



## Installation Guide: S&S® T143 Long Block Engine for 1999–'06 Harley-Davidson® Big Twin Except 2006 Dyna® Models

### 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 affect your factory warranty. In addition such installation and use may violate certain federal, state, and local laws, rules and ordinances as well as other laws when used on motor vehicles used on public highways, especially in states where pollution laws may apply. Always check federal, state, and local laws before modifying your motorcycle. It is the sole and exclusive responsibility of the user to determine the suitability of the product for his or her use, and the user shall assume all legal, personal injury risk and liability and all other obligations, duties, and risks associated therewith.

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 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:

The T143 is 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® 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.

Instruction contents:	5. Oil line installation
1. Introduction	6. Exhaust system
2. Modification notes	7. Engine break-in
3. Engine to frame assembly	8. Tuning guidelines
4. Fuel system	9. Service intervals

**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

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

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

### NOTES

**S&S® T-Series 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 longblock assemblies. Certificate of origin is required to title any motorcycle.

## 2. Modification Notes

Modifying S&S engines in any fashion voids all manufacturer warranties.

**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.

### CAUTION

- 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. Under no circumstances should parts be heated past 400°F!

**S&S strongly recommends trial-fitting every engine before frame is painted or powder coated.**

## 3. Engine To Frame Assembly

### NOTES

- The engine should be installed into the frame before the ignition, fuel, exhaust, and oil system components are installed.
- 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 mounts without stressing the engine case at any point.

### CAUTION

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

- A. Clean frame engine mounts and carefully remove any irregularities from mounting surfaces. Also inspect crankcase mounting bosses for burrs.
- B. 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

### CAUTION

**Improper alignment of engine and frame mounts may cause abnormal stresses resulting in damage to crankcases or other parts**

## 4. Fuel system installation and tuning

**NOTES** - S&S® Engine assemblies for 1999-'06 big twins do not include a fuel system.

S&S T143 engines are equipped with S&S B3 Special Application cylinder heads which require a special intake manifold/throttle body or carb due to the shape and location of the intake ports. S&S offers a special 70mm throttle body and air cleaner kit for fuel injected applications, and carb kits for carbureted applications. Contact your S&S Customer Service Representative for details.

### A. Install fuel system.

1. Install carburetor or throttle body, fuel injectors, and intake according to instructions included with fuel system.

### B. Re-install and connect fuel tank.

1. Refer to appropriate service manual. Inspect fuel lines and clamps - replace as necessary.
2. 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.
3. Fill the fuel tank with a sufficient quantity of gasoline for the initial start-up procedure.
4. Double check that all fuel line connections have been made correctly and there is no gas leakage at any point in the system.

**5. Oil Line Installation for 1999-2006 Harley-Davidson® FL models and 1999-2005 Dyna® models.**

- A.** 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**

- B.** Inspect your stock oil lines and case breathing line for damage and replace if needed with stock HD lines.
- C.** 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**

- D.** Using the supplied QTY of 2 - 3/8 spacers and socket head cap screws, re-install your stock oil line cover to the motor and transmission.

**Picture 4**



**Picture 4**

**E. Oil recommendations**

MOTOR OIL VISCOSITY	TYPICAL AMBIENT TEMPERATURE
SAE 20W50 (RECOMMENDED FOR MOST APPLICATIONS)	ABOVE 30° F (-1° C)
SAE 25W60	ABOVE 40° F (4° C)
SAE 50	ABOVE 60° F (16° C)
SAE 60	Above 80° F (27° C)

**NOTES**

- S&S® Cycle recommends the use of S&S V-Twin 20W-50 synthetic oil in our engines for normal operating conditions. See chart above for additional recommendations.
- S&S Cycle recommends the use of S&S® oil filters, PN 31-4103 (black), or PN 31-4104 (chrome).

F. 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. Turn ignition on and turn the engine over with the starter motor until oil pressure light goes off.
4. Verify that engine oil is returning to oil tank.
5. Start motorcycle. Verify oil pressure by watching oil pressure light.

**NOTES**

- If oil pressure fails to indicate 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**

1. Contact S&S for exhaust systems specifically designed for T143 engines.
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 pre-loaded, 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. 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 and Break-in Procedure**

1. For the initial start up, a baseline tune for a T143 should be established. This is necessary for the initial start-up and heat-cycling of the engine.
2. 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.
3. Shut off engine and thoroughly check for any leaks or other problems. Let engine cool to the touch.
4. 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.
5. First 50 Miles:
6. 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.
7. 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.
8. 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.
9. 100-500 Miles: Avoid lugging the engine and high heat conditions. Max of 5,000 RPM. Change oil at 500 miles.
10. 500-1,000 miles: Ride bike normally, but avoid continuous high load operation and high heat conditions.
11. From 1,000 miles on: Break-in is complete, enjoy!

**B. Dyno Procedure for the 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**.

#### **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.*

#### **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.*

## **8. Tuning Guidelines**

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

### **A. Exhaust Systems**

#### **Muffled exhaust systems.**

The S&S T143 engine comes with S&S B3 Special Application cylinder heads. Due to the unique exhaust port configuration, stock Harley-Davidson® exhaust pipes will not fit, and a special exhaust system is required. An exhaust system specifically for the T143 engine is available for some models from S&S Cycle. There are also components available to help you build your own exhaust system. See below, or contact your S&S Customer Service Representative for more information.

#### **Drag pipes**

While drag pipes can be used with good results to achieve top end horsepower, they are generally not recommended for low and midrange power applications. Fuel injection calibration is generally easier for engines with muffled exhaust systems.

### **B. 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:

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

*\*Number of teeth on each sprocket*



#### **CAUTION**



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

## 9. Service Intervals

S&S® RECOMMENDED REGULAR SERVICE INTERVALS	
ITEM	INTERVAL
Engine Oil & Filter	Change at 500, 2,500 miles, and every 2,500 miles thereafter. <sup>1</sup>
Air Cleaner	Inspect at 50 and 500 miles, every 2,500 miles thereafter. <sup>2</sup>
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 500 miles 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.
<sup>1</sup> S&S recommends that petroleum-based oil not specifically formulated for aircooled motorcycles should be changed every 1,000 miles. <sup>2</sup> Replace more frequently if required or if engine is operated in a dusty enviroment.	

*S&S Exhaust Flange Mounting Kit #550-0216 includes weld-on adaptors, snap rings and flanges to make it easy to adapt an existing 2" exhaust system to the s&s B3 cylinder heads on the T143 engine, or to fabricate a whole new system.*



**550-0216**

