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S&S[®] California X-Wedge™ Engine Owner's Manual

DISCLAIMER:

S&S parts are designed for high performance, off road, racing applications and are intended for the very experienced rider only. The installation of S&S parts may void or adversely effect your factory warranty. In addition such installation and use may violate certain federal, state, and local laws, rules and ordinances as well as other laws when used on motor vehicles used on public highways, especially in states where pollution laws may apply. Always check federal, state, and local laws before modifying your motorcycle. It is the sole and exclusive responsibility of the user to determine the suitability of the product for his or her use, and the user shall assume all legal, personal injury risk and liability and all other obligations, duties, and risks associated therewith.

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.
- (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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Congratulations on purchasing an S&S® engine! Your new engine is designed and manufactured with the same care and attention to detail as those used to set speed records and win races around the world.

This manual has been prepared to acquaint you with the operation, care, and required maintenance of your engine. It also notifies you of important safety information and provides authorized service personnel with necessary emissions control specifications. Other S&S publications discuss repairs and/or changes to the engine configuration. For information related to other components and systems on the motorcycle consult the manufacturer's manuals.

This engine conforms to U.S. Environmental Protection Agency and the State of California applicable exhaust gas and evaporative emissions regulations effective on the date of manufacture. A small volume motorcycle manufacturer, kit manufacturer or assembler may use this engine without applying for a separate emission certificate.

Per the tampering and defeat device prohibitions, under the Clean Air Act and California State law, it is illegal to remove or render inoperative any device or element of an emissions control system, or to install any part or component that would bypass, defeat, or render inoperative any device or element of design installed on the vehicle under the Clean Air Act or California State law regulations. This includes but is not limited to any changes made to camshafts, fuel metering system, ignition, exhaust system or evaporative system.

ENGINE IDENTIFICATION NUMBER

The Engine Identification Number (EIN) is stamped on the outside of the front motor mount on both the left and right side of the crankcase. It consists of a ten-character code, with the first and last characters being stars (*). The second character is a letter that designates the code for the manufactured year of the engine. The final four characters before the star are the crankcase serial/sequence number for that year.

Example: *H5500103* represents crankcase sequence number 103 made in 2007

Year Code	
2005	F
2006	G
2007	H
2008	J
2009	K
2010	L

OPERATION

Engine Speed and Load



Exceeding 5,800 RPM under any circumstances may damage the engine.

An engine that is run long distances at high speed or under heavy load may overheat. Oil and spark plugs should be inspected more frequently when the engine is subjected to extreme temperatures.

Idle Speed

Engine idle speed is controlled electronically and is not adjustable. Typical idle speed will be 1,000 to 1,050 RPM after engine warm-up.



Do not idle engine more than five minutes with motorcycle stationary. Overheating may result.

Oil Pressure

Minimum hot (200° F) oil pressure is 8psi at idle and 40psi at 2800 rpm.

Altitude

The S&S Variable Fuel Injection system will automatically adjust for changes in altitude from sea level to 10,000 feet. No other adjustments are needed.

Break-In

During the first 500 miles of operation, critical parts are "breaking-in" against each other. For this reason:

- 1- Avoid excessive heat build-up. Do not allow engine to idle for long periods of time.
- 2- Keep the outside of the engine clean.
- 3- Do not subject engine to unusual stress or load such as with sidecar or trailer.
- 4- Avoid hard acceleration until the engine is warmed up.
- 5- Do not lug the engine. Vary the engine speed; avoid maintaining a steady speed for long distances.

First 50 Miles (80 Kilometers) :

- 1- Ride very conservatively.
- 2- Keep the engine speed below 2,500 RPM.
- 3- Change the oil and filter at 50 miles (80 kilometers).

Up to 500 Miles (800 Kilometers):

- 1- Avoid lugging the engine or maintaining a steady RPM for long periods.
- 2- Keep the engine speed below 3,500 RPM.
- 3- Change the oil and filter at 500 miles (800 kilometers).

Up to 1,000 Miles (1,600 Kilometers):

- 1- Ride normally, be conservative.
- 2- No harsh treatment such as drag races, burnouts, or dyno runs.
- 3- Change the oil and filter at 2,500 miles (4,000 kilometers).

