



Installation Instructions for S&S Easy Start Camshafts for X-Wedge® Engines

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.

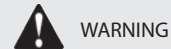
SAFE INSTALLATION AND OPERATION RULES:

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 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.

ROCKER COVERS

The rocker covers on an S&S® X-Wedge® engine are just covers. They provide no support to the rocker arms or valve train and may vary in style from OE manufacturers, but their only function is to be a cover. It should also be noted that the stock S&S covers are interchangeable between the front and rear cylinder and the hardware used to secure them is all the same.

Removal

1- Remove five $\frac{5}{16}$ x 18- 1 $\frac{7}{8}$ " Allen head fasteners from the rocker covers.



Picture 1

NOTE: All of the rocker cover fasteners are the same length so they can go on either the front or rear rocker cover in any location.

2- This is a good time to remove the gasket from the head. Plan to replace the gasket each time the rocker cover is removed.



Picture 2

ROCKERS ARMS/PUSHRODS

The rocker arms used in an S&S® X-Wedge® are stamped steel. They are identical across both cylinders, but we recommend that they be reinstalled in their original position once used. Also, all pushrods are the same length, but we recommend that they be installed in their original position during reassembly.

Removal

- 1- Verify that the front cylinder is on the base circle of the cams.

NOTE: Base circle of the cam is when the tappet is at its lowest point of the camshaft lobe.

- 2- Loosen the rocker arm nuts and lift the rockers out. Note that there is a rectangular steel channel under the rockers. It is best to remove this and store it with the rocker each time they are removed.



Picture 3

NOTE: The rocker arm channels are marked F (Front) and R (Rear).

- 3- Rotate the engine over to the same position (T.D.C. on the compression stroke) and repeat step 2 for the rear cylinder. The pushrods can be removed at this time.

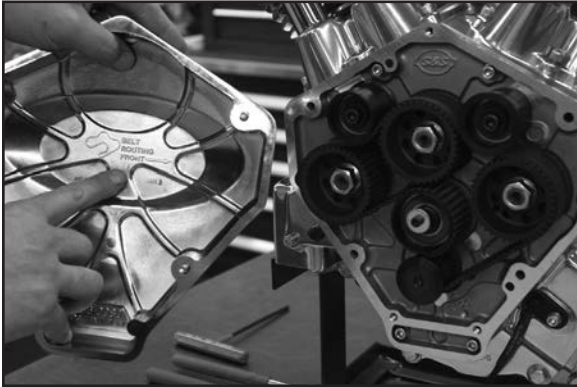


Picture 4

NOTE: During disassembly keep track of the original pushrod locations.

BELT REMOVAL

- 1- Remove the belt cover.



Picture 5

NOTE: A broken belt can be a sign of a stuck valve.

- 2- Rotate the engine until the timing pin locations on all three cams (marked with white circles below) line up with their corresponding holes in the intermediate cam cover. The FTDC mark will align with the notch in the pinion sprocket.



Picture 6

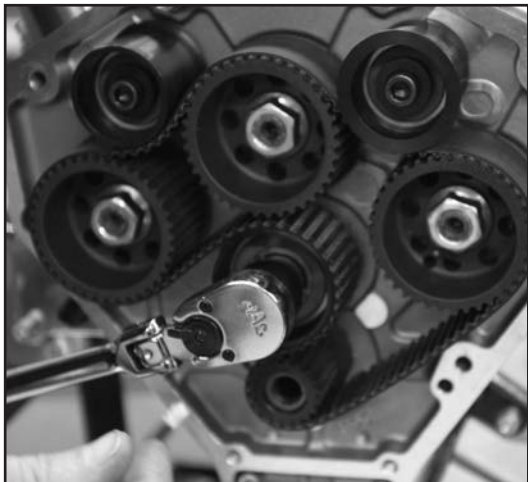
- 3- Remove the pinion bolt and washer using a TP45 tool.
- 4- Insert the $\frac{3}{16}$ " diameter dowel pins into the cam sprocket timing holes. You may need to rotate the cams to achieve alignment.



Picture 7

NOTE: MAP sensor must be installed on the rear intake manifold spigot for correct engine operation. Installation to the front manifold will result in an incorrect signal to the VFI module.

- 5- Use the special S&S® socket PN 106-0750 or an 11/16" wrench to take the tension off the cam belt tensioner. Once it is fully relieved, you can use a bolt in the lower intermediate cam cover mounting area to hold the wrench or ratchet in place.



