MOTORHEAD memo

by Kip Woodring

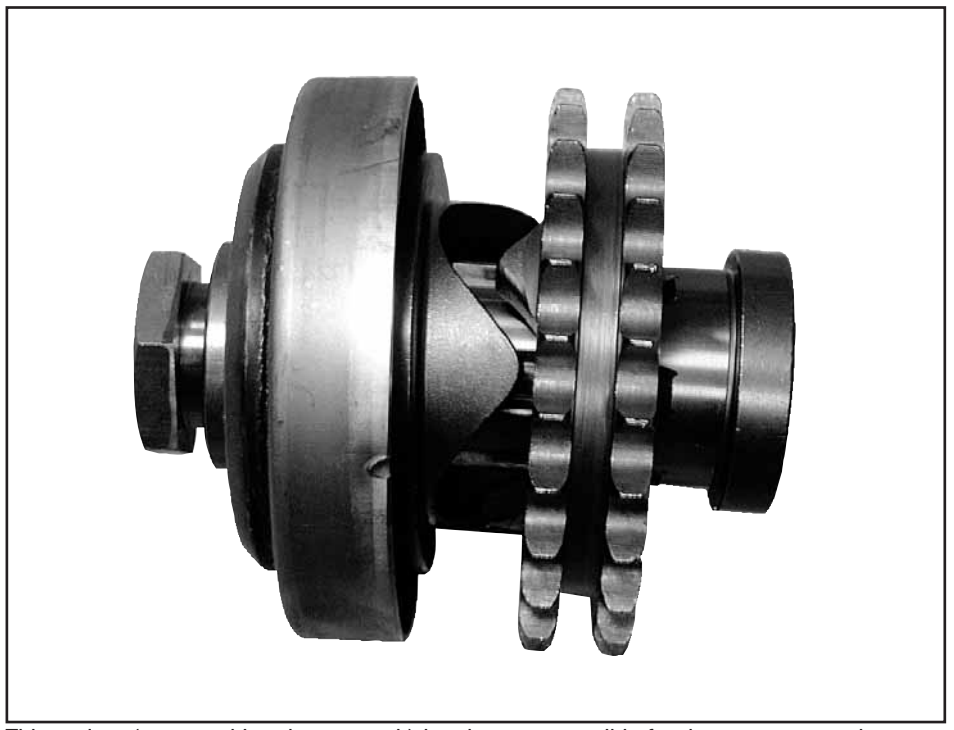
I suppose it had to happen sooner or later. I mean what with (as Mr. Editor Roorda calls it) "our obsession with displacement" resulting in 96" 2007 Big Twins, it was inevitable. Yup, I am naturally referring to the total redesign of a 36-year-old drivetrain shock absorber system, commonly known as the "compensator."

You've heard it before—the two gremlins that still have the most potential for leaving you stranded alongside the road on a 21st century motorcycle remain either basic fuel delivery or electrical problems. (These days "basic" injected fuel delivery is also electrical in nature, so maybe that's down to one and a half things?) The point is, more than ever, a lot is riding on reliable current flow for your ride. So, by incorporating the alternator rotor into the compensator the primary drive chain and into the transmission. Since the factory figured out that having a cushion off the crank did everything from keeping parts alive to making the riding experience less primitive and abrupt, every Harley has come with one. As imperfect as the execution(s) might be, you do without this shock absorption at your own peril, particularly when the pulsating energy of this latest 4 3/8" stroke engine is factored in.

Since you'd have to be Rip Van Winkle not to be aware of the constant upward creep of not only sheer displacement, but the lovely buckets of torque that go with them, I feel it's not too much of a "shock" to say there's never been a greater need for this kind of compensation! Sure, we all know about the trick new six-speed gearbox, the extra stroke and sprinkled throughout the primary drive and transmission, trying to live out a normal span of working life under adverse conditions—oh, and owners who think the bottom end is falling out of their machines when they hear ominous grumbling noises—which, by the way, are almost invariably made by a compensating sprocket that has come undone. Don't think it's uncommon either—it could even happen to you!

