

## FEULING® CAMCHEST INSTALLATION INSTRUCTIONS FOR MILWAUKEE EIGHT ENGINES



**FEULING RECOMMENDS THE FOLLOWING INSTALLATION PROCEDURES FOR ALL OILING SYSTEM COMBINATIONS ON M-EIGHT ENGINES REGARDLESS OF BRAND OR STACK UP.**

### IMPORTANT NOTICES

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, which 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. Always rotate engine to TDC of compression stroke on the servicing cylinder.

**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, 465 & 472 grind camshafts are direct bolt-in, the 508, 521, 538 and 592 grinds require high lift valvesprings when used with factory & CVO cylinder heads - See Feuling valvespring kits #1107 & 1108. The SE cylinder heads do have high lift valvesprings and can accommodate the 508, 521, 538 cam as a bolt-in. The 592 grind will require highlift highload valvesprings (See #1207) on all cylinder heads along with checking valve to piston clearance and lifter to lifter cuff clearance.

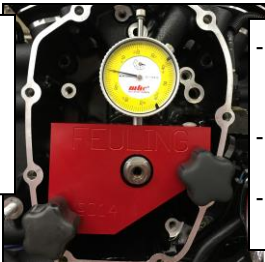
**WARRANTY NOTE:** Feuling offers an additional 12 month warranty for a total of 2 years if product is installed by a professional installer, meets crank runout criteria under 0.005", oil tank is dropped and cleaned at time of install and the WARRANTY REGISTRATION form is filled out on [www.FeulingParts.com/warranty](http://www.FeulingParts.com/warranty)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

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. If using 1 piece pushrods which is highly recommend by FEULING - see FEULING #4087. Remove fuel tank, front head mount, exhaust, oil/water lines, engine rocker box top covers and rocker arms to access the pushrods. SEE TECH TIP PAGE 4
3. Inspect pinion shaft for burrs, use fine grit wet sand paper to clean and assure smoothness of shaft.

Measure flywheel pinion shaft run out & end play. Excessive pinion shaft runout and or end play will cause damage and or failure and voids manufacturer's warranty. **Feuling recommends crankshaft runout and bearing play combination at or below 0.003" but our warranty does covers 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.

Ideal end play is 0.003"-0.004, Pinion shaft OD to camplate bore ID has a recommended clearance of 0.0005" – 0.0035".

FEULING  
CRANKSHAFT  
RUNOUT  
MEASURING  
TOOL  
#9014



- Crank runout under 0.005"  
Ideal is under 0.003"
- End play 0.003" – 0.004"
- Pinion shaft OD to camplate bore ID 0.0005" – 0.0035"

FEULING INNER CAM  
BEARING #2080





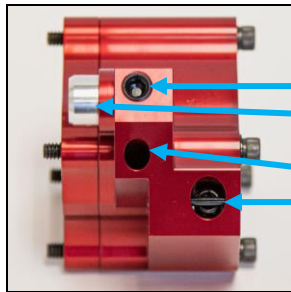
4. Feuling highly recommends dropping the oil tank & performing a deep clean & flush on the oiling system to remove any & all debris. This is required for our 2 year warranty policy – See warranty registration form on [www.FeulingParts.com/warranty](http://www.FeulingParts.com/warranty)  
**Note any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



**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

6. 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 11-13

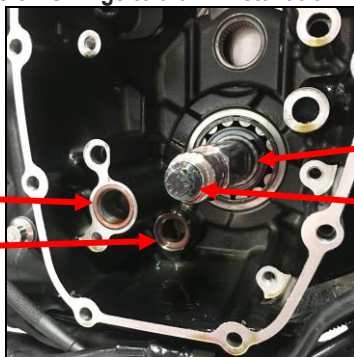
Due to the weight of the M8 oil pump/camplate & the out of spec case dowel pin locating hole, if not properly centered the pump/camplate will drop and rest on pinion shaft leading to offset oil pump/camplate and premature wear/failure.



