



Emission-Related Installation Instructions for S&S® 50-State Fuel Injected 4 $\frac{1}{8}$ " Bore Engines

DISCLAIMER:

These S&S parts are designed for high performance, on highway, motorcycle applications and are intended for the very experienced rider only. The installation of these S&S parts has specific requirements that must be met in order to meet certain federal, state, and local laws, rules and ordinances when used on motor vehicles used on public highways. Always check federal, state, and local laws before building your custom 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, 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.
- (4) These S&S parts are designed exclusively for use in American v-twin motorcycles. S&S shall have no warranty or liability obligation if an S&S part is used in any other application.
- (5) See the S&S Emissions Control System Warranty in the engine owners manual concerning the emissions system control parts.

INSTALLATION OVERVIEW

This S&S® 50-State Fuel Injected 4-1/8" Bore Engine is approved for use in assembled highway motorcycles and conforms to USEPA and the State of California exhaust and evaporative emissions regulations applicable to the model year in which it was produced. A small volume manufacturer, kit manufacturer, or assembler using this engine does not have to apply for a separate emission certificate with the EPA or the State of California. A vehicle built according to the given requirements is considered a certified vehicle by the EPA and the State of California.

Included in these instructions are requirements the manufacturer of the motorcycle, kit manufacturer, or assembler is required to follow in order to insure the engine meets exhaust, evaporative, and permeation emission standards. Prior to starting installation of this engine these requirements should be read and understood.

Failure to meet the requirements outlined in these instructions is a violation of the Clean Air Act and California State Law and will make the manufacturer of the motorcycle, kit manufacturer, or assembler subject to penalties and fines.

INSTALLATION REQUIREMENTS

No changes may be made to the engine that could reasonably be expected to increase its exhaust emissions for any pollutant. This includes changes to the fuel metering system; changes to the ignition system; changes to the camshaft; changes to the evaporative system; and modifying, recalibrating, removing, or failing to properly install any other specified component. The following requirements for gear ratio, weight, exhaust, labels, evaporative system, and permeation must also be met when installing this engine.

Gear Ratio

This engine may only be installed in a highway motorcycle or kit with an N/V ratio less than or equal to 45.5. The N/V ratio is the engine RPM divided by the vehicle speed in miles per hour in high gear. This determines the maximum RPM of the engine for a given vehicle speed in high gear. To find the N/V ratio for your application divide the engine speed by the vehicle speed while traveling in high gear. The following table gives maximum RPM's for the given speed and N/V ratio.

N/V Ratio	Speed (mph)	Maximum RPM in High Gear
45.5	55	2503
45.5	60	2730
45.5	65	2958
45.5	70	3185

The N/V ratio can also be calculated based on the number of teeth on primary and secondary sprockets, transmission gear ratio in high gear, and rear tire loaded radius. To calculate the N/V ratio first find the final drive ratio using the following formula:

Primary drive ratio = clutch sprocket teeth/engine sprocket teeth

Secondary ratio = rear sprocket teeth/front sprocket teeth

Transmission ratio = internal gear ratio in top gear

Final drive ratio = (primary ratio) x (secondary ratio) x (transmission ratio)

Next the rear tire circumference must be calculated based on the loaded radius of the tire:

Measure the loaded radius (LR) of the rear wheel by measuring the distance from the ground to the center of the rear axle in inches. This can be performed with the motorcycle positioned upright on level ground and the rider sitting in a normal riding position. It may be helpful to average the measurements on both the left and right sides to ensure an accurate number.

Circumference= (6.2832) x (LR)

Next calculate the N/V ratio using the following formula:

N/V ratio= (Final drive ratio x 1056)/(Circumference)

Weight

S&S® 50-State Fuel Injected 4-1/8" Bore Engines may only be installed in a highway motorcycle with a final curb mass that is equal to 1,058 lbs or less.

Exhaust

S&S® 50-State Fuel Injected 4-1/8" Bore engines require the use of a 2-into-1 style exhaust system and with an exhaust back pressure in the range of 0 to 21 inches of water. The exhaust backpressure is measured using a fitting tapped straight into the exhaust pipe in a location that is after the 2 into 1 collector and before entering the baffles of the muffler. Pressure is best measured at this location using a manometer that reads in inches of water. The measurement must be taken with a warm engine operating at 3000 RPM +/- 100 PRM in neutral.

