



# FEULING

CAMCHEST INSTALLATION INSTRUCTIONS FOR TWIN CAM ENGINES



GEAR DRIVE & CHAIN DRIVE  
WITH MECHANICAL TENSIONERS

**PART #S:** 1000, 1001, 1002, 1003, 1004, 1007, 1010, 1013, 1014, 1021, 1301, 1302, 7000, 7010, 7050, 7070, 7071, 7072, 7073, 7080, 7081, 7201, 7201P, 7202, 7202P, 7203, 7203P, 7203ST, 7204, 7204P, 7207, 7207P, 7214, 7214P, 7214ST, 7216, 7216P, 7216ST, 7230, 7230P, 7232, 7232P, 7234, 7234P, 7236, 7236P, 7236ST, 8000, 8010, 8030, 8031

**FEULING OE+ CAMPLATE (PART #8030 & 8031)** CAN BE USED WITH THE FACTORY HD®. OR ANY TWIN CAM® OIL PUMP WITH THE '99-'06 STYLE BOLT PATTERN. **FEULING HIGHFLOW CAMPLATES (PART #8000 & 8010)** REQUIRE A FEULING HP+ OIL PUMP (PART #7000) OR RACE SERIES OIL PUMP (PART #7050), USE THE PROVIDED ALLEN HEAD OIL PUMP BOLTS OR SEE OPTIONAL FEULING x ARP BOLT KIT (PART #8020).

FEULING RECOMMENDS THE FOLLOWING INSTALLATION PROCEDURES FOR ALL OILING SYSTEM COMBINATIONS ON TWIN CAM® ENGINES.

### IMPORTANT NOTICE:

This installation should be done by an experienced mechanic who has access to a factory service manual & all required tools. Measure flywheel pinion shaft run out & end play. Excessive pinion shaft runout & or end play will cause damage & or failure & voids manufacturer's warranty. Ideal end play is 0.003"–0.004". Ideal crankshaft runout is at or below 0.003", our warranty covers up to 0.005" combination of runout & bearing play, measure crank bearing play by lifting up on the tip of the pinion shaft.

**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, &/or others. Removal of the rocker arms &/or pushrods with the valve train loaded can damage rocker arms, push rods, bushings &/or camplate. Rotate engine to TDC of compression stroke on the servicing cylinder.

### VALVESPRING/CAMSHAFT NOTES:

\*1999–2004 Twin Cam cylinder heads with stock valve springs can accommodate up to the Feuling Reaper 525 camshaft as a bolt in but may require minor case clearance for intake lobes. The Feuling Reaper 543, 574, 594, & 630 camshafts require high lift valve springs when used with factory '99-'04 cylinder heads. See Feuling Beehive Spring Kits (Part #1120, 1122, 1100, & 1200).

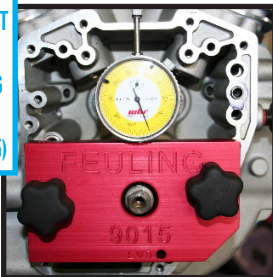
\*2005–2017 Twin Cam cylinder heads will accommodate Feuling Reaper 525, 543, & 574 camshaft grinds as bolt ins but may require minor case clearance for intake lobes. Feuling Reaper 594 & 630 will require high lift valve springs when used with factory cylinder heads. See Feuling Beehive Spring Kits (Part #1121, 1123, 1105, 1205).

### INSTRUCTIONS:

1. Refer to the factory service manual for your model and year of engine, for removal of exhaust, cam cover, camchest and oil tank.
2. If using 1 piece pushrods, highly recommend by FEULING – see #4072 or 4073 for full travel lifters & #4074 or 4076 for short travel lifters. NOTE: The OEM 1 piece pushrods will work with Feuling 525, 543 & 574 grinds. Remove fuel tank, exhaust, rocker box top covers, breathers & rocker arms to access pushrods.
3. Inspect the flywheel pinion shaft for burrs, use fine grit wet sand paper to clean and assure smoothness of shaft.
4. Measure flywheel pinion shaft runout, crank bearing play & crank end play. Excessive pinion shaft runout & or end play will cause damage & or cause failure & 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 & adding that amount to the runout for your total.

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

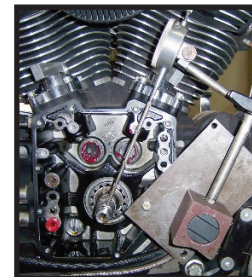
CRANKSHAFT  
RUNOUT  
MEASURING  
TOOL  
(PART #9015)



Crank runout under 0.005"  
Ideal is under 0.003".  
Including bearing play.  
End play 0.003" – 0.004"  
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.



A dial indicator  
can be attached  
to the case to  
check runout  
as a secondary  
option to the  
#9015.

5. 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 – (visit [www.FeulingParts.com/warranty](http://www.FeulingParts.com/warranty) for more info).

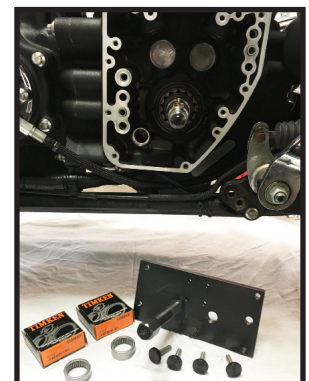
**NOTE: ANY DEBRIS IN THE OIL TANK WILL RUN DIRECTLY THROUGH THE BRAND NEW OIL PUMP & CAMPLATE. See oil pan gaskets (Dyna: Part #2100 & Touring: Part #2101).**

6. Feuling recommends replacing the inner cam bearings with full complement style needle bearings (Part #2076).

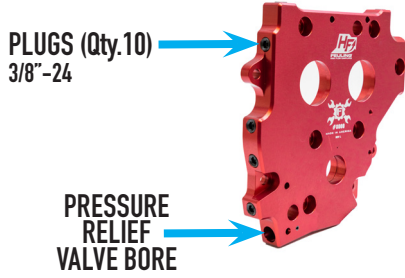
INNER CAM BEARINGS PART #2076  
(DRAG # 0924–0239)



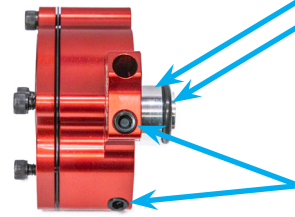
Install new inner cam bearings  
using the proper tools & press lube.



7. Wash, clean, & inspect the new FEULING components. Verify that all threaded holes around the profile are plugged & the pressure relief valve, spring & roll pin are installed. All Feuling camplates come with the pressure relief valve pre-set & tested from the factory with a full pop off at 55-60 PSI.



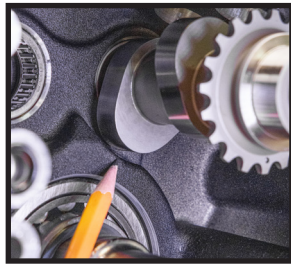
Verify camplate has all plugs (qty. 10) & the pressure relief valve, spring & roll pin are installed.



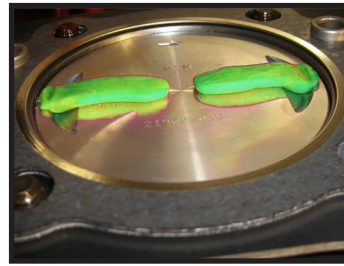
Oil Pumps: #7000, 7010 & 7050  
 Verify subseal standoff & o-ring is installed into back of oil pump.  
 Verify oil pump has 3 allen head plugs in the scavenge housing.

