



Installation Instructions: S&S® T111 Engine Assembly

DISCLAIMER:

Many S&S parts are designed for high performance, closed course, racing applications and are intended for the very experienced rider only. The installation of S&S parts may void or adversely affect your factory warranty. In addition such installation and use may violate certain federal, state, and local laws, rules and ordinances as well as other laws when used on motor vehicles used on public highways. 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 an S&S part on it.
- Consult an appropriate service manual for your motorcycle for correct disassembly and reassembly procedures for any parts that need to be removed to facilitate installation.
- Use good judgment when performing installation and operating motorcycle. Good judgment begins with a clear head. Don't let alcohol, drugs or fatigue impair your judgment. Start installation when you are fresh.
- Be sure all federal, state and local laws are obeyed with the installation.
- For optimum performance and safety and to minimize potential damage to carb or other components, use all mounting hardware that is provided and follow all installation instructions.
- Motorcycle exhaust fumes are toxic and poisonous and must not be breathed. Run motorcycle in a well ventilated area where fumes can dissipate.

IMPORTANT NOTICE:

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



WARNING

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



CAUTION

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

NOTE

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

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

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.

Instruction Contents:

1-Introduction	8-Exhaust System
2-Additional Features	9-Initial Start-up & Engine Break-In
3-Modification Notes	10- Tuning Guidelines
4-Engine to Frame Assembly	11- Engine Specs & Torque Values
5-Ignition System	12- Service Intervals
6- Fuel System	
7-Oil Line Installation	

Please read these instructions carefully before starting work. Proceed with the installation only after the instructions are completely understood. These instructions should be supplemented by the appropriate OEM service manual for your motorcycle. Follow all safety information.

1- Introduction

S&S® T111 Engines are designed and intended for installation in a stock Harley-Davidson® Twin Cam 88® chassis. It will bolt directly to the stock transmission and engine mounts of chassis designed for stock Twin Cam 88® engines. The T111 Engine is available in silver powder coat or black powdercoat finish.

Installation can be performed by any Harley-Davidson® repair shop equipped to do complete engine overhauls.

No special tools other than those used in normal engine building operations are required.

NOTES:

- *Installation of a fuel injected engine in a motorcycle that was originally equipped with a carburetor is fairly difficult and expensive. This conversion requires a fuel pump equipped gas tank as well as wiring harness.*
- *All S&S T111 assemblies are for Twin Cam 88® non-counterbalanced engine applications, and are not for use in Twin Cam 88B® counterbalanced applications.*

2- Additional Features:

- *Greater overall strength than stock crankcases, especially in the front motor mount, an important consideration in high performance applications.*
- *All oil passages between the crankcase and cam support plate are o-ring sealed.*
- *Compatible with stock components. Use stock oil pump, cam support plate, gear cover, etc.*
- *Uses 1999–2002 Timken® style sprocket shaft bearing.*
- *Uses 2003–up pinion shaft bearing*

S&S® T111 instructions often refer to procedures described in other S&S instructions or a Harley-Davidson® Service Manual. These materials should be cross referenced as necessary.

IMPORTANT

Before proceeding, verify that serial numbers on crankcases match numbers on packing carton and certificate of origin. Contact S&S immediately if numbers do not match.

NOTE: *Valid certificate of origin is required for any transfer or sale of long block assemblies. Certificate of origin is required to title and license any motorcycle which is to be driven on public streets and highways.*

3- Modification Notes

S&S® Cycle cautions against modifying these crankcases due to the possibility of damaging or weakening them. Modifying S&S crankcases in any fashion voids all manufacturer warranties. Should the customer elect to modify the crankcases regardless, it is imperative that they and the information tag attached to them be inspected beforehand to confirm that the correct model, style, bore size, etc. have been provided. The customer must confirm that crankcases and related parts are correct before assembling them or having them modified in any manner, and assumes all liability for modifications.

Under no circumstance will S&S be held responsible for expenses related to the modification of any S&S part in the event warranty service is required. Modified parts will not be accepted for credit or exchange. This will apply regardless of cause or fault: customer, retailer, manufacturer, or other.