Oxygen sensors for closed loop control must be installed in the exhaust head pipes. The sensors must be located such that they are in the range of 4 to 12 inches from the inlet of the head pipe.

Labels

Two unique labels with the headings "Vehicle Emissions Control Information" (VECI) and "Vehicle Evaporative Hose Routing" are provided with the engine. The VECI label contains the engine family identification, engine tune-up specifications, and the serial number of your engine. The Vehicle Evaporative Hose Routing label shows the proper evaporative system hose routing for the engine.

Both labels must be installed on the motorcycle frame or on a part that is permanently attached to the frame and must be located so they are visible with the seat removed.

NOTE: *Clean the area where the label will be affixed before installing it. Once affixed the label is permanent and can not be removed without the label being destroyed.*

Evaporative System

To meet evaporative emission regulations the evaporative system must be installed on the motorcycle. An evaporative canister, vapor valve, and low permeation hose has been included with the engine for hooking up the evaporative system. It is required these components are installed and the following requirements for the fuel tank and cap are met.

The fuel tank must be constructed out of metal and shall have a maximum capacity of 6 US gallons or less. The fuel tank shall be located such that no surface of the tank is closer than ½ inch to the engine. A fuel tank vent must be provided to vent fuel vapors out through the vapor valve to the evaporative canister and a Harley-Davidson® #61272-92B or equivalent fuel cap must be used. The fuel cap cannot freely vent to atmosphere.

Permeation

The EPA permeation standard applies to fuel tanks and fuel hose. To meet the permeation standard the following conditions must be met for the fuel tank and fuel hose.

The fuel tank consists of the tank itself, and any components mounted directly to it excluding fuel hoses. This includes the fuel cap if it is mounted directly to the tank. To meet the permeation standard the fuel tank must be constructed of metal and all gaskets on the fuel tank must have a total exposed surface area of less than 1,000 mm².

The exposed surface area of the gaskets is considered to be the surface area of the gasket that is exposed to fuel or fuel vapor. *To determine the exposed surface area of a circular gasket the following equation would be used:*

Exposed Surface Area = $a \times 3.14 \times d$

where: a = thickness of the gasket

d = ID of circular opening

To determine the exposed surface area on an o-ring seal the following equation would be used:

Exposed Surface Area = $0.25 \times 3.14 \times (X^2 - Y^2)$

where: X = ID of circular opening

Y = OD of inset groove for o-ring

The fuel hose used on the engine must also meet permeation standards. The permeation standard applies to any hose that carries fuel or fuel vapor that is not vented to atmosphere. This includes, but is not limited to, the fuel hose from the tank to the fuel rail and any fuel tank crossover hose.

The fuel hose included with S&S® engines meets the permeation standards based on the design of the hose. This fuel hose may be used and can be shortened if needed. Any additional fuel hose used that is not vented to atmosphere must meet R11-A or R12 SAE J30 specifications. Additional low permeation fuel hose is also available from S&S.

INSTALLATION NOTES

S&S® Engines may include instruction sheets for individual components. Most instructions apply to all S&S Engines. In the following instances, however, components or procedures supplied with and described for S&S 50-State Fuel Injected 4-½" Bore Engines are different from those for other S&S Engines.

- *The camshafts supplied in S&S 50-State Fuel Injected 4-½" Bore Engines are of proprietary S&S design. The camshafts have been designed to allow the engine to meet exhaust emission standards. Substitution of camshafts with different specifications is not permitted and would be in violation of the Clean Air Act and California State Law.*
- *Throttle bodies with S&S 50-State Fuel Injected 4-½" Bore Engines are not adjustable. In case of issues, contact S&S Cycle Technical Services, 608-627-1497.*
- *Engine control modules included with S&S 50-State Fuel Injected 4-½" Bore Engines contain a locked file and are not adjustable. Any tuning instructions included with the Pro Tune 2 software does not apply.*

INSTALLATION INSTRUCTIONS

This S&S 50-State Fuel Injected 4-½" Bore Engine has been manufactured, assembled, and calibrated by S&S Cycle, Inc. Before proceeding, verify that this engine fulfills the requirements for your motorcycle. Installing an S&S engine into a motorcycle requires specialized knowledge, skills, and tools. For this reason installation should be performed by a professional mechanic.

WARNING

Improper installation of engine or related components could result in injury or death to the operator and/or passenger and damage to the motorcycle.

