

**Instruction 106-6046**

**09-20-16**

Version 3

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Printed in the U.S.A.

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## **Installation and Adjustment Instructions for S&S Adjustable Pushrods For Hydraulic Tappets**

### **DISCLAIMER:**

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

**NOT LEGAL FOR SALE OR USE IN CALIFORNIA ON ANY POLLUTION CONTROLLED MOTOR VEHICLES**

### **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 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.

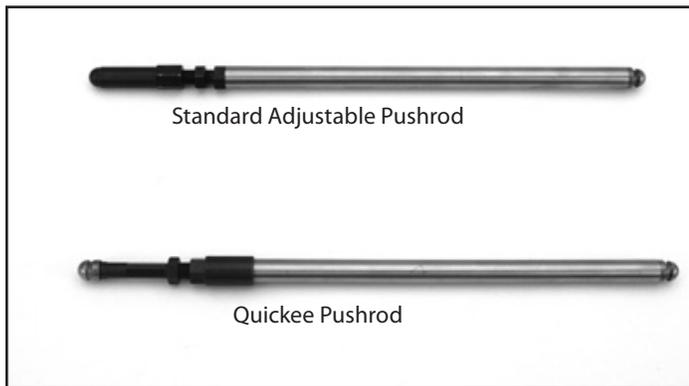
A part that is suspect of being defective must not be replaced by a Dealer without prior authorization from S&S. If it is deemed necessary for S&S to make an evaluation to determine whether the part was defective, a return authorization number must be obtained from S&S. The parts must be packaged properly 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.

## Introduction

S&S adjustable pushrods, for engines with late style hydraulic tappets, may be one of two types. See **Picture 1**. S&S Standard Adjustable Pushrods, which feature a threaded adjusting sleeve and a fixed adjusting screw, generally require the removal of the rocker covers and arms for installation or removal. S&S Quickee Pushrods have an adjusting screw that threads into the pushrod body, allowing the pushrod to collapse, becoming short enough to be installed and removed from an engine without disassembling the rocker covers. Quickee pushrods are also used in the S&S Valve Train Upgrade Kits for 1966-84 big twins.



Picture 1

### NOTES:

- Pushrod installation and adjustments must be made when engine is cold. Read instructions thoroughly and follow all recommended steps and procedures.
- If S&S® Standard Adjustable pushrod kit contains four different length pushrods, the longest pushrod is for the front exhaust, next longest is the rear exhaust. Of the two shorter pushrods, the longer one is the front intake, the shortest pushrod is the rear intake. Pushrod kits for 1999–up big twin engines have two different lengths—short for the intakes, long for the exhausts. Pushrod kits for Sportster® models contain four identical pushrods.
- S&S Quickee Pushrods for Harley-Davidson® shovel and Evolution® engines contain two long and two short pushrods. Quickee pushrods for Sportster® models and 1999–up big twins are the same length.
- S&S adjustable pushrods have a thread pitch of 32 threads per inch. This means that one complete turn equals .031" of change in pushrod length and one flat is .005".
- Basic adjustment instructions are for installing S&S adjustable pushrods with the stock-style hydraulic lifters. If the S&S HL2T (Hydraulic Lifter Limiter Travel) kit has been installed in the tappets, pushrod adjustment must be done according to the HL2T instructions.
- To determine if HL2T kit has been installed in the tappets of an assembled engine, compress the hydraulic piston assembly by lengthening the pushrod four complete turns of the pushrod adjuster. After 20 minutes try to spin the pushrod between your fingers. If the pushrod can not be turned with finger pressure, an HL2T kit is installed in the lifters and the HL2T adjustment procedure must be followed. See Section C, Page 3.
- When adjusting Quickee Pushrods, count flats on the 6 sided female adjuster on the pushrod, not the 4 sided male adjusting screw.
- Quickee pushrods for 1966–'84 big twin engines must be used with the S&S hydraulic conversion kit which includes S&S hydraulic tappets and tappet guides. Pushrods with oil holes are for use with S&S rocker arms. Pushrods without oil holes are for stock rocker arms.

