

# FEULING

CAMCHEST INSTALLATION INSTRUCTIONS FOR MILWAUKEE EIGHT ENGINES

Camshaft	#1350
HP+ Camshaft Kit	#1450
Race Series Camshaft Kit	#1460
HP+ Oil Cooled Camchest	#7252
Race Series Oil Cooled Camchest	#7261

## FEULING 472 Grind Camshaft and associated kits part #s:

6/28/22



MODEL YEAR 2017:	
CID	107" - FLHR, FLHRC, FLHX, FLHXS, FLTRX, FLTRXS, FLHTKL, FLHTK, FLHTCU, FLHTCUTG, 114" - FLHTKSE, FLHXSE
MODEL YEAR 2018:	
CID	107" - FLHR, FLHRC, FLHRXS, FLHXS, FLTRX, FLTRXS, FLHTKL, FLHTK, FLHTCU, FLHTCUTG, FLTHKL, FLRT, FLDE, FLFB, FLHC, FLSL, FXBB, FXFB, FXLR 114" - FLHTKSE, FLHXSE, FLFBS, FLHCS, FXFBS
MODEL YEAR 2019:	
CID	107" - FLHR, FLHRC, FLHX, FLTRX, FLHTCU, FLHTK, FLTHKL, FLDE, FLFB, FLHC, FLSB, FLSL, FXBB, FXBR, FXFB, FXLR 114" - FLHRXS, FLHXS, FLTRXS, FLHTKL, FLHTK, FLHTCUTG, FLRT, FLFBS, FLHCS, FXFBS 117" - FLHTKSE, FLHXSE

MODEL YEAR 2020:	
CID	107" - FLHR, FLHRC, FLHX, FLTRX, FLHT, FLHTCU, FLDE, FLFB, FLHC, FLSB, FLSL, FXBB, FXFB, FXLR 114" - FLHRXS, FLHXS, FLTRXS, FLHTKL, FLHTK, FLHTCUTG, FLHTK, FLTHKL, FLRT, FLFBS, FLHCS, FXBRS, FXFBS, FXLRS 117" - FLHTKSE, FLHXSE
MODEL YEAR 2021:	
CID	107" - FLHR, FLHX, FLTRX, FLHT, FLHTCU, FLHC, FLSB, FLSL 114" - FLHRXS, FLHXS, FLTRK, FLHTK, FLHTCUTG, FLHTK, FLRT, FLFBS, FLHCS, FXBBS, FXBRS, FXFBS, FXLRS 117" - FLTRXSE, FLHTCUTGSE, FLHTKSE, FLHXSE
MODEL YEAR 2022:	
CID	107" - FLHR, FLHX, FLTRX, FXS 114" - FLHRXS, FLHXS, FLTRXS, FLTRK, FLHTK, FLHTCUTG, FLHTK, FLRT, FLFBS, FLHCS, FXBBS, FXFBS 117" - FLHXSE, FLHXST, FLTRXSE, FLTRXST, FLHTCUTGSE, FLHTKSE, FXLRS, FXLRST

NOTE: FEULING DOES NOT RECOMMEND TUNING BEYOND STOCK EMISSION STANDARDS

**CAMPLATE NOTES:** FEULING HighFlow Camplate #8017 is designed to ONLY work with Feuling oil pumps: see HP+ #7018, #7019 & RACE SERIES #7020, #7021 oil pumps. Note: Use the Feuling provided Allen head oil pump bolts or the optional FEULING x ARP bolt kit see #8022.

FEULING OE+ Camplate #8037 is ONLY for use with the factory HD® oil pumps and is designed to use the factory oil pump bolts or the optional FEULING X ARP bolt kit see #8023.

VALVESPRING/CAMSHAFT NOTES: FEULING REAPER 405, 445 & 472 grind camshafts are direct bolt-ins

FEULING RECOMMENDS THE FOLLOWING INSTALLATION PROCEDURES FOR ALL OILING SYSTEM COMBINATIONS ON MILWAUKEE EIGHT® ENGINES.

**WARRANTY NOTE:** Feuling offers an additional 12 month warranty for a total of 2 years if product is installed by a professional installer, meets crank runout criteria under 0.005", oil tank is dropped and cleaned at time of install and the WARRANTY REGISTRATION form is filled out on [www.FeulingParts.com/warranty](http://www.FeulingParts.com/warranty) (Feuling recommends for peak engine performance and longevity ideal crankshaft runout is at or below 0.003").

