITH S&S SUPER E OR G CARBURETOR

1. S&S Super E & G carburetors have a mixture enrichment/fast idle lever used to aide in cold starts and help during the warm-up period. Do not ride the motorcycle with the lever engaged.
2. Turn the fuel supply valve on, wait a moment to make sure the carburetor bowl is full, and twist the throttle twice to prime the carburetor—starting in extremely cold weather may require additional priming.
3. Pull the fast idle lever up, turn on the ignition and press the start button or kick the engine through.
4. If the engine does not start after several kicks or five seconds of cranking, shut the ignition off for 15 seconds to let the starter cool.
5. Open the throttle slightly and press the starter button or kick the engine through again. It may be necessary to re-prime the engine. If the engine kicks back, the throttle may be opened too far.
6. Once the engine is running, use the fast idle lever to maintain the proper engine speed required during warm-up.
7. When the engine has warmed up enough to idle without the enrichment system, disengage the fast idle lever. The fast idle lever is not required to restart a hot engine.

INITIAL START UP WITH IST IGNITION

1. Start the motorcycle up as outlined above.
2. The IST ignition comes with a general ignition map that will allow the engine to be started and run. Within 3 to 5 hours of operation the IST module will optimize this map for your engine, based on

data from the knock sensor and other sensors.

3. Ride the motorcycle as you would normally, being sure to include hills, highway speeds (for at least 20 minutes at a time) and around town. Be sure to use the throttle in as many settings as possible—without going past the suggested break-in procedures!
4. Once the engine is completely broken in, the IST will be tuned to optimize the engine's performance.
5. Do not run the engine on a dyno until the IST has had time to tune itself to your engine.

START-UP — ENGINES EQUIPPED THE VARIABLE FUEL INJECTION (VFI)

1. Turn the ignition and kill switches on. Listen for the fuel pump as it pressurizes.
2. Do not twist the throttle open to prime the system.
3. Press the starter button and let engine crank over—do not twist the throttle. If the engine is extremely hard to start—hot or cold—contact the S&S® Tech Line or visit www.sscycle.com for the location of the closest VFI Tuning Center.