During the break-in period the ECU will automatically limit engine RPM in 2 stages during the first 20 hours of engine operation. During the first 2 hours of operation the engine rev limiter is 4250 RPM. From 2 hours to 20 hours of engine operation the rev limit is 5125 RPM. After 20 hours the rev limit is set at the engines maximum RPM of 5800 RPM.

Pre-ride Checklist

Before riding, or with each tank of gas, confirm that your motorcycle is in good operating condition. The motorcycle owner's manual has specific information regarding this subject.

To ensure safe, reliable engine operation:

- 1- Check oil level in oil tank.
- 2- Check for oil and fuel leaks.

Starting and Warm-Up

General:

- 1- Before starting engine, shift transmission into neutral.
- 2- Never allow engine to exceed 2,500 RPM immediately after cold start. Engine should be run slowly for 15 to 30 seconds. This allows the engine to warm up and oil to reach all surfaces requiring lubrication.
- 3- Use oil meeting recommendations found in maintenance section of this Owner's Manual for expected ambient temperature range and type of operation.

Cold, warm, or hot engine:

- 1- Close throttle.
- 2- Turn key to IGNITION.
- 3- Turn Engine-Stop switch to RUN. Check engine light will briefly light
- 4- After check engine light goes out push start button.

Gear Speed Changes

For normal riding, the recommended acceleration shift points to higher gears while accelerating are shown below. Note, for best fuel economy, use the smaller numbers in each speed range.

Recommended Acceleration Shift Points		
Gear Change	Engine RPM	Approximate Road Speed*
1st to 2nd	2100 to 2750	12 to 16 mph (19 to 26 km/h)
2nd to 3rd	2400 to 2850	20 to 24 mph (32 to 39 km/h)
3rd to 4th	2500 to 2850	29 to 33 mph (47 to 53 km/h)
4th to 5th	2500 to 2750	38 to 42 mph (61 to 68 km/h)
5th to 6th	2500 to 2700	47 to 51 mph (76 to 82 km/h)

*Based on an N/V Ratio of 44.7

For normal riding, the recommended shifting procedure to lower gears while decelerating is:

- 1- Disengage clutch.
- 2- As motorcycle slows, shift into appropriate gear for beginning next mode of operation.
- 3- When slowing to a stop, the clutch should be disengaged when:
 - a- The motorcycle speed drops below approximately 15 mph (24 km/h).
 - b- Rough engine operation is evident.
 - c- When the engine is lugging.

The motorcycle should be shifted into neutral if it is going to be shut off or kept at an idle for more than a few seconds.

MAINTENANCE

To maintain your new engine warranty and to assure proper emissions system operation, regular inspections and servicing must be performed.

Periodic

The motorcycle should be checked frequently (for example, with each tank of gasoline) for fuel or oil leaks and oil level. See the motorcycle owner's manual for other recommended periodic maintenance.

During Break-In

At 50 Miles (80 Kilometers):

- 1- Change engine oil and filter.
- 2- Inspect for fuel and oil leaks.
- 3- Inspect air cleaner element and service as required.

Engine Maintenance at 500 Miles (800 Kilometers):

- 1- Change engine oil and filter.
- 2- Inspect for fuel and oil leaks.
- 3- Inspect air cleaner element and service as required.
- 4- Check tightness of engine mounts.

Regular Service Intervals

Regular lubrication and maintenance will help keep your new S&S engine operating at peak performance. The following table presents the required service schedule for normal operating conditions. Failure to complete the required engine maintenance can result in engine damage and an increase in emissions. Please refer to the motorcycle owner's manual for any additional required chassis maintenance.

Engine Service Intervals	
Item	Interval
Engine Oil & Filter	Change at 50, 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).
Timing Belt	Inspect every 10,000 miles (16,000 kilometers). Replace every 30,000 miles (48,000 kilometers).
Fuel Lines & Fittings, Vacuum Lines, Evaporative 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	Non-adjustable. Inspect every 2,500 miles.
Operation of Throttle & 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	Non-adjustable. Inspect every 5,000 miles.
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.
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. 2- Replace more frequently if required or if engine is operated in a dusty environment.	

⚠ CAUTION

Motorcycles operated under adverse conditions (severe cold, heat, dusty, or wet conditions, extended idling, pro-longed high speed, or extreme load) should have regular maintenance performed more frequently to ensure safe, reliable operation.