### INSTRUCTIONS:

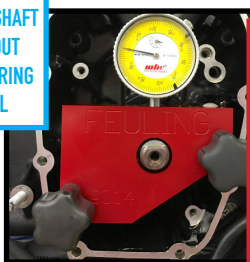
1. Refer to the proper factory service manual for your model and year of engine, for removal of cam cover, camchest and oil tank.
2. FEULING highly recommends using 1 piece pushrods! See FEULING #4087 for FULL travel lifters and #4088 for SHORT travel lifters. TIP: Remove fuel tank, front head mount, right side floor board, exhaust, oil/water lines, engine rocker box top covers & rocker arms to access the pushrods. SEE TECH TIP PAGE 5
3. Inspect pinion shaft for burrs, use fine grit wet sand paper to clean and assure smoothness of shaft.

A.) Measure flywheel pinion shaft run out & bearing play. Excessive pinion shaft runout & combination of bearing play will cause damage and or failure and voids manufacturer's warranty. **Feuling recommends crankshaft runout & bearing play combination at or below 0.003" but our warranty does cover up to 0.005".** Measure crank bearing play by lifting up on the tip of the pinion shaft with dial indicator in place and adding that amount to the runout.

B.) Measure crankshaft end play. Ideal end play is 0.003" - 0.004".

C.) Pinion shaft OD to camplate bore ID has a recommended clearance of 0.0005" - 0.0035".

CRANKSHAFT RUNOUT MEASURING TOOL



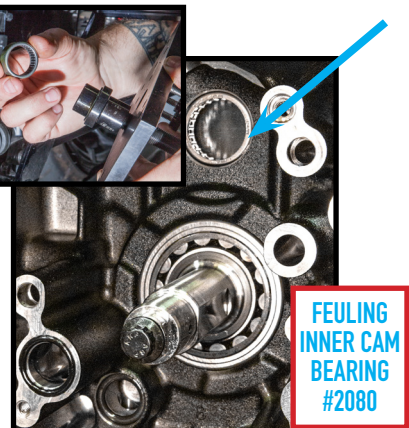
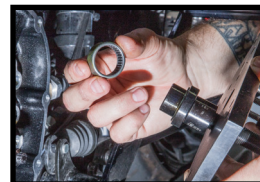
A.) Crank runout under 0.005" Ideal is under 0.003". Including bearing play.

B.) End play 0.003" - 0.004"

C.) Pinion shaft OD to camplate bore ID 0.0005" - 0.0035"



Measure crank bearing play by lifting up on the tip of the pinion shaft with dial indicator in place.



FEULING INNER CAM BEARING #2080

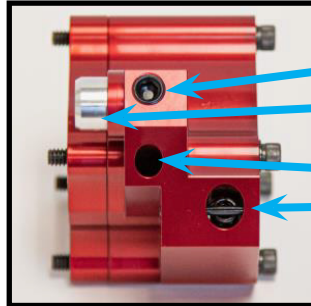
4. Feuling highly recommends dropping the oil tank & performing a deep clean & flush on the oiling system to remove any & all debris. This is required for our 2 year warranty policy – See warranty registration form on [www.FeulingParts.com/warranty](http://www.FeulingParts.com/warranty) **Note: Any debris in the oil tank will run directly through the brand new oil pump & camplate.**

5. Feuling recommends replacing the inner cam bearing with a full complement style bearing see FEULING part #2080.

6. Wash, clean and inspect the new FEULING components.



Camplates #8017 & 8037 have 8 black Allen head plugs installed around the profile to plug cross drillings.



Oil pumps: 7018, 7019, 7020, 7021

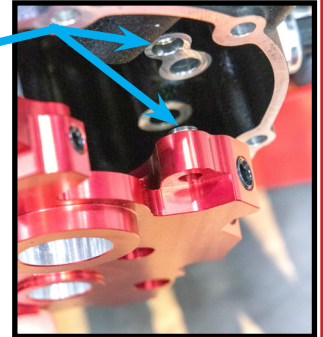
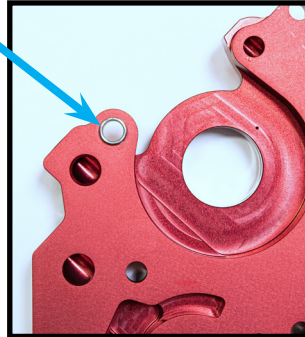
- 1.) Single Allen head plug installed.
- 2.) Subseal scavenge port pick up Boss installed.
- 3.) Camchest pick up bore.
- 4.) Pressure relief valve/spring held in with a roll pin.
- 5.) 2 Magnets.

7. If installing a high lift cam, inspect camshaft for rotating clearance on engine case and lifter to lifter cuff clearance. Also verify correct valvespring to camshaft combination – See Feuling #1107, #1108 or #1207. Feuling 508, 521, 538 and 592 grinds require high lift valvesprings.