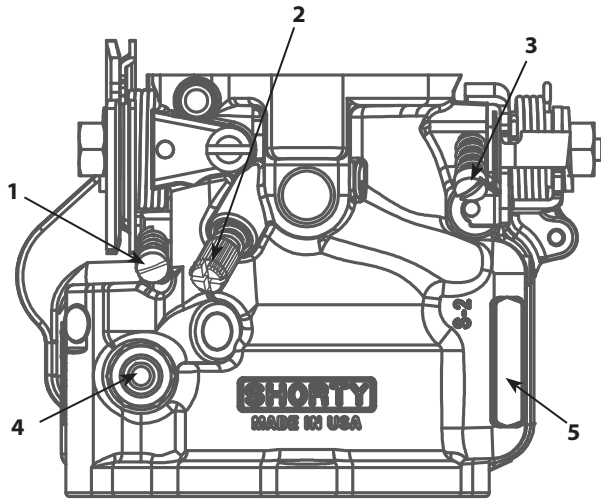
SUPER E & G CARBURETOR TUNING GUIDE

1. Verify carburetor is set to stock settings:
 - a. Idle mixture screw, 1¼ turns from lightly seated.
 - b. Idle speed screw, ½ turn clockwise from engagement point.
 - c. Accelerator adjustment screw, two turns counter-clockwise from seated.
2. Start bike, bring to operating temperature.
3. Set idle speed adjusting screw, clockwise to increase RPM, counter-clockwise to decrease RPM. Idle RPM range should be 950 to 1050 RPMs.
4. Adjust idle mixture by turning idle mixture screw slowly clockwise until the engine runs poorly. Note position. Slowly turn the screw counter-clockwise until it starts to stumble. Note position. Set the idle mixture screw halfway between the positions, or at the strongest idle. Inconsistent idle may indicate a manifold leak.
5. With engine idling, turn accelerator adjustment screw clockwise until it lightly seats. Snap throttle open—engine should stumble. Turn screw counter-clockwise ¼ or ½ of a turn at a time, until engine responds to throttle twist with smooth, quick response.
6. Ride motorcycle in various RPM ranges, and then try to maintain a consistent 40- to 50-MPH. If the engine has a flat spot, or is popping/sneezing in the air cleaner, it can indicate a lean condition. If you notice stumbling or sputtering, it can indicate a rich condition.
7. Low RPM operation is controlled by the intermediate jet (#11 on following page). If sneezing or popping is experienced below approximately 3000 RPMs the intermediate jet must be replaced with a larger sized (richer) jet. If the engine does not run smoothly at low speeds, fouls plugs, blows black smoke or gets bad gas mileage a smaller (leaner) intermediate jet needs to be installed. Always readjust the idle mixture (#2) and idle speed (#1) screws after making a jet change.
8. To test the main jet, do a roll-on from 50-MPH to 70-MPH in 3rd gear. If the engine backfires or breaks up in the carb, increase the main jet size .004". If the engine is flat or will not accelerate, decrease the main jet by .004".
9. Since 2004 S&S shorty carbs have been fitted with an adjustable main jet air bleed (#13). Changing this jet to a larger size will delay the signal to the main jet, therefore aiding with high speed tuning as described in step 8. This also aides with tuning an engine that is fitted with an exhaust system that is not intended for high performance. The air bleed uses main jets, the stock size is 40. If it needs to be changed the range is normally 50 to 60.
10. **NOTE:** *Drag or straight pipes, especially large diameter or long designs, can prevent you from obtaining optimum carburetor performance.*
11. If the S&S teardrop air cleaner is being replaced with an aftermarket air cleaner, be sure to remove the auxiliary bowl vent screw (#14). Never use a velocity stack on a street driven motorcycle! Poor throttle response will be experienced.
12. Always be sure to attach the hose to the overflow tube fitting (#6) and route it toward the back of the engine.

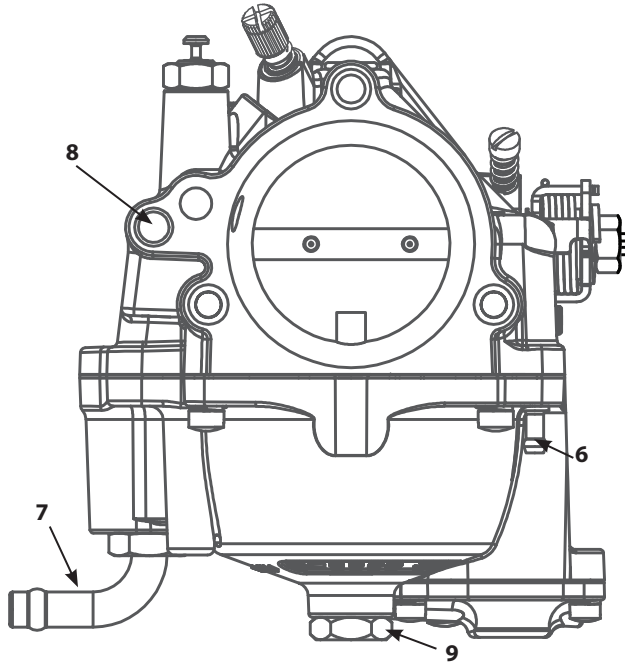
Approximate Jetting For S&S® Super E & G Carburetors

Displacement	883cc	74 – 88ci	96 – 107ci	111 – 124ci
Intermediate Jet	.265 – .028	.0295	.031	.031
Main Jet	.066	.072	.076	.078