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

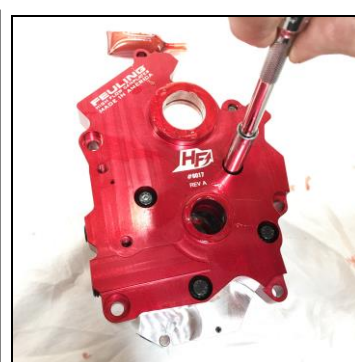
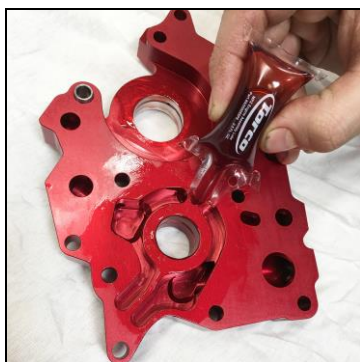
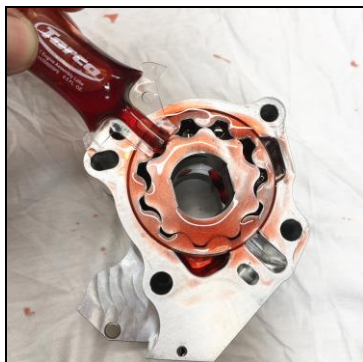
Install new O-rings and apply engine assembly lube

1. Camplate
- 2.) Scavenge port



Install crank bolt then rotate crankshaft so flats are vertical

8. Use engine assemble lube on camplate, camshaft, crankshaft, cam bearing, oil pump, scavenge port hole/oil pump o-ring and lifter bores.

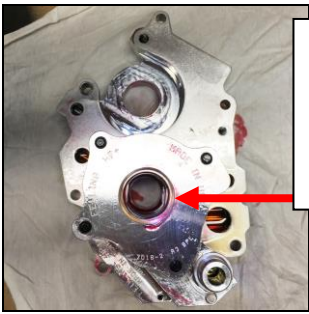


**NOTE: DO NOT USE LOCTITE ON OIL PUMP OR CAMPLATE BOLTS**, use moly lube paste, assembly lube OR OIL on bolt threads & underhead flange. Loctite will interfere with the stack up clearance of the oil pump & can cause sealing issues with camplate to engine case.

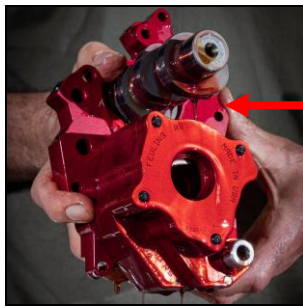
**\*THE FEULING OIL PUMPS DO NOT USE AN O-RING ON THE BACK COVER**

9. Rotate oil pump gears so gear flats are vertical to match the crankshaft per step 7. We found having the crank and gear flats vertical make for the easiest install of the oil pump and camplate assembly.

**NOTE: FEULING X ARP OPTIONAL BOLT KITS: OE+ CAMPLATES USE #8023 WHICH INCLUDE WASHERS FOR THE OIL PUMP BOLTS. HIGHFLOW CAMPLATES USE OPTIONAL ARP KIT #8022 WHICH DOES NOT USE OIL PUMP BOLT WASHERS.**



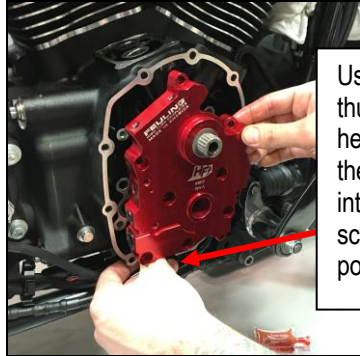
Rotate pump gears so flats are vertical to match crankshaft



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



10. Install the oil pump & camshaft into the camplate on the bench, fasten oil pump 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.**



Use your thumb to help push the oil pump into the scavenge port



Rotate engine using the crank bolt, alternately tighten camplate bolts, step to final torque.  
  
Rotate engine & tighten and torque the oil pump after camplate is tight

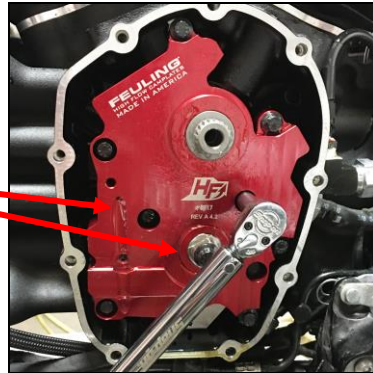
11. With the oil pump and camplate bolts finger tight rotate the engine over by hand multiple times, tighten and torque the camplate bolts first. Alternately tighten camplate bolts in a crisscross pattern rotating engine in between step torque **40 in-lb, 80 in-lb** then to a final **120 in-lb**.

