

Twin Cam Gearcase Upgrade

Part II: Feuling and Andrews install

IN PART I, WE COVERED WHY THE SPRING-LOADED CAM-shaft chain tensioners in 1999–2006 Twin Cam-powered bikes (except 2006 Dynas) wear out in 20,000–40,000 miles and why it's smart to upgrade to the hydraulic tensioners found in later model Twin Cam engines. We also talked about why you must use special conversion camshafts when changing a spring-loaded tensioner Twin Cam engine

to a later-model hydraulic tensioner and cam support plate setup. Since you have to change the camshafts for this upgrade, we went with performance camshafts from Andrews Products that would give the bike a nice boost in pulling power without requiring any headwork or a stronger, harder-to-pull-in clutch. As the accompanying dyno chart shows, that's exactly what these Andrews cams delivered! Of course, our 2005 Big Twin was already equipped with a high-performance air cleaner and exhaust system. These upgrades must be done to get the full benefit of a performance camshaft, no matter the brand or lift/duration. The fuel injection



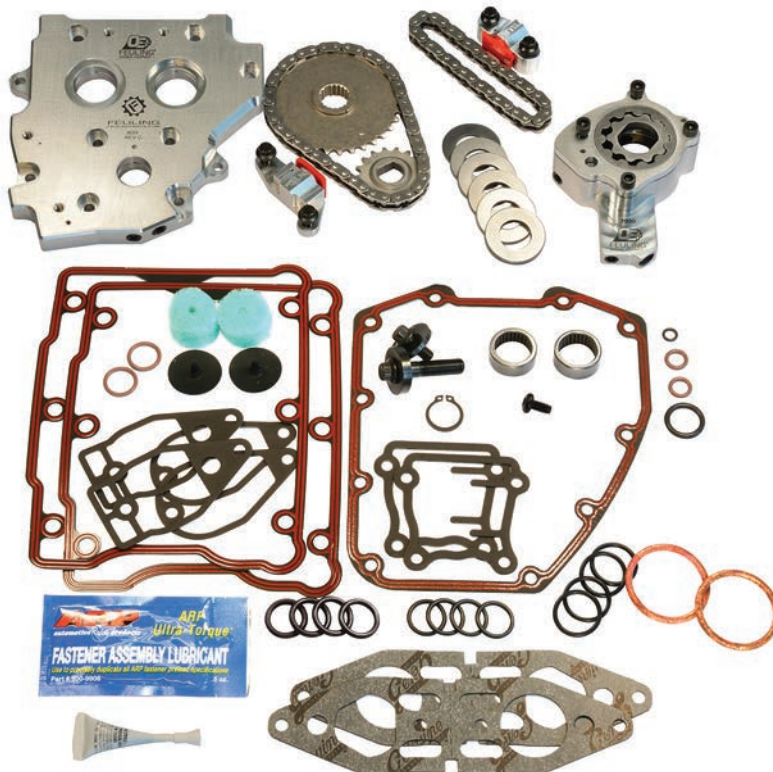
system must also be readjusted after the installation, or engine damage due to a very lean fuel mixture will occur. In this article, we're going to cover the rest of the components we used for this build and finish the installation.

As for the other components needed to upgrade the entire gearcase compartment, we contacted the crew at Feuling to get one of their excellent Hydraulic Cam Chain Tensioner Conversion kits (#7088/\$729.95). This kit includes a Feuling billet aluminum oil pump, cam support plate, and hydraulic tensioners. Also included are both cam chains and sprockets, a full set of sprocket alignment spacers, two Timken inner cam bearings, as well as Loctite and moly lube. All-new ARP 12-point chrome moly hardware for the cam support plate, oil pump, rear camshaft sprocket, pinion shaft sprocket, and chain tensioner is also supplied. Finally, all needed gaskets and O-rings, including rocker box gaskets so the factory one-piece pushrods can be reused if you don't want to run adjustable pushrods as we did, is also included. This kit fits all 2002–06 Delphi ECM-equipped engines. The kit's 34-tooth rear cam sprocket does not have the Hall effect timing tab on its face that's needed for the Magneti-Marelli fuel-injection system found on early rubber-mounted Twin Cam engines. If a sprocket with this timing tab is needed for your engine, Andrews offers sprocket #216015. Of course, Feuling has a variety of gearcase compartment upgrade kits available for all Twin Cam and Milwaukee-Eight engines, as well as its own line of performance camshafts. All Feuling products are made in the USA.

