



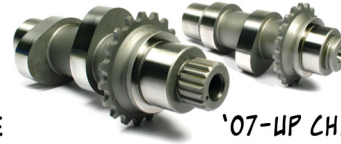
**FEULING® CAMSHAFT INSTALLATION INSTRUCTIONS
FOR H-D TWIN CAM® ENGINES**



'07-UP GEAR DRIVE



'99-'06 GEAR DRIVE



'07-UP CHAIN DRIVE

NOTE: SOME OF FEULING'S PRODUCTS: NAMELY CAMSHAFTS, VALVE-SPRINGS, AND HIGH FLOW FUEL INJECTORS ARE NOT LEGAL FOR SALE OR USE IN CALIFORNIA ON ANY POLLUTION CONTROLLED MOTOR VEHICLES. THE FOLLOWING DISCLAIMER IS ASSOCIATED WITH THESE FEULING® PRODUCTS.

*FEULING® DOES NOT RECOMMEND TUNING BEYOND STOCK EMISSIONS STANDARDS.

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WAKE UP YOUR TWIN CAM® ENGINE WITH A SET OF FEULING® REAPER® SERIES CAMSHAFTS. FEULING® USES THE FORCE OF THE REAPER'S® SCYTHE TO PUT THE POWER BAND WHERE IT COUNTS, CREATING A REAL SEAT OF THE PANTS FEEL. THE REAPER® CAMSHAFT PROFILES PRODUCE MORE POWER AND MORE TORQUE INCREASING CRANKING COMPRESSION, IMPROVING THROTTLE RESPONSE, ACCELERATION AND FUEL MILEAGE. DYNO PROVEN AND TRACK TESTED.

IMPORTANT NOTICE

THIS INSTALLATION SHOULD BE DONE BY AN EXPERIENCED MECHANIC WHO HAS ACCESS TO A FACTORY SERVICE MANUAL AND ALL REQUIRED TOOLS. THIS PROCEDURE REQUIRES USE OF SPECIALTY TOOLS.

CAUTION

INCORRECT INSTALLATION CAN CAUSE ENGINE DAMAGE NOT COVERED UNDER WARRANTY. FAILURE TO INSTALL COMPONENTS CORRECTLY CAN CAUSE ENGINE SEIZURE. ENGINE SEIZURE MAY RESULT IN SERIOUS INJURY TO MOTORCYCLE, OPERATOR, PASSENGER, AND/OR OTHERS.

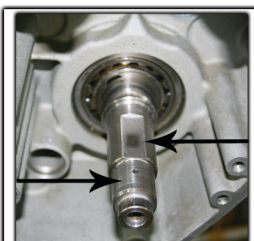
IMPORTANT NOTICE

MEASURE FLYWHEEL PINION SHAFT RUN OUT. EXCESSIVE PINION SHAFT RUN OUT WILL CAUSE CAM CHAIN, CAM GEAR, CAM SUPPORT PLATE AND OIL PUMP DAMAGE AND OR FAILURE. EXCESSIVE PINION SHAFT RUN OUT WILL VOID MANUFACTURER'S WARRANTY.

GRIND	VALVE LIFT	OPEN	CLOSE	DURATION @.053°	LIFT @ TDC	LOBE CENTERLINE	FITMENT
525 INTAKE 525" EXHAUST	525" 535"	4° 51°	42° 5°	226° 236°	.099° .112°	.109° .113°	525 Cams are a direct bolt in replacement for T/C 88", 95" 96" & 103" engines, can be used with stock valve springs, pushrods & lifters
543 INTAKE 543" EXHAUST	543" 553"	15° 56°	43° 12°	238° 248°	.160° .140°	.104° .112°	543 Cams are a direct bolt in replacement for T/C 96", 103" & 110" engines. '99-'04 T/C 88" & 95" engines require higher lift valve springs, can be used with stock pushrods and lifters
574 INTAKE 574" EXHAUST	574" 574"	15° 61°	45° 14°	240° 255°	.163° .143°	.105° .113.5°	574 Cams are a direct bolt in replacement for T/C 96", 103" & 110" engines. Performance pushrods and lifters are recommended but not required. '99-'04 model 88" & 95" require higher lift valve springs
594 INTAKE 594" EXHAUST	594" 604"	19° 64°	56° 16°	255° 260°	.190° .167°	.108.5° .114°	594 Cams require performance valve springs, pushrods, lifters, clutch and increased compression ratio.
630 INTAKE 630" EXHAUST	630" 630"	20° 60°	58° 19°	258° 263°	.188° .171°	.109° .112.5°	630 Cams require performance valve springs, pushrods, lifters and increased compression ratio.

1. Refer to HD® manual, engine section, reference sub assembly service and repair bottom end, for removal of camplate, oil pump and cams.
2. Inspect the pinion shaft for burrs, use a scotch pad or emery cloth to assure smoothness of shaft. Measure the pinion shaft and pinion shaft bore of camplate, recommended clearance (+/- .0005" - .0025")
3. Inspect flywheels for pinion shaft run out. Feuling recommends a maximum run out tolerance of 0.0025". If installing gear drive camshafts the run out tolerance is very important, it is advisable to be under the maximum tolerance.

INSPECT PINION SHAFT



Remove burrs & scoring from pinion shaft to assure smoothness

MEASURE CRANK RUN OUT



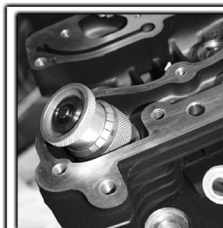
Dial indicator with Magnetic base



Feuling Runout Measuring Tool #9015

Max run out 0.0025"

MEASURE VALVE SPRING COIL BIND CLEARANCE & VALVE SEAL TO RETAINER CLEARANCE



Installed valve spring height is critical!