12. 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.

13. 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 oil pump & camplate 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



14. Install chain & sprockets, lining up timing marks. 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 critical for wear and longevity of tensioner pad.

15. 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



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

## 16. Tech tip for breather install service



### **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.



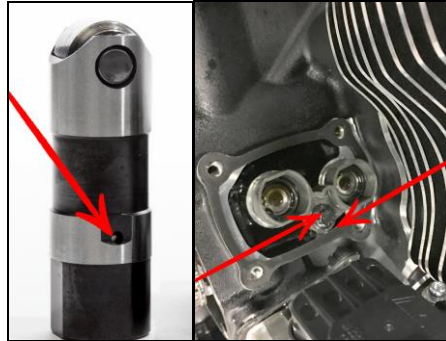
17. Install lifters, pushrods and rocker arms, Feuling recommends using an oil squirt can to manually pump up the lifters, pushrods and rocker arms during assembly. This will aid in lubrication for initial startup and will provide a quiet engine with immediate oil psi.

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

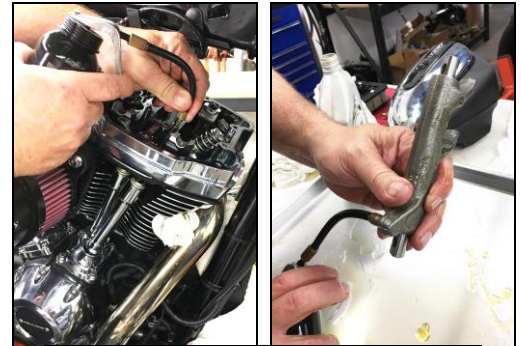
18. Install lifter feed holes facing each other, we also recommended rotating the engine over with the lifter 'cuffs' finger tight to center the holders on the lifters before final torque



Manually pump up lifters



Install oil feed holes install facing each other



Manually pump up pushrods & rocker arms

19. Feuling one piece pushrods are designed to work with all Feuling M8 camshafts and any other brand cams running stock base circles. These pushrods will put the correct pre-load on Feuling and factory HD full travel lifters. Ideal lifter pre-load for Feuling full travel hydraulic lifters is 0.090" - 0.110".

20. 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. 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 bleed 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 head stand offs. The rocker arm 'stand offs' are a weak link and prone to cracking

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 and will operate quieter than factory HD® or HP+® lifters.

### **LIFTER/PUSHRODS ADJUSTMENT NOTES**

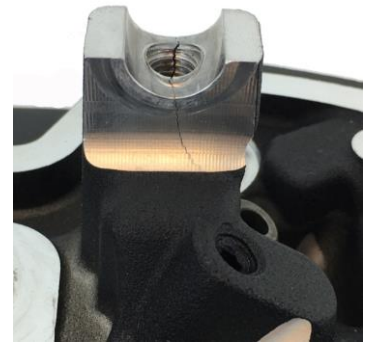
Feuling full travel hydraulic lifters are designed with 0.200" of total travel and run best with 0.090"-0.110" of pre-load. Feuling one piece pushrods are designed to work with all camshafts using stock base circles including Feuling, factory HD & SE camshafts. If using adjustable pushrods adjust the pushrod for 0.090"-0.110" of lifter pre-load.