1- Engine Installation

Install engine into the chassis following the chassis service manual. Ensure the engine sits flat on the engine mounts prior to tightening mounting bolts. Shims may be used if needed.

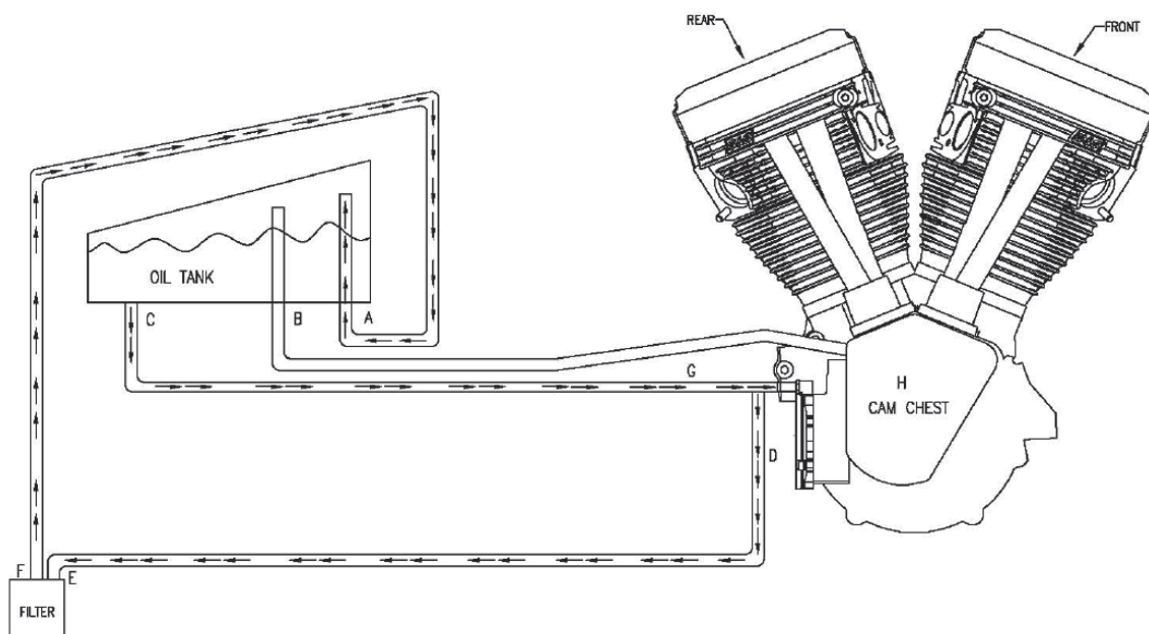
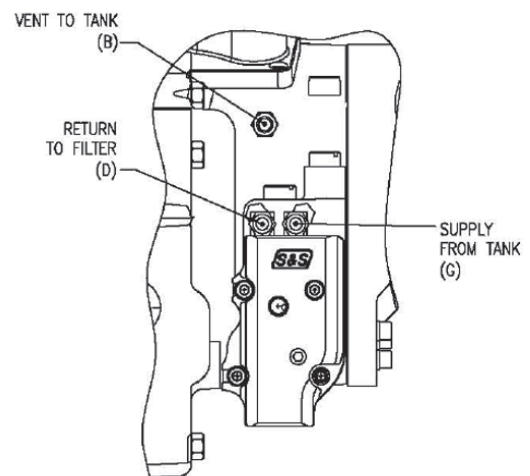
2- Install Oil Lines

CAUTION

- New oil tanks and lines must be flushed to remove any debris that could damage the engine's oiling system.
- Recommended oil tank capacity is 4 quarts oil and 1 quart air space. Use ½" ID oil line to ensure an adequate oil supply capacity.
- Minimum oil tank capacity is 3.5 quarts oil and 1 quart air space.

V-SERIES OILING SYSTEM DIAGRAM

- 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. SUPPLY FROM TANK
H. CAM CHEST



Clean the oil tank to remove any debris. Using new ½"ID hoses connect the oil return hose, oil supply hose, and the oil tank vent hose following the instructions below.

Oil Line Connections

- A- First, flush the oil tank and lines and install a new oil filter that has been filled with oil.



New oil tanks and lines must be flushed to remove any debris that could damage the engines oiling system.

