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TECHLINE
BY DONNY PETERSEN

Isolated Drive System

Is H-D's new IDS kit a fix or an enhancement?

HARLEY-DAVIDSON IS FLYING UNDER THE RADAR with this one and with good reason, albeit, in my opinion, a selfish one. There is an innocuous addition to H-D's 2008 Genuine Motor Accessories and Genuine Motor Parts catalog. An unobtrusive entry on page 461 lists a rubber-mounted rear pulley that only fits 2007 Touring model Twin Cams.

The 2008 Touring models use this same pulley assembly as a stock component. Therefore, this kit was manufactured for use in only one year's models. I highly doubt any manufacturer would go to the trouble of making a kit that only fits some models of one production year. Maybe it is just my suspicious mind at work again, but in my opinion the only reason for this kit is to fix the fifth-gear noise problem in six-speed Cruise Drive transmissions. I believe Harley-Davidson is not calling this a fix to the problem because it would be an admission that there is a problem. The Motor Company has steadfastly maintained that the fifth-gear whine or clatter noise — take your pick — are consistent with the transmission design. Different types of gears juxtaposed together give off a different noise than the one veteran H-D riders are used to, and therefore comfortable with.

All 2008 Touring models come equipped with an Isolated Drive System (IDS). This IDS sprocket setup is now available as a retrofit kit for all 2007 Touring models.

This is the mantra, but many riders are not buying it and neither am I. It's true that there are different noises in new models for veteran riders to adjust to, but this situation is more than that. At the very least, this is a noise issue that conflicts with Environmental Protection Agency (EPA) decibel guidelines. I have said before that I do not view the noise as problematic from a mechanical point of view. In other words, I do not foresee six-speed Cruise Drive transmissions self-destructing all over the place. However, it offends the ears of many Harley riders and needs correction for the EPA.

The Isolated Drive System Sprocket Kit

All 2008 Touring models come equipped with an Isolated Drive System (IDS). This IDS sprocket kit (#40287-07) is now available for retrofitting on all 2007 Touring models with a rubber-mounted rear wheel sprocket-pulley, except for the H-D International (HDI) Touring models sold in Japan.

The IDS kit will work on bikes with original equipment (OE) wheels and all H-D accessory wheels, except the 80-spoke laced wheel (#42925-04), the polished-aluminum solid spun disc wheel (#43760-03), or the slotted six-spoke wheel (#43932-02, chrome/#43933-02, black). The rear pulley has six stops cast

on the inside portion facing the rear wheel compensator bowl. The rear drive belt sprocket-pulley compensator bowl has six rubber dampers incorporated in it to form an isolated secondary drive system that buttresses against the pulley stops when the kit is assembled. Sudden movement, such as rapid acceleration in the rear drivetrain, causes the pulley stops to compress the rubbers, thus absorbing energy. However, the sudden movement we'll be concentrating on is the power pulses emanating from the engine.

Yes, this is about noise coming from the six-speed transmission fifth gear. How this noise occurs is the really interesting part. The blurb describing the IDS in the 2008 H-D accessories catalog states that it "improves rider comfort and ride quality by dampening the mechanical noise and vibration caused by the engine's torque pulses … the motorcycle is quieter while accelerating, shifting, and cruising." Vibration reduction is sometimes not seat-of-the-pants noticeable, but it always improves the quality of the ride experience. However, I don't notice any untoward vibration that needs fixing on my 2007 FLHXI. Nor do I notice any noise from acceleration inside the power band, since this seems to cure the fifth-gear clatter on many 2007 Twin Cams. Furthermore, I am not aware of any noise while cruising unless the motorcycle is lugging or approaches lugging conditions while riding in too low an rpm, especially in fifth gear.

As for shifting, I can feel and hear that the traditional Harley shifting clunk has been reduced with the IDS. The rubbers absorbing the sudden strain on the drivetrain soften the Harley clunk when engaging a gear, especially from neutral. Any noise reduction assists in meeting EPA dictates. I think the key phrase from the H-D catalog is "dampening the mechanical noise." To me, the other feel-good marketing words bury this phrase. Dampening the mechanical noise is what the IDS is all about and the reason for its design. The intention, I am sure, is to cure the fifth-gear clatter in the 2007 Twin Cams. In my opinion, the Motor Company does not want to admit liability for the fifth-gear noise, forcing a recall — voluntary or otherwise. Therefore, those riders annoyed by the clatter must pay for their own peace of mind.

In early testing, the IDS successfully diminished the fifth-gear clatter. As I have said before, I do not think the noise is a harbinger of future breakdown. One of my myriad e-mail buddies who is in tune with his 2007 motorcycle gave a glowing testimonial of the IDS. The first thing he noticed, while running at 60-65 mph in fifth gear, was that the noise was all but gone. He was shocked, as he did not expect any effect on the fifth-gear noise, and had accepted the clatter because of the straight-cut gears. He told

Isolated Drive System (IDS) kit rear pulley has six stops cast on the inside portion that faces the rear wheel compensator bowl. The rear drive belt sprocket-pulley compensator bowl has six rubber dampers incorporated in it to form an isolated secondary drive system that buttresses the pulley stops.

me he had to listen intensely with the radio off to notice that the noise was still there after installation of the IDS. However, his biggest praise for the IDS was that while running the backcountry roads he was able to settle into a particular gear and have no noise whatsoever. He then took the opportunity to lug her down to 1500 rpm in fourth and fifth and with smooth throttle, the bike just pulled right up without any clatter or chatter. I did not ask about detonation or pinging.