Think about it. In the last three and a half decades, we've gone from 74 inches of Shovelhead motivation, to 96 inches of Twin Cam twist. Along that route stock-standard torque has roughly doubled, to say nothing of what happens when such displacements are made more efficient, increased significantly... or both! Inevitably, this makes things ever tougher for most everything that come loose at some point in the life of the bike, even unto the present day. So in a way, making the two parts into one, à la the '07 redesign, is a logical solution, although in my view a potentially risky one. Counting the 2007 iteration, there have been five modifications and/or redesigns of the compensator and more than a few attempts at rethinking the best methods for keeping it in its place. Most coincide nicely with the increasing jackhammer treatment of primary drive components that results from a longer stroke. Only time will tell if what Harley hath wrought for this model year will hold up and perform better than what came before, but it couldn't be much worse.

In the meantime, for the vast majority of us currently living with any of the earlier setups (and/or mysterious scary noises from the lower end of the engine), I offer this:



This gadget (or something damn near it) has been responsible for the uneasy truce between unbridled engine power and the components that must transfer it to the tarmac. It also tends to sacrifice itself on their behalf before any real damage is done to the other bits. Maybe because of all these talents and traits, Harley-Davidson calls it a "compensating sprocket assembly." I'd call it cheap insurance.

The secret of its success lies in the tow ramps (or cams) and the (three, in this instance) diaphragm-type springs staked inside that metal shell on the left and the clever way they interact to transfer the engine's strongest "point" loads from linear to lateral motion. On the other hand, the compensator's Achilles' heel is shown here too. That would be the splined shaft extension peeking out of the right half of this assembly and a not always secure relationship with the nut it's supposed to be tightly hooked up with, on the left.

in 2007 models we are faced with a situation wherein if one goes it'll take the other with it. I guess progress (or saving a buck on the assembly line) has its price.

The idea behind a so-called compensating sprocket assembly is simple. Whatever the specifics of the design, it hangs there off the left end of your crankshaft to cushion the not-inconsiderable hammering loads that run directly from the crank through stoutness of design that make the new "96" engine the torquiest (if that's a word) ever. *But,* consider this: Pretty much the same chain that has connected the crank to the tranny since 1936 is still the weakest potential link! If the compensator can't keep the chain alive, the rest don't matter! The curious thing is, primary chains are arguably the most reliable part in the drivetrain. What suffers most then, are all the bearings and seals lives and works downstream of the crankshaft. Abrupt throttle chops and gassing, along with the loading and unloading of the primary drive, have always been with us. What makes it all such an issue now is the simple fact that these forces have been (and are) multiplied enormously, by our constant pursuit of more engine capacity and capability. Still, the compensator does and will do the job of protecting the drivetrain from too much abuse, given half a chance.

In effect, the ongoing issue seems mostly to be how to keep the compensator tightly attached to the sprocket shaft. Over the years, half the grief with practical execution of that simple notion has had to do with a compensator nut forced to keep not one but several items attached—most obviously the so-called spring cup portion of the compensator assembly and the alternator rotor. Unfortunately, too many of them have tried to

• When a compensator assembly malfunctions through improper tightening or just plain wears out or screws up, the accompanying noise transfers along the sprocket shaft into the bottom end, making you think the connecting rods, crank pin and associated bearings are trashed, causing The Dreaded Insidious Knock. Ninety-nine and forty-four one hundredths percent of the time, the bottom end is fine!

• A new procedure from the factory for tightening the compensator nut! Although it's supposed to apply to 2003–2005 models, there's such good logic behind it, I'd consider it the way to go for any year and any compensator. It's all spelled out in detail in Service Bulletin #M-1170, but the important thing is the new