- B- For S&S T-Series engines, connect oil lines following instructions found in S&S instruction sheet 510-0039, "S&S Oil Supply Line Installation Kit". For S&S V-Series engine connect oil lines following the diagram on the previous page. Do not connect the oil feed line to the engine at this time.
- C- Clamp off the open end of the oil feed line and fill the oil tank with oil of the appropriate type and grade recommended in the S&S® 50-State Fuel Injected 4-½" Bore Engine Owner's Manual.
- D- Unclamp the feed line to allow the line to fill with oil; then quickly attach it to the fitting on the oil pump. The oil pump was primed at the factory so no further priming should be necessary. It is necessary to confirm that oil is circulating properly prior to operating the motorcycle.
- E- To confirm proper circulation of oil:
- 1- Remove both spark plugs.
 - 2- Remove the oil return line from the oil tank and place the end in a suitable container.
 - 3- Using the starter, turn the engine several rotations. Oil should come out the return line. If not, repeat the procedure as needed.
 - 4- Reconnect the return line to the oil tank and install the spark plugs.



Lack of oil circulation through the engine will cause damage to the internal engine components.

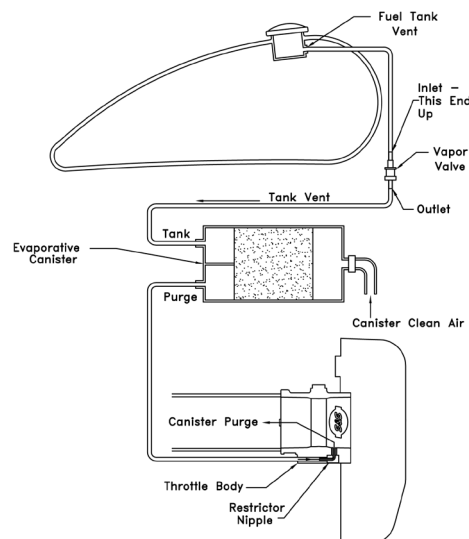
3- Install Evaporative System

The evaporative system must be installed in its entirety following the instructions and diagram provided below.

- A- Determine a location for the evaporative canister that allows the vapor lines to be connected and install the evaporative canister onto the motorcycle.
- B- Determine the routing of the evaporative vent hose connecting from the fuel tank vent, through the vapor valve, and to the fitting on the canister labeled "tank". The vapor valve must be installed in a vertical position with the smaller end pointing up as shown in "Evaporative Hose Routing Diagram". Ensure the hose will not come in contact with any hot or moving parts.

NOTE: The vapor valve must be installed in a vertical orientation with the smaller diameter end pointing up as shown in the "Evaporative Hose Routing Diagram".

- C- After the evaporative vent hose routing has been determined, cut the hose to length and make the connections.
- D- Determine the routing of the evaporative purge hose that connects the fitting labeled "purge" on the canister to the 90 degree purge fitting on the throttle body as shown in the "Evaporative Hose Routing Diagram". Ensure the hose will not come in contact with any hot or moving parts.
- E- After determining the evaporative purge hose routing, cut the hose to length and make the connections.
- F- Secure the evaporative hoses to the motorcycle using proper wire ties so they will not come in contact with any hot or moving parts.



4- Install Wiring and Engine Control Module (ECM)

WARNING

- The safety of the motorcycle rider is dependent on proper installation of this product. If you are not certain of your capabilities or do not have the correct tools for this installation, please consult a shop to have it done for you. Improper installation of this product could result in injury or death to the rider.
- Do not connect the battery until completing the installation of the wiring and control system of the motorcycle. Failure to do so may result in damage to your wiring harness and other motorcycle electronics which can result in costly repair and service fees. Leaving the battery disconnected during the entirety of the installation will also prevent accidental starting of the motorcycle which could cause injury to yourself or others around you.

CAUTION

To avoid damage to motorcycle and motorcycle components, follow the guidelines specified by the manufacturer when assembling and servicing your motorcycle.

Overview

This S&S® Fuel Injected 4-1/8" Bore engine comes equipped with an S&S® single throat throttle body and S&S® Variable Fuel Injection system (VFI) with closed loop fuel and ignition knock control. Included as part of the VFI system is the engine control module (ECM), oxygen sensors with mounting bungs, knock control sub harness, and an ignition coil. A wiring diagram has also been provided at the end of this manual for reference during installation.

Wiring Harness

The wiring of the fuel injection system is critical for operation of your engine and requires special attention to ensure it is completed properly. At the end of this manual a wiring diagram has been included for reference. There are several options to build the wire harness for the motorcycle and it is important that the steps below for the oxygen sensors, knock control, bank angle sensor, and road speed input are followed. S&S recommends using one of the following options for building the wiring harness.