Engine Oil

Engine oil is a major factor in the performance and service life of the engine. For operation in ambient conditions over 35° F use 20W-50 and for operation in ambient conditions below 40° F use 10W-40.

S&S recommends Mobil 1 20W-50 V-Twin oil is used in ambient conditions over 35° F.

NOTE: *S&S recommends regular oil changes every 1,000 miles if using a petroleum-based oil not specifically formulated for motorcycles."*

Checking, Adding & Changing Engine Oil

The level of the engine oil should be checked periodically, it is recommended to do this whenever filling the bike with fuel. The location of the oil tank will vary depending on the setup of the bike. See the motorcycle manufacturer's instructions for checking and changing oil. The S&S recommended oil capacity is 5 quarts with a minimum of 3.5 quarts.

The oil filter is the same as those used by the S&S T-series engines. PN 31-4103 (black) and PN 31-4104 (chrome).

Fuel Pump and Filters

The fuel system uses a fuel pump to supply fuel at 58psi to the fuel injectors. Fuel pressure can be verified using a fuel pressure tester on the Schrader valve located on the fuel rail. Depending on the application, the fuel pump and filter could be located internal or external to the fuel tank. See the motorcycle manufacturer's instructions for the location of the fuel filter.

Air Cleaner Element

The air cleaner element comes pre-oiled and does not need to be oiled before use. The element should be replaced every 5,000 miles (8,000 kilometers). If the element is torn, punctured, or has excessive oil build-up replace the element.

Replacement:

- 1- Remove air cleaner cover.
- 2- Remove element.
- 3- Wipe any residual dirt or debris from backplate and cover.
- 4- Install new element on air cleaner backplate.
- 5- Reinstall air cleaner cover.

 **CAUTION**

A damaged, torn, punctured, or crushed element may allow unfiltered air to enter the engine. In the event of a damaged air cleaner element, replace element immediately.

Hydraulic Lifters

Hydraulic lifters are self-adjusting. They automatically adjust length to compensate for engine expansion and valve train wear keeping the valve train free of lash while the engine is running. When starting the engine the valve train may be noisy until the lifters refill with oil. If the valve train remains noisy after twenty minutes of operation, this may be an indication that one or more of the lifters is not functioning properly. Consult an S&S service agent if further service is required.

Spark Plugs

Spark Plug Removal:

- 1- Disconnect spark plug wires from spark plugs by pulling on the molded connector boots. It may help to twist or rock the boots back and forth slightly while pulling.
- 2- Unscrew spark plugs.

Spark Plug Inspection:

If either of the following conditions occurs, further service is required.

- 1- A spark plug with a black, glossy-wet coating indicates that oil is entering the combustion chamber.
- 2- A spark plug that is wet with gasoline or has sooty deposits indicates either a faulty ignition or a problem with fuel delivery.

Spark Plug Installation:

Spark plugs must be screwed in correctly to avoid cross-threading and tightened adequately to ensure proper heat transfer. Do not over-tighten.

 **CAUTION**

Threads may strip in the aluminum cylinder heads if over-tightened. Repair will not be covered under warranty.

- 1- Inspect spark plug threads and clean if necessary.
- 2- Check plugs for a gap of 0.038" to 0.042".
- 3- Apply anti-seize to threads of spark plugs.
- 4- Start screwing spark plugs in by hand. They should screw in easily.
- 5- Torque spark plugs to 18 to 22 lb-ft (24 to 30 N-m).

Ignition Timing

The ignition timing is electronically controlled and is not adjustable.

Cam Belt Drive Inspection

To inspect belt-

- 1- Remove the belt cover.
- 2- Visibly inspect the belt for the following conditions:
 - a- If the following conditions are found replace the belt:
Internal or external cracks, tears, and chipped or missing teeth.
 - b- Frayed edge cords are acceptable, but the belt should be monitored for continued wear.
- 3- If belt is found to be acceptable install a new gasket and replace the belt cover

NOTE: *Thin translucent debris inside the belt cavity is normal.*

Cam Belt Drive Replacement



WARNING

Be sure the battery is disconnected to prevent any accidental engine turnover during the service.