Feuling's bolt-in replacement, 6061 billet aluminum, OE+ cam support plates are more rigid and machined to finer tolerances than the stock H-D cast aluminum support plates. The

TOOLS NEEDED

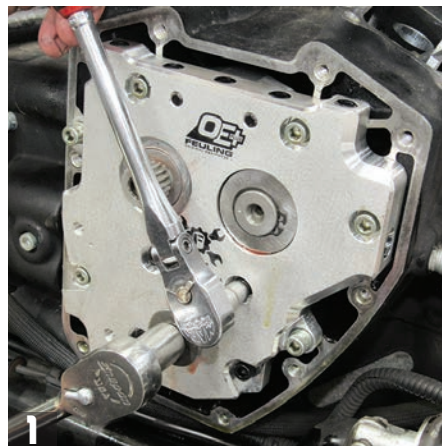
- Flat-bladed screwdriver
- 3/16" Allen
- 9/32" wrench
- 1/2" wrench (2)
- 5/16" socket
- 3/8" socket (12-point)
- Flat feeler gauge
- Steel straightedge
- Sprocket locking tool
- Pushrod tube holder
- Torque wrench (in-lbs.)
- Torque wrench (ft-lbs.)



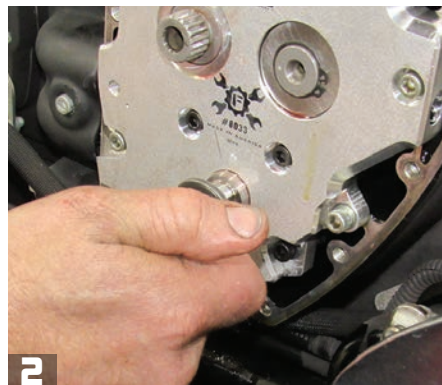
pressure relief valve and spring are pre-set, matched, and seated by Feuling with a pop off pressure of 50–60 psi. These support plates will accept the factory oil pump and feature a tighter cam journal bore tolerance for improved cam fitment, added oil pressure feed holes to the front and back of the cam journals to prevent excessive thrusting wear, and an additional cam journal oil groove for cold start protection and increased cam journal lubrication.

Feuling's bolt-in replacement, 6061 billet aluminum, OE+ oil pumps provide 16-percent more scavenge volume and 10-percent more oil pressure and feed volume than the stock H-D pump. These pumps feature chrome moly gerotor gears and assemblies without pump housing O-rings like H-D's stock and SE oil pumps.

The inner and outer chain tensioners supplied in this kit are bolt-in replacements for the stock units and are precision machined from billet 6061



1 With the support plate loosely attached to the right case, Dan uses a 5/16" socket to tighten the support plate and oil pump bolts to 40 in.-lbs., then 80 in.-lbs., and a final torque of 120 in.-lbs. in a crisscross pattern as he rotates the engine.



2 Dan can now remove the stock pinion shaft bolt and flat washer using a 1/2" socket and sets them aside. They will no longer be needed.

WE'RE GOING to be using three special tools in this part of the build. The first is a JIMS cam/crank sprocket lock tool. This tool, which is made from non-marring Delrio, allows you to lock the camshaft and crankshaft sprockets so you can properly remove, replace, and torque the sprocket bolts. We're using tool #1285, which is for all 1999-06 Touring, 1999-05 Dyna, and 2000-06 Softail Twin Cams. JIMS offers tool #994 for all 2006-17 Dyna, 2007-18 Softail, and 2007-17 Touring and Trike Twin Cams.

SPECIAL TOOLS

The second tool is a Feuling pushrod tube holder #9012, which Dan uses to hold the pushrod up and out of the way when he's adjusting the pushrods. However, you can also use a long spring to do the same thing.

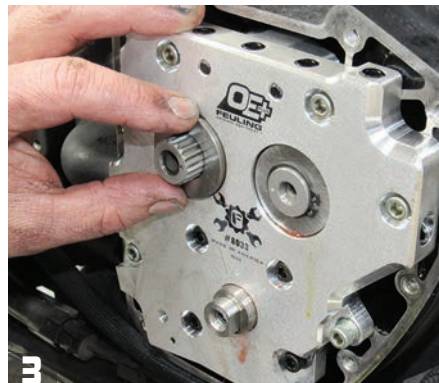
The third special tool you'll see Dan using is a pushrod retainer tool, which makes removing and installing the stock pushrod tube top retainers really easy. Of course, you can also use a flat-bladed screwdriver, but it takes a little more effort and finesse. ■

aluminum. The chain pads are injection-molded nylon with Teflon added to increase wear and friction resistance. These tensioners are single-piston units that have the same output pressure as the stock units. As for Feuling's sprockets, both stock replacement roller chain sprockets are made of machined steel, and the pinion shaft sprocket has a tighter tolerance fit to the pinion shaft than the stock units.