20 TPI = 0.050" per turn	Required Turns: 2
24 TPI = 0.0417" per turn	Required Turns: 2.4
32 TPI = 0.0313" per turn	Required Turns: 3.2

### **TECH TIP FOR USING 1 PIECE PUSHRODS WITH CAMSHAFT/OILING SYSTEM INSTALL:**

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

## HELP PREVENT MILWAUKEE EIGHT CYLINDER HEAD CRACKING!



Use Feuling x 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. **See Feuling #3037 or #3047**

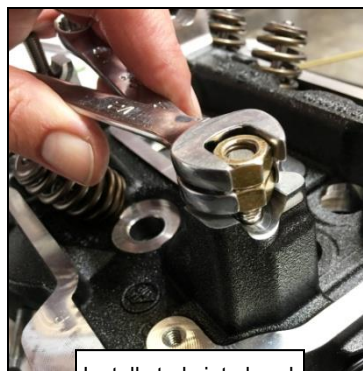
### FEULING ROCKER STUD/NUT INSTALLATION:

1. Double nut the stud with qty. 2, 5/16-24 nuts, loctite the stud course threads and install into the cylinder head
2. Torque studs to 48-72 in-lbs (4-6 Ft. Lbs)
3. FEULING recommends filling the rockers with oil using an oil squirt can, fill from the pushrod seat until oil squirts out the exit oil holes.
4. Install rocker arms/shafts, Loctite the fine threads final torque 24-26 Ft Lbs
5. Verify rocker arm moves and rotates freely
6. Note: Excessive rocker arm end play, due to stand off wear and factory tolerance stack up with create added valvetrain noise

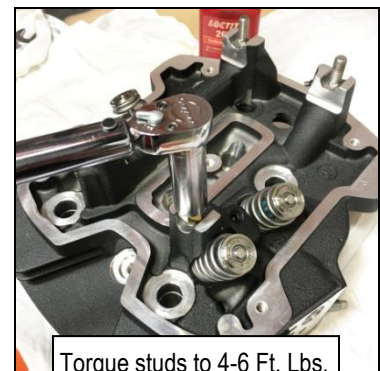
**NOTE:** It is important to seat the rocker arm shafts by evenly tightening the nuts to estimated 10 Ft. Lbs. then loosening to allow the shafts to settle in, then re-tighten evenly and step the torque 5/10/15/20 Ft. Lbs. then to a final 24 – 26 Ft. Lbs



Double nut stud fine threads & Loctite course threads



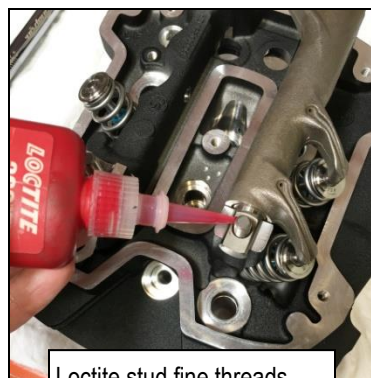
Install studs into head



Torque studs to 4-6 Ft. Lbs. 48 - 72 Inch



Fill rocker arm with oil using a oil squirt can



Loctite stud fine threads and install nuts



Evenly seat rocker arm to 8-10 Ft. Lbs, loosen to allow shaft to settle then evenly step torque to final 24-26 Ft. Lbs. Verify rocker



### **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® M-EIGHT ENGINE TROUBLE SHOOTING GUIDE**

### **SUMPING:**

- Oil level too high – see above
- Note if measuring the sump level from the crank sensor there is still 4 – 4.5oz. left in sump
- Normal operating sump level range is 4 – 8 oz. drained from bottom 1/4NPT plug, camchest oil level range is 5.5 - 6.5oz when removing cam cover
- Detonation, check tune, fuel, exhaust/intake leaks
- Blow by through rings and cylinders, perform a leakdown test
- 1/4 NPT sump plug screwed in too deep on bottom of engine case blocking pick up port
- Leaky piston cooling jet valves and or leaky cooling jet gaskets
- Run vented dipstick See Feuling #'s: 3085, 3086, 3087, 3088
- Oil type: If running synthetic try running conventional, we highly recommend the use of conventional oil in the M-Eight engine
- Oil pump sub seal O-ring damaged and or incorrect installation, install oil pump/camplate per our instructions
- Loctite was used on oil pump and camplate bolts, interfering with oil pump side clearances and camplate sealing to case
- Oil pump housing, cover or camplate face scored from debris running through it and or dry start up etc., excessive crank end play/runout
- 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.