Belt Removal:

- 1- Remove the belt cover.
- 2- Immobilize the engine by placing it in gear with the rear wheel on the ground.
- 3- Use special S&S socket PN 106-0750 to take the tension off of the belt tensioner. Once it is fully relieved, you can use a bolt in the lower cam plate mounting area to hold the ratchet in place.
- 4- Remove the two idler pulleys at the top of the cam plate. Note their orientation: one has a bevel going towards the cam plate and the other facing away from the cam plate.
- 5- Slide the belt off.

NOTE: An $\frac{1}{16}$ " open-end wrench may be used in place of S&S socket tool, PN 106-0750.



WARNING

Do not bend the belt tighter than the size of the pulleys. Do not twist the belt or crease it.

Belt Installation:

- 1- Installation of a new belt is simple, but requires the use of S&S Cam Alignment Pins, PN 106-0576 for each of the three cams.
- 2- Rotate the cams around until they are positioned over the alignment holes. Install the S&S Cam Alignment Pins.
- 3- Align the notch on the crank pulley with the FTDC mark on the cam plate.
- 4- Make sure the tension is removed from the belt tensioner.
- 5- Pass the belt around the cam gears—there is a diagram of the belt and its installation pattern inside the cam cover.
- 6- Install the rear idler pulley with the pulley oriented so the flange is against the cam plate. Tighten idler pulley bolt to 20 ft/lbs
- 7- Install the front idler pulley with the pulley oriented so the flange is on the outside of the belt. Tighten idler pulley bolt to 20 ft/lbs
- 8- Once you have everything aligned, release the tension on the belt tensioner.
- 9- Install a new gasket and replace the belt cover.

NOTES:

- $\frac{3}{16}$ " by 2" long dowel pins may be used in place of S&S® cam Alignment Pins PN 106-0576.
- If you do not have S&S Cam Alignment Pins or $\frac{3}{16}$ " dowel pins, the belt is marked with alignment points on its edge. Align the hole in the cam sprockets with the alignment holes in the cam plate, align the crank pulley with FTDC, and align the belt marks with the dot on the edge of the sprockets.

Engine Specifications

- Bore = 4.125"
- Stroke = 4.375"
- Displacement = 117 CID
- Valve sizes = 2.000" Intake and 1.605" Exhaust
- Pistons = Forged, common front and rear
- Wristpin diameter = 0.927"
- V angle = 56.25 degrees
- Cam drive = 30 mm wide belt with automatic tensioner
- Valve train = Hydraulic roller tappet with pushrods
- Rocker arm ratio = 1.7:1
- Crankshaft = Forged and nitrided one piece
- Rod type = 7.400" forged, split design $\frac{7}{16}$ " bolt
- Bearing type = Tri metal plain style rod and main
- Main bearing journal = 2.36" dia.
- Rod bearing journal = 2.20" dia.
- Oil system = Dry sump, internal gerotor pump
- Induction and Engine Management = 2 $\frac{1}{16}$ " throttle body with S&S closed loop VFI
- Fuel injectors = 34.8 lb/hr @ 3 bar fuel pressure
- Compression = 9.75:1
- Complete engine weight = 163 lbs

S&S® CYCLE, INC. EMISSION CONTROL WARRANTY STATEMENT

The following warranty applies to the emission control system and is in addition to the S&S Cycle, Inc. LIMITED WARRANTY.

YOUR WARRANTY RIGHTS AND OBLIGATIONS

The following is an explanation of the emission control system warranty on your 2008 and later engine. New motor vehicles and engines must be designed, built, and equipped to meet stringent anti-smog standards. S&S must warrant the emissions control system parts on your engine for the period of time listed below, provided there has been no abuse, neglect, or improper maintenance of your engine.

The emission control system included with your new engine may include parts such as the throttle body and intake manifold. Also included may be hoses, connectors, and other emission-related S&S assemblies or parts.

Where a warrantable condition exists, within the warranty period noted below, your authorized S&S dealer will repair your engine at no cost to you, including diagnosis, parts, and labor.

MANUFACTURER'S WARRANTY COVERAGE

Class III motorcycles (280 cc and larger): for a period of use of five (5) years or 30,000 kilometers (18,641 miles), whichever first occurs.

If an emission-related part on your engine has been deemed defective by S&S, the part will be repaired or replaced by S&S. This is your emission control system DEFECTS WARRANTY.

OWNER'S WARRANTY RESPONSIBILITIES

As the engine owner, you are responsible for the performance of the required maintenance listed in your owner's manual. S&S recommends that you retain all receipts covering maintenance on your engine.