**TECH TIP: IMPORTANT**

NOTE: Some engine cases have excessively large dowel pin locating hole diameters, making it extremely important to properly center the camplate and oil pump. Follow steps 12-15.

Due to the weight of the M8 oil pump/camplate & the out of spec case dowel pin locating hole, if not properly centered the pump/camplate will drop & rest on pinion shaft leading to offset oil pump/camplate & premature wear/failure.

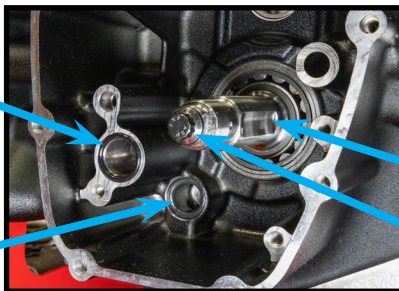


8. Install new O-rings into engine case using assembly lube on O-rings to aid in installation. Rotate crankshaft so flats are vertical.

Install new O-Rings & apply engine assembly lube.

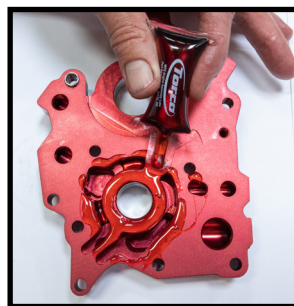
- 1.) Camplate
- 2.) Scavenge Port

1.)  
2.)



Install crank bolt then rotate crankshaft so the flats are vertical.

9. Use engine assembly lube on camplate, camshaft, crankshaft, cam bearing, oil pump, scavenge port hole/oil pump o-ring & lifter bores.



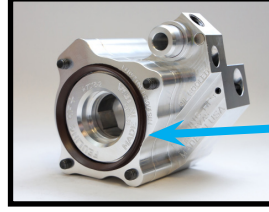
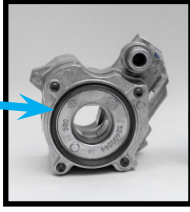
**NOTE: DO NOT USE LOCTITE ON OIL PUMP OR CAMPLATE BOLTS, use moly lube paste, assembly lube or oil on bolt threads & underhead flange. Loctite will interfere with the stack up clearance of the oil pump & can cause sealing issues with camplate to engine case.**

10. Rotate oil pump gears so gear flats are vertical to match the crankshaft per step 8. We found having the crank and gear flats vertical make for the easiest install of the oil pump and camplate assembly and best seal to the scavenge port.

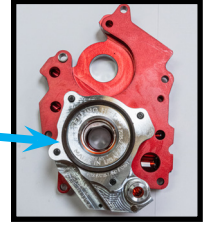


**11.** Due to the mass call volume & inquires with requests for the M-Eight oil pump back cover O-ring/seal groove, we've added the groove! (5/11/21). Although Feulings in house testing on healthy engines did not show a benefit. The O-ring may have potential benefits in certain circumstances such as engines with higher cylinder leak down, poor subseal O-ring seal, raised sump hole & or sump plug (see **M8 PRO TIP** on page 5) & looser lifter to lifter bore clearances.

**STOCK PUMP WITH BACK COVER SEAL**

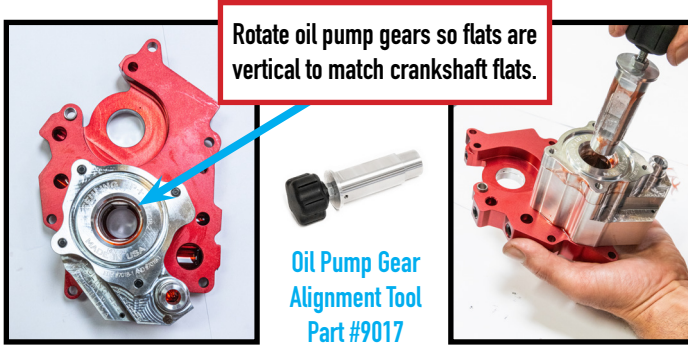


**FEULING PUMP WITH FACTORY BACK COVER SEAL**



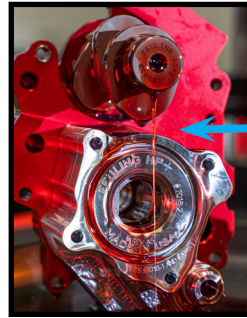
If desired, install O-ring/seal from factory pump. Remove O-ring/seal from factory cover and install into Feuling back cover.

\* The oil pump scavenge port O-ring/seal must be installed into the engine case, well lubed & the oil pump must properly fit & seal at the scavenge port. Any sacrifice of this seal will result in scavenging and wet sumping issues.



Rotate oil pump gears so flats are vertical to match crankshaft flats.