### **PRESSURE ISSUE:**

- Low oil level
- Pressure relief valve in oil pump not seating and sealing, possible debris stuck in valve and or scoring on seat/bore
- 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
- Leaky piston cooling jet valves and or leaky cooling jet gaskets
- 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
- Loose lifter to lifter bore clearance, we recommend 0.001” -0.0015” lifter to lifter bore clearance – See Feuling tool #9004
- Loose rockershaft to bushing clearance and or excessive side end play
- Out of spec pressure side of oil pump due to scoring
- Loctite was used on oil pump and camplate bolts interfering with oil pump side clearance stack up and or camplate sealing to case
- Broken oil pump gears, inspect for debris in oil, excessive end play and or crankshaft runout
- Stripped or loose camplate bolts causing camplate to leak

### **EXCESSIVE NOISE**

- Low oil pressure
- Thrusting wear on rocker arm stand offs in cylinder heads and or short rocker arms and excessive side clearance from factory
- Quick install pushrods flexing and creating valvetrain harmonics, possible pushrods contacting tubes
- 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 – See Feuling tool #9004
- Excessive crankshaft runout and or excessive crankshaft end play
- Valvetrain harmonics, bad valvespring to camshaft combination
- Flexing crankshaft
- Excessive piston to cylinder clearance
- Compensating assembly worn, compensating bolt not installed all the way

4/7/2020





# FEULING®

## REAPER® CAMSHAFTS FOR MILWAUKEE EIGHT ENGINES

GRINDS: 405, 465, 472, 508, 521, 538, 592



- FEULING® REAPER® camshafts have wide lobe separations producing very wide power bands.
- Smooth camshaft lobe ramps are easier on valve-train components eliminating excessive valve-train noise and wear.

**BETTER THROTTLE RESPONSE - INCREASED MPG - EASY STARTING - UNIQUE IDLE SOUND - MADE IN THE U.S.A.**

**405 CAM (Feuling #1340, Drag #0925-1163)** - A workhorse, producing a wide powerband increasing torque and HP throughout the entire RPM range when compared to stock. Direct bolt in replacement for Milwaukee Eight engines, can be used with stock valve springs, pushrods, lifters and exhaust. Will respond well with slip-on mufflers and or complete exhaust system and a high flow air cleaner. Note Feuling recommends using mufflers with smaller cores for best lower RPM power and pull.

**465 CAM (Feuling #1343, Drag #0925-1164)** The 465 Reaper is an accelerator, producing solid bottom end performance with substantial gains above 2,800 RPM when compared to stock. This direct bolt in replacement for M-Eight engines is our 'Go To' for 107 - 114" 4 3/8" stroke engines, can be used with stock valve springs, pushrods, lifters and exhaust. Will respond well with slip-on mufflers and or performance exhaust system and air cleaner. Use of performance valve-springs is not required but may result in a quieter, smoother running valve-train See Feuling #1107 or #1108. This cam will also respond well with increased bore and or compression.

**472 CAM (Feuling #1350)** - The 472 Reaper is a great all-around camshaft and Feuling's go to for 4 1/2 stroke 114" - 117" & looking for a little more than our 465 grind and wanting a bolt-in. The 472 has a great bottom end with substantial gains above 2,900 RPM when compared to stock. Responds very well to increased bore and or compression, exhaust system and air cleaner. Use of performance valve-springs is not required but may result in a quieter, smoother running valve-train See Feuling #1107 or #1108.

**508 CAM (Feuling #1349, Drag #0925-1283)** - 'The Grim Reaper' Aggressive pulling power with a "nasty" sound. This camshaft revs up faster than the 521 grind, sounds nastier and pulls harder but is more difficult to tune. The 508 grind will shine in 114" and larger cubic inch engines with added compression ratio. Ported cylinder heads are not required but will complement the cam and add even more pulling power throughout the range. The stock throttle body produces an excellent powerband and use of a high flow throttle body increases peak power numbers. A high flow exhaust system & air cleaner is highly recommended for optimal performance. FEULING recommends matching this cam with our RACE SERIES oiling system #7097. High lift valve springs are required, see Feuling Beehive valve spring kit #1107 and #1108. Heavy duty pushrods are highly recommended see #4087.