The best solution is the S&S universal wiring harness for Delphi Style modules, part number 550-0264, and closed loop control sub harness, part number 550-0478. When these harnesses are used together, the only additional wiring that will need to be completed is to connect the wires for switched and constant power, chassis ground, speed input, and fuel pump wiring and to install the provided knock control harness. Full instructions to completing these wiring connections are included with these S&S harnesses. This is the easiest method to build the wire harness for the motorcycle.

Another option is to use a HD® fuel injection sub harness from a 2002-2003 FLH or Softail. If this harness, or equivalent, is used, the wiring for the closed loop control must be added to the harness. An S&S closed loop control conversion harness, part number 55-1595, must be purchased and added to the stock harness. Please see S&S instruction sheet 51-1203 to install the 55-1595 harness.

WARNING

Take special care not to route the wiring directly over areas prone to reach high temperatures. Failure to do so may result in damage to your wiring harness and other motorcycle electronics which can result in costly repair and service fees.

Engine Control Module

The engine control module (ECM) provided with this Fuel Injected 4-1/8" Bore engine has been calibrated by S&S® for your engine and contains a locked calibration file in order to be in compliance with anti-tampering requirements. Included with the ECM are mounting and installation instructions for the ECM and a ProTune 2 CD with instructions for accessing the ECM via a computer. ProTune 2 will allow the user to read and clear engine fault codes and verify sensor outputs for diagnostic purposes.

Oxygen Sensors

The closed loop fuel control system uses oxygen sensors placed in the front and rear exhaust head pipes. A kit has been included with the engine which includes the oxygen sensors and mounting bungs. Many exhaust systems come with bungs already installed; if your system did not come setup with bungs installed, you can install them following the instructions below.

- A- You will need to install an oxygen sensor in each head pipe. The 3/4" holes to mount the sensors will need to be positioned 4" to 12" from the exhaust flange. To determine the best position for the oxygen sensors, the head pipes should be installed on the bike.

B- To make locating the sensor a bit easier, S&S technicians have created a mock-up sensor. As you can see in **Picture 1**, the tip of an oxygen sensor was cut off so the weld-in boss could be threaded on to it and allow the unit to sit flush on a head pipe. A spark plug with the electrode cut off can also be used to make a similar mock-up tool. Now the assembly can be put on a head pipe to verify that it will not come in contact with any moving parts. Once you are certain of the mounting position, scribe or trace the outside shape of the mounting boss with a marker. **See Picture 2.**



Picture 1



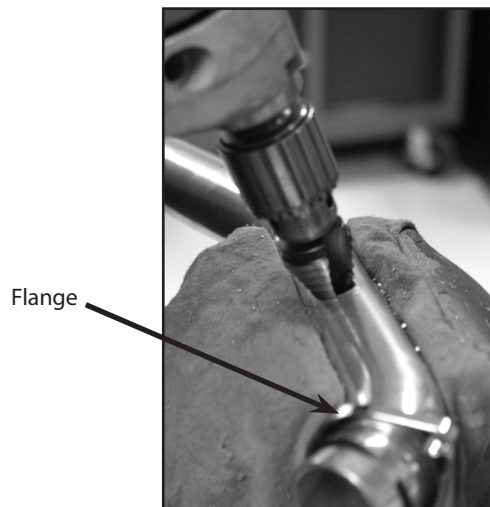
Picture 2

C- Use an appropriate size drill to achieve a $\frac{3}{4}$ " hole in each of the head pipes. **See Picture 3.**

⚠ CAUTION

If exhaust mounting flanges are installed on head pipes, make sure the flange is above the weld-in boss before it is welded in place.

D- If exhaust mounting flanges are installed on the head pipes, make sure the flange is above the weld-in boss before it is welded in place. **See Picture 3.**



Picture 3

E- Weld the boss in place using stainless-steel filler rod. When it cools, run an M 18x1.5 tap through it to verify that none of the threads were damaged or distorted. **See Picture 4.**



Picture 4

- F- Install the oxygen sensor in each head pipe and torque it to 30-44 ft-lbs. **NOTE:** New oxygen sensors come with a high-temperature lubricant on the threads. Be sure to use a high-temperature lubricant that is safe for oxygen sensors if sensors are being re-used.