8. When installing a new set of cams, inspect camshaft for rotating clearance in the cam compartment by installing the cams in the case and rotating the cam. Clearance cam chest as needed. If installing a high lift camshaft verify piston to valve clearance. High lift camshafts will also require performance valve springs. See Feuling Beehive spring kits.

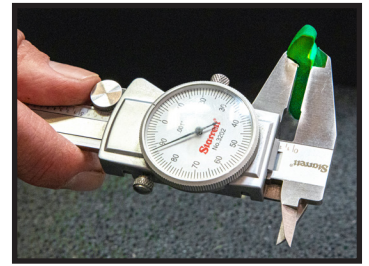
TECH TIP: Piston to valve clearance should not be less than the pre-load set on the hydraulic lifter.



Verify camshaft lobe rotating clearance to engine case.

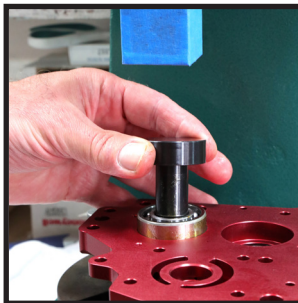
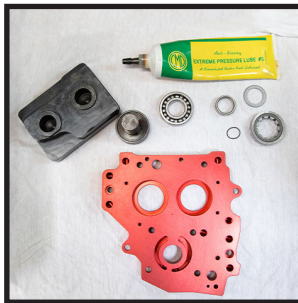


On high lift camshafts measure valve to piston clearance.



Measure thickness of clay after cycling engine.

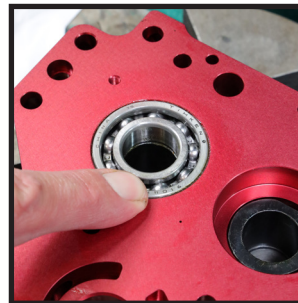
9. Install new cam bearings into the camplate. Feuling part #2078 for chain drive cams or part #2075 for gear drive cams. Bearings should be installed following HD® factory service manual procedures. Feuling recommends using press lube when installing the new bearings. NOTE: Chain drive cams use one roller bearing with race and one ball bearing. The roller bearing with race is installed into the rear cam position.



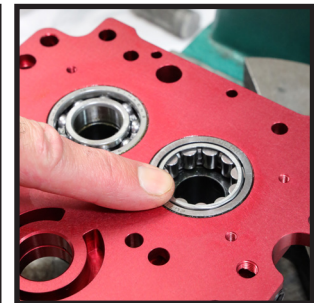
PART #2078 FOR CHAIN DRIVE CAMS



PART #2075 FOR GEAR DRIVE CAMS



Ball bearing goes in the front cam bore.



Chain drive roller bearing goes in the rear cam bore.

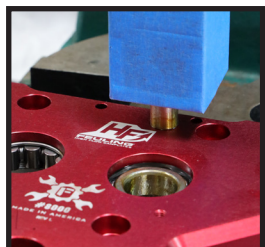
Press the bearings into the camplate using the proper press tools & lube, verify bearings are pressed square & flush with the camplate.

10. Camplates #8000 & 8030 (Kit #'s 8010 & 8031) are designed to use the factory style mechanical tensioners. When using these camplates for chain drive, install the provided tensioner pins and chain guide tower. If needed Feuling sells the pins & tower separately see part #7078. CHAIN DRIVE NOTE: Install inner tensioner prior to cam install.

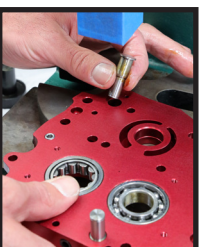
- A) Start by installing the inner tensioner pin. Setup the cam support plate so the front of the camplate is facing upward. Apply press lube to the OD of the pin and press the pin in until it is fully seated.
- B) Flip the camplate over so the backside of the camplate is facing upward. Install the front tensioner pin following the same procedure as the inner listed above.



TENSIONER PINS & GUIDE (PART #7078)



PINS SHOULD BE FLUSH



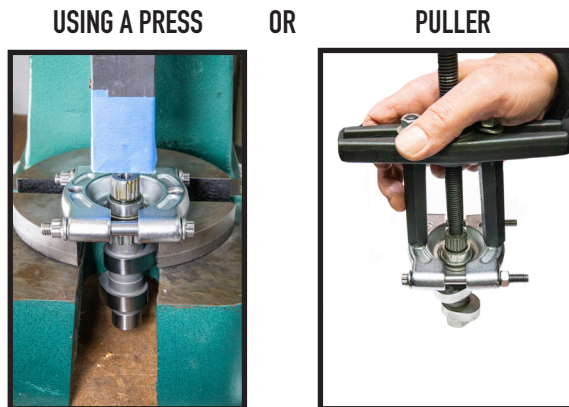
GEAR DRIVE NOTE: If running gear drive, do not install chain tensioner pins or chain guide tower.

**11. CHAIN DRIVE CAMS:** Replace the thrust washer and bearing race on the rear camshaft with the one provided in the new bearing kit. The bearing and race are a matched set and need to be installed as a pair. Mix matching races and bearings can create improper endplay leading to unwanted noise, bearing damage or failure. Ideal camshaft end play is 0.003" – 0.008".

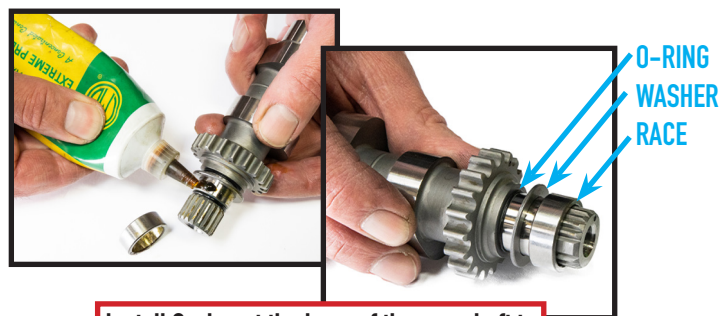
**A.) REMOVING EXISTING REAR CAM**



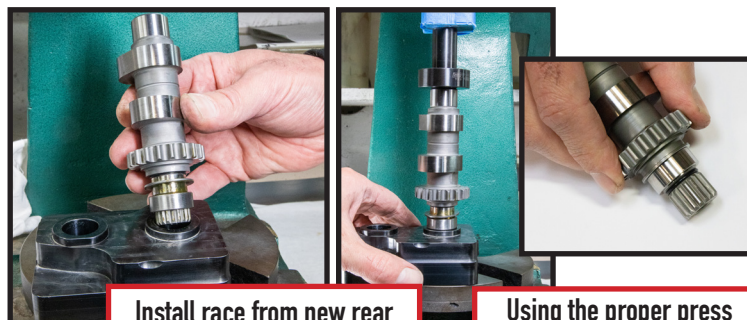
Remove existing rear cam race from outer journal. Use a separator in a press or with a standard puller.



**B.) INSTALLING NEW REAR CAM RACE**



Install O-ring at the base of the camshaft to center the new thrust washer.