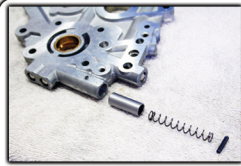
Too little clearance will create coil bind

causing valve-train damage while too much will cause spring surge. Ideal valve spring clearance is achieved at open spring height. Reference your valve spring specs and recommendation

4. Clean and inspect new camshafts.



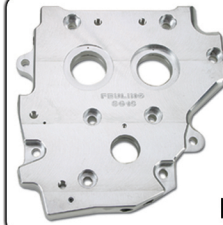
5. Clean and inspect camplate and all related components. Inspect camplate pressure relief valve & spring. Inspect camplate, cam & pinion shaft bores for size and burrs. Clean camchest and all mating surfaces, it is recommended to clean and flush oil tank, any residue/debris in oil tank will flow directly through the newly installed oil pump, camplate & camshafts causing catastrophic damage not covered under warranty.



Inspect pressure relief valve

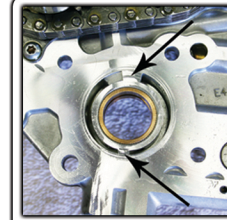


Feuling camplate pressure testing tool



Inspect camplate pinion & cam bores for size & fitment

verify camplate has all external plugs



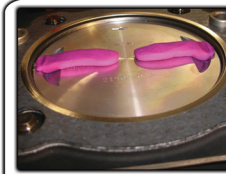
Inspect camplate for scoring, if scoring is present replace camplate. Scoring will effect oil psi & oil scavenging

6. Verify cam lobes DO NOT interfere with the engine case, high lift cams with modified pistons will require measurement of valve to piston clearance. Clay pistons, install cylinder heads use lightweight checking springs, install proper gaskets, cycle engine then measure clay.

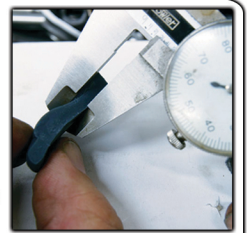


Verify Intake lobes of camshafts clear engine case

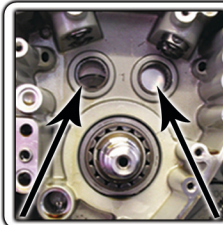
Crank bearing boss & lifter bosses



Measure valve to piston clearance
clay pistons and measure thickness of clay after cycling engine



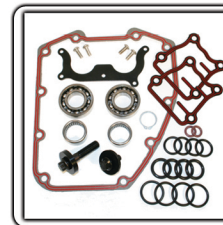
7. Install new inner cam bearings into engine case, use the correct bearings for your model engine and use the proper installation tools. Feuling has a full line of camshaft installation kits for all T/C models.



Replace inner cam bearings use the proper tools

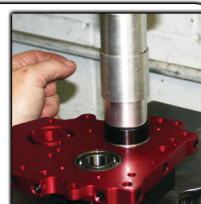
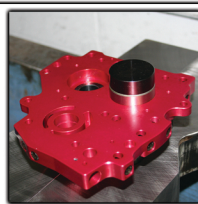
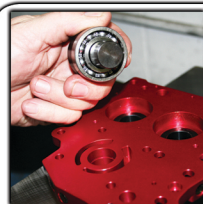


Apply extreme pressure lube on bearings & cams prior to pressing in

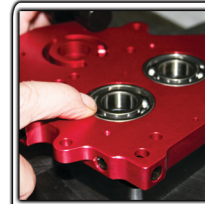


Feuling has a full line of cam installation kits

8. Install new outer cam bearings in '99-'06 Except '06 dyna style camplates, use the correct bearings, press lube and proper installation tools, verify the bearings are installed flush with camplate face. It is important that these bearings are installed straight.

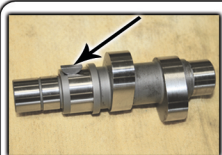


Press in new cam bearings using the proper tools use high pressure press lube on bearings & bores



Verify bearings are flush with camplate

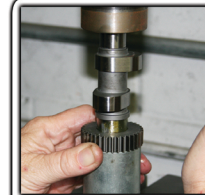
9. Gear Drive camshafts - Install the cam keys into camshafts then press the inner cam gears onto the camshafts. Use the proper tools.



Install cam keys - use arbor press or vise with soft jaws



Line up gear with camshaft

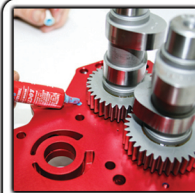


Press cam gears onto camshafts

10. Camplate style '99-'06 Except '06 dyna - Install camshafts, press camshafts into camplate bearings using the proper tools then install the bearing retainer plate. Gear Drive systems - Install retaining ring on front camshaft.



Line up timing marks, press in camshafts using lube and the proper tools



Install bearing retainer plate using loctite



Feuling #8001

Bearing Retainer Plate



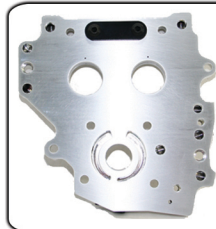
Install retaining ring

11. Installing gear drive camshafts in camplate with hydraulic chain tensioners - '06 Dyna and '07 - Up style - the oil holes for the hydraulic chain drive tensioners must be blocked off. Feuling offers a block off plate kit part #8016

Block Off Plates



Feuling #8016

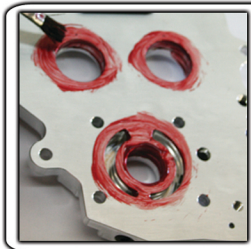


Install block off plates when installing gear drive cams in hydraulic tensioner style camplates

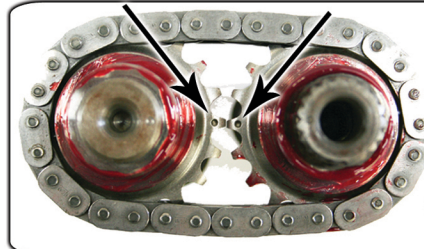


Apply Loctite to block off plate bolts

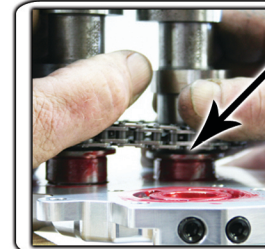
12. Installing camshafts into '06 Dyna and '07 - Up style camplate: Install camshafts into well lubed camshaft bores, lead with rear camshaft. Install spacer washers, front camshaft retaining ring and chain tensioners, for chain drive set-up. If different thickness spacers are desired for alignment of chains or gears see your H-D dealer for different thickness spacers.