Knock Control

The knock sensor comes installed on the rear cylinder head of the engine. This mounting location is critical for the operation of the system and it cannot be relocated.

Included with the engine is a knock sensor wiring harness to connect the knock sensor to the ECM. To install this harness follow the steps below.

Knock Sensor Wiring Harness Installation

- A- Connect the black, plastic connector of knock sensor wiring harness to the knock sensor to determine the harness length available to route to the Engine Control Module (ECM).
- B- Route the harness so that the exposed terminals of the knock sensor wiring harness are near the gray, 36-terminal ECM connector.
- C- Verify that there is enough slack in the harness to allow for engine movement. Also be sure that the harness is secured with the supplied wire ties so that it is not touching any hot or moving parts of the engine.
- D- Remove the socket plugs in terminal positions #16 and #34 of the 36-position ECM connector. **See Picture 5.**



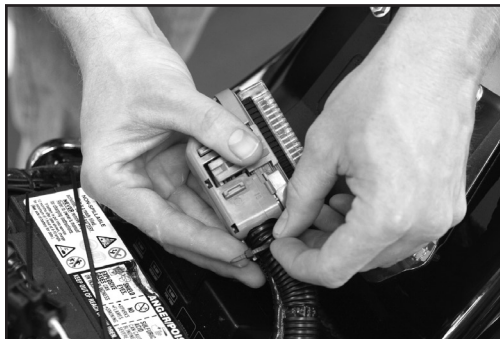
Picture 5

- E- Insert the white wire into position #34. Next, insert the white wire with the blue stripe into position #16. **See Picture 6.**



Picture 6

- F- Confirm the terminals are all in proper alignment and reinstall the clear plastic cover. Next, close the cover of the 36-position connector, making sure to get all the clips back in place. Finally, reinstall a wire tie at the base of the 36-position connector. **See Picture 7.**

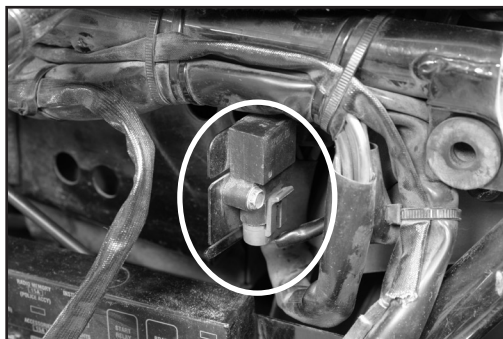


Picture 7

Bank Angle Sensor

A bank angle sensor input to the ECM is required for the engine to run. It is recommended a Harley-Davidson® bank angle sensor, part number 32495-98, be used. If using the S&S universal wiring harness, this sensor is a direct plug and play. If using a stock based wiring harness the wiring and connector for the bank angle sensor must be added.

This sensor must be mounted with the connector end facing downward and with the cast H-D® part number facing either the front or the back of the motorcycle, as shown in **Picture 8**.



Picture 8

Vehicle Speed Sensor (VSS) and Speedometer

A properly connected and calibrated vehicle speed input is important for proper engine operation as the ECM uses the vehicle speed input for idle control and engine history data. It is recommended a H-D(R) #74430-00A or equivalent vehicle speed sensor be used. This sensor is compatible with most after market speedometers. The speed input into the ECM can come directly from this sensor, in parallel to the speedometer, or from an output signal from the speedometer.

Due to differences in gear ratio and tire sizes between bikes, the Wheel Speed Gear Factor in the ECM must be adjusted for the gearing and tire size used. It is important this step is completed as engine idle control activates based on the vehicle speed calculated from the Wheel Speed Gear Factor.

Checking the Wheel Speed Gear Factor can be done while running the bike on a dyno that has a speed output or by riding the bike on the road and comparing distances traveled between the ECM and odometer. Procedures for both methods can be found below.