Install race from new rear cam bearing as the race is matched to the bearing.

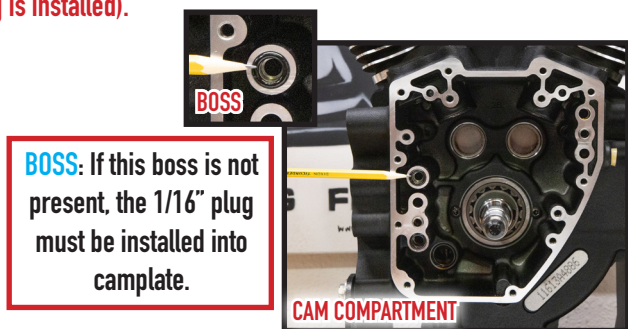
Using the proper press tools and lube install the race onto the camshaft.

**12. CAMPLATE BOSS PLUG:** Examine the cam compartment for the boss on the left side of the engine case.

**A.) DYNA & TOURING ('A' Engines):** If the boss is not present ('99-'00) the plug included with your camplate MUST be installed, if the boss is present it is not required to install camplate plug as the boss is a 'dead' hole, however, Feuling recommends installing the provided plug in all "A" engines to help prevent any potential oil leak at the boss.

**B.) SOFTAIL ('B' Engines):** The boss passage is used to feed oil to the crankshaft counter balancers. The camplate plug should NEVER be installed when used with a "B" engine, unless the crankshaft balancers have been removed.

When installing the 1/16" pipe plug into the camplate use Loctite and torque to 55-60 in-lbs. (NOTE: Use of the O-ring at the boss is still required even if the plug is installed).



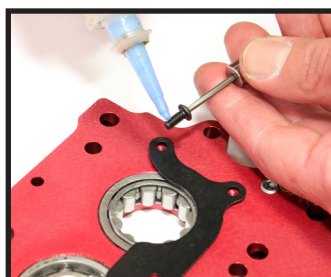
If installing the 1/16" boss plug, apply Loctite & torque to 55-60 in/lbs.



**13. Install bearing retainer plate & screws using blue Loctite (242 or 243). Torque to 20-30 in-lbs.**

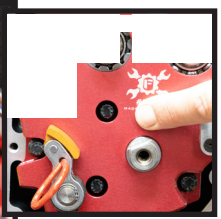
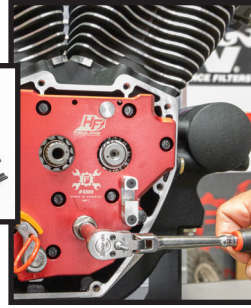
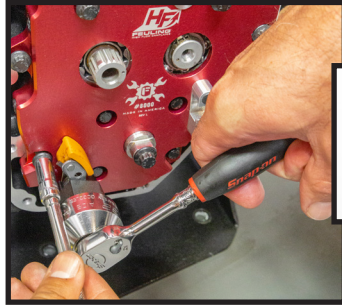


Install bearing retainer plate screws using Blue Loctite (242 or 243).

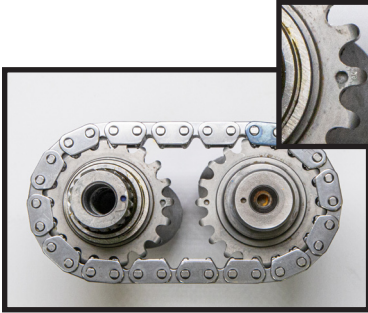


Torque to 20-30 in-lbs.

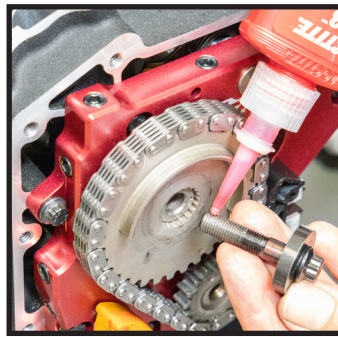
**14.** Install rear tenoner. Use lube on the tenisoner pin. Use correct tenisoner unloader tool and pin the tenisoner back in place before installing the cams. Install tenisoner retaining ring, be careful not to over stretch the ring.



**15.** Install chain onto camshafts, verify timing marks are aligned. Using the proper press tools & lube, press front cam into the cam support plate, making sure the cams stay aligned & seat into the camplate at even pace. Once seated, rotate cams by hand to verify there is no binding & everything moves freely. Install retaining ring on front camshaft & verify that it is fully seated in the camshaft groove.



Install chain on the cams & verify that the timing marks are aligned.

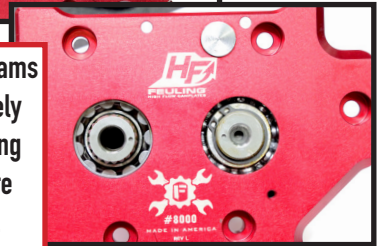


Press front cam into ball bearing, rear cam slip fits into roller bearing.



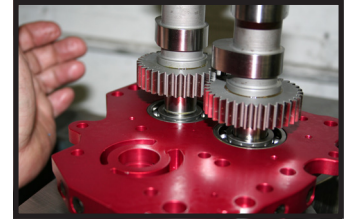
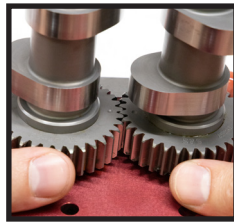
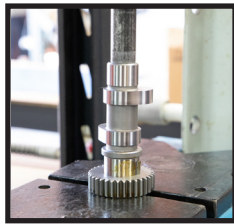
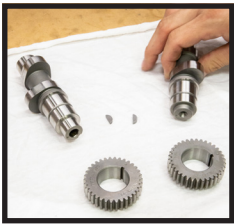
Install retaining ring on front camshaft.

Verify the cams rotate freely & the timing marks are aligned.



### GEAR DRIVE INSTALL

- A) Cam gears are not included with Feuling Reaper cams. (See Drag Specialties [Part #DS199532](#)).
- B) Install the cam keys into camshafts then press the inner cam gears onto the camshafts using proper press tools and lube.
- C) Using the proper press tools & lube press cams into the cam support plate one at a time. Start with the front camshaft making sure the cam fully seats into the bearing & then install the retaining ring. Next align timing marks & press the rear camshaft into the bearing until fully seated.
- D) Rotate cams by hand to verify there is no binding and everything moves freely, also verifying that timing marks are still in line.
- E) Install retaining ring on the front camshaft and verify that it is fully seated in the camshaft groove.



**16.** Apply engine assembly lube to oil pump gears, oil pump housing, camplate oil pump mating surface and pinion shaft bore. Assemble oil pump verifying that all O-rings (HP+/RS oil pumps only) are in place and prime oil pump using an oil can and clean motor oil.



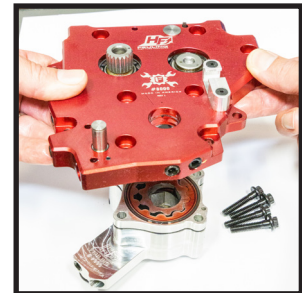
Apply assembly lube to the inside of the pump housings.



Lubricate the inner & outer gear sets.