Oil Pump Gear Alignment Tool Part #9017

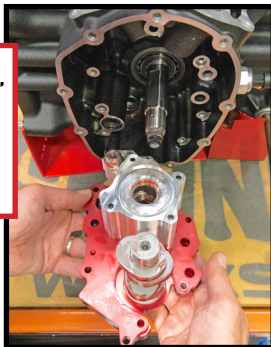


Use assembly lube on camplate bore, thrusting surfaces, camshaft & pinionshaft



**12.** Install the oil pump & camshaft into the camplate on the bench, fasten oil pump bolts finger tight, align the oil pump gear flats with the crankshaft flats & slide complete assembly onto the crankshaft. Once the camplate assembly is in position we recommend pressing firmly on the oil pump with your left thumb or a finger to press oil pump into the scavenge port O-ring. **Feuling recommends this procedure so the components are always going in towards the crankshaft, this procedure produces the best seal on the oil pump scavenge port hole.**

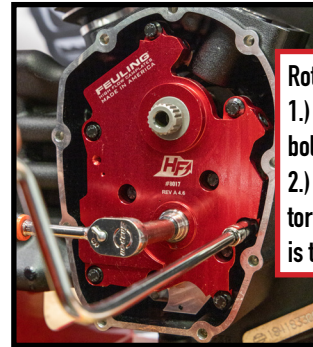
Install pump, plate and cam as an assembly.



Use your thumb or finger to help push the oil pump into the scavenge port of engine case.



Rotate engine using the crank bolt.  
1.) Alternately tighten camplate bolts, step to final torque.  
2.) Rotate engine & tighten & torque the oil pump after camplate is tight.



**13.** With the oil pump and camplate bolts finger tight rotate the engine over by hand multiple times, tighten and torque the camplate bolts first. Alternately tighten camplate bolts in a crisscross pattern rotating engine in between; **step torque 40 in-lb, 80 in-lb then to a final 120 in-lb.**

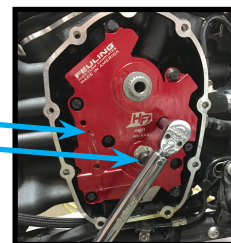
**14.** With the camplate torqued to 120 in-lbs rotate engine several more times by hand & tighten & torque the oil pump bolts. Alternately tighten oil pump bolts in a crisscross pattern, rotating engine in between step torque from **40 in-lb, 80 in-lb then to a final 120 in-lb.**

\*This process will center the camplate and oil pump as best as possible to the engine and crankshaft runout. We recommend re-checking the torque after 10-15 Min.

**15.** It is advisable to have clean fresh oil in the oil tank, and while rotating the engine over to center the oil pump & camplate, the system will start to prime and you should see oil coming out the tensioner feed hole & around the pinion shaft. This aids in initial start-up oil psi and lubrication.


With clean, fresh oil in the tank and a full oil filter, while rotating the engine to center and torque the camplate & oil pump, the system will prime and you will see oil coming out tensioner feed hole and pinion bore.

Tank must be full enough for the pickup to grab oil.

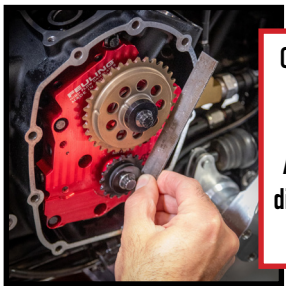


**16.** Install chain & sprockets, first check sprocket alignment with a straight edge, use correct thrust washer thickness to achieve proper sprocket alignment. See Feuling #8041 for spacer thickness selection/options. Sprocket alignment is crucial for tensioner pad wear and longevity. Final sprocket & chain assembly must have timing marks lined and in correct position with rear cylinder on TDCC.

**17.** Install chain tensioner/housing by installing bottom bolt first then rotate top of tensioner to line up the top bolt, FEULING recommends doing this before installing pushrods and loading the cam to ensure slack in chain on the tensioner side. Apply assembly lube to pad/chain.

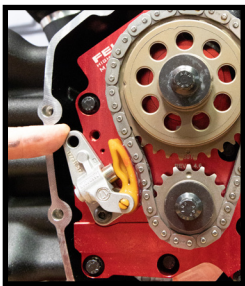


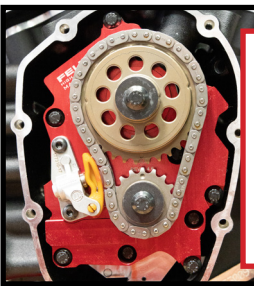
Part #8041



Check sprocket alignment with a straight edge.