Checking the Wheel Speed Gear Factor while running on a dyno:

- A- Locate instruction sheet 51-1145 that has been provided with the ECM. Follow the instructions to install the ProTune 2 software, and connect to the ECM.
- B- In ProTune 2 open the gauge panel by selecting "Gauge". In the window that opens, click on "View" then "Add". In the list that appears, locate the panel labeled "Vehicle Speed", and click "Add". This is = vehicle speed in MPH.
- C- While driving the motorcycle at a steady speed on the dyno, observe the vehicle speed in ProTune 2 and compare to the speed shown by the dyno.
- D- If the speeds are equal the Wheel Speed Gear Factor is correct. If the speeds are not equal calculate the error using the following equation:

$$\frac{ECM_mph}{Dyno_mph} = error$$

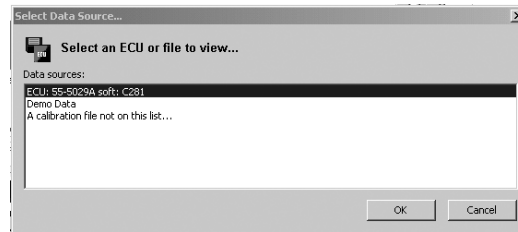
- E- Proceed to adjusting Wheel Speed Gear Factor on the next page.

Checking the Wheel Speed Gear Factor using odometer miles:

- A- Locate instruction sheet 51-1145 that has been provided with the ECM and follow the instructions provided in it to install the ProTune 2 software and connect to the ECM.
- B- Record the initial ECM and speedometer mileage. The ECM mileage may be accessed by clicking on the "ECM Information" button. The Total Engine Mileage (miles) appears at the top of the "Stats Overview" tab. This will be your initial ECM mileage.
- C- Ride the motorcycle to accumulate mileage on both the ECM and speedometer.
- D- Record the final ECM and speedometer mileages and subtract the initial mileages from them to get the mileage traveled during the trip for both the ECM and speedometer. If the distances are equal the Wheel Speed Gear Factor is correct. If they are not equal proceed to the next step.
- E- Calculate the Wheel Speed Gear Factor error using the following equation:

$$\frac{ECM_miles}{Speedometer_miles} = error$$

- F- Proceed to adjusting Wheel Speed Gear Factor on the next page.



Adjusting Wheel Speed Gear Factor:

- A- To access the Wheel Speed Gear Factor in ProTune 2 select "ECM Basic Setup".
- B- The Select Data Source dialog box will appear. The dialog box will list the current active data sources; i.e. the ECM if it is connected, the demonstration data built into the software, and any calibration files that you accessed since starting the software. To select a data source, click on it to highlight it and then click "OK" or press "Enter". Select the ECM file from this dialog box and click "OK".
- C- The ECM Basic Setup dialog box will appear. The top line of the dialog box shows the ECM or file that you are editing. Beneath it is an information box which will show you information about a function when it is selected.
- D- The Wheel Speed Gear Factor is a value used by the ECM to scale the input from the speedometer to calculate the vehicle speed. To adjust wheel speed gear factor multiply the current value by the error found when checking the wheel speed gear factor.
- E- When you have finished viewing or editing the properties, click OK or press Enter to save the changes to the current data source. Click Cancel or press Esc if you do not wish to save the changes.
- F- Rerun the procedure for checking Wheel Speed Gear Factor to verify it is now set correctly.

The Wheel Speed Factor will now be calibrated. If changes are made to the gearing, tire size, or speedometer in the future this process must be repeated.

5- Fuel System

WARNING

Fuel hose must be clamped securely with proper clamps and can not contact any hot surfaces where it could melt or catch fire, causing serious injury or death.

This Fuel Injected 4- $\frac{1}{8}$ " Bore engine requires a fuel supply of 58 psi to the fuel injectors. A fuel pump and regulator assembly is available from S&S® (PN 55-5089) that is designed for being mounted inside the fuel tank. Other pumps may be used as long as the supply is regulated to 58 psi and it provides a minimum supply of 45 L/hr. It is recommended a fuel filter that filters to 10 micron be used.

WARNING

Connections

Fuel is supplied to both fuel injectors from a fuel rail located on top the injectors. Included with the engine is a piece of low permeation fuel hose for connection from the fuel supply to the fuel rail. Position fuel hose to avoid contact with hot cylinders or other engine parts.

6- Throttle/Cables

Throttle Requirements

NOTE: S&S throttle bodies require the use of a two cable, pull open - pull closed throttle assembly. All models equipped with a single cable throttle mechanism must be converted to the two cable, pull open - pull closed type. S&S offers a variety of these throttle assemblies.

WARNING

Single, braided wire cable throttle mechanisms cannot mechanically close the throttle. If the throttle inadvertently sticks in the open position, loss of control of motorcycle and personal injury to you or others may result.