Pre-Lube camshaft bores, thrust surfaces, Pinion bore and oil pump mounting surface



Line up timing marks and pre-lube cam journals

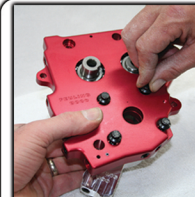


When installing camshafts into the late model camplate lead with the rear cam

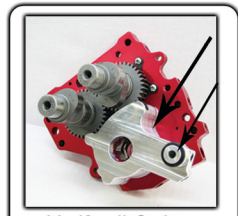
13. Apply engine assembly lube to oil pump gears, oil pump housings, camplate oil pump mating surface, pinion shaft bore, camshaft bearings, camshaft bores. Bolt oil pump to camplate, Do not use loctite on oil pump & camplate bolts.



Apply engine assembly lube to oil pump housings & gears

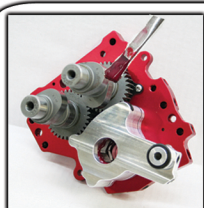


Bolt oil pump to camplate finger tight DO NOT use loctite or hardening compound

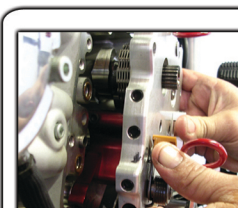
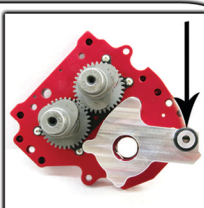
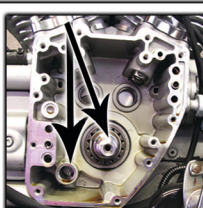


Verify all O-rings are installed correctly

14. Apply engine assembly lube to camshafts, inner cam bearings, pinion shaft, scavenge port hole of engine case and pick up port of oil pump. Installation of the rear oil pump port into the scavenge port hole of the engine case is crucial for proper oil scavenging. Install camplate assembly, align the oil pump gear flats with the crankshaft flats, slide assembly onto crankshaft, using slight pressure slip oil pump pick up port into port hole of case then slide camplate onto dowel pins.



Apply engine assembly lube to camshafts, inner cam bearings, scavenge port hole of case and pick up port of oil pump



Install camplate & oil pump as a complete assembly



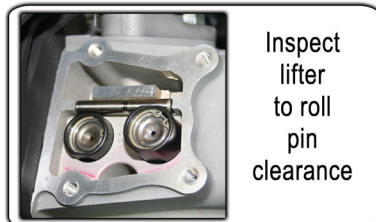
Wiggling assembly while rotating engine back & forth will aid alignment & installation

15. Tighten camplate bolts first - With camplate & oil pump bolts only finger tight rotate engine over several times. This will center the camplate assembly. Alternately tighten all camplate bolts to 10 inch lbs. Then rotate engine over again and final torque camplate bolts to 90 – 120 inch lbs.

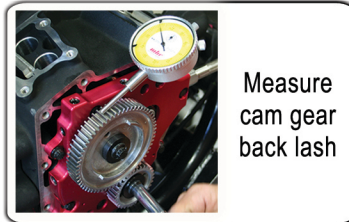
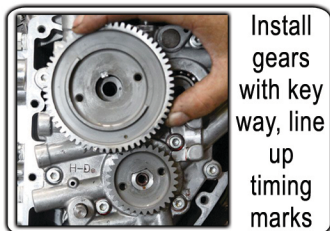
16. With oil pump bolts only finger tight, rotate engine over several times. This will center the oil pump gerotors and pump housings to crankshaft. Alternately tighten the four oil pump bolts to 10 inch lbs. Rotate engine over again then final torque the oil pump bolts to 90 – 120 inch lbs.



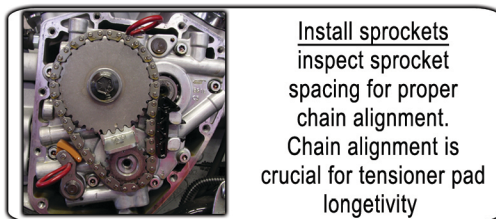
17. Inspect lifter to roll pin clearance. Cycle the camshafts and verify the lifter does not drop below the roll pin then verify the bottom of the lifter flats do not interfere with the roll pin at peak lift



18. Installing Gear Drive System - Line up gear timing marks then tighten with crank and pinion bolts and hardened spacers. Use new bolts and washers and use loctite on bolt threads and lube on bolt underhead flanges. Torque to spec. Gear drive systems require measuring back lash, measure in 4 locations taking the average. Gear drive systems may also require clearancing inside of cam cover.



19. Installing Chain Drive - Refer to your factory service manual. Line up sprocket timing marks use new cam and crank bolts and washers use loctite on bolt threads and lube on bolt underhead flanges. Chain drive systems require sprocket spacing for proper chain alignment - see dealer if different thickness spacers are required.



WARRANTY:

All 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 FOP's option if the parts are returned to FOP by the purchaser within the (12) month warranty period. In the event warranty service is required, the original purchaser must notify FOP of the problem immediately. Some problems may be rectified by a telephone call and need no further action. A part that is suspect of being defective must not be replaced without prior authorization from FOP. If it is deemed necessary for FOP to make an evaluation to determine whether the part was defective, it must be packaged properly to avoid further damage, and be returned prepaid to FOP 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. After an evaluation has been made by FOP and the part was found to be defective, repair, replacement or refund will be granted. Excessive flywheel pinion shaft run out will damage camplate, oil pump, lifters and or cause engine damage and or failure. Damage to Feuling® products due to excessive pinion shaft run out will void manufacturer's warranty. Valve spring coil bind and spring surge will cause lifter and camshaft damage. Damage to Feuling® products due to valve spring coil bind and or spring surge will void manufacturer's warranty.