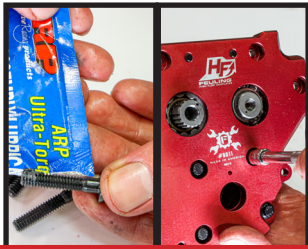


Lubricate O-rings and stretch O-rings if needed.

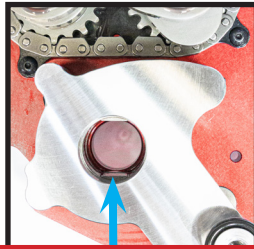


Attach oil pump to the camplate finger tight.

**17.** Using moly lube on the threads and under head flange of the oil pump bolts install the oil pump to the cam support plate finger tight, align the oil pump gears so they are horizontal, and install the O-ring on the back of the oil pump with assembly lube. **DO NOT USE LOCTITE ON OIL PUMP BOLTS.**



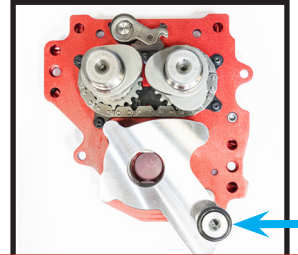
Install oil pump to the camplate finger tight. Note: Use moly lube or engine oil on the fasteners.



Align the oil pump gear flats horizontally to aid installation onto the crankshaft.



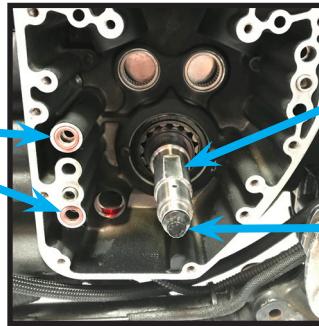
FEULING PART #9017 CAN BE HELPFUL WHEN ALIGNING GEARS



Install O-ring on the back of the pump before installing assembly in the cam compartment.

**18.** Install the O-rings on the left side of the cam compartment, lubing the O-rings, pinion shaft and inner cam bearings. Install pinion sprocket bolt into the pinion shaft and rotate the engine until the flats are horizontal to match the oil pump gears.

O-rings installed in case.



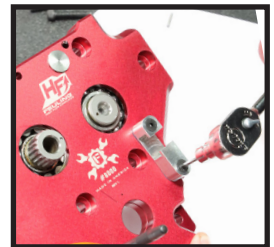
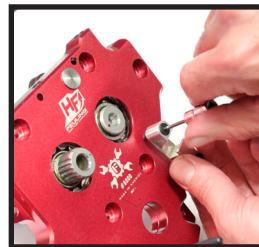
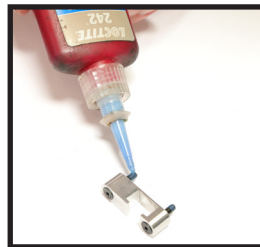
Rotate crankshaft until flats are horizontal.

TECH TIP: The pinion shaft sprocket bolt can be installed into the pinion shaft during engine assembly and used to easily rotate the engine.

**19.** Apply Blue Loctite (242 or 243) to provided chain guide tower hardware. Install chain guide tower to camplate using the two threaded holes on the right side of the camplate face.

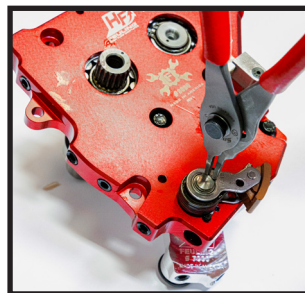


TENSIONER PINS & GUIDE (PART #7078)

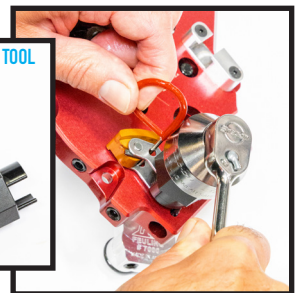


**20.** Install outer cam chain tensioner. Lube pin and tensioner ID. Install tensioner retaining ring, be careful not to over stretch the ring. Use correct tensioner unloader tool and pin the tensioner in position for installation.

**NOTE:** If using optional ARP bolts, the lower left bolt/flange may interfere with tensioner, the unloader tool may be needed to position tensioner in order to insert bolt.

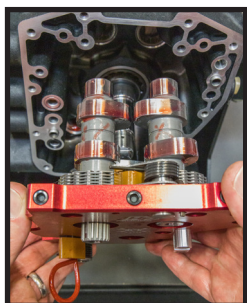


TENSIONER UNLOADER TOOL



**21.** Install Camplate and oil pump into camchest as a complete assembly. Slide the assembly onto the crankshaft, use your left hand fingers or thumb to press inward on the oil pump and use your right hand to guide the camplate onto the dowels. It can be helpful to rock the assembly side to side to help guide the oil pump gears and camplate into position.

**Note:** You should feel positive engagement from the oil pump subseal O-ring.



Using the lifter bores to pull with your right hand can aid in installation.

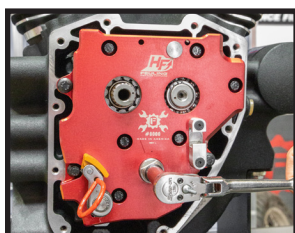
Using your finger or thumb to press pump inward can aid in installation.

**22. TIGHTEN AND TORQUE CAMPLATE BOLTS FIRST, THEN OIL PUMP BOLTS SECOND.**

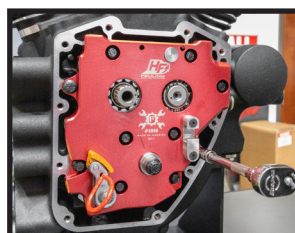
**A) CAMPLATE:** Apply moly lube to the under head flange and threads of the camplate fasteners. Install camplate fasteners finger tight. The engine should be rolled over several times to center the camplate. Alternately tighten the camplate bolts to **10 in-lbs**, then rotate the engine several times again. Using the same alternating sequence final torque camplate bolts to **90-120 in-lbs**.



Install camplate bolts finger tight. Use moly lube or engine oil on the under head flange & threads.



Rotate the engine 4-5 times to align the camplate then tighten camplate bolts to **10 in/lbs**.



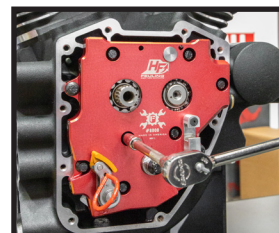
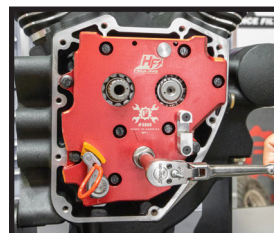
Rotate the engine several more times and final torque to **90-120 in/lbs**.



If using optional ARP bolts, the bolt flange may interfere with tensioner, the unloader tool may be used in order to insert bolt.

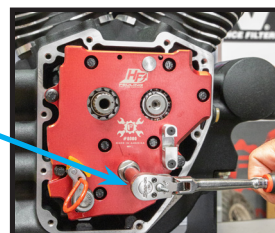
**B) OIL PUMP:** Rotate engine over several times to center oil pump. Tighten oil pump bolts in a crisscross pattern to **10 in-lbs**, then rotate the engine several more times. Step torque oil pump in the following torque steps while rotating engine between steps, **45 in-lbs, 90 in-lbs, final torque to 120 in-lbs**. At this point the engine should be primed with oil & you should see oil coming from the pinion shaft bore.