Any motorcycle equipped with single cable throttle system must be converted to a two cable system. Kits with 36" (91cm), 39" (99cm), 42" (107cm), 48" (122cm), or 52" (132cm) length cables are available. Throttle assembly kits may be ordered separately. See descriptions on next page.

Two cable throttle systems designed for a butterfly type carburetor/throttle body have cable fittings that can simply be "plugged in" to the S&S throttle body throttle linkage.

Optional S&S Two Cable Throttle Kits

Kits fit 1" (25.4mm) O.D. handlebars and can be used on most chassis. An adapter sleeve is available for use with handlebars having $\frac{7}{8}$ " (22.2mm) diameter ends. Fittings on provided cables readily "plug in" to S&S® throttle bodies. Kits include one opening side cable, one closing side cable, left and right handlebar grips, and handlebar clamps.

- Throttle kit with 36" (91cm) cables PN 19-0450
- Throttle kit with 39" (99cm) cables PN 19-0448

NOTE: 1981 to 1990 OEM style cables may be used as replacement cables for throttle kits above.

WARNING

Gasoline is extremely flammable and explosive under certain conditions. Do not smoke or expose gasoline to sparks or open flame.

CAUTION

Gasoline fumes are toxic when inhaled. Perform installation in a well ventilated area away from open flames or sparks. Unwarranted sparks and inadvertent engagement of starter while working on electrical components can cause serious injury or death.

Fuel hose must be clamped securely and not contact any hot surfaces where it could melt or catch fire, causing serious injury or death

NOTE: Throttle grip assembly must be assembled correctly and work freely to prevent possible sticking during operation. Cable routing must be free of tight bends to minimize cable to cable housing friction. Throttle must not bind and must snap shut to fully closed position when released.

WARNING

Incorrect cable adjustment may cause throttle to stick open, causing loss of control of motorcycle, serious injury or death.

7- Final Assembly and Checks

- A- Check fuel line routing and connections.
- B- Test throttle to ensure it opens and closes freely. Turn handlebars to extreme left and open and close throttle, and then turn bars to extreme right and repeat. Throttle must snap closed in all positions.
- C- Reassemble any remaining components.
- D- Install emission control label on motorcycle frame in a location that is visible when the seat is removed.
- E- Verify all emission related instructions and requirements have been met.
- F- Fill gas tank.
- G- Check injectors, the fuel rail and fuel line connections for leaks.

Gasoline leaks at inlet o-rings, fuel line connections, or fuel injector may flood engine and overflow into surrounding area creating fire hazard.

8- See S&S® 50-State 4-1/8" Bore Engine Owner's Manual for Engine Starting and Break-in Instructions



Failure to break-in engine according to correct procedure may result in serious damage to engine that is not repairable under warranty.

8- Troubleshooting Tips

The following is a list of common issues found during a new installation. Included with the ECM is also a CD and instructions for running the Pro Tune 2 software. This will allow access from a computer connected to the ECM to read engine fault codes and sensor outputs for troubleshooting problems. See the instructions included with the ProTune 2 CD for installing the software on a PC.

A- Engine will not start:

- I- Weak or no-spark condition may be caused by fouled plugs, a discharged battery, improper wiring to the coil, or damaged coil. Verify condition of components and wiring.
- II- Lack of fuel may be caused by lack of fuel in the tank, improper wiring to pump, fuel hoses disconnected, or improper fuel pressure. Verify adequate fuel in tank and fuel pressure at fuel rail is 58 psi.
- III- Bank angle sensor not installed or wired incorrectly. Verify installation of bank angle sensor and wiring.

B- Engine will not run at steady speed or RPM:

- I- Restriction in fuel supply. Verify fuel pressure at fuel rail.
- II- Injector or oxygen sensor wires swapped front to rear. Check for proper orientation of wires to the fuel injectors and oxygen sensors.
- III- Lack of Vehicle Speed Signal (VSS) or improperly calibrated VSS. The ECM uses the VSS to determine when the engine should be in idle control. If this signal is not connected to the ECM, the idle control system will not work properly and may cause engine speed to vary. Likewise, if the Wheel Speed Gear Factor is not correct, the ECM may not enter idle control at the appropriate time. Additionally, if the end of the VSS in the transmission is contaminated (i.e. with metal filings), it may produce a signal when the vehicle is stopped and inhibit idle control.

CONCLUSION

Complete remainder of installation according to the applicable service manuals. Refer to the S&S® 50-State 4-1/8" Bore Engine Owner's Manual for important information on breaking in the engine.