**521 CAM (Feuling #1346, Drag #0925-1210)** - Aggressive pulling power with a "nasty" sound, the Reaper 521 grind will shine in 114" and larger cubic inch engines with added compression ratio. Ported cylinder heads are not required but will complement the cam and add even more pulling power throughout the range. The stock throttle body produces an excellent powerband, use of a high flow throttle body increases peak power numbers. A high flow exhaust system and air cleaner is highly recommended for optimal performance. Feuling recommends matching this cam with our Race Series oiling system #7097. High lift valve springs are required on stock & CVO cylinder heads, see Feuling Beehive spring kits #1107 or #1108. SE cylinder heads have high lift valvesprings and do accept the 521 grind cam. Heavy duty one piece pushrods are also highly recommended see #4087.

**538 CAM (Feuling #1351)** - Aggressive camshaft with a "nasty" sound. The 538 grind will shine in 124" and larger cubic inch engines with added compression ratio. Ported cylinder heads are not required but will complement the cam and add even more pulling power throughout the range. A high flow exhaust system, throttle body and air cleaner are highly recommended. FEULING recommends matching this cam with our RACE SERIES oiling system. High Lift valve springs are required on stock & CVO cylinder heads, see FEULING BEEHIVE valve spring kit #1107 or #1108. SE cylinder heads have high lift valvesprings but will need to be verified. Heavy Duty one piece pushrods are also highly recommended see #4087.

**592 CAM (Feuling #1348, Drag #0925-1265)** - 'The big nasty' Put your big boy pants on and get serious with bore size, ported cylinder heads, compression and throttle body. Aggressive camshaft requiring high lift and higher load valvesprings, performance pushrods and lifters. High flow air cleaner and exhaust highly recommended. FEULING also recommends matching this cam with our RACE SERIES oiling system #7097 or #7099. High lift valve springs are required, see FEULING BEEHIVE valve spring kit #1207. Heavy duty pushrods are highly recommended see #4087.



**\*Cam specs measured on the lifter @ 0.050" lift with 1.61 rocker arm ratio**

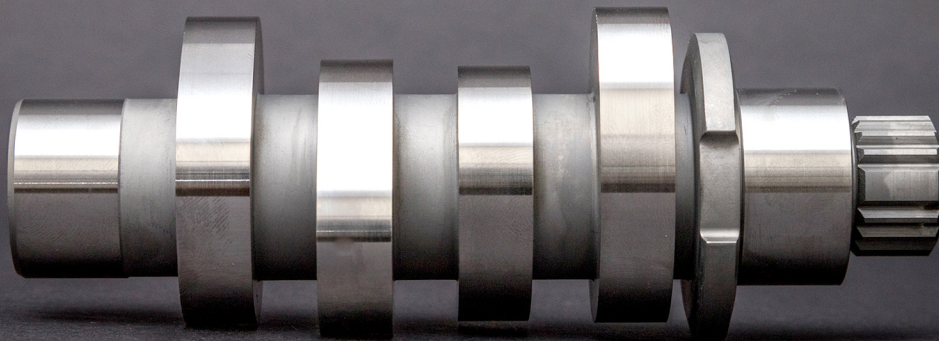
**DISCLAIMER:** NOT LEGAL FOR SALE OR USE IN CALIFORNIA ON ANY POLLUTION CONTROLLED MOTOR VEHICLE. FEULING DOES NOT RECOMMEND TUNING BEYOND STOCK EMISSION STANDARDS.