For further information, contact S&S Technical Services at 608-627-8324, or e-mail ssstech@sscycycle.com

NOTE: *Modification includes but is not limited to appearance changes such as painting, powdercoating, plating, and polishing. Proper preparation for these procedures as well as the processes themselves may require the use of polishing compounds, chemicals or procedures that are potentially harmful to crankcases.*



- **Passages and internal cavities may become obstructed by residues from materials used to polish, paint, plate or powdercoat surfaces. Additionally, surface finishing processes can damage critical machined surfaces. Any of the above may cause premature wear, damage or failure of other engine components as well as the crankcases themselves.**
- **Glass bead and polishing residues are abrasive and can be difficult to remove from recesses and small passages. Abrasive residues can cause oil contamination and extensive engine damage. Engine damage caused by powder coating, polishing, glass bead blasting, or other modification will not be covered under warranty.**
- **Powder Coating: Subjecting heat-treated alloys such as those used in S&S crankcases to excessive heat can drastically alter their strength and their critical properties. The degree of change depends upon the temperatures reached and the duration of exposure. When powder coating or otherwise processing alloy parts, S&S exposes them to a maximum temperature of 370°F for no longer than 20 minutes. Under no circumstances should parts be heated past 400°F!**

S&S strongly recommends trial-fitting every engine before frame is painted or powdercoated.

4- Engine to Frame Assembly

The engine should be installed into the frame before the ignition, fuel, exhaust, and oil system components are installed. Follow the engine to frame fitting below:

Engine to Frame Test Fit

NOTE: *The engine must be fitted to the frame it is installed into. It must rest squarely on its attachment points, and bolted solidly to the frame without stressing the engine case at any point.*



Failure to correctly mount the engine can cause problems not covered under warranty including but not limited to, excessive vibration, driveline misalignment, and broken castings.

- a. Test-fit instructions for T111 style cases with stock 1999–up engine mounts.
 - i. Clean frame engine mounts and carefully remove any irregularities from mounting surfaces. Also inspect crankcase mounting bosses for burrs.
 - ii. Position engine in frame, check for clearance at frame, and alignment to transmission. It is a good idea to replace rubber engine mounts at this time. Old mounts deform over time and can induce unwanted stresses on the engine case.

Replace all other motorcycle components removed for engine installation. Consult authorized Harley-Davidson® service manual for installation procedure for stock parts not covered in S&S instructions.

NOTE: *On certain models it may be necessary to switch the shift linkage to the outside of the shift lever. Make certain that there is clearance between the shifter rod and the engine crankcases.*



Timing that is too advanced will result in detonation and engine damage. Timing that is too retarded will result in engine over-heating and engine damage.



If S&S determines that engine damage was caused by improper ignition timing, repair will not be covered under warranty.

Excessive ignition advance will cause engine to kick back against the starter during start-up and “buck” when ridden at steady speed with partial throttle. An advanced condition can also cause pinging or ignition knock and possible piston damage. These symptoms may not be noticed if electronic ignition with “soft” advance curve is used.

Excessive ignition retard causes sluggish performance and severe overheating with possible subsequent damage to the engine, and must also be avoided. Immediate or rapid exhaust pipe discoloration is usually a sign of retarded ignition timing.

5- Fuel system installation and tuning

NOTES: *S&S® Engine assemblies are available with either carbureted or fuel injected systems. Assembled Engines are shipped with the carburetor or fuel injection system installed. Refer to the included instructions for operation and tuning.*