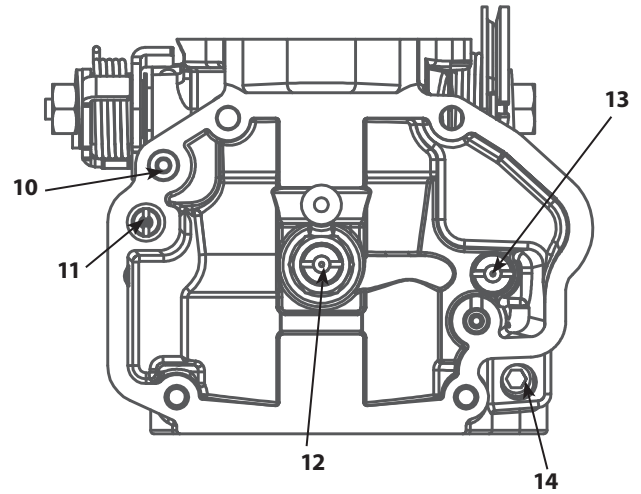
These jetting recommendations are a starting point only. Re-jet carb for best performance.



- 1- Idle Speed Screw
- 2- Idle Mixture Screw
- 3- Accelerator Pump Adjustment Screw
- 4- Enrichment Device
- 5- Serial Number



- 6- Overflow Tube Fitting
- 7- Fuel Inlet
- 8- Bowl Vent Hole
- 9- Bowl Plug



- 10- Accelerator Pump Pushrod
- 11- Intermediate Jet
- 12- Main Jet
- 13- Main Jet Air Bleed
- 14- Auxiliary Bowl Vent Plug

ENGINE SERVICE INTERVALS

Item	Interval
Engine Oil & Filter	Change at 500, 2,500 miles (80, 800, 4,000 kilometers), every 2,500 miles (4,000 kilometers) thereafter ¹ .
Air Cleaner Element	Inspect at 50 and 500 miles (80 and 800 kilometers), every 2,500 miles (4,000 kilometers) thereafter ² . Replace every 5,000 miles (8,000 kilometers).
Tappet Oil Screen	Inspect every 2,500 miles (4,000 kilometers). Replace every 5,000 miles (8,000 kilometers).
Petcock, Lines, & Fittings, Vacuum Lines	Inspect at 50 and 500 miles (80 and 800 kilometers), every 2,500 miles (4,000 kilometers) thereafter.
Fuel Tank Filter Screen & In-Line Fuel Filter (If used)	Inspect every 5,000 miles (8,000 kilometers).
Engine Idle Speed	Adjust as required.
Operation of Throttle & Enrichment Device Controls	Inspect at 500 miles (800 kilometers) and every 2,500 miles (4,000 kilometers) thereafter.
Spark Plugs	Inspect every 5,000 miles (8,000 kilometers). Replace every 10,000 miles (16,000 kilometers) or as needed.
Ignition Timing	Inspect every 5,000 miles (8,000 kilometers).
Engine Mounts	Inspect at 500 miles (800 kilometers) and every 5,000 miles (8,000 kilometers) thereafter.
External Fasteners Except Engine Head Bolts	Re-torque at 500 miles (800 kilometers) and every 5,000 miles (8,000 kilometers) thereafter.
<p><i>1- S&S recommends that petroleum-based oil not specifically formulated for motorcycles should be changed every 1,000 miles (1,600 kilometers) after the break-in period.</i></p> <p><i>2- Replace more frequently if required or if engine is operated in a dusty environment.</i></p>	

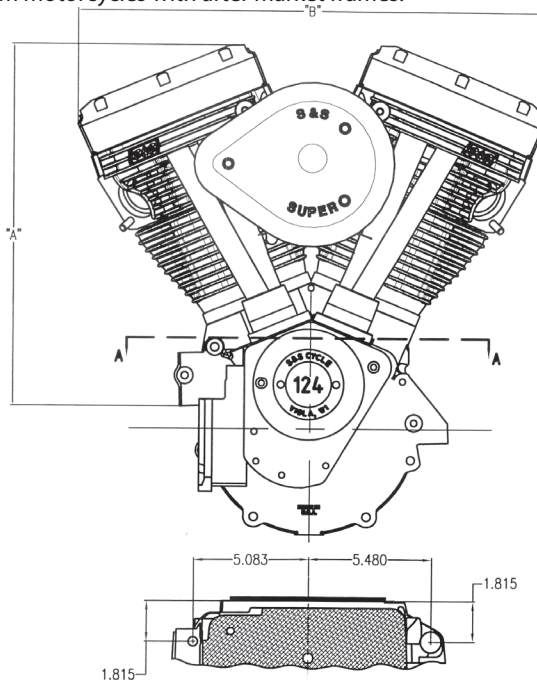
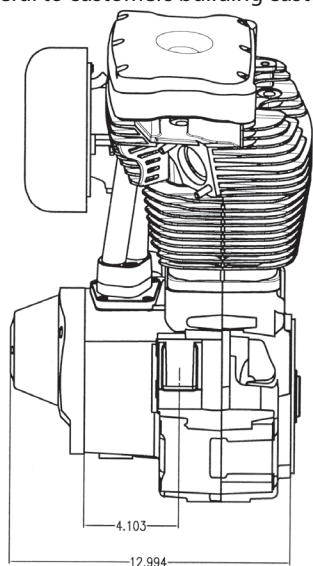
ENGINE SPECIFICATIONS