You are responsible for presenting your motorcycle to an S&S dealer as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

As the engine owner, you should be aware that S&S may deny your warranty coverage if your engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

If you have any questions regarding your warranty rights and responsibilities, you should contact S&S Cycle, Inc., 235 Causeway Blvd LaCrosse, WI 51603 or the California Air Resources Board, P.O. Box 8001, 9528 Telstar Avenue, El Monte, CA 91734-8001.

ADDITIONAL WARRANTY TERMS

The warranty period begins on the date the engine is delivered to the ultimate purchaser, or on the date it is first placed in service.

The emission control system of each new S&S engine was designed, built, and tested using only genuine S&S parts and with these parts the engine is certified as being in conformity with emission control regulations.

We recommend that you go only to an authorized S&S dealer for repairs under this warranty. He/she has factory-trained mechanics and genuine S&S parts. However, in the case of an "emergency" (as define below), you could have repairs performed at any available service establishment or by the owner, using any replacement part. An authorized S&S dealer not being reasonably available, or a part not being available within a reasonable time period (not to exceed 30 days from the time the motorcycle is initially presented to an S&S dealer for repair) constitutes an emergency. S&S will reimburse the owner for such repairs, including diagnosis, only if it is established that the repairs are covered under this emission warranty. S&S's parts reimbursement, however, will not exceed our suggested retail price for all warranted parts replaced and our labor reimbursement will be limited to our recommended time allowances for emission system repairs at the geographically appropriate hourly labor rate.

To obtain reimbursement from S&S for such emergency repairs, you must keep all failed parts and original receipts, so you can present them to an authorized S&S dealer for his inspection. S&S recommends that you bring your engine to an authorized dealer for inspection to ensure that the emergency repairs were done properly.

The use of replacement parts which are not equal in quality to genuine S&S parts may impair the effectiveness of the emission control system or otherwise damage your engine. If other than genuine S&S parts are used for maintenance, replacement or repair of components affecting emission control, you should obtain written assurances that such non-S&S parts are warranted by their manufacturer to be equal in quality to genuine S&S parts in both performance and durability. The use of non-S&S replacement parts does not invalidate the existing warranty, if any, on other S&S components unless the non-S&S parts cause damage to warranted parts or result in the creation of an emission non-compliant engine. However, S&S ASSUMES NO LIABILITY UNDER THIS WARRANTY WITH RESPECT TO ANY PARTS WHICH ARE NOT GENUINE S&S PARTS, unless genuine S&S parts cause damage to non-genuine S&S parts.

WHAT IS COVERED BY THIS EMISSION WARRANTY

The emission control system warranty covers the following "warranted parts" only:

- Throttle body or carburetor as applicable
- Evaporative canister
- Intake manifold
- Air cleaner backplate
- Electronic control unit and supporting sensors (if applicable)
- Spark plug (first 10,000 miles)
- If used on the above: hoses, clamps, fittings, tubing, sealing gaskets, and mounting hardware.

WHAT IS NOT COVERED BY THIS EMISSION WARRANTY

The following items are not covered by the S&S Cycle, Inc. Emission Control Warranty:

Malfunctions in any "warranted parts" caused by any of the following: abuse, misuse, unapproved modification or alteration, tampering, disconnection, or improper or inadequate maintenance. The warranty also does not cover replacement of listed parts in the event that the engine has been rendered emission non-compliant through actions noted above.

Repairs improperly performed or replacements improperly installed.

Use of replacement parts or accessories not conforming to S&S specifications, which adversely affect performance.

Use in competitive racing or related events.

Damage resulting from accident, acts of nature, or other events beyond the control of S&S.

The repairs or replacement of "warranted parts" which are scheduled for replacement prior to 30,000 kilometers or 18,641 miles (such as spark plugs, which are scheduled for replacement at 10,000 miles), once these parts have been replaced at the first replacement interval as part of required maintenance services.

Repairs and services performed by anyone other than an authorized S&S dealer (except in the case of emergency as defined above).

Inspections, replacement of parts and other services and adjustments required for required maintenance.

Loss of time, inconvenience, loss of use of the engine and donor vehicle, towing of the vehicle, or commercial loss and/or consequential damages.

Repairs on any engine of which vehicles odometer mileage has been changed so that actual mileage cannot be readily determined.