Picture 8

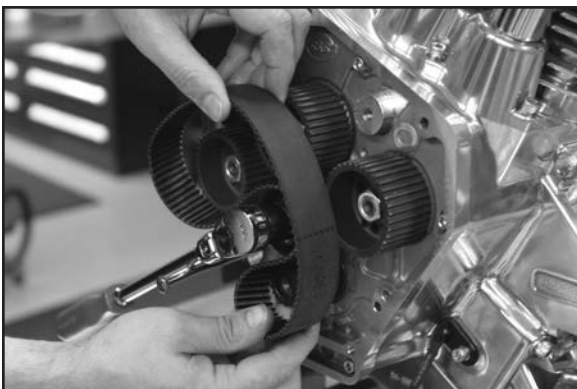


Picture 9

- 6- Remove the two idler sprockets at the top of the intermediate cam cover. Note their orientation—the rear has a bevel facing the intermediate cam cover and the front faces away.

NOTE: Belt cannot be installed after the pinion bolt and washer are installed.

- 7- Slide the belt off.



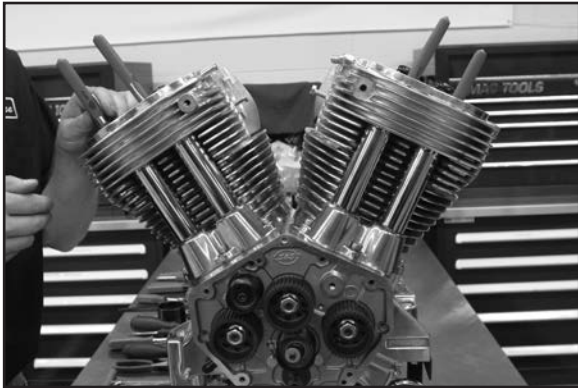
Picture 10

NOTE: The belt can be held to the cam sprockets using a clothes pin or paper clamp to ease installation.

CAUTION

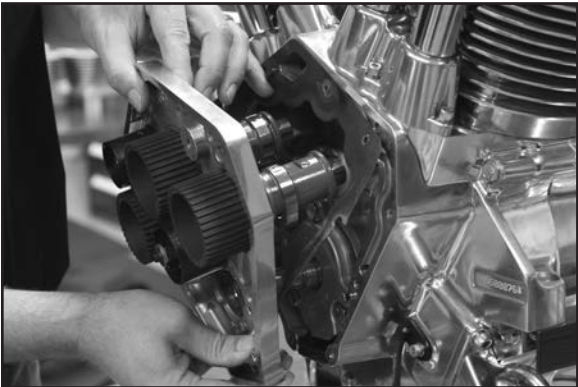
Do not substitute a standard Torx® T45 in place of the Torx Plus TP45.

- 1- Use magnets to hold the tappets up (if still in place).



Picture 11

- 2- Loosen and remove the intermediate cam cover assembly. Place the intermediate cam cover on a flat surface protected by a clean rag.



Picture 12

NOTE: A small drain pan will be required as oil from the cam chest area will be present when cover is removed.

- 3- The back side of the cams have flats that will fit a 1 $\frac{1}{8}$ " wrench and the front side of the cam has a nut on it. Loosen the nut by holding the cam still with a wrench on the back side. Now use an arbor press to remove the sprocket from the cam and now the cam can be removed from the plate by pressing on the end of the cam shaft.



Picture 13



Picture 14

NOTE: Use caution throughout this process to avoid damaging the camshaft lobes, camshaft plate bearings and the gasket surfaces.

CAMS- Standard and Easy Start

The S&S® X-Wedge® is a three-cam design engine. It features a common intake and two separate exhaust cams. The intake cam is located in the center and has two lobes. The exhaust cams feature one lobe and compression releases. The front exhaust cam has its lobe located closed to the cam plate (outward). The rear exhaust cam has its lobe located the furthest from the cam plate (inward).

Easy Start Cams

S&S has developed a unique product to assist with starting with a compression release cam. The premise is simple, at cranking RPM, a spring loaded lever holds the exhaust valve open slightly while the engine turns over, lowering compression. Once the engine fires and RPM exceeds 500 RPM, centrifugal force takes over and sends the lever to a retracted position, allowing the exhaust valve to seat fully.

There is no service required on these cams. If you have the cams out of the bike for any reason, verify that the lever operates smoothly and do a visual inspection or any debris that may prohibit smooth operation.

NOTE: With the S&S Easy Start cams in your bike the measured compression will be lower than standard engines. If you have any concerns with cylinder pressure perform a standard leakdown test.