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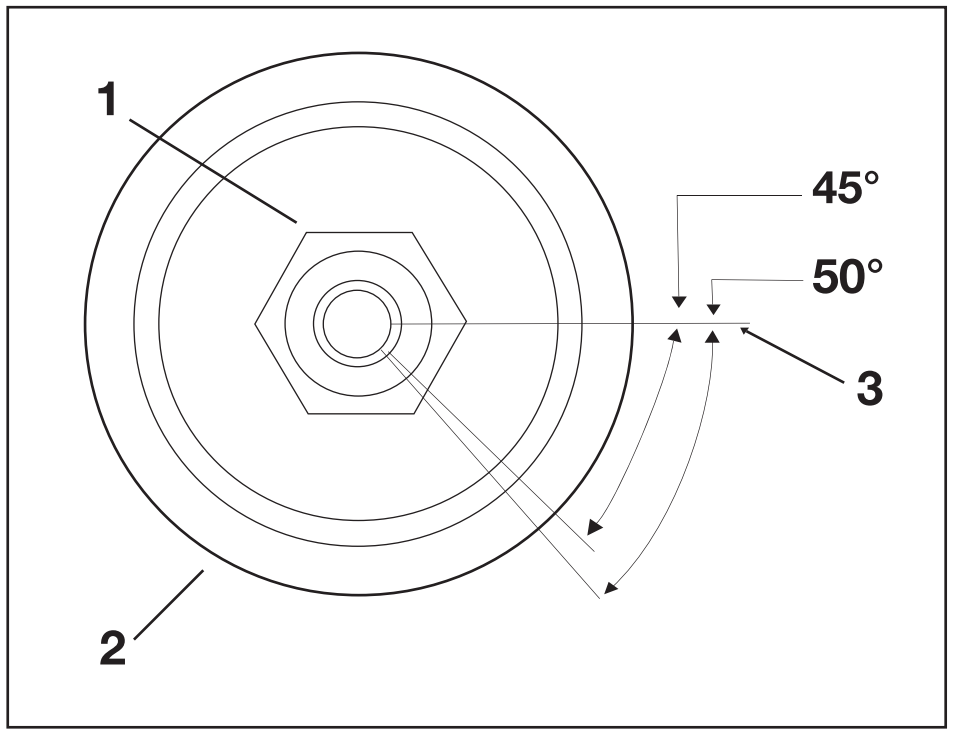

Even the factory has had trouble keeping these two together over time, as witnessed by the new procedure for securing the comp nut. Apply red Loctite to an absolutely clean nut, then crank it on to 75 ft./lbs. From there, you're supposed to follow this diagram and essentially twist the nut down like a lid on a jar, to get sufficient "stretch." This is the latest thinking on a chronic issue from The Motor Company.

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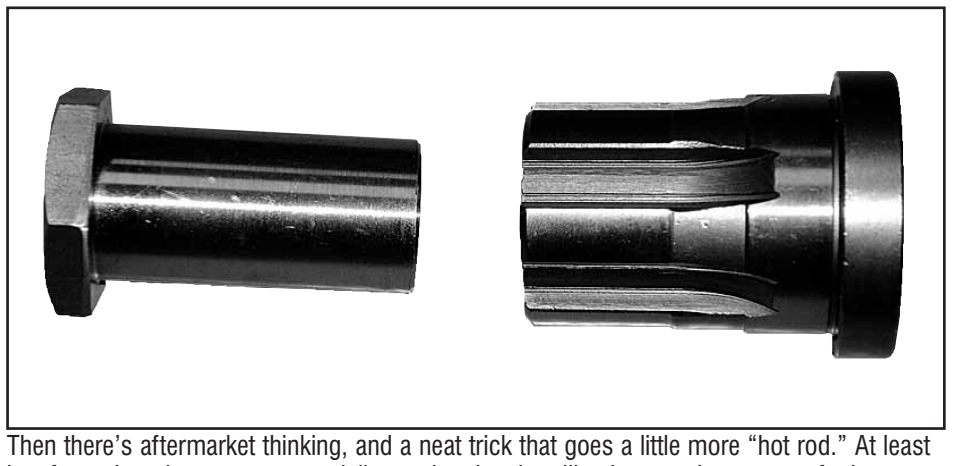
procedure acknowledges that stretching the fastener is the important thing. Since much the same has been done with Harley head bolts for the last 20-some years, the bulletin talks about ignoring previous "tighten to torque" thinking in favor of putting a mere 75 ft/lbs on the (red Loctite'd) nut—initially—then cranking it down another 45 degrees (50 degrees max). This puts the emphasis of a successful attachment on the tension (elasticity) of the nut and its interface with the threads on the end of the crank's sprocket shaft.