- S&S hydraulic lifters have .200" of hydraulic plunger travel. When adjusting pushrods, the plunger should be positioned near the center of its travel. This would be 4 turns or 24 flats which is equal to .125".

### CAUTION

- Failure to follow recommended steps and procedures may result in damage to engine components.
- When installed and adjusted, S&S Quickee Pushrods must have a minimum thread engagement of .500" (Pushrod tube to Adjuster, not including the jam nut) or severe damage to the pushrod as well as your engine may occur.
- When adjustment is complete, the jam nut must have full thread engagement with the adjuster screw. If you do not have full engagement, the pushrod is not correct for the application or position.

### WARNING

Installing or adjusting pushrods while engine is hot could result in burns from contact with hot engine parts.

### Pushrod Installation

1. Remove pushrod cover clips and lift cover assemblies to view tappets.
2. Remove spark plugs and rotate engine until front piston is at the top of its stroke, with both front lifters at their lowest position (TDCC—top dead center compression).

NOTE: To ensure that the piston is at the correct position to remove pushrods, rotate the engine forward and watch the intake pushrod. The intake pushrods are the two closest to the center of the engine. Watch the intake pushrod rise and fall as the engine is rotated. When the intake pushrod is at its lowest position, the piston is on its compression stroke. Check to see if the piston is at TDC. If it isn't, rotate the engine a few more degrees to bring the piston to the top of the cylinder.

3. Remove front pushrods.
  - a. If installing standard adjustable pushrods, disassemble the rocker cover and rocker arm assembly, per the appropriate service manual.
  - b. If installing Quickee pushrods, stock pushrods may be cut out with a bolt cutter to save time. See NOTE and CAUTION below.

NOTE: Since S&S Quickee pushrods do not require rocker arm disassembly for installation, stock pushrods may be cut out of the engine to save time. S&S recommends that they be cut with a bolt cutter.

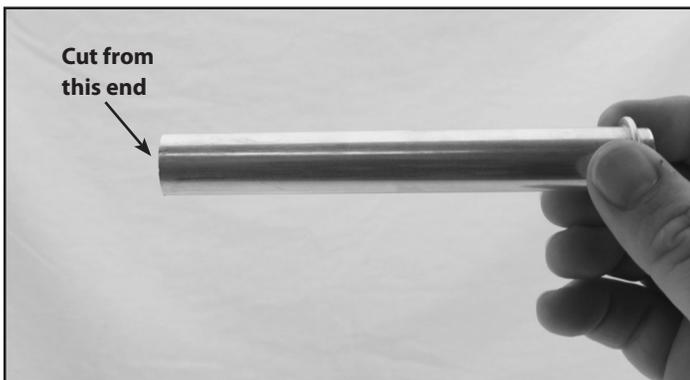
### CAUTION

Do not cut pushrods with a saw, metal chips may enter engine and cause extensive damage not covered by warranty.

### WARNING

Make sure tappet is at lowest point of travel and pushrod is not under valve spring pressure before cutting pushrods. Sudden release of valve spring pressure may cause cut pushrods to fly out of motor, potentially causing serious injury.

- Clean and inspect the pushrod tubes. Replace all o-rings. Apply a light coat of engine oil to the o-rings. If using stock pushrod tubes and Quickee pushrods in an Evolution engine, the inner tube should be shortened to avoid contact with pushrod during operation. See **Picture 2**. Shorten the tube according to the following chart:



**Picture 2**

Displacement	Cylinder Length	Final Length of Inner Pushrod Tube
100	4.745	4"
88,107	5.375	4.75"
93,113	5.5	4.875"
80,89,96	5.55	4.875"
98	5.625	5"
103	5.75	5"

- Insert new pushrods through tube assemblies with the adjuster ends down, and install in appropriate positions.
- Reinstall rocker assemblies according to appropriate service manual procedures, if they were removed.

### Basic Pushrod Adjustment

- Holding pushrod so the top ball end is in the rocker arm cup, extend adjusting screw until the bottom ball end just contacts the tappet cup. Turn the pushrod adjuster and additional 4 complete turns (24 flats) to compress hydraulic unit in exhaust lifter, and tighten locknut. Allow sufficient time for lifter to bleed down (typically 20 minutes) Pushrods must spin freely with fingers.