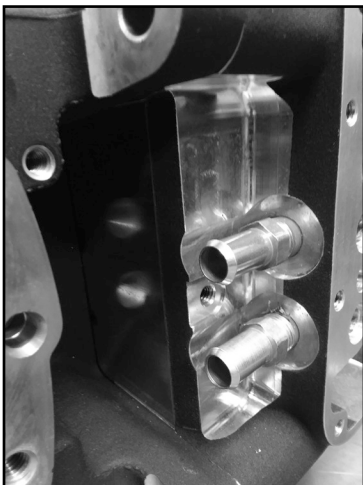
- a. Install fuel system.
 - i. Engine assemblies supplied with Super E carburetors, refer to included instruction sheet 51-1012.
 - ii. Engine assemblies supplied with fuel injection, refer to included Induction System instruction Sheet.
- b. Re-install and connect fuel tank.
 - i. Refer to appropriate service manual. Inspect fuel lines and clamp—replace as necessary.
 - ii. Check fuel line connections and routing. Avoid hot surfaces. Make certain that the protective cover has been placed over fuel line, and that it is clear from sharp edges and abrasive surfaces.
 - iii. Fill the fuel tank with a sufficient quantity of gasoline for the initial start-up procedure.
 - iv. Double check that all fuel line connections have been made correctly and there is no gas leakage at any point in the system.

6- Oil Line Installation

- a. **For 1999–2006 Harley-Davidson® FL models and 1999–2005 Dyna® models.**
- b. Remove the oil supply, oil return and crankcase breather fittings from the back of your stock TC crankcase. Clean any thread sealant from the threads and apply new thread sealant to the threads and install into your S&S crankcase as illustrated in **Picture 1** and **Picture 2**. If your fittings are damaged or you do not have your stock fittings, purchase HD® part number 26314-99.

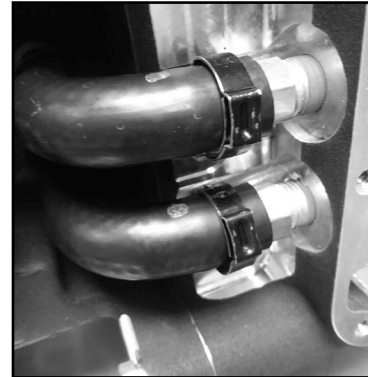


Picture 1



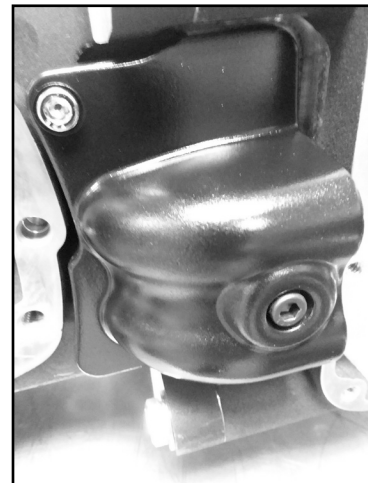
Picture 2

- c. Inspect your stock oil lines and case breathing line for damage and replace if needed with stock HD lines.
- d. Connect your lines to the fittings you just installed and use new HD® hose clamps, part number 10157 to secure to the barbed fittings. **Picture 3**



Picture 3

- e. Using the supplied QTY of 2 - $\frac{3}{8}$ spacers and socket head cap screws, re-install your stock oil line cover to the motor and transmission. **Picture 4**



Picture 4

C- Oil recommendations

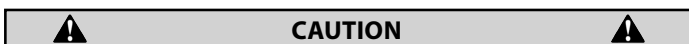
NOTES:

- S&S® Cycle recommends the use of S&S 20W-50 synthetic oil in our engines.
- S&S Cycle recommends the use of S&S® oil filters, PN 31-4103 (black), or PN 31-4104 (chrome).

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

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

D- Verify oiling system operation before starting



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



Restricted oil flow may result in extensive engine damage not covered under warranty.



Improper installation of oil lines or fittings may result in parts damage not covered under warranty.

1. Fill the oil tank to the proper level.
2. Remove spark plugs. Ground plug wires to cylinder head with either a jumper wire or through a test plug.
3. Remove oil sender unit.
4. Turn ignition on and turn the engine over with the starter motor until engine oil appears at the oil pressure sender hole.
5. Re-install and re-connect oil sender unit.
6. Verify that engine oil is returning to oil tank.
7. Start motorcycle. Verify oil pressure by watching oil pressure light.