Then there's aftermarket thinking, and a neat trick that goes a little more "hot rod." At least insofar as it makes sure a potentially touchy situation, like the massive torque of a hot 124" engine spitting even an extra-tight comp nut off, won't happen. This is accomplished by machining 0.150"–0.175" from the threaded end of the nut and 0.075"–0.100" from the splined end of the extension shaft. Hard to believe that keeping these parts together means putting distance between them, but there you have it! And it works beautifully!

• Good as that idea is, it might not be enough to simply count on a factory procedure for nonfactory lunacies. In the real world of wide drive, mega-displacement ground-pounders, crap happens! The compensator parts involved might just be aftermarket, mismatched, or used, imperfectly machined, genuine stuff (it happens, OK?), or whatever! There's just a fistful of ways to sabotage a tight "comp" nut, no matter what technique you're using. There's also a way to prevent that sabotage: Simply toss a flywheel washer or two from an old Shovelhead under the head of the comp nut or *much* better yet, machine a bit off each of the two mating ends—the shaft extension and the comp nut—to ensure that they don't bottom out on each other. Happens more often than you think, particularly with applications that require, shall we say, more creativity than factory situations. And obviously, if bottoming happens, however much torque or stretch you think you're getting, it's a lie!

• Never underestimate the power of threadlockers, such as Permatex and Loctite. It helps to think about the way the forces act on—and the parts react to—the mechanics of H-D's compensator hardware. Basically, when you nail and/or back off the gas suddenly, the compensator's two interlocking cams ride up on each other's ramps, cushioning the shock loads by turning the peak load into sideways pressure and compressing the attached springs to absorb what would otherwise be a punishing impact. Meanwhile, the main thrust goes back along the primary chain through the transmission and the clutch to the rear wheel. After the initial "hit" from this sort of load passes, the cams are forced by spring tension to rotate back to their "neutral" position, ready for the next go round. Sometimes these high-strength adhesives along with the aforementioned serious attention to proper fastening techniques are all that can keep a compensator together under high-power duress.

Once upon a time, this alternator rotor was its own thing and a separate commodity from the compensator function. That's why, occasionally, you can have a compensator that's plenty tight and still have what sounds like a box of rocks rattling around in the crankcases. Fact is, those splines on the inside of the rotor are not just for looks and if they get worn or torn up, you will have issues, whether acoustic or electrical in nature.

But wait, there's more! Even if the compensator is all snugged up and chemically welded into its workstation, you might still hear The Dreaded Insidious Knock—and this time around it could be coming from a loose/worn /rattley old alternator rotor. Couple quick things to check: Pull the outer primary and try to move the compensator's spring cover with your hands. Shouldn't happen! If it does you're either stouter than Schwarzenegger in his prime or the damn comp nut is loose (or bottomed out). If not, the compensator is most likely tight (whew!) but the splines on your alternator rotor are rotten (whah!).

In the end (or at bottom if you prefer), any of this mischievous type of behavior exhibited by your own scoot should be nipped in the bud and properly repaired in a timely manner, if not for the sake of all those expensive parts connecting the crank to the primary drive and ultimately the gearbox, then for the sake of the crank itself! The old method of "locking in" a certain amount of end play with bearing spacing hasn't been with us since 2003, so, left unchecked at high engine speeds, excessive banging around of heavy masses like rotors and compensators has an even better opportunity to commit mayhem on things like left-side engine cases and main bearings. I'm not sure there's any form of adequate compensation for a messed up deal like that. ♦

That's why, to my mind anyway, the factory's decision to combine what amounts to the spring cover from the compensator and the rotor for the alternator on 2007 models is a mixed bag... er... "box". While it strengthens the part, it also bodes ill in case of any problems that arise in either the compensator function or the all-important heart of the electrical system—namely the alternator. Since engine management has assumed a status of epic importance for a model range that relies on it for virtually every function required to go for a ride, it damn well better be better!