*Note: With Standard Adjustable Pushrods tighten nut against adjuster sleeve. With S&S Quickee Pushrods, tighten nut against the pushrod body.*

- Repeat procedure for Intake pushrod.

*NOTE: If pushrods can not be turned between fingers after 20 minutes, tappets contains S&S HL2T spacers. Detailed instructions for the HL2T kit are presented in the next section.*



**Failure to allow hydraulic unit to bleed down before rotating engine or adjusting the other pushrod could result in valve-to-valve contact and serious valve train damage. Lifters are bled down when pushrod can be turned with fingertips.**

- Bring rear piston to Top Dead Center Compression (TDCC) and repeat above procedures for rear cylinder.
- Replace spark plugs and pushrod tube clips. Start motorcycle and check for leaks.

### Notes For Sportster® Models

- In order to access the pushrod adjuster screws in 1991 and later Harley-Davidson® Sportster® and Buell® models, it will be necessary to use pushrod cover assembly kit for 1986–'90 Sportster® models, S&S part 93-4038, and the appropriate length pushrod cover keepers. 1991-'03 models will also require pushrod cover adapter kit, S&S part 33-5355.
- On 1991 and later models, it is necessary to disassemble the rocker arm/rocker box to remove the stock one piece pushrod cover.

### Notes For Twin Cam 88®, 96™, and 103™ and Milwaukee Eight® Engines

- S&S pushrod kits for the Twin Cam 88®, 96™, and 103™ and Milwaukee Eight® engines are available as a kit containing pushrods only, however, it will be necessary to use S&S pushrod covers, or similar aftermarket product, in order to be able to access the adjuster units on the pushrods. S&S offers kits for stock height 1999–up big twin engines that contain the four adjustable pushrods, pushrod tube set, gaskets and o-rings for a complete assembly.
- If equipped with S&S Easy Start compression release cams, you must use extra care when adjusting pushrods. Because the decompression lobe is near TDC, it is possible to adjust the pushrod while the tappet is on the lobe if it is not exactly at TDC. This will cause incorrect exhaust pushrod adjustment. To verify correct position, you can rotate the engine in the forward direction and feel for the exhaust tappet to slightly lift (about .030") and set back down on the base circle. This is the proper point to adjust the pushrods.
- Once the stock non-adjustable pushrods have been removed, S&S Standard pushrod kits for the Twin Cam 88®, 96™, and 103™ may be installed and removed from the engine without removing the rocker covers. Remove fasteners from tappet covers. Turn the adjusters to make the pushrods as short as possible. Hold the pushrods up against the rocker arm cups and swing pushrods and tappet covers out as an assembly. To install, reverse the process. Insert pushrods through pushrod cover assemblies. Install intake and exhaust pushrod assemblies, along with the tappet cover and new gasket, into position in front cylinder. See **Picture 3**.



**Picture 3**

## Adjusting Pushrods With S&S HL<sub>2</sub>T Limited Travel Kit Installed

### NOTES:

- The S&S HL<sub>2</sub>T kit is designed to limit the travel of the hydraulic lifter making it impossible for the lifter to collapse. Stronger valve springs are often used to avoid valve float at high rpm. The HL<sub>2</sub>T kit prevents high valve spring force from collapsing lifters. With the HL<sub>2</sub>T kit installed, stock hydraulic lifters work like solid lifters at high rpm, while retaining normal hydraulic function for minimal noise and maintenance under normal conditions. Adjustable pushrods must be used with the HL<sub>2</sub>T kit.
- S&S Limited Travel Kit 33-5338 fits all S&S tappets and all Harley-Davidson® replacement tappets for 1999-'17 big twins (18538-99C & 18572-13) and 1991-'17 Sportster® models (18526-89A & 18538-99C).
- S&S Limited Travel kit does not fit Harley-Davidson® replacement tappets (18523-86B) for 1984-'99 big twins and 1986-'90) Sportster® models.
- If using aftermarket tappets, consult the manufacturer to determine compatibility. See Limited Travel washer dimensions below.