The following chart contains information about a number of S&S engines covered by this owners manual.

Engine	Displacement	Bore	Stroke	CR	Cam	Tappets	Fuel System	Ignition System
V80	80"	3½"	4¼"	8.4:1	508	Hydraulic	"Super E or None"	"Super Stock or None"
V96	96"	3⅝"	4⅝"	9.5:1	585	"Hydraulic w/HL2T"	Super E	"Super Stock or IST"
V96 TÜV	96"	3⅝"	4⅝"	10.1:1	520	"Hydraulic"	Super E	IST
V111	111"	4⅞"	4⅞"	9.8:1	585	"Hydraulic w/HL2T"	Super E	"Super Stock or IST"
V113 TÜV	113"	4"	4½"	10.1:1	547	"Hydraulic w/HL2T"	Super G	IST
V124	124"	4⅞"	4⅝"	10.8:1	640	"Hydraulic w/HL2T"	Super G or VFI	"Super Stock, IST, or VFI"
V124 TÜV	124"	4⅞"	4⅝"	9.5:1	547	"Hydraulic w/HL2T"	Super G	IST

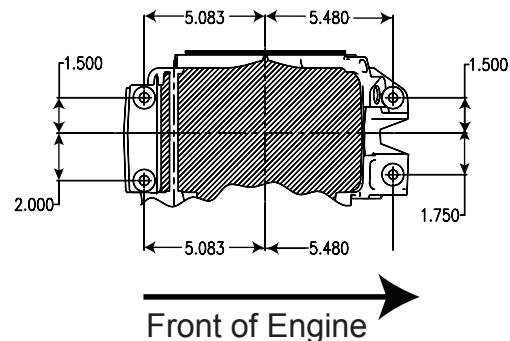
ENGINE DIMENSIONS

Some S&S engines are taller than stock engines. These diagrams show the dimensions of various S&S engines. This information will be most useful to customers building custom motorcycles with after market frames.



SECTION A-A

Engine	A	B
V80	15.898"	20.299"
V88	15.736"	20.165"
V96	15.912"	20.310"
V96 TUV	15.912"	20.310"
V100	15.623"	20.062"
V107	15.728"	20.163"
V113	15.846"	20.266"
V113 TUV	15.846"	20.266"
V124	15.979"	20.366"
V124 TUV	16.048"	20.424"



Front of Engine



CHARGING SYSTEM NOTE - If you are going to use a 45 amp alternator you must install a S&S® spacer (PN 31-4033). If you do not use this spacer the rotor could bottom out against the case when the sprocket shaft nut is tightened.

IMPORTANT INFORMATION

- S&S engines are not recommended for inexperienced riders because the increased performance requires a higher level of riding skill.
- Do not lug your S&S engine. This is a high performance engine, designed to produce excellent horsepower at higher RPM. It was not well suited to pull heavy loads at low RPM. We recommend that the engine not be operated below 2500 RPM for extended periods of time. Shift to a lower gear to keep the engine speed up when traveling at lower speeds.
- Your S&S Engine is air cooled, which means that it depends on air moving across the cooling fins to keep it from over heating. Do not allow your engine to idle for extended periods of time. Avoid stop and go traffic or any other situation where the motorcycle is not moving while the engine is running.
- To avoid engine damage, do not operate the engine above 6200 RPM.