ADDITIONAL WARRANTY PROVISIONS:

FOP shall have no obligation in the event an FOP part is modified by any other person or organization, or if another manufacturer's part is substituted for one provided by FOP. FOP shall have no obligation if an FOP part becomes defective in whole or in part as a result of improper installation, improper break-in or maintenance, improper use, abnormal operation, or any other misuse or mistreatment. FOP shall not be liable for any consequential or incidental damages resulting from the failure of an FOP part, the breach of any warranties, the failure to deliver, delay in delivery, delivery in non-conforming condition, or any other breach of contract or duty between FOP and the customer. The installation of parts may void or otherwise 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 operated on public highways, especially in states where pollution laws may apply. Always check with 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/her use, and the user shall assume all legal, personal injury risk and liability and all other obligations, duties and risks associated therewith. Our high performance parts, engines and motorcycles are intended for experienced riders only. Feuling® Oil Pump Corporation reserves the right to change prices and/or discounts without notice and to bill at the prevailing prices at the time of shipments. The words Harley®, Harley-Davidson® and H-D® and all H-D® part numbers and model designations are used in reference only. Feuling® Oil Pump Corporation is in no way associated with, or authorized by Harley-Davidson Motor Co®. To manufacture and sell any of the engine parts described in this instruction sheet.

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FEULING® CAMPLATE INSTALLATION INSTRUCTIONS FOR H-D TWIN CAM® ENGINES '99 - '16
HIGH FLOW Part #'s: 8000, 8010, 8011, 8015 **OE+** Part #'s 8030, 8031, 8032, 8033
 Part #'s 8011 & 8032 See supplemental instruction sheet



#8000



#8010



#8011



#8015

The Feuling® HIGH FLOW camplates for Twin Cam® engines increase engine oil flow and volume by enlarging critical oil passages and oil pump reservoirs. The cam plate is blue printed and matched to the Feuling oil pumps; this allows the Twin Cam® Engine to take full advantage of the increased volume from the Feuling high volume oil pumps. Made from 7075 billet aluminum, the hard alloy increases the strength and hardness while maintaining tighter tolerances at operating temperature. The Alloy allows elimination of the pinion shaft bushing, and on part #8015 it also allows elimination of the cam bearings. HIGH FLOW camplates are anodized and OE+ camplates are natural finish.

Increased oil flow to pinion shaft and connecting rod bearings and optimized oil flow to the lifters, piston cooling jets, cam gears and or chain tensioners.

Cooler engine temperatures and more Horsepower and Torque to the rear wheel

Tighter cam bearing bore tolerance for improved press fit on #'s 8000, 8010, 8011, 8030, 8031, 8032

Pressure relief valve and spring are designed for increased volume and pressure, eliminating the need to stretch the spring or use a shim.

IMPORTANT NOTICE

This installation should be done by an experienced mechanic who has access to a factory service manual and all required tools. This procedure requires use of specialty tools.

CAUTION

Incorrect installation can cause engine damage not covered under warranty. Failure to install components correctly can cause engine seizure. Engine seizure may result in serious injury to motorcycle, operator, passenger, and/or others.

IMPORTANT NOTICE

Measure flywheel pinion shaft run out. Excessive pinion shaft run out will cause camplate, oil pump, cam chain, cam gear damage and or failure. Excessive pinion shaft run out will void manufacturer's warranty. Damage created by valvespring coil bind and or valvespring surge will void manufacturer's warranty.



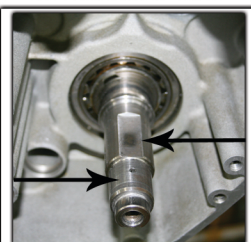
THE FEULING® HIGH FLOW CAMPLATES ARE ONLY COMPATIBLE WITH THE FEULING® HP+® & RACE SERIES® OIL PUMPS, DUE TO THE ENLARGED OIL PASSAGES & CAMPLATE KIDNEY SHAPES



THE FEULING® OE+ CAMPLATES #8030, 8031, 8032, 8033 FOLLOW THE SAME INSTALLATION INSTRUCTIONS AS THE FEULING HIGH FLOW CAMPLATES WITH THE ADDITION OF THE 1/4" SELF TAPPING SCREW FOR USE ON 'A' ENGINES WHEN THE 'BOSS' IS NOT PRESENT, USE LOCTITE & TORQUE SCREW TO 35-45 IN-LBS. FEULING® OE+ CAMPLATES ARE COMPATIBLE WITH FEULING® OE+, FACTORY HD® AND AFTERMARKET OIL PUMPS

1. Refer to HD® manual, engine section, reference sub assembly service and repair bottom end, for removal of camplate, oil pump and cams.
2. Inspect the pinion shaft for burrs, use a scotch pad or emery cloth to assure smoothness of shaft. Measure the pinion shaft and pinion shaft bore of camplate, recommended clearance (+/- .0005" - .0025")
3. Inspect flywheels for pinion shaft run out. Feuling recommends a maximum run out tolerance of 0.0025". If installing gear drive camshafts the run out tolerance is very important, it is advisable to be under the maximum tolerance.

INSPECT PINION SHAFT



Remove burrs & scoring from pinion shaft to assure smoothness

MEASURE CRANK RUN OUT



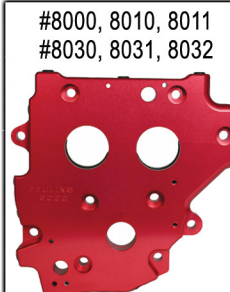
Dial indicator with Magnetic base



Feuling Runout Measuring Tool #9015

Max run out 0.0025"

WASH & INSPECT NEW CAMPLATE



#8000, 8010, 8011
 #8030, 8031, 8032

10 Plugs

Inspect cam & pinion bores for size & fitment

verify camplate has all external plugs & pressure relief valve, spring & roll pin are installed