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

# MILWAUKEE-EIGHT® CAMSHAFT SPEC CHART



PART #'S	GRIND	VALVE LIFT	OPEN	CLOSE	DURATION @ .050"	LIFT @ TDC	LOBE CENTERLINE	OVERLAP	DESCRIPTION	RPM RANGE
#1340 0925-1163	405 Intake Exhaust	.395" .405"	4° 36°	24° 11°	200° 205°	.068" .049"	103° 108°	7	<b>Bolt in.</b> A workhorse for 107 and 114 engines. Wide powerband throughout the entire RPM range when compared to stock. Will respond well with slip-on mufflers and a high flow air cleaner.	1750-5700
#1343 0925-1164	465 Intake Exhaust	.445" .465"	4° 50°	23° 6°	207° 236°	.100" .100"	99.5° 112°	10	<b>Bolt-in.</b> Best all around camshaft, Feuling's go to especially in 4 3/8 stroke. Solid bottom end with substantial gains above 2,800 RPM when compared to stock. Responds well to increased bore and or compression	1850-5950
#1350	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
#1349 0925-1283	508 Intake Exhaust	.508" .511"	20.5° 44°	37° 17.5°	237° 241.5°	.180" .146"	98.5° 103.25°	38	Shines in 114 + cubic inch engines with added compression. The 508 revs up faster than the 521 grind, sounds nastier and pulls harder out of the hole. Requires high lift valve springs.	2250-5900
#1351	538 Intake Exhaust	.538" .542"	20.5° 48°	38.5° 18°	239° 246°	.180" .157"	99° 105°	38	Shines in 124 + cubic inch engines with added compression. Cylinder head & intake work + high flow throttle body & performance exhaust recommended. Requires high lift valve springs.	2350-5975
#1346 0925-1210	521 Intake Exhaust	.518" .521"	17° 51.5°	34° 11.5°	231° 243°	.162" .125"	98.5° 110°	28.5	Shines in 114 and larger engines with increased compression. Easier to tune, better street manners & revs up higher than the 508. Requires high lift valve springs.	2250-6250
#1348 0925-1265	592 Intake Exhaust	.578" .592"	20° 68°	34° 16°	234° 264°	.182" .146"	97° 116°	36	"The Big Nasty" Get serious with bore size, ported cylinder heads & throttle body. Aggressive camshaft requires performance pushrods, lifters, high flow air cleaner, stepped exhaust and high lift/high load valve springs (See #1207).	2750-6350+



#### \* 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.
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- 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

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





# 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](http://www.feulingparts.com/warranty).

#### SOLID LIFTER NOTE:

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

### INSTRUCTIONS:

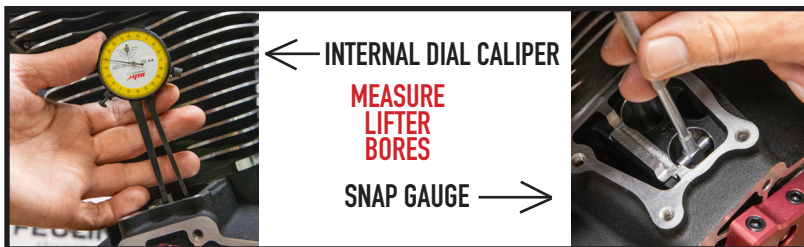
1. For removal of lifters & inspection of lifter bores, refer to the factory service manual for your model & year engine.
2. Clean, inspect and measure lifter bores to make sure the tolerances are within specification. For maximum lifter performance Feuling® recommends a lifter to lifter bore clearance 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)

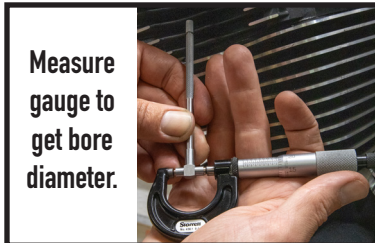


There are multiple methods to measure lifter to lifter bore clearance. An easy & accurate method is to use Feuling tool #9004, set of precision ground balls to accurately measure lifter bore diameter & roundness.

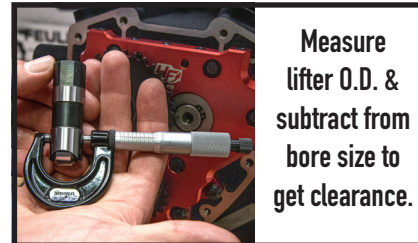
The correct size ball will pass through the lifter bore 'snugly', this will give you the correct bore size taking roundness of the bore into account.



INTERNAL DIAL CALIPER  
 MEASURE LIFTER BORES  
 SNAP GAUGE



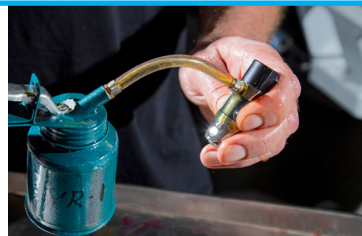
Measure gauge to get bore diameter.



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

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
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.

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