**NOTE:** The engine should rotate freely throughout the whole process. If there is any binding or tight spots the oil pump should be removed and inspected for possible pinched O-ring or damage.

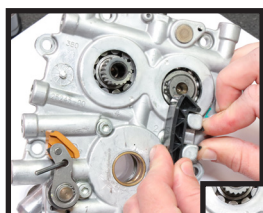


**23.** It is advisable to have clean fresh oil in the oil tank, and while rotating the engine over to center the oil pump & camplate, the system will start to prime and you should see oil come out of the pinion shaft bore. This aids in initial start-up oil psi and lubrication.

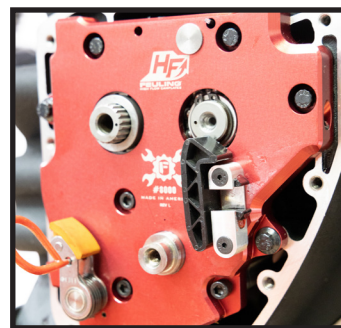
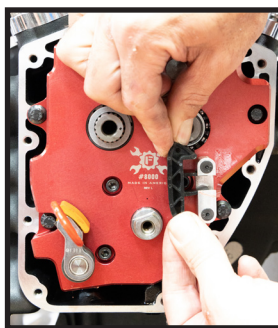
With clean, fresh oil in the tank and a full oil filter, while rotating the engine to center & torque the camplate & oil pump, the system will prime & you will see oil come out the pinion bore.  
Tank must be full enough for the pickup to grab oil.



**24.** Remove OEM chain guide from OEM camplate and install into the FEULING chain guide tower.

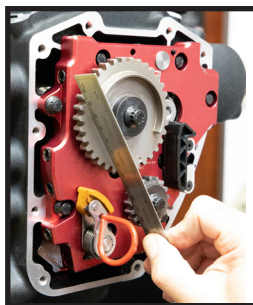
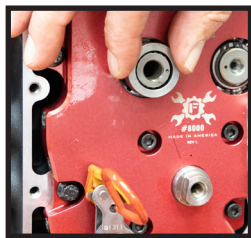


Remove OEM chain guide.



**25.** Install cam sprocket alignment spacer onto rear cam. Install & tighten sprockets. Check sprocket alignment with a straight edge. Use correct alignment spacer thickness to achieve proper sprocket alignment. See FEULING Part #8040 for spacer thickness selection/options. Sprocket alignment is critical for wear & longevity of tensioner pad. Lube tensioner pad & chain guide pad.

**SPROCKET ALIGNMENT SPACERS (PART #8040)**



Use a straight edge to align cam drive sprockets. Alternate size spacers can be used to move rear cam sprocket in & out as needed.



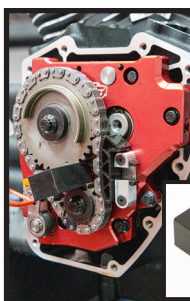
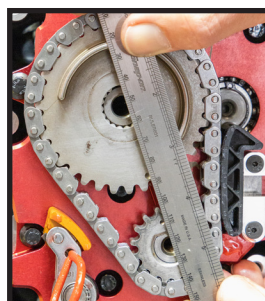
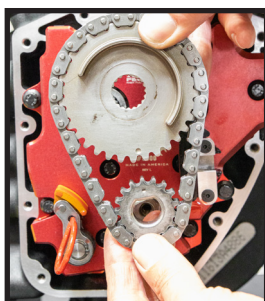
Lube tensioner pad & chain guide pad.



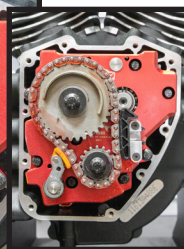
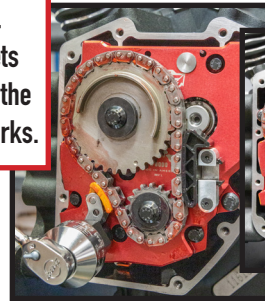
**26.** Install drive sprockets or gears.

**CHAIN DRIVE**

- A) Install chain onto sprockets lining up sprocket timing marks. Install onto cam and pinion shaft. Verify timing marks are aligned with a straight edge.
- B) Using a sprocket locking tool install the sprocket retention hardware. Apply a small amount of molly lube to the under head flange of the bolts and Loctite 263 (Red) to the threads. Both bolts should be initially torqued to **15 Ft Lbs.** and then loosened one full rotation. Final torque the pinion shaft bolt to **24 Ft Lbs.** and the rear cam sprocket bolt to **34 Ft Lbs.**
- C) Rotate engine, verify timing marks line up on rear cylinder TDCC. Lube tensioner pad & guide. Use tensioner unloader tool, remove pin, and gently lay tensioner onto chain. Rotate engine, verify assembly rotates freely.

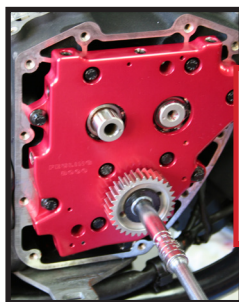


Install sprockets lining up the timing marks.

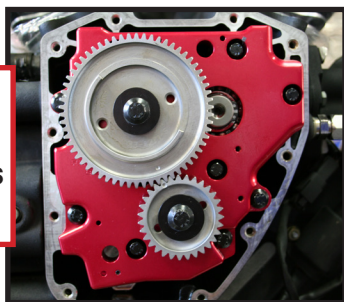


**GEAR DRIVE**

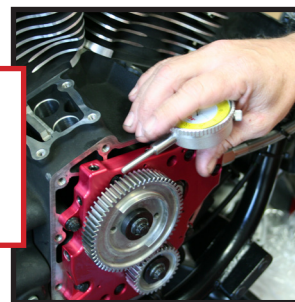
- A) Install gears lining up timing marks. Always verify that cam gear backlash is within tolerance. See cam gear manufacture instructions for procedures and specifications.
- B) Apply a small amount of molly lube to the under head flange of the bolts and Loctite 263 (Red) to the threads. Both bolts should be initially torqued to **15 Ft Lbs.** and then loosened one full rotation. Final torque the pinion shaft bolt to **24 Ft Lbs.** and the rear cam sprocket bolt to **34 Ft Lbs.**



Install outer crank & cam gear lining up the timing marks with rear TDCC.



Check gear backlash and verify within tolerance.



**27.** Pump up lifters using an oil squirt can and install into the engine case along with the anti-rotation pins. Install new lifter block gaskets and lifter block covers. Apply Loctite 243 (Blue) to lifter block fasteners and torque to **120 In. Lbs.**

**Note:** Feuling lifters are not directional. However, it is recommended that all lifter oiling holes are oriented the same direction.