Adjust cam sprocket with different thickness spacers - see [part # 8041](#)





Step Torque cam & crank bolts first to 15 ft/lbs. loosen then re-step torque up to a final torque:  
**Cam Bolt - 34 Ft/Lbs**  
**Crank Bolt - 24 Ft/Lbs**



TECH TIP FOR BREATHERS

Note: The breather valves do not sit squarely on cylinder heads thus cocking the valve, compromising the seal and function of the breather. The O-ring groove on the valve is too large for the O-ring, we recommend running an additional smaller O-ring on the top of the OE O-ring which can help hold the OE O-ring in position and assist in sealing. Use HD drain plug O-ring #11105 or a -012 to -013 O-ring.



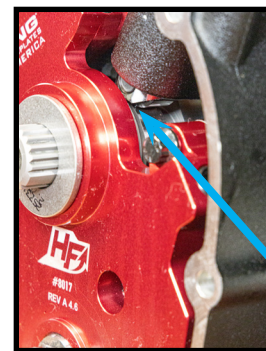
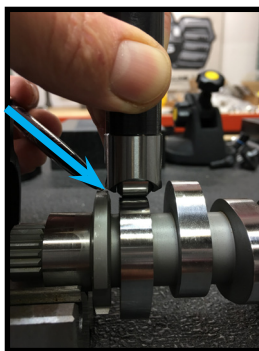
**18.** Install lifters, pushrods and rocker arms, Feuling recommends using an oil squirt can to manually pump up the lifters, pushrods and rocker arms during assembly. This will aid in lubrication for initial startup and will provide a quiet engine with immediate oil psi.

*\*It's advised to install & assemble the pushrod tubes before filling the pushrods with oil to prevent oil draining out onto engine.*

**19.** Check all clearances - lifter to camshaft flange clearance on front exhaust lobe, lifter to lifter cuff at peak lift, & if using one piece pushrods check length for proper pre load on lifters.

\*Check Lifter body to camshaft flange clearance on front exhaust lifter/cam lobe.

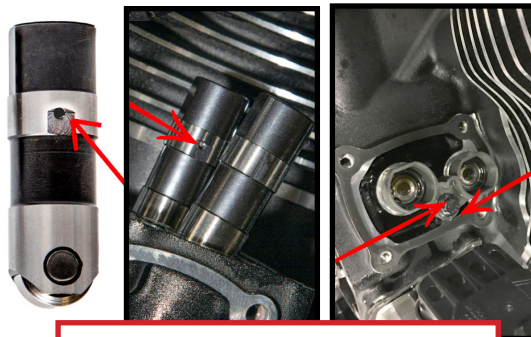
\*New lifters are recommended by Feuling® but not required. See Feuling HP+® series lifters #4000 or RACE SERIES lifters #4017, RACE SERIES lifters have a slower bleed down rate and operate quieter than factory HD® or HP+® lifters.



**20.** Install lifter feed holes facing each other, we also recommended rotating the engine over with the lifter 'cuffs' finger tight to center the holders on the lifters before final torque.



Manually pump up lifters



Install lifter oil feed holes facing each other



Manually pump up pushrods & rocker arms



**NOTE:** 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.



**21.** Feuling #4087 one piece pushrods are designed to work with all Feuling M8 camshafts and any other brand cams running stock base circles. #4087 pushrods will put the correct pre-load on Feuling full travel and factory HD full travel lifters. Ideal lifter pre-load for Feuling FULL travel hydraulic lifters is 0.090" - 0.110". Feuling SHORT travel lifters use FEULING #4088 one piece pushrods with ideal pre-load at 0.060" - 0.070".

**22.** Using one piece pushrods: With engine on TDC of adjusting cylinder tighten the rocker arm shaft bolts evenly until they are seated with estimated **10 Ft. Lbs.**, then loosen the bolts or nuts to allow the shafts to settle in, then re-tighten evenly and step to final torque. If using Feuling stud/nut kit final torque is **24-26 Ft. Lbs.** Re check after 10 minutes. Wait estimated 15-20 minutes for the lifters to bleed down before rotating the engine to tighten the other cylinder rocker arms, when the lifters are bled down the pushrods will spin/rotate by hand. Following this procedure will eliminate any chance of valve/piston interference during installation. Feuling recommends the installation of #3047 rocker arm studs and nuts to prevent cylinder head cracking. **For FEULING ROCKER STUDS/NUTS TECH TIP SEE NEXT PAGE.**

\*FEULING Rocker Stud/Nut kit #3037 or complete lower rocker kit #3047 will reduce stress on the rocker arm mounting stand offs. The rocker arm 'stand offs' are a weak link and prone to cracking.

### LIFTER/ PUSHROD ADJUSTMENT NOTES

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")

\*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. We DO NOT recommend bottoming the lifter & adjusting back upwards.