SERVICE SPECIFICATIONS FOR S&S ENGINES

For the most part if an S&S engine requires service, a qualified mechanic who services Harley-Davidson® engines can do the work. However the specifications for S&S engines are somewhat different. These charts are provided for reference. For more detailed information about any specific S&S component, installation instructions are available for free download from the S&S website www.sscycle.com.

TORQUE SPECIFICATIONS		
Item	Torque	Recommended
Rocker Box ¼"	100-120 in-lbs	Loctite® 243
Rocker Box base ⅝"	15-18 ft-lbs	Loctite 243
Rocker arm support plate	15-18 ft-lbs	Loctite 243
Cylinder head bolts	8 ft-lbs, 18 ft-lbs, 90°	Oil threads
Cylinder studs	10 ft-lbs	Loctite 272
Crankcase fasteners	12-15 ft-lbs (¼) 18-20 ft-lbs (⅝)	
Piston oilers	25 in-lbs	Loctite 243
Pinion nut	50 ft-lbs	Loctite 272
Tappet guide fasteners	90-120 in-lbs	Loctite 243
Pushrod locknuts	90-120 in-lbs	
Gear cover fasteners	100-120 in-lbs	Loctite 243
Timing hole plug	120 in-lbs	Anti-seize
Oil pump cover/mounting bolts (4)	90-120 in-lbs	
Oil pump top mounting (2)	60 in-lbs	
Intake manifold to head	16 ft-lbs	Loctite 243
Intake manifold to carb	18 ft-lbs	Loctite 243

Item	Torque	Recommended
Compression releases	32-37 ft-lbs	Anti-seize
Exhaust flange to head	15-18 ft-lbs	Anti-seize
Head temp sensor	10-12 ft-lbs	Anti-seize
Knock sensor	11 ft-lbs	Anti-seize
Crank position sensor	90-120 in-lbs	
Spark plug	11-18 ft-lbs	Anti-seize
<i>NOTE: 12 in-lbs equals 1 ft-lbs</i>		

SPECIFICATIONS & WEAR LIMITS		
Description	Specification	Wear Limit
Rocker Arm		
Shaft in bushing	.0007"-.0018"	.0035"
Bushing fit in rocker arm (press)	.0012"-.0032"	<.0012"
Rocker arm endplay	.001"-.012"	
Cylinder Head		
Valve to guide fit intake	.0012"-.0020"	.0035"
Valve to guide fit exhaust	.0017"-.0025"	.0040"
Valve guide in head (press)	.0015"-.0030"	<.0015"
Valve seat in head (press)	.0050"-.0070"	<.0050"
Seat width intake	.031"	.041"
Seat width exhaust	.047"	.057"
Valve stem protrusion	2.045"-2.060"	2.080"
Pistons		
Fit in cylinder	.002"-.0026"	.0055"
Compression ring gap	.017"-.026"	.030"
Oil ring gap	.010"-.040"	.050"

Description	Specification	Wear Limit
Connecting Rods		
Side play	.006"-.036"	.040"
Wristpin in rod	.0005"-.001"	.002"
Crankpin running clearance	.001"-.0012"	.002"
Flywheels		
Run out at bearing	.0005"-.001"	.006"
Timken endplay	.001"-.005"	.005"
Pinion bearing fit	.0004"-.001"	.002"
Cam Chest		
Breather gear endplay	.005"-.015"	.016"
Breather clearance	.0015"-.003"	.004"
Camshaft in bushing	.0007"-.002"	.0035"
Camshaft endplay	.005"-.015"	.016"
Pinion shaft in bushing	.001"-.0025"	.0035"
Bushing fit in gear cover (press)	.0007"-.0023"	<.0006"
Oil pump shaft	.0005"-.0025"	.0035"
Lifters		
Lifter fit in guide	.0006"-.0017"	.0022"



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