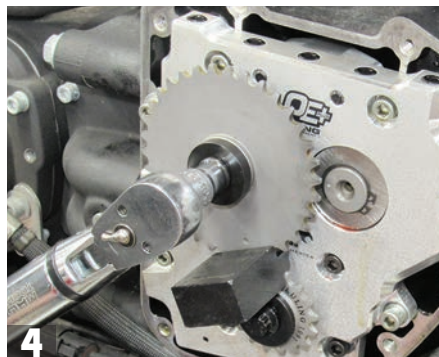
We also got a set of Feuling's per-

formance HP+ lifters (#4000/\$159.95), which are CNC-machined and precision ground units that are bolt-in replacements for the stock lifters. However, Feuling recommends you also install a Feuling or comparable high-volume oil pump if using its lifters. Feuling's performance HP+ lifters increase oil flow to the valves, valve springs, valve guides, rocker arms, and rocker arm shafts.

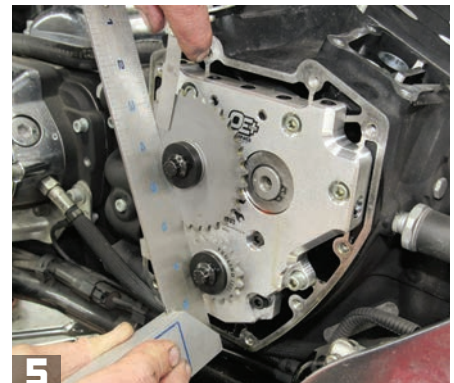
To make this installation go quicker and easier, we also got a set of Andrews



3 Dan reinstalls a new Feuling 0.130" cam spacer onto the end of the new Andrews rear camshaft. He then positions both new Feuling sprockets onto their respective shafts.



4 Dan secures both new Feuling sprockets using the new Feuling bolts and washers, a sprocket locking tool, and a 12-point 3/8" socket. He torques the pinion bolt to 24 ft.-lbs. and the cam sprocket bolt to 34 ft.-lbs.



5 With a steel straightedge across the tooth section of both sprockets, Dan uses a flat feeler gauge to check if the sprockets are aligned. Our gap is 0.020"; the maximum is 0.010", so Dan installs a new Feuling 0.140" spacer.



6 After he removes and positions both new Feuling sprockets in the new Feuling cam chain with their timing dots aligned, he slips both sprockets onto their shafts. They can only go on one way.

AFTER BOTH SPARK PLUGS are removed so the engine can be rotated easily, Dan uses a 1/2" socket on the pinion shaft bolt to rotate the engine as he torques the oil pump bolts, as per the H-D procedure.

TIPS & TRICKS

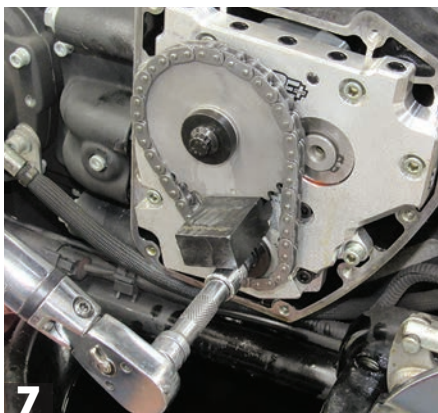
Dan prefers to use a hand pump oil can to fill new lifters with motor oil before installing them. However, submerging the lifters in new motor oil for about two hours before installing them will also do the job.

Before installing a cylinder's pushrods, rotate the engine so both lifters for that cylinder's valves are at their lowest position, which is when the piston is at top dead center of its compression stroke. The easiest way to do this is to remove both spark plugs, lift the rear wheel off the ground, put the transmission in third gear, and rotate the engine using the rear wheel.

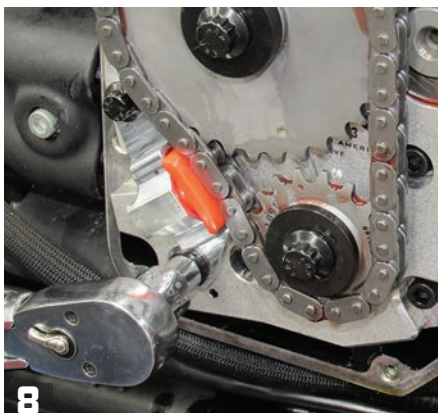
When positioning an intake pushrod and tube over its lifter, be sure to come in on the exhaust pipe side of the lifter cover. If you try to swing the pushrod in from the intake manifold side, the pushrod will be slightly too long to get past the lifter cover even when fully collapsed (shortened).

Once the lifters for the pushrods you just adjusted have bled down, which is when you can turn the pushrods with just your fingers, rotate the engine so the lifters for the other cylinder are at their lowest position. Once the second set of lifters have bled down, rotate the engine to make sure the valvetrain operates correctly before closing up the pushrod tubes. ■

Products anodized aluminum EZ-Install pushrods (#292188/\$202.63), which are also available in chrome moly steel. (Extra long or short pushrods are also available as special items.) EZ-Install pushrods can be installed without removing the gas tanks or rocker boxes. However, Andrews recommends swapping out the four stock Twin Cam upper pushrod tubes with H-D's shorter upper tubes (#17938-83) and the stock Twin Cam pushrod tube retainers for H-D's earlier retainers (#17634-99). This



Using the new Feuling bolts and washers, an H-D sprocket locking tool, some red Loctite, and a 12-point 3/8" socket, Dan torques the pinion bolt to 24 ft.-lbs. and the cam sprocket bolt to 34 ft.-lbs.