NOTES:

- If oil fails to appear at oil sender hole within 30 seconds of starter operation, allow the starter to cool. Verify that oil line routing is correct and that the oil tank is full to the proper level.
- Oil pressure indicator lamp should light when ignition is turned on. Lamp will go out after engine is started and there is oil pressure at the switch in the crankcase.



Avoid excessive time of starter engagement. Overheating of starter motor will result in damage. Oil pump should prime and deliver oil to the oil sender hole within 30 seconds.

6- Exhaust System

NOTE: The engine must be correctly mounted into the frame before the exhaust system is installed.

1. Place new woven-metal gasket into exhaust ports of cylinder heads.
2. Inspect the exhaust pipe header flanges and retaining rings. Replace if distorted, warped, or otherwise damaged.
3. Apply a high-temp. anti-seize lubricant to threads of exhaust studs at cylinder heads.
4. Install exhausts to cylinder heads. Hand tighten exhaust stud nuts.
5. Attach exhausts to lower mounting bracket. Shim if necessary. Hand tighten mounting hardware.
6. Tighten exhaust flange nuts at head to 60-80 in-lbs.



In some instances, brake master cylinder must be spaced out from frame to clear crankcase. UNDER NO CIRCUMSTANCES SHOULD MASTER CYLINDER OR BRAKE LINE BE ALLOWED TO CONTACT EXHAUST PIPE IN FINAL INSTALLATION. Heat transferred to brake fluid may expand and cause brakes to seize, resulting in possible fire hazard and loss of control of motorcycle with injury or death to rider and others.

NOTE: Make certain that the exhaust system is not preloaded, or in a bind, at the lower mounting points. Make all spacing adjustments prior to final-tightening of the upper exhaust mounting hardware at the cylinder heads. Failure to follow this procedure may cause excessive vibration and result in failure of exhaust pipes or mounting hardware

7- Initial Start-Up and Engine Break-In

NOTE: 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.

- a. Initial start-up
 - i. For the initial start up, the fuel and ignition systems should be adjusted to their baseline settings. (Baseline settings allow the bike to start and run, and are the starting point for tuning.) This is adequate for the initial start-up and heatcycling of the engine.
- ii. 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, and that oil is returning to the oil tank.
- iii. Shut off engine and thoroughly check for any oil leaks, fuel leaks, or other problems. Let engine cool to the touch.
- iv. After engine has cooled, start up again and allow the motor to build some heat. Engine should not be run 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.
- v. Repeat this procedure 3 or 4 times. Each successive time it should take slightly longer to warm up and you can increase the temperature slightly each time. You can be more liberal each time with the rpm, gently vary rpm continuously from idle up to 2500 rpm in the final cycle. The motor should not reach full operating temperature during these cycles. Do not allow engine temperature to become excessive.

b. Engine break-in

- i. Closely monitor engine for excessive heat buildup. Do not allow the engine to idle for long periods of time. Be especially watchful when air temperatures exceed 90°. Slow speed operation in urban areas during the summertime is especially hard on engines. Temperature for engine oil should be between 180°–240° F. If engine oil temperature stays above 220° F, and correct ignition timing has been verified, S&S® Cycle suggests that an oil cooler be installed. Do not run engine under conditions where oil temperatures continue to remain high.
- ii. For the first 50 miles ride the motorcycle in a very conservative manner. 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. Change the oil at 50 miles. This will remove the heavy accumulation of break in residue from the oiling system.
- iii. The next 500 miles should be spent running engine no faster than 3500 rpm or 60 mph. Correct any obvious ignition or fuel problems, if present. Avoid continuous steady speeds, and do not lug the engine. Avoid continuous steady speeds, and do not lug the engine. Vary engine rpm. change the oil again at 500 miles.



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.

- iv. 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.
- v. After 1000 miles, verify Ignition and fuel system settings and adjustments. Change the engine oil. The break in process is complete.

8- Tuning Guidelines

Ignition timing and carburetor jetting are responsibilities of the customer. If not thoroughly familiar with these procedures, contact a professional mechanic.

a. Gearing

Gearing depends on the total weight of the machine and rider, the size of the engine, cam, exhaust system and type of riding. 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.