Install new lifter block gaskets & torque to **120 in. lbs.**



**OIL CAN (PART #9005)**

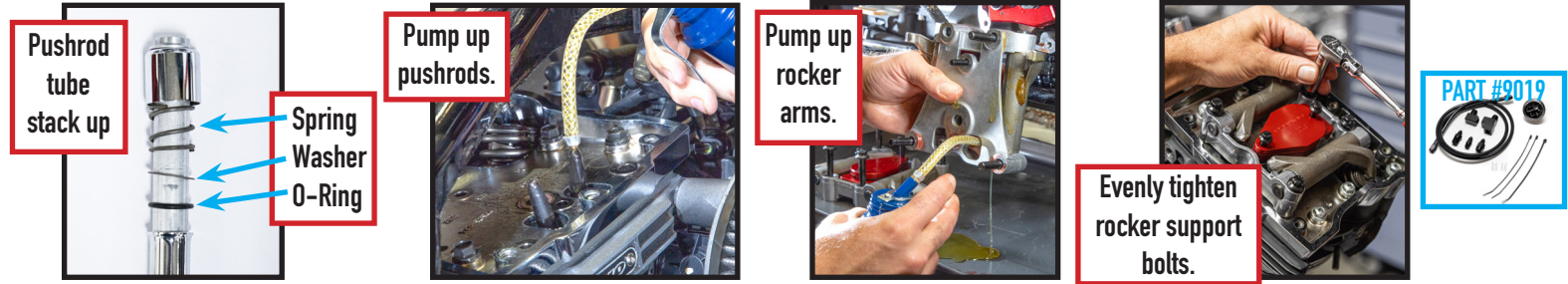
Pump up lifters before installing into the lifter bores.



Install lifters into engine case with anti-rotation pins.



**28.** Prep pushrod tubes, cylinder heads & lifter blocks with new O-rings. With your sprocket timing marks aligned the rear cylinder is on TDCC, the rear lifters are ready for pushrod installation. See tech notes below on One Piece & Adjustable pushrod installation. Pump up pushrods & rocker arms with an oil squirt can during installation. After rear lifters have bled down (10-25 min) & you can rotate the pushrods by hand, you are now ready to install front pushrods. Rotate engine to front TDCC & install front pushrods. See **pro tip** below.



**29.** Finish assembling the motorcycle following the factory service manual. If the motorcycle is not equipped with an oil pressure gauge Feuling recommends using a remote oil pressure gauge to verify that the motorcycle has good oil pressure at initial startup. See Feuling **#9018** an **#9019**.

**ONE PIECE PUSHRODS FULL TRAVEL PART # 4072 & 4073 SHORT TRAVEL PART #4074 & 4076**

- A) Install the rear cylinder pushrods and pushrod tubes verifying that the intake and exhaust pushrods being installed into the correct position. Prime pushrods with oil using an oil squirt can. **NOTE:** longer pushrods are the exhaust.
- B) Install new lower rocker box breather o-ring and then install the rear rocker arm support using Red Loctite (262 or 263) on the bolts. Using a crisscross pattern bring down the rocker arm support evenly. Once the rocker support is seated final torque the rocker arm support fasteners to **18-22 Ft. Lbs.**
- C) Install new breather filter element, umbrella valve and gaskets. Using Blue Loctite (242 or 243) torque the breather bolts to **120-156 In. Lbs.**
- D) Install rear rocker cover & new gasket. Using Blue Loctite (242 or 243) torque the six rocker cover fasteners to **15-18 Ft.Lbs.** using a crisscross pattern.
- E) Verify that the rear cylinder pushrods have bled down by rotating the pushrods by hand. If the pushrods will not spin by hand the lifters have not bled down. If they do spin by hand install the pushrod tube clips.
- F) Rotate the engine over one full revolution. Your pinion sprocket timing mark should be back in the same spot and the timing mark on the cam sprocket/gear should be 180 degrees off. With your engine in this rotation you now have the front cylinder on TDCC and can install the pushrods, rocker arms, and rocker cover repeating steps A-F.

**ADJUSTABLE PUSHRODS 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")

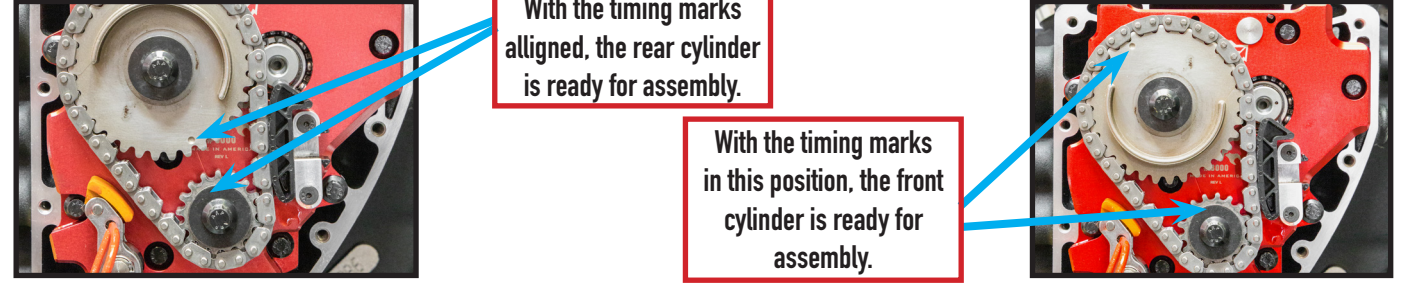
\*Always start with fully pumped up lifters! When using adjustable pushrods start at zero lash & adjust the pushrod longer, crushing the lifter to add pre-load. We DO NOT recommend bottoming the lifter & adjusting back upwards.

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

**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

**REAR TDCC PRO TIP: FINDING FRONT & REAR CYLINDER TDCC FRONT TDCC**



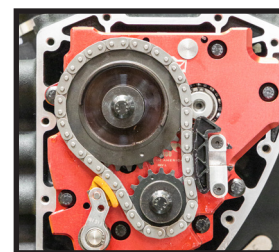
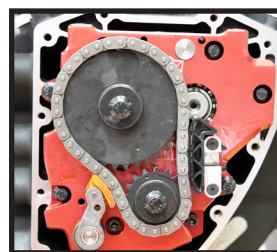
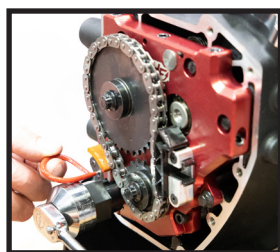
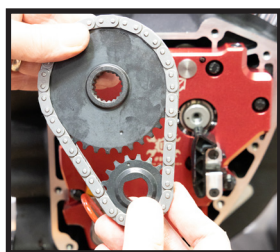
With the timing marks aligned, the rear cylinder is ready for assembly.

With the timing marks in this position, the front cylinder is ready for assembly.

\* With the cam cover off during top end assembly you can easily rotate the engine and determine the stroke of the engine. This is a simple and precise way to determine which cylinder is on TDCC. \*



**30. Newer outer roller chain & sprockets from '07-'17 engines can be used with the mechanical tensioners – see images below:**



## FEULING® REAPER CAM SPECS FOR TWIN CAM® ENGINES

Grind	Valve Lift	Open	Close	Duration @ .053"	Lift @ TDC	Lobe Centerline	Overlap	Description
525	Intake 525" Exhaust 535"	4° 51°	42° 5°	226° 236°	.099" .112"	109° 113°	9	A real workhorse. Bolt in for 88-103 engines. Producing strong low and mid range power. 1750-5500 RPM
543	Intake 543" Exhaust 553"	15° 56°	43° 12°	238° 248°	.160" .140"	104° 112°	27	"The Freeway Flyer". An Excellent compromise between the 525 and 574 achieving the best all around performance. Bolt in for 96 and 103 engines. 1900-6000 RPM
574	Intake 574" Exhaust 574"	15° 61°	45° 14°	240° 255°	.163" .143"	105° 113.5°	29	Wicked power band for 103 and larger engines. Responds well to head work and increased compression. Go to bolt in camshaft for 110 engines. 2100-6500 RPM
594	Intake 594" Exhaust 604"	19° 64°	56° 16°	255° 260°	.190" .167"	108.5° 114°	35	Freight train pulling power. Works best with larger displacement engines and added compression. Will respond well to ported heads and open intake. Requires high lift valve springs. 2200-6250 RPM
630	Intake 630" Exhaust 630"	20° 60°	58° 19°	258° 263°	.188" .171"	109° 112.5°	39	Eye blurring mid and top end power. Designed for worked 120+ engines. Requires high lift valve springs. 2500-6900+ RPM

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## FEULING® TWIN CAM® TROUBLE SHOOTING GUIDE

Having oiling, noise, sumping issues with your Twin Cam engine? Please review the trouble shooting guide that Feuling has compiled over the years to help assist you.