Picture 15



Picture 16

CAM BEARING REMOVAL

- 1- Remove the cam bearing seals.
- 2- To remove the cam bearing use an arbor press and appropriate size tool. Be sure to support the intermediate cam cover evenly to prevent distortion during the pressing out stage. Be sure that you are pressing the bearings out from the cam chest side of the plate.
- 3- Inspect the bearing surface of the intermediate cam cover after removal of the bearings. If bores are damaged cam plate replacement is required.

CAM BEARING INSTALLATION

- 1- Be sure the bearing surfaces of the intermediate cam cover are clean and free of gouges or scratches. An arbor press is required for this procedure.
- 2- Clean all cam bearings to remove rust preventative before installation.
- 3- Be sure to press from the number side of the bearing from the cam chest side of the plate.
- 4- Align bearing to ensure straight installation into the bore and press until they are .035" - .045" below the bore surface.
- 5- Verify the needle bearings roll smoothly. Apply assembly lube to all bearings and seal surfaces.
- 6- Install the seals flush with the face of the intermediate cam cover.

CAM SHAFT INSTALLATION- Standard and Easy Start

- 1- Install key into camshaft (S&S® recommends the center cam first—but you can start with any cam). Install the cams and sprockets in the following order: Intake, front exhaust, rear exhaust.



Picture 17

NOTE: The X-Wedge® engine uses three different camshafts, one intake and two exhaust. The intake cam has two lobes and is located in the center. The exhaust cams contain the compression release features. The front exhaust cam has the lobe located closest to the cam plate (outward). The rear exhaust cam has the lobe located the furthest from the cam plate (inward).

- 2- Slide camshaft through the bearing and seal carefully to prevent damage to the seal.
- 3- Align and install sprocket onto camshaft. Make sure timing marks on sprockets are facing outwards.
- 4- Apply Loctite® 242 (blue) to the threads of the camshaft nut.
- 5- Hold back side of the camshaft with a 1½-inch wrench letting the wrench rest against the bench surface.
- 6- Install the camshaft nut and torque clockwise to 60 ft-lbs.
- 7- Verify the camshafts rotate freely and add a coat of assembly lube to all cam surfaces.



Picture 18

- 8- Install new camchest gasket.



Picture 19

9- The intermediate cam cover can now be installed onto the crankshaft and crankcase—be sure not to damage the pinion shaft seal.

NOTES:

- Before installing the intermediate cam cover, apply a coating of high-temp wheel bearing grease to the inside of the pinion seal.
- Position all four cam lobes toward the center of the intermediate plate before installing on to the crankcase to aid in clearing the rollers on the tappets.

10- Treat the six ¼-20 intermediate cam cover fasteners with blue Loctite® 242 and torque to 90-120 in-lbs.

NOTE: The tensioner is a non-service item and should be replaced as a unit.

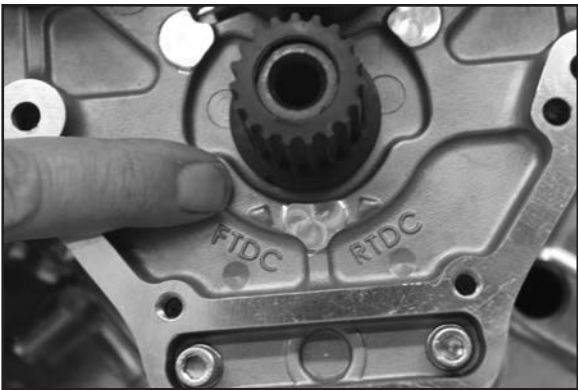


Picture 20

11- Install the cam belt cover with a new gasket. Treat the ¼-20 fasteners with blue Loctite 242 and torque to 90-120 in-lbs.

PINION SPROCKET INSTALL

1- Be sure the engine is at top dead center front (TDCF) cylinder.



Picture 21

NOTE: It is possible to install this 180° off. Be sure the dot matches the mark on the sprocket and front piston is at TDC.

- 2- Slide the sprocket over the pinion shaft. You must align the notch on the sprocket to the dot on the crankshaft and the FTDC mark on the intermediate cam cover. Make sure that the front piston is at TDC!
- 3- Apply oil to the threads of the head of the bolt.
- 4- Do not apply Loctite®.
- 5- Slide washer onto bolt. Tighten bolt and washer to crankshaft by using TP45 (Torx® Plus 45). Torque to 35 ft-lbs.