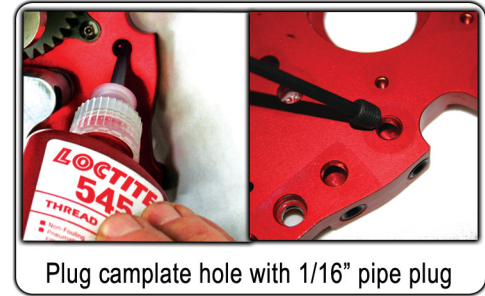
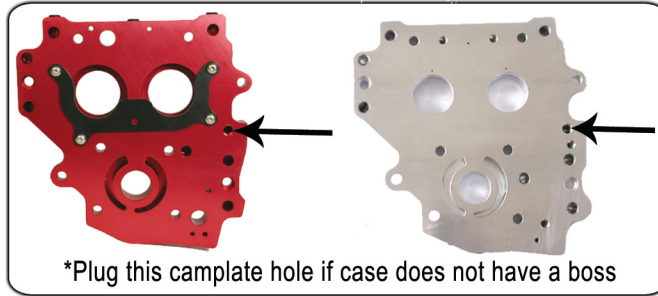
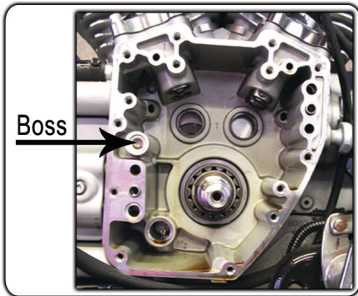


#8015 & 8033

12 plugs

4. Wash and clean Feuling camplate and all related components. Inspect cam & pinion shaft bores for burrs, if needed use a scotch pad to clean the surface. Clean camchest and all mating surfaces, it is recommended to clean and flush oil tank, any residue/debris in oil tank will flow directly through the newly installed oil pump & camplate, causing catastrophic damage not covered under warranty.

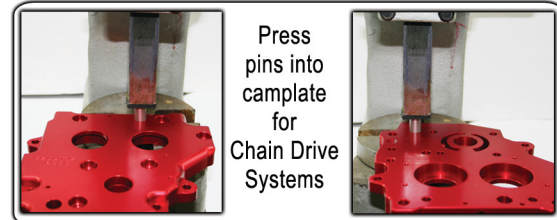
5. Refer to pictures, Examine the camchest and note the addition of a boss on the late 99A crankcase. The boss is designed to feed the B motor crank balance shaft chain tensioner. Note, 'A' motors with the boss will NOT have a through hole and 'B' motors will have a through hole including a screen.



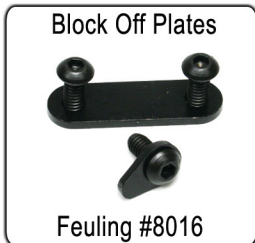
6. If the boss is present, as shown in figure 1, install the proper factory O-ring into the groove of the boss on the engine case.

7. If the boss is NOT present in the camchest then it is required to install the supplied 1/16" pipe plug (HIGH FLOW camplate), 1/4" Self tapping screw (OE+ Camplate) into the correct camplate hole as shown in pictures. Use Loctite and torque 1/16" plug to 55 – 60 in-lbs, 1/4" self tapper 35-45 in-lbs. If the engine is an 'A' motor and the boss is present and is not a through hole you can install the supplied plug for added security if desired to prevent leakage. Tighten plug flush with camplate face and make sure there isn't an interference with the case boss. The use of the O-ring is still required.

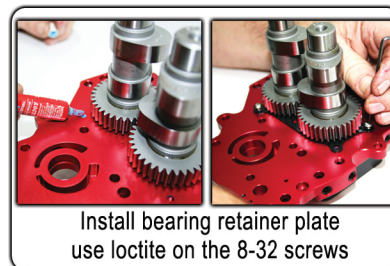
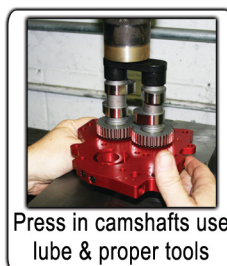
8. Camplates #8010 & 8031 - Chain Drive Systems require tensioner pins, tensioner tower and fasteners, which are included in the #8010 & 8031 camplate kit, if needed Feuling sells the pins & tower separately see part #7078. If using a gear drive cam system no pins or tower are used.



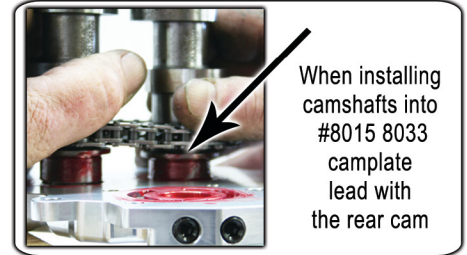
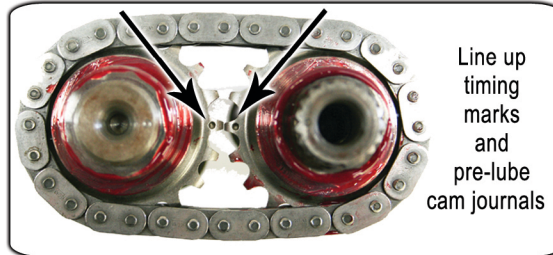
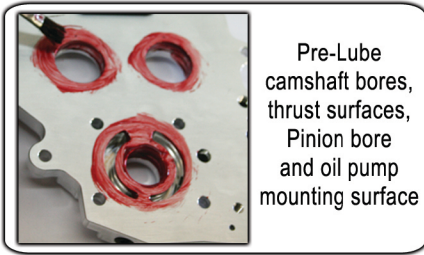
9. Camplate #8015 & 8033 – If using gear drive cams the oil holes for the hydraulic chain drive tensioners must be blocked off. Feuling offers a block off plate kit part #8016



10. Camplates #8000, 8010, 8030, 8031. Install new cam bearings into camplate using the correct bearings for your model camshafts. Install camshafts and then install the Feuling bearing retainer plate. Install bearings and cams using the proper tools and extreme pressure lube, according to the appropriate H-D® manual.



11. Camplate #8015 8033 - Install camshafts into well lubed camshaft bores, lead with rear camshaft. Install spacer washers, front camshaft retaining ring and chain tensioners, for chain drive set-up. If different thickness spacers are desired for alignment of chains or gears see your H-D dealer for different thickness spacers.