**ALWAYS CHECK YOUR OIL PRESSURE – WHAT IS YOUR OIL PRESSURE COLD? HOT?**

### LOW OIL PRESSURE

1. Check and verify engine oil level.
2. Pressure gauge not reading properly – double check with another mechanical PSI gauge.
3. Pressure relief valve in the camplate is leaking, sticking open or not seating properly – see Feuling camplate PSI test tool Part #9010.
4. Broken oil pump gears due to debris and excessive crankshaft runout.
5. Pinched oil pump O-ring(s).
6. Loose camplate/oil pump bolts, stripped camplate 'dowel pin' bolts.
7. Camplate scored at oil pump mounting surface, pressure gears and/or housing scored from debris running through oil pump.
8. Excessive crankshaft pinion shaft runout causing oil cavitation.
9. Intermittent oil psi loss on bagger/FL models during hard acceleration – oil tank baffle shifted & blocking oil pick up hole.
10. Mis-alignment of oil pump – center camplate to pinion shaft then oil pump to pion shaft by rotating engine over while tightening bolts.
11. Leaky piston cooling jets.
12. Leaky camplate hydraulic tensioners ('07-'17 including '06 Dyna models) – when tightening outer tensioner push tensioner toward chain.
13. '99-'06 leaking fittings and/or issues with the 90 degree rubber oil lines, sucking/pulling air. Oil line broken on the inside causing a "flapper valve".
14. '99-'06 style hydraulic tensioner camplates using bearing retainer plates – plate was not installed causing a leak through one of the bolt holes.
15. '07 & later inter connect gasket seal leaking, sucking/pulling air – check transmission to engine mounting bolt torque & oil around mating seam.
16. Camplate top plug not sealing, camplate leaking at oil passages – warped camplate.

### NO OIL PRESSURE

1. Check & verify engine oil level.
2. Pressure relief valve stuck open in camplate – see Feuling camplate PSI test tool Part #9010.
3. Missing plug in camplate face (boss vs. no boss).
4. Air lock in oiling system – fill oil filter full of oil – if this is initial engine start up.
5. Broken oil pump gears – gears & housings not lubricated properly during install, debris running through engine, excessive crankshaft runout.
6. Broken/loose piston cooling jets.
7. Stock oil pump installed on Feuling High Flow camplate.
8. Blocked pick up part in oil tank. Possible debris from prior failure.

### TENSIONER WEAR

1. Dark discoloration – indicator of excessive heat, check tune, oil quality & oil change intervals.
2. Excessive wear – excessive crankshaft runout, excessive crankshaft end play, sprocket mis alignment, sprocket runout, burrs on chains and or damaged chains, lack of oil changes, excessive heat due to improper tune, poor oil quality.

# FEULING® TWIN CAM® TROUBLE SHOOTING GUIDE (CONTINUED)

## WET SUMPING / BLOW-BY

1. To verify the engine is wet sumping, run engine to operating temperature then shut down it down & pull the allen head plug from the bottom of the engine case. Measure oil & if more than 5oz. drains from the sump there is a wet sumping issue.
2. Oil level too high – run oil level no more than ¾ - 7/8 full cold, check oil level per owner's manual.
3. Sub seal of oil pump mis aligned with the scavenge port hole of the engine case & or torn o-ring.
4. Piston rings not seated, creating excessive blow by & oiling system cavitation, run a cylinder leak down test – vent oil tank – See Feuling vented dipsticks & oil tank breather kits.
5. Scavenge gears and or housing scored from debris running through the oil pump causing out of tolerance scavenge side of oil pump.
6. Excessive runout in pinion shaft – causing oil pump/system cavitation.
7. Pinched oil pump O-ring(s).
8. FL/Baggers – 6 speed transmission with dipstick in rear of trans can allow more oil to be added to oil tank and not show on the dipstick.
9. Excessive RPM on rev limiter, de-seated piston rings.
10. Flapper umbrella valves in rocker box breathers stuck or installed incorrectly.
11. Rocker box breathers need to be serviced – new filter, umbrella valve & gaskets (See Part #3200).
12. Return oil passages plugged, pick-up hole in crankcase plugged.
13. '99-'06 leaking fittings and or issue with the 90-degree rubber oil lines, sucking/pulling air.

## DIPSTICK BLOW OUT

1. Oil level too high, run oil level ¾-7/8 full cold.
2. Rocker housing gaskets are incorrect or were installed improperly. Note: some S&S heads require special lower gaskets.
3. Excessive cylinder leak down – run a cylinder leak down test.
4. Breather valves in rocker boxes installed incorrectly, it's common to find them installed upside down with the flapper below the breather element.
5. Spark knock, piston detonation, rings not seated or coming un-seated under hard acceleration.
6. Excessive RPM on rev limiter, de-seating rings.
7. Vent oil tank – see Feuling vented dipsticks or oil tank breather kits.
8. Use conventional oil over synthetic for better ring/cylinder seal.

## NOISY VALVE-TRAIN

1. Lifter to lifter bore clearance too large. Feuling recommends a clearance of 0.001"–0.0015" for proper lifter performance – see tool #9004 and oversized lifter #'s 4051, 4052.
2. Pushrods flexing and hitting pushrod tubes – look for shiny ring witness mark around pushrod normally seen towards the cylinder head.
3. Low oil pressure – Check with mechanical gauge if one is not equipped on the bike, refer to low oil pressure section if necessary.
4. Rocker arms/bushings out of tolerance.
5. Bad valve spring to camshaft combination creating valve-train separation – see Feuling Beehive spring kits.
6. Insufficient 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 spring kits.
8. Pushrod center hole plugged.
9. Leaky or broken piston cooling jets.
10. Oil filter with failed or missing anti-drain back valve, causing valve-train noise at initial start up.

## ENGINE NOT ROTATING

1. Pinched O-ring in oil pump.
2. Burr on oil pump gear eliminating the side clearance of oil pump, pump locks up as soon as bolts get tight.
3. Debris inside oil pump teeth, binding gears.
4. Dry oil pump housing and gears.
5. Gear drive cams on '07-'17" not installed correctly, possible use of washer behind rear cam gear.
6. Cam/ cam chain tensioner assembly cocked, creating binding especially with '07-'17 models... Use lube.