KIT	OD	ID
33-5338	.605 OD	.440 ID

### HL<sub>2</sub>T Kit Installation

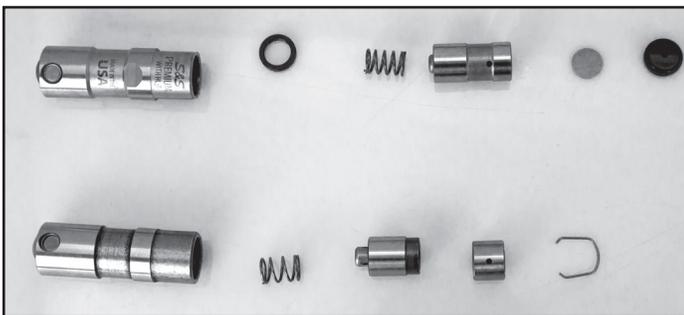
1. If tappets are installed in the engine, it is recommended that they be removed. Be sure that each tappet is kept with its original tappet block and bore.

*NOTE: This procedure is the preferred method of installation. However, kit can be installed without removing lifters from engine.*

2. Remove hydraulic piston retaining wire clip from one assembly at a time.



**Be careful not to deform wire clip during disassembly.**



Picture 4

4. Completely disassemble tappet removing all parts.
5. Thoroughly clean all parts including tappet body. Remove any oil which might prevent hydraulic unit from fully collapsing during adjustment.
6. Insert one spacer from S&S HL<sub>2</sub>T kit in tappet body.
7. Reassemble tappet in reverse order making sure original parts are returned to their original positions. See **Picture 4**.
8. Replace wire retaining clip in tappet body.
9. Put tappet back in original tappet bore.
10. Repeat Steps 2 through 8 for three remaining tappets.
11. Reassemble engine with modified tappets.

12. Adjust pushrods.

*NOTE: In all cases engine must be cold and lifter must be at lowest point of travel for pushrod adjustment.*

- a. Remove sparkplugs.
- b. Remove spark plugs and rotate engine until front piston is at the top of its stroke, with both front lifters at their lowest position (TDCC – top dead center, compression).

*NOTE: To ensure that the cylinder is at the correct position to adjust pushrods, rotate the engine forward and watch the intake pushrod. The intake pushrods are the two closest to the center of the engine. Watch the intake pushrod rise and fall as the engine is rotated. When the intake pushrod is at its lowest position, the cylinder is on its compression stroke. Check to see if the piston is at TDC. If it isn't, rotate the engine a few more degrees to bring the piston to the top of the cylinder.*

- c. Extend one of the front pushrods until it contacts the hydraulic piston assembly in the lifter body, then extend pushrod an additional four complete turns, until piston assembly is in contact with HL<sub>2</sub>T spacer and the valve is lifted off of its seat. If tappets contain oil, as when pushrods are readjusted after engine has been run, or if all oil was not removed during installation, allow at least 20–30 minutes for piston assembly to bleed down. If pushrod can be turned between the fingers, tappet piston is not in contact with HL<sub>2</sub>T spacer. Lengthen pushrod one additional turn and test again after 20 minutes.
- d. If pushrod can not be turned between the fingers, loosen pushrod adjustment until pushrod can be rotated with the fingers with slight drag. Continue loosening (shortening) pushrod one full turn (6 flats).

*NOTE: Shortening adjuster an additional six flats or one full turn from zero lash often results in quieter valve train operation. This provides additional travel for the hydraulic piston assembly, which can improve the ability of the hydraulic unit to maintain zero lash under normal operating conditions.*

- e. Tighten lock nut.
- f. Repeat steps c, d, and e for the other front pushrod.
- g. Repeat above procedures for rear cylinder, this time bringing rear piston to TDCC (top dead center compression).
- h. Replace spark plugs and install pushrod clips.

*NOTE: Perform this operation on one cylinder at a time. Do not turn engine until pushrod adjustment is complete, and pushrod can be spun with fingers.*