12. Apply engine assembly lube to the pinion shaft, oil pump gears, oil pump housings, oil pump sub seal, camplate oil pump mating surface, camplate oil passages, pinion shaft bore, camshaft bores, camshafts, spacer washers, chain tensioners, scavenge port hole of engine case and apply engine oil or moly lubricant to the oil pump and camplate bolts and underhead flanges.

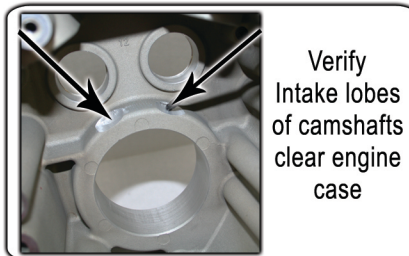


13. Bolt the complete Feuling Oil Pump to the camplate **finger tight**, with the pressure housing of the pump facing the camplate. **DO NOT** use loctite or any type of hardening compound on oil pump or camplate bolts or O-rings, the compound will interfere with stack up tolerance. Grease can be used to hold O-rings in place and moly lube or engine oil should be used on all bolts and underhead flanges

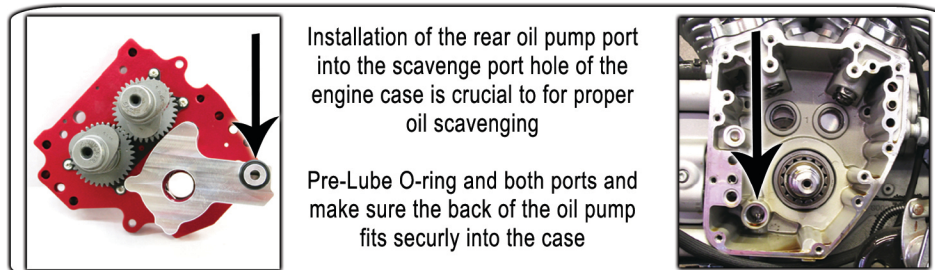
14. Check oil pump O-rings for proper fit.



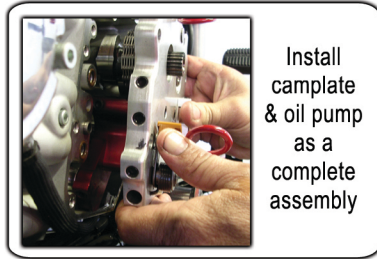
15. Verify camshaft lobes DO NOT interfere with the engine case. Install new O-rings into proper location on crankcase.



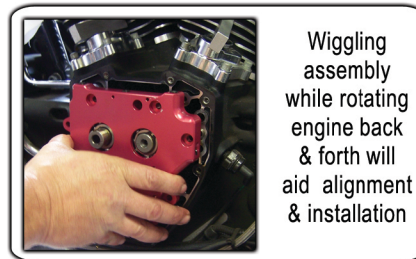
16. Pre-Lube scavenge port hole of engine case and rear pick up port of the oil pump, this connection is crucial for proper oil scavenging.



17. Installation - Align the Gerotor gear flats of the oil pump with the crankshaft flats. Slide the complete assembly onto the crankshaft, using slight pressure, slip oil pump pick up port into scavenge port hole of crankcase. It's helpful to use pressure from your thumb to push on the oil pump housing to assure proper fit into the scavenge port hole of case, at the same time wiggling assembly to align camplate with dowel pins on engine case. It's helpful to rotate the engine back and forth to help slide the assembly into position.



Install camplate & oil pump as a complete assembly



Wiggling assembly while rotating engine back & forth will aid alignment & installation

18. Tighten camplate bolts first - With camplate & oil pump bolts only finger tight rotate engine over several times. This will center the camplate assembly. Alternately tighten all camplate bolts to 10 inch lbs. Then rotate engine over again and final torque camplate bolts to 90 – 120 inch lbs.

19. With oil pump bolts only finger tight, rotate engine over several times. This will center the oil pump gerotors and pump housings to crankshaft. Alternately tighten the four oil pump bolts to 10 inch lbs. Rotate engine over again then final torque the oil pump bolts to 90 – 120 inch lbs.

THIS TIGHTENING SEQUENCE WILL CENTER THE CAMPLATE AND OIL PUMP TO THE CRANKSHAFT AND IS THE ONLY RECOMMENDED PROCEDURE. FIRST CENTER CAMPLATE THEN CENTER OIL PUMP



Final torque on pump and camplate bolts 90 - 120 Inch Lbs.



PARTS LIST

PART #	DESCRIPTION	QTY.
8000	CAMPLATE ASSEMBLY-GEAR DRIVE '99-'06 EXC. '06 DYNA	1
8010	CAMPLATE ASSEMBLY-CHAIN DRIVE '99-06 EXC. '06 DYNA	1
8015	CAMPLATE ASSEMBLY-'06 DYNA & NEWER MODELS	1
8000-01	RELIEF VALVE (PLUNGER)	1
8000-02	SPRING, RELIEF VALVE	1
8000-03	1/8" ROLL PIN	1
8000-04	3/8" - 24 PLUG, #8000, #8010	10
8000-05	3/8" - 24 PLUG, #8015	12
8000-06	PLATE, BEARING RETAINING, #8000, #8010	1
8000-07	8 - 3/2 X 3/8" SCREWS, RETAINING PLATE, #8000, #8010	4
8000-08	1/16" PIPE PLUG, (BOSS HOLE)	1
8000-09	CHAIN TOWER, #8010	1
8000-10	8-3/2 X 7/8" SCREWS, TOWER, #8010	2
8000-11	TENSIONER PINS #8010	2
8015-01	BLOCK OFF PLATES	2
8015-02	1/4"-20 BUTTON HEADS, BLOCK OFF PLATES	2

WARRANTY:

All 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 FOP's option if the parts are returned to FOP by the purchaser within the (12) month warranty period. In the event warranty service is required, the original purchaser must notify FOP of the problem immediately. Some problems may be rectified by a telephone call and need no further action. A part that is suspect of being defective must not be replaced without prior authorization from FOP. If it is deemed necessary for FOP to make an evaluation to determine whether the part was defective, it must be packaged properly to avoid further damage, and be returned prepaid to FOP 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. After an evaluation has been made by FOP and the part was found to be defective, repair, replacement or refund will be granted.