#### CHART FOR ADJUSTABLE PUSHRODS

THREADS PER INCH	DISTANCE PER 1 FULL TURN	FEULING FULL TRAVEL TURNS TO .100"	FEULING SHORT TRAVEL TURNS 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

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

### ONE PIECE PUSHRODS TECH TIPS

- Remove gas tank, spark plug wires from plugs, left side spark plugs, fuel injector plug ins, compression release plug ins etc.
- Remove voltage regulator bracket bolts qty. 2
- Remove front top engine mount, from frame first then cylinder heads.
- Remove right side floor board then exhaust.
- Remove oil/water lines, use a small catch tray on top of trans cover, wad of rags in the front to catch oil/water.
- Remove cam cover, rotate engine to timing marks.
- Remove top rocker covers, rocker arms, pushrods, pushrod tubes, lifter covers.



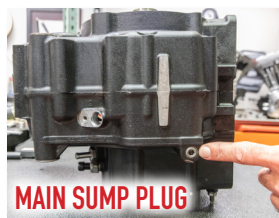
### M-EIGHT PRO TIP: BOTTOM CASE SUMP PLUG

The main sump port on the inside of the engine case is in a slightly different location & height in each engine case. This port is created when the bottom plug hole is machined and tapped by the factory. The machining breaks through the casting wall, creating the sump port.

**NOTE:** The further the bottom plug installs into the case, the more of the scavenge port hole is blocked off. For optimum oil scavenging & lower sump levels, verify that your plug doesn't block this port. It is advisable to trim the plug & or use thread tape to change the position of the plug if it blocks the port.

- Easy work when the cases are split, as it's visible.

- With the engine in the motorcycle, the threads can be counted from the bottom of the engine case using a mirror & a 90 degree pick, count the threads up to the side scavenge hole.



WITHOUT  
PLUG



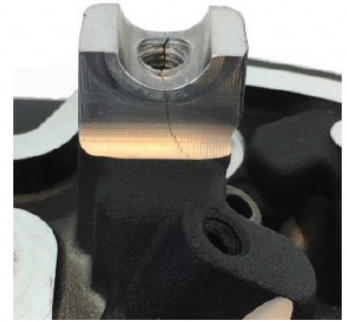
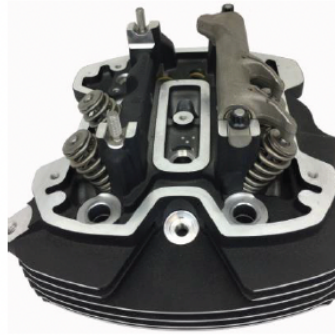
WITH  
PLUG  
(PLUG PAINTED  
ORANGE FOR  
REFERENCE)



# ROCKER STUD INSTALL

TOP ENGINE BUILDERS DEMAND QUALITY FASTENERS!

PART #'S:  
3037, 3047



## INSTRUCTIONS:

1. Refer to the proper service manual for your model motorcycle engine.
2. Wash, clean and inspect all new Feuling hardware.
3. Clean and inspect all bolt holes.
4. Lightly coat the under head flange of all bolts with moly lube as well as washers when applicable.
5. Lightly coat threads with Loctite when and where applicable. (See owners manual)
6. It is recommended to use new gaskets and O-rings to insure proper sealing.
7. Check gaskets and O-rings for proper installation.
8. When installing fasteners on moving parts always rotate engine over several times before tightening to insure the parts are centered.
9. First finger tight each fastener using the proper sequence from your service manual, if no sequence is giving always use an alternating sequence starting in the center working your way out.
10. Torque the fasteners following your recommended torque values and always tighten fasteners stepping the torque value in small increments.

PART#3047  
(OPTIONAL)



## ROCKER STUD INSTALLATION

### HELP PREVENT M-EIGHT CYLINDER HEAD CRACKING!

Use Feuling/ARP rocker arm shaft studs and nuts to help relieve stress on the Milwaukee Eight cylinder heads. The factory and SE cylinder heads have an extremely weak link with the rocker arm shaft standoffs. By using a stud some of the stress is transferred from the standoff casting into the stud. The use of higher lift camshafts and heavier valvesprings puts additional stress on the cylinder head making the use of our stud kit a must.

1. Double nut the stud with qty. 2, 5/16-24 nuts, loctite the stud course threads & install into the cylinder head.
2. Torque studs to **5 Ft. Lbs.**
3. Feuling recommends filling the rockers with oil using a oil squirt can, fill from the pushrod seat until oil squirts out the exit oil hole.
4. Install rocker arms/shafts, Loctite the fine threads.