### \* 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)

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'99-'06 (EXCLUDES. '06 DYNA)



TWIN CAM

# FEULING® BEEHIVE VALVESPRINGS



*QUICKER REVVING - SMOOTHER MOTION - LIGHT WEIGHT TI RETAINERS*

**FEULING® ECONO BEEHIVE®** valvesprings – direct bolt in & designed to run on stock to mild camshafts at an economical price. These BEEHIVE® springs are made from the same premium stress relieved conical ovate wire as our High Load springs but developed for economical engine budgets. They have an excellent level of fatigue life & are made to handle the demands of mild performance engines with 585” & smaller lift camshafts. Dyno proven & track tested.

**FEULING® ENDURANCE BEEHIVE®** valvesprings are a direct bolt in replacement, no spring seat or rocker cover machining required up to 650”. Endurance springs are machined from a premium grade Hi-tensile chrome silicon single conical ovate wire, shot-peened with a specially processed thermal heat treat and super NexTex® finish to give these valve springs the needed fatigue life to exceed the high demands of engines from stock to performance.

**FEULING® HIGH LOAD BEEHIVE®** valvesprings handle up to 750” lift camshafts for TC and 650” lift on M-Eight engines. Designed for steep ramped large lift aggressive camshafts – These Feuling® valvesprings are made from premium stress relieved conical ovate wire with a nitrided surface heat treatment, shot-peened surface enhancements along with a Nano Peen™ polish. They have an extremely high level of fatigue life and are designed to handle the highest demands of performance engines with high lift, steep ramped camshafts. Dyno proven and track tested – best matched with Race Series Lifters.

**ECONO**



**ENDURANCE**



**HIGH LOAD**



PART #1120: w/ Steel Retainers // TC '84-'04  
PART #1121: w/ Steel Retainers // TC '05-'17  
PART #1122: TC '84-'04 // w/ Ti Retainers  
PART #1123: TC '05-'17 // w/ Ti Retainers

PART #1100: w/ Ti Retainers // TC '84-'04  
PART #1101: w/ Ti Retainers // SE HEADS  
PART #1105: w/ Ti Retainers // TC '05-'17

PART #1200: w/ Ti Retainers // TC '84-'04  
PART #1201: w/ Ti Retainers // SE HEADS  
PART #1205: w/ Ti Retainers // TC '05-'17

## ROCKER BOX BREATHERS FOR TWIN CAM ENGINES

FEULING Rocker box Breathers for Twin Cam engines. Properly sized breather holes for optimum engine breathing. Machined from billet 6061 aluminum with square surfaces promoting excellent gasket and breather system sealing. Anodized Feuling red. Kits include: billet breather housings, gaskets, breather filter elements, umbrella valves and ARP hardware. **MADE IN THE USA**

**NOTE:** Rocker Cover Gaskets purchased separately

PART #3200

DRAG #1012-0247

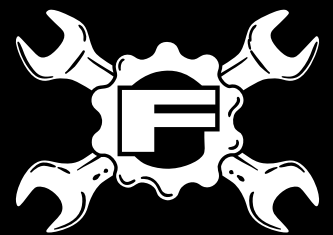
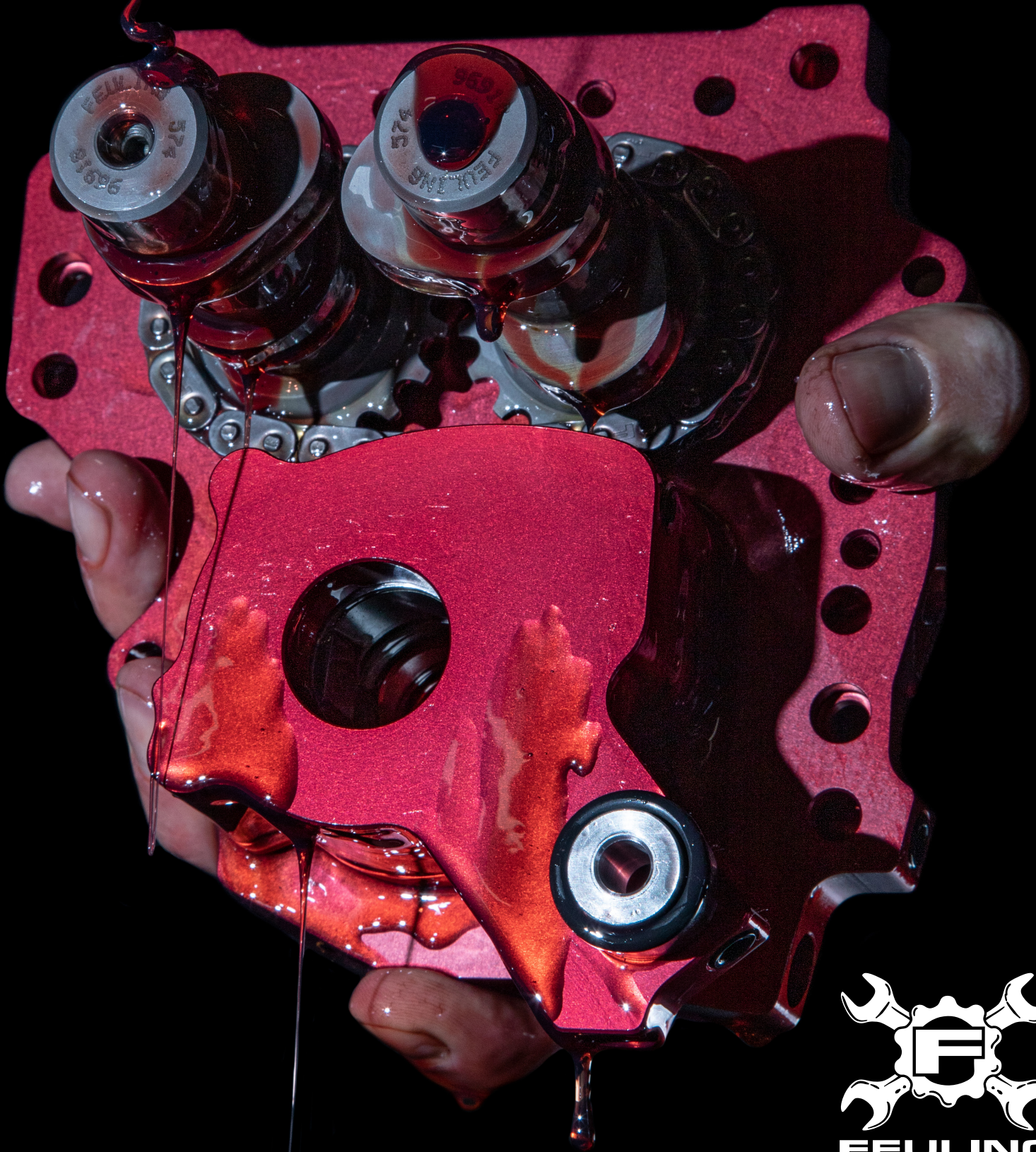
ROCKER BOX BREATHERS // FITS: TWIN CAM '99-'17

\$ 199.95



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

**THINGS OF QUALITY** **HAVE NO FEAR OF TIME**



**FEULING**

'99-'06 (EXCLUDES '06 DYNA)

GEAR DRIVE & CHAIN DRIVE  
WITH MECHANICAL TENSIONERS