Excessive flywheel pinion shaft run out will damage camplate, oil pump, lifters and or cause engine damage and or failure. Damage to Feuling® products due to excessive pinion shaft run out will void manufacturer's warranty.

ADDITIONAL WARRANTY PROVISIONS:

FOP shall have no obligation in the event an FOP part is modified by any other person or organization, or if another manufacturer's part is substituted for one provided by FOP. FOP shall have no obligation if an FOP part becomes defective in whole or in part as a result of improper installation, improper break-in or maintenance, improper use, abnormal operation, or any other misuse or mistreatment. FOP shall not be liable for any consequential or incidental damages resulting from the failure of an FOP part, the breach of any warranties, the failure to deliver, delay in delivery, delivery in non-conforming condition, or any other breach of contract or duty between FOP and the customer. The installation of parts may void or otherwise 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 operated on public highways, especially in states where pollution laws may apply. Always check with 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/her use, and the user shall assume all legal, personal injury risk and liability and all other obligations, duties and risks associated therewith. Our high performance parts, engines and motorcycles are intended for experienced riders only. Feuling® Oil Pump Corporation reserves the right to change prices and/or discounts without notice and to bill at the prevailing prices at the time of shipments. The words Harley®, Harley-Davidson® and H-D® and all H-D® part numbers and model designations are used in reference only. Feuling® Oil Pump Corporation is in no way associated with, or authorized by Harley-Davidson Motor Co®. To manufacture and sell any of the engine parts described in this instruction sheet.



FEULING®

FEULINGPARTS.COM



LIFTER INSTALLATION INSTRUCTIONS



FULL TRAVEL HYDRAULIC LIFTER PART #'S: 4000, 4017, 4018, 4019, 4025, 4050, 4051, 4052, 4061, 4062
 SHORT TRAVEL LIFTER PART #'S: 4017ST, 4018ST, 4019ST, 4050ST, 4051ST, 4052ST SOLID LIFTER PART #'S: 4055



IMPORTANT NOTICE:

This installation should be done by an experienced mechanic who has access to a factory service manual and all required tools.

CAUTION:

Incorrect installation can cause engine damage not covered under warranty. Failure to install components correctly can cause engine seizure. Engine seizure may result in serious injury to motorcycle, operator, passenger, and/or others. Removal of the rocker arms and/or pushrods with the valve train loaded can damage rocker arms, push rods, bushings and/or camplate. Rotate engine to TDC of compression stroke on the servicing cylinder.

WARRANTY NOTE:

Standard 1 year warranty included, an additional 1 year warranty is available for a total of 2 years if product is installed by a professional V-Twin installer, crankshaft runout is below 0.005", oil tank is dropped and cleaned at time of install and the WARRANTY REGISTRATION form is filled out - form can be found on www.feulingparts.com/warranty.

SOLID LIFTER NOTE:

Feuling recommends starting with zero lash cold, then finding the sweet spot for your engine combination.

INSTRUCTIONS:

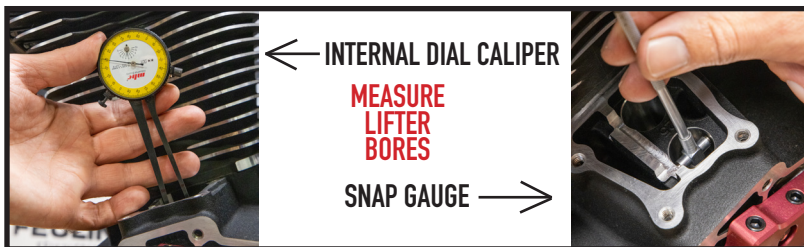
1. For removal of lifters & inspection of lifter bores, refer to the factory service manual for your model & year engine.
2. Clean, inspect and measure lifter bores to make sure the tolerances are within specification. For maximum lifter performance Feuling® recommends a lifter to lifter bore clearance of 0.001"–0.0015". If needed, Feuling® offers oversized lifters Part #'s 4051 (+0.001") & 4052 (+0.0015").

LIFTER BORE MEASURING BALLS (PART #9004)

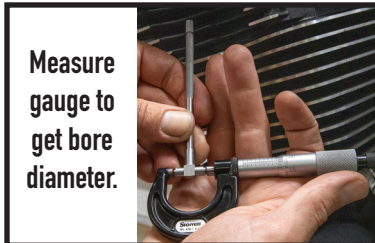


There are multiple methods to measure lifter to lifter bore clearance. An easy & accurate method is to use Feuling tool #9004, set of precision ground balls to accurately measure lifter bore diameter & roundness.

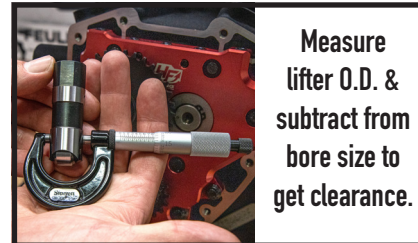
The correct size ball will pass through the lifter bore 'snugly', this will give you the correct bore size taking roundness of the bore into account.



INTERNAL DIAL CALIPER
 MEASURE LIFTER BORES
 SNAP GAUGE



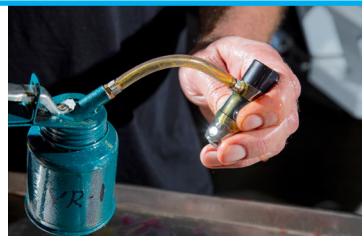
Measure gauge to get bore diameter.



Measure lifter O.D. & subtract from bore size to get clearance.

NOTE: Recommended lifter to lifter bore clearance 0.001"–0.0015". The closer the clearance is to 0.001", the higher the oil psi at the lifter will be, producing a quieter, happier valvetrain.

Pump up each lifter prior to installation.