**\*NOTE:** It is important to seat the rocker arm shafts by evenly tightening the nuts to estimated 10 Ft. Lbs. then loosening to allow the shafts to settle in, then re-tighten evenly and step the torque to a final **24 – 26 ft/lbs.**



Loctite course threads.



Install stud.



Torque to 5 ft/lbs (48-72 in/lbs)



Fill rocker arm with oil.



Loctite fine threads.



See \*NOTE final torque: 24-26 ft/lbs





### **OIL LEVEL – DO NOT OVERFILL OIL TANK**

It is important to get the correct hot oil level in your bike. Feuling recommends running the oil level 90%-99% full when hot.

Note: The oil pick up port is on the right side of the engine. Letting the bike idle or warm up on the kickstand will naturally fill the engine case and skew the oil level in the tank.

**We recommend the following steps to achieve proper oil level:**

1. Check cold oil level.
2. Ride the bike until operating temperature is reached.
3. Shut the bike off while still in the upright position. (This insures an accurate reading)
4. Once the bike is on the kickstand check oil level.
5. Add or remove oil as needed

## **FEULING® MILWAUKEE EIGHT® TROUBLE SHOOTING GUIDE**

### **OIL LEVEL – DO NOT OVERFILL OIL TANK**

IT IS IMPORTANT TO GET THE CORRECT HOT OIL LEVEL IN YOUR BIKE. FEULING RECOMMENDS RUNNING THE OIL LEVEL 90%-99% FULL WHEN HOT.

NOTE: THE OIL PICK UP PORT IS ON THE RIGHT SIDE OF THE ENGINE. LETTING THE BIKE IDLE OR WARM UP ON THE KICKSTAND WILL NATURALLY FILL THE ENGINE CASE AND SKEW THE OIL LEVEL IN THE TANK.

WE RECOMMEND THE FOLLOWING STEPS TO ACHIEVE PROPER OIL LEVEL:

1. CHECK COLD OIL LEVEL.
2. RIDE THE BIKE UNTIL OPERATING TEMPERATURE IS REACHED.
3. SHUT THE BIKE OFF WHILE STILL IN THE UPRIGHT POSITION. (THIS INSURES AN ACCURATE READING)
4. ONCE THE BIKE IS ON THE KICKSTAND CHECK OIL LEVEL.
5. ADD OR REMOVE OIL AS NEEDED

### **SUMPING:**

1. Oil level too high.
2. Note: if measuring the sump level from the crank sensor there is still 4 – 4.5oz. left in sump.
3. Normal operating sump level range is 4 – 8 oz. drained from bottom 1/4 NPT plug, camchest oil level range is 5.5 – 6.5oz when removing cam cover.
4. Oil pump sub seal O-ring damaged and or incorrect installation, install oil pump/camplate per our instructions.
5. Detonation, check tune, fuel, exhaust/intake leaks, detonation will create extra leakdown/blow by.
6. Blow by through rings and cylinders, perform a leakdown test.
7. 1/4 NPT sump plug screwed in too deep on bottom of engine case blocking pick up port. – see Feuling pro tip.
8. Leaky piston cooling jet valves and or leaky cooling jet gaskets.
9. Run vented dipstick. See Feuling #'s: 3085, 3086, 3087, 3088.
10. Oil type: If running synthetic, try running conventional, we highly recommend the use of conventional oil in the M-Eight engine.
11. Oil pump sub seal O-ring damaged and or incorrect installation, install oil pump/camplate per our instructions.
12. Loctite was used on oil pump and camplate bolts, interfering with oil pump side clearances and camplate sealing to case.
13. Oil pump housing, cover or camplate face scored from debris running through it and or dry start up etc., excessive crank end play/runout.
14. Breather valves in rocker boxes not working correctly and or issue with O-ring seal inside head. Note the valves do not sit squarely on cylinder head thus cocking the valve and compromising the seal. The O-ring groove on the valve is too large for the O-ring, we recommend running an additional smaller O-ring on the top of the OE O-ring which can help hold the OE O-ring in position and assist in sealing. Use HD drain plug O-ring #11105 or a -012 to -013 O-ring.
15. Back of oil pump hitting crank bearing retaining bolts if installed, oil pump bolts too long, sticking out of back of pump, making contact with engine case.
16. Oil pump back cover seal – see Feuling pro tip.