BELT INSTALLATION/REPLACEMENT

1- Installation of a new belt is simple, but requires the use of S&S® Cam Alignment pins for each of the three cams.

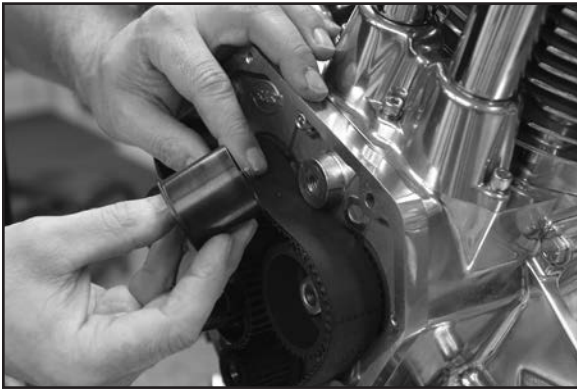
WARNING

Do not bend the belt tighter than the size of the sprockets. Do not twist the belt, crimp or crease it.

- 2- Make sure the tension is removed from the belt tensioner.
- 3- Rotate the cams until they are positioned over their alignment holes and then insert the pins.
- 4- Next, rotate the engine to FTDC and align the timing mark.
- 5- Pass the belt around the cam sprockets—there is a diagram of the belt and its installation pattern inside the cam cover. The belt should be orientated so that you can read the words on the belt when installing it.

NOTE: *The belt installation routing diagram can be found inside the timing belt cover.*

- 6- Install the idler sprockets noting their orientation. The rear sprocket has a bevel facing the intermediate cam cover, the front one faces away. Torque to 15-18 ft-lbs.
- 7- Remove the alignment pins.



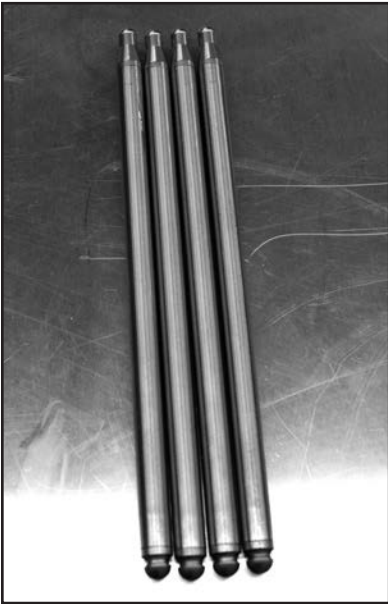
Picture 22

NOTES:

- *If you do not have S&S Cam Alignment Pins, Gates marks the belt with alignment points on its edge. Align the belt marks with the cam alignment holes or use 3/16" dowels.*
 - *Belt installation can be done with rocker arms in place if pins are used, but it is easier to do with the rockers loosened.*
- 8- Once you have everything aligned, release the pressure on the belt tensioner.
 - 9- Oil the pinion bolt and torque to 35 ft-lbs.
 - 10- Install a new gasket and replace the cam cover. Torque the 1/4-20 bolts to 144 in-lbs. with Loctite® 242.

INSTALLATION/ADJUSTMENT

- 1- Pushrods in the X-Wedge® are all the same size and length. It is still recommended that they be put back in the place they started, rather than mixing them around.



Picture 23

- 2- Start with one cylinder at T.D.C. on the compression stroke—which puts the tappets at the base circle of the cams. Install the pushrods back in the position they started in. Apply assembly lube to both ends of the pushrod.



Picture 24



Picture 25

WARNING

Be sure that the pushrod tip is seated in the tappet cup. Severe engine damage may occur if the pushrod tip is not in proper position. Use a light and look down in the hole to verify the position.

NOTE: X-Wedge pushrods are installed with the small diameter tip facing the rocker arm.

- 3- Install the rocker channel over the studs. There are front and rear channels with "F" and "R" identifying marks.



Picture 26

- 4- Insert the rocker arm fulcrum into the rocker and then pass the assembly over the stud in the head. Apply assembly lube to the fulcrum surface and rocker arm tip. Be sure to install the washer under the retaining nut and then tighten the nut to 30 ft-lbs. for valve travel testing.
- 5- Once you are satisfied with the valve adjustment, apply red Loctite® 272 to the threads and tighten it to 30 ft-lbs.

INSTALLATION

- 1- Ensure the gasket surface is clean and free of debris or old gasket residue.
- 2- Position a new gasket on each head.
- 3- Install the rocker covers and tighten the hardware to 15-18 ft-lbs. using blue threadlock on the threads. Use a star pattern, not a circular pattern.