After removing the sprocket locking tool, Dan installs the new Feuling outer hydraulic tensioner using new Feuling bolts and fastener assembly lubricate. He uses a 5/16" socket to torque the bolts to 90-120 in.-lbs.



After filling the new Feuling lifters with motor oil via a pump oil can, Dan drops the new lifters into their bores in the right crankcase with their flat sides towards the front and rear wheels.



Next in are the two stock lifter anti-rotation devices, one for each cylinder's two lifters.



With new Feuling-supplied Comet gaskets in place, Dan reinstalls the two stock lifter covers using the stock bolts, blue Loctite, and a 3/16" Allen. He torques the bolts to 90-120 in.-lbs. in a crisscross pattern.



After removing the old ones, Dan installs the new Feuling-supplied Comet O-rings into the stock pushrod tubes, lifter covers, and rocker boxes. He then rotates the engine so the rear lifters are at their lowest point.



After Dan slips a new Andrews EZ-Install adjustable intake pushrod (there are two intakes and two exhausts) into a stock pushrod tube, he positions the pushrod and tube onto the engine. Next in is the exhaust pushrod and tube.



14 Using a 9/32" wrench and two 1/2" wrenches, Dan adjusts the Andrews EZ-Install pushrods as per the Andrews instructions regarding number of turns, etc. He then lets the rear lifters bleed down.



15 Once Dan has installed and adjusted the front pushrods, and has rotated the engine to check the valvetrain, he uses a special tool to pop in the stock pushrod tube retainers, but you can also use a flat-bladed screwdriver.



16 After putting the new Feuling-supplied Comet gasket on the right crankcase, Dan reinstalls the stock cam cover using the nine stock bolts, blue Loctite, and a 3/16" Allen. He torques the bolts to 90-120 in.-lbs.

change will make it easier to access the adjuster on the EZ-Install pushrods. And though this is true, we ended up using the stock Twin Cam pushrod tube assemblies. It was a tight fit, but Dan has a lot of experience with Andrews' fine line of pushrods, which, like all Andrews products, are made in the USA.

As stated earlier, after you install this Andrews or any cam, the engine's air/fuel mixture settings must be readjusted or the engine will run way too lean, causing engine damage. Dynojet's Power Vision flash tuner (\$439.63) is an easy system to use and it allows you to access all the parameters you need to dial in the bike's fuel delivery system for this or any new camshaft. In fact, the Power Vision can be used for any

modification you want to make to the engine, be it a minor upgrade like an air cleaner or a major one like increasing the engine's displacement. The Power Vision comes with a detachable screen that you use to reprogram the bike's stock ECM. This screen doesn't stay on the bike. It's provided to give you easy access to the ECM, so you can alter the ECM's fuel maps, etc. without a computer. In fact, Dynojet has thousands of tuning maps available, so there's a free downloadable map ready for almost every air cleaner, exhaust system, or cleaner/pipe combination you can make to your bike. We've used a Power Vision tuner on many *American Iron Magazine* projects and have always gotten excellent results.

As stated last month, when it was time to pick a shop to do the wrenching for us, we went to see our longtime friends Rob and Dan at Rob's Dyno

Service. Rob's Dyno is our go-to shop. It is a full service facility for all things Harley-Davidson, Indian, and Victory, as well as lots of metric brands. These guys are always a pleasure to work with and they do high-quality work. Plus, it definitely makes things easy when the shop doing the performance work can also correctly retune the engine! The accompanying dyno chart shows two sets of horsepower and torque readings. The baseline set show what we had after we installed an S&S performance air cleaner, which we'll show you how to install in a future issue. The bike was already fitted with a set of S&S 4" Power Tube performance mufflers when we got the bike. The second set of power readings show the power increases we got after this two-part build was done and Rob had reset the fuel mixtures using a Power Vision tuner. **AIM**

SOURCES

Andrews Products

TW-88 Aluminum Pushrods (EZ Install)
#292188, \$202.63
847/759-0190
AndrewsProducts.com

Dynojet Research

Power Vision
\$439.63
702/399-1423
Dynojet.com

Fueling

OE+ Hydraulic Cam Chain Tensioner Conversion Kits
#7088, \$729.95
HP+ Lifters
#4000/\$159.95
866/966-9767
FuelingParts.com

Rob's Dyno Service

978/895-0441
RobsDyno.com