OIL CAN (PART #9005)

3. Thoroughly clean & inspect each new Feuling® lifter, clean your pushrods & make sure the center oil through hole is open & free of debris.
4. Use an oil squirt can to fill & pump up the lifters with oil through the side feed hole, pump oil through the feed hole until the air bubbles are pushed out & lifter is rock hard. If needed work the oil back and forth through the feed hole & pushrod seat. Light weight oil can be helpful.
5. Apply engine assembly lube or liberal amounts of engine oil to the lifters, rollers, lifter bores and camshaft lobes.
6. We recommend that you use your oil can to fill the pushrod oil holes & rocker arms with engine oil before final installation.



7. Install lifters in the lifter bores of the crankcase, with the lifter flats facing forward & rearward. Avoid cam damage! Do not drop lifters onto cam lobes. **TWIN CAM ENGINES:** face the side oil feed holes inward towards the cylinders. **M8 ENGINES:** face side oil feed holes towards each other.
8. Check all clearances – lifter to camshaft lobe clearance, lifter to lifter blocks, lifter flats to roll pin, pushrod to pushrod tubes & if using one piece pushrods check length for proper pre load on lifters. **M8 ENGINES:** Lifter body to camshaft flange clearance on front exhaust lifter/cam lobe.
9. Assemble & adjust one cylinder at a time, the servicing cylinder needs to be on TDC of compression stroke so the cam lobes are at their lowest point.
10. Run the correct pre-load on your lifters! We recommend running hydraulic lifters just under 1/2 travel at operating temperature.

- A.) Feuling **full travel** lifters are designed to run with 0.090" – 0.110" of cold pre-load (total lifter travel = 0.200")
- B.) Feuling **short travel** lifters are designed to run with 0.060" – 0.070" of cold pre-load (total lifter travel = 0.115")
- C.) Feuling **solid** lifters: We recommend starting with zero lash cold, then finding the sweet spot from there for your engine combination.

Always start with fully pumped up lifters! When using adjustable pushrods start at zero lash & adjust the pushrod longer, crushing the lifter to add pre-load. It is helpful to have the rocker arm in hand to feel for zero lash. We DO NOT recommend bottoming the lifter & adjusting back upwards. If using one piece pushrods, have the correct lengths to achieve correct pre-load. See Feuling One Piece Pushrods (TC: #4072, 4073, 4074, 4076) (M8: #4087, 4088).

11. Know your adjustable pushrod thread pitch! Feuling® adjustable pushrods have changed throughout the years, Feuling has produced rods with 32, 24 & 20 threads per inch. Our current line up: HP+ & RS = 24 TPI, QUICK install = 20 TPI & FAST install = 32 TPI. – See adjustment chart below.

12. Refer to your factory service manual for final assembly.

CHART FOR ADJUSTABLE PUSHRODS

		FEULING FULL TRAVEL	FEULING SHORT TRAVEL
THREADS PER INCH	DISTANCE PER 1 FULL TURN	URNS TO .100"	URNS TO .065"
20	0.050"	2	1.3
24	0.0417"	2.39	1.55
28	0.0357"	2.80	1.82
32	0.0313"	3.19	2.07
36	0.0275"	3.63	2.36
40	0.0250"	4	2.6

***CORRECT ADJUSTMENT
REQUIRES STARTING WITH
FULLY PUMPED UP LIFTERS**

- NOTE:** Majority of engines will see 0.010-0.020" of growth with temperature which reduces the initial cold pre-load set on the lifters, use our recommended pre-load settings.
NOTE: Never set more lifter pre-load on the lifter than what you have for valve to piston clearance, we recommend a min of 0.020" less lifter pre-load than piston to valve clearance.
NOTE: M8 Engines – Smaller than stock base circle cams can have a clearance issue between lifter body and camshaft flange on front exhaust lifter.

TROUBLE SHOOTING NOISY VALVE-TRAIN

1. Lifter adjustment – Starting with a fully pumped up lifter, from zero lash put 0.90" – 0.100" of pre-load on Feuling® hydraulic lifters.
2. Lifter to lifter bore clearance out of spec, Feuling® recommends a clearance of 0.001" – 0.0015" for proper oil psi at lifter.
3. Pushrods flexing & hitting pushrod tubes – look for a shiny ring witness mark around pushrod normally seen up towards the cylinder head.
4. Low oil pressure – inspect pressure relief valve, excessive wear in oil pump and or camplate face.
5. Pushrod center oil hole plugged.
6. Clearance for roller rocker arms on underside of rocker box covers .
7. Steep ramped camshafts, valves closing so fast the valves bounce off valve seats – see Feuling® Beehive valvesprings.
8. Excessive crankshaft runout.
9. Gear drive camshafts, excessive gear drive backlash or excessive crankshaft runout.
10. Rocker arms/bushings out of tolerance.
11. Valvespring clearance to lower rocker box housing.
12. Valvespring coil bind and or valvespring harmonics – match up valvespring open height with peak lift of camshaft.
13. Leaky/broken piston cooling jets.

*** STANDARD 1 YEAR WARRANTY:**

- WARRANTY COVERS MANUFACTURE DEFECTS.
- DOES NOT COVER PARTS THAT HAVE FAILED DUE TO IMPROPER INSTALLATION, MAINTENANCE, EXCESSIVE CRANKSHAFT RUNOUT, OR MISUSE.
- DOES NOT COVER ANY CONSEQUENTIAL DAMAGE RESULTING FROM A FAILURE OF A FEULING PRODUCT.

*** OPTIONAL 2 YEAR WARRANTY:**

- ADDITIONAL YEAR WARRANTY IS ONLY AVAILABLE IF PARTS ARE INSTALLED BY A PROFESSIONAL INSTALLER.
- THE ONLINE WARRANTY FORM MUST BE COMPLETED BY THE DEALER PRIOR TO BIKE DELIVERY.
- OIL TANK MUST BE DROPPED & CLEANED.- CRANKSHAFT RUNOUT MUST BE BELOW 0.005"

NOTE : FOR FULL WARRANTY INFORMATION VISIT WWW.FEULINGPARTS.COM/WARRANTY

3740 Oceanic Way – #304 – Oceanside, CA. 92056 // www.FeulingParts.com // 1(866)966-9767