### **PRESSURE ISSUE:**

1. Low oil level.
2. Pressure relief valve in oil pump not seating and sealing, possible debris stuck in valve and or scoring on seat/bore.
3. Scoring in oil pump housing and or camplate face surface, possible dry start up, debris in oil and or excessive crankshaft end play and or crankshaft runout.
4. Leaky piston cooling jet valves and or leaky cooling jet gaskets.
5. Loose camplate pinionshaft bore ID to crank pinionshaft OD clearance, we recommend 0.0005" – 0.0035", possible bad install not centering camplate & oil pump properly creating excessive pinion bore wear.
6. Loose lifter to lifter bore clearance, we recommend 0.001" – 0.0015" lifter to lifter bore clearance – See Feuling tool #9004.
7. Loose rockershaft to bushing clearance and or excessive side end play.
8. Out of spec pressure side of oil pump due to scoring.
9. Loctite was used on oil pump and camplate bolts interfering with oil pump side clearance stack up and or camplate sealing to case.
10. Broken oil pump gears, inspect for debris in oil, excessive end play and or crankshaft runout.
11. Stripped or loose camplate bolts causing camplate to leak.

### **EXCESSIVE NOISE**

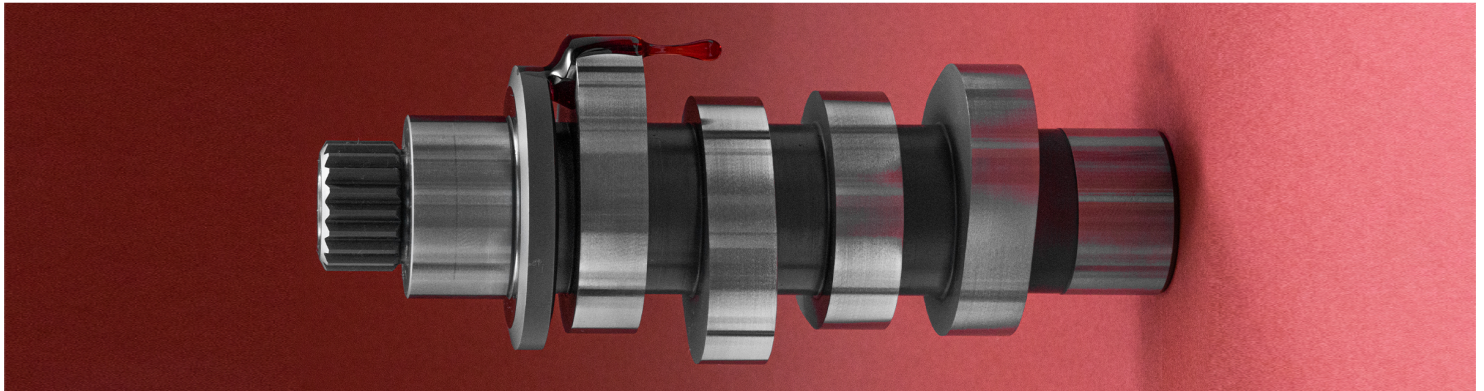
1. Low oil pressure.
2. Thrusting wear on rocker arm stand offs in cylinder heads and or short rocker arms and excessive side clearance from factory.
3. Quick install pushrods flexing and creating valvetrain harmonics, possible pushrods contacting pushrod tubes.
4. Under performing lifters: Scored lifter internals, valvetrain harmonics, loose lifter to lifter bore clearance, we recommend 0.001" – 0.0015" lifter to lifter bore clearance. 5. See Feuling tool #9004.
6. Excessive crankshaft runout and or excessive crankshaft end play.
7. Valvetrain harmonics, bad valvespring to camshaft combination, damaged valvesprings due to excessive heat especially rear head exhaust.
8. Flexing crankshaft.
9. Excessive piston to cylinder clearance.
10. Compensating assembly worn, compensating bolt not installed all the way.
11. Excessive heat buildup in cylinder heads causing valvespring failure and or excessive harmonics.



# MILWAUKEE-EIGHT® CAMSHAFT SPEC CHART



PART #S	GRIND	VALVE LIFT	OPEN	CLOSE	DURATION		LOBE		OVERLAP	DESCRIPTION	RPM RANGE
					@ .050"	LIFT @ TDC	CENTERLINE				
#1350 0925-1325	472	Intake Exhaust	.468" .472"	8° 50.7°	25° 7.75°	213° 238°	.117" .110"	98.5° 111.5°	16	<b>Bolt-in.</b> Great all around camshaft, Feuling's go to for 4 1/2 stroke 114" & 117" looking for a little more than our 465 grind. Great bottom end with substantial gains above 2,800 RPM when compared to stock. Responds very well to increased bore and or compression	1900-5900



**\* 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](http://WWW.FEULINGPARTS.COM/WARRANTY)

DISCLAIMER: NOT LEGAL FOR SALE OR USE IN CALIFORNIA ON ANY POLLUTION CONTROLLED MOTOR VEHICLE. FEULING DOES NOT RECOMMEND TUNING BEYOND STOCK EMISSION STANDARDS