The following formula will determine final drive gear ratio:

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

9. Engine Specifications & Torque Values

Displacement	Bore	Stroke	Compression Ratio
111"	4 $\frac{1}{8}$ "	4 $\frac{1}{8}$ "	9.77:1

Cylinder Heads	Specification
Valve guide in head (tight)	.0015"-.003"
Valve seat in head (tight)	.005"-.0075"

Crankcase	Specification	Service Wear Limit
Timkin® race in case (tight)	.001"-.003"	less than .0025"
Pinion race in case (tight)	.001"-.003"	less than .0025"
Valves (Fit in guide)	Specification	Service Wear Limit
Intake	.0012"-.0015"	.0025"
Exhaust	.0018"-.0023"	.0035"
Seat Width	.040"-.062"	
Stem Protrusion	2.045"-2.060"	2.080"
Rocker Arms	Specification	Service Wear Limit
Shaft fit in bushing (loose)	.0007"-.0018"	.0035"
Bushing fit in rocker arm (tight)	.002"-.004"	
Hydraulic Lifters	Specification	Service Wear Limit
Lifter fit in guide (loose)	.0006"-.0017"	.003"
Flywheels	Specification	Service Wear Limit
Runout (shaft at flywheel)	.0005"-.001"	.003"
End play	.001"-.005"	exceeds .005"
Pistons	Specification	Service Wear Limit
Fit in cylinder	.002"-.0025"	.005"
End gaps: Top two compression	.017"-.025"	.028"
Oil control rails	.016"-.035"	.050"
Connecting Rods	Specification	Service Wear Limit
Crankpin bearing	.001"-.0012"	.002"
Running clearance	.0005"-.001"	.002"
Piston pin fitment in rod		
Connecting rod side-play	.015"-.035"	.040"

Torque Values	Specification	S&S Suggestion
Rocker box hardware 1/4"	120 in-lbs.	Loctite® 243
Rocker box hardware 5/16"	18 ft-lbs.	Loctite 243
Tappet guide fasteners	120 in-lbs.	Loctite 243

Pushrod locknuts	120 in-lbs.	
Crankcase fasteners 1/4"	120 in-lbs.	
Crankcase fasteners 5/16"	15 ft-lbs.	
Gearcover fasteners	120 in-lbs.	Loctite 243
Intake manifold-to-head	16 ft-lbs.	Loctite 243
Intake manifold-to-carb	18 ft-lbs.	Loctite 243
Exhaust flange-to-head	60-80 in-lbs.	Anti-seize
Spark plug	11-18 ft-lbs	Anti-seize
Cylinder studs	10 ft-lbs.	Loctite 262
Piston oiler screws	35 in.-lbs.	Loctite 243

10. Service Intervals

S&S® Recommended Regular Service Intervals	
Item	Interval
Engine Oil & Filter	Change at 50, 500, 2,500 miles, every 2,500 miles thereafter ¹
Air Cleaner	Inspect at 50 and 500 miles, every 2,500 miles thereafter. ²
Petcock, Lines, & Fittings. Vacuum Lines	Inspect at 50 and 500 miles, every 2,500 miles thereafter
Fuel Filters	Every 5,000 miles
Engine Idle Speed	Adjust as required.
Throttle & Enrichment Device Control	Inspect and lubricate throttle cables at 500miles and every 2,500 miles thereafter
Spark Plugs (Champion RA8HC or equiv.)	Inspect every 5,000 miles. Replace every 10,000 miles or as needed
Ignition Timing - 28 deg. total advance max	Inspect every 5,000 miles
Engine Mounts	Inspect every 500 miles and every 5,000 miles thereafter
External Fasteners (except cyl. head bolts)	Re-torque at 500 miles and every 5,000 miles thereafter

¹S&S recommends that petroleum-based oil not specifically formulated for air cooled motorcycles should be changed every 1,000 miles

²Replace more frequently if required or if engine is operated in a dusty environment