Another e-mail friend, Mike, relates his story: "I installed H-D's IDS kit on my '07 Street Glide. The bike has had the fifth-gear clatter since it was new in September '06, and I have fought my dealer ever since. At one point, H-D reps contacted me to bring my bike into the shop of my choice for them to test it. They said they had a few tricks they wanted to try. Other owners were also involved from various areas of the country. No one's bike was ever fixed, to my knowledge, in this testing. Most just sold or traded their bikes. I was told to watch for the P&A catalog release in July 2007 for a cure to this clatter. The IDS kit was it. This kit completely rid my bike of the clatter, no matter the rpm or gear. I don't intentionally lug my bike, but I tried just to put this kit to the test. It works. The bike only has the sewing machine sound now … H-D has yet to say this kit was aimed at the clatter/tranny noise and has not offered these kits to known filers as a warranty item." Although these early reports are positive, we must wait for the mileage to pile up before declaring this a total success.

Powertrain Harmonic Pulse Dampener

Another reader, George from the east coast of Canada, hypothesized that perhaps the real reason for the IDS is a powertrain harmonic pulse dampener that stops refractions returning up the powertrain, thus silencing the Cruise Drive fifth-gear clatter. This guy turned out to be an astute observer. He thinks that those of us postulating that the gear clatter originates in the six-speed Cruise Drive transmission are missing the mark, and that the problem is one of harmonics, transferring noise reflecting back through the powertrain. George makes good sense as he presents his case, "What the IDS does, in my opinion, is dampen the reflection, i.e., stops it at the rear wheel … Incidentally, the chatter is present in all gears, but for some reason, more prominent in fifth. I believe this is due to the spur gear's capability to transmit the full reflection without distortion. The helical-cut gears dampen the reflection, reducing the chatter and, as a sidebar, eliminating the fifth-gear whine completely. The problem is with the compensating gear in the primary … I think the compensator is not strong enough to do the job in fifth … it's unloading. I concur that the problem is really in the primary. That being said, because the compensator cannot absorb (dampen) the power pulse … it is delivered through the transmission to the rear wheel and is reflected back. I suppose it is like a whipping line tied to a post. The wave travels down the line, hits the post, and reflects back. I believe this is due to

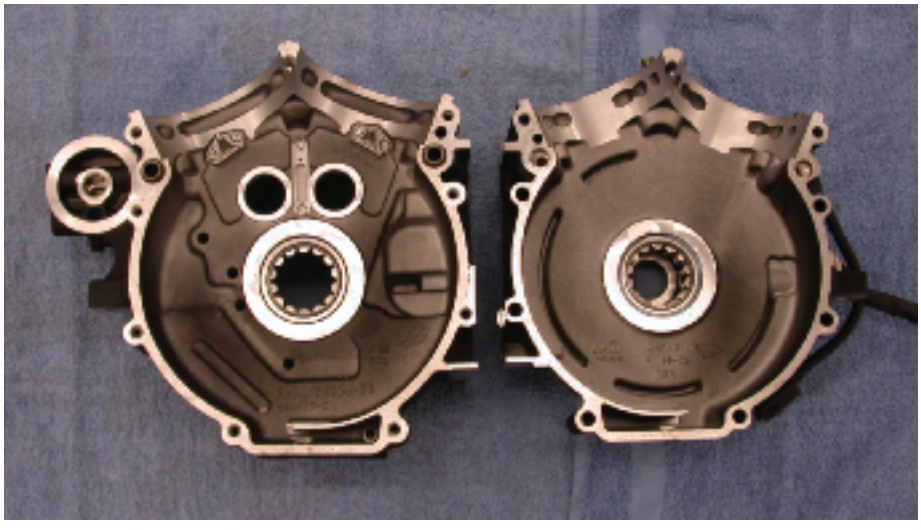
the spur gear's capability [to transmit] the full reflection without distortion. I think the theory is that a harmonic is being developed on the ignition stroke … and is peculiar to fifth … the IDS supposedly dampens the harmonic before it can be reflected back into the transmission."

There are many theories as to the noise's origin: piston slap, spark knock, weak engine compensator, engine power pulses, and primary echo chamber. The Internet discussions are labeling this noise as a whine. However, to me, the noise in question it is not a whine but a clatter. In my experience, a piston slap is a slapping sound, ignition knock is a knock, a compensator knock sounds like all hell is breaking loose, power pulses emanate as a vibration sensation, an echo is an echo, and spur gear noise is a backlash situation that causes a single click or a multiple clatter. I could tell both these guys, as well as many others who e-mailed me, are mechanically adept and have something to say that is worth listening to and examining. Any good mechanic can immediately identify the type of noise and its origin. Moreover, the origin is a backlash in fifth gear. Or is it?

Maybe the clatter is the end result and not the origin at all? To titillate the reader further, maybe it's not a normal backlash situation at all, as the spur gears engage under load. Maybe it's a power pulse coming from the engine and transferring into the transmission causing the noise. But the compensator sprocket assembly is supposed to absorb the energy of power pulses through its thick diaphragm spring plates. Why would this situation not occur in five-speed transmissions where there are five sets of spur gears? There are thus a few problems with the excellent e-mail theories espoused.

I know that some respected people believe the noise originates in the front cylinder as a piston slap and travels back through the powertrain, amplifying in the primary system. Well, we at Heavy Duty Cycles have looked for evidence of this, and we found none. Piston slap leaves telltale damage to both piston skirt and cylinder wall. We have yet to see this as a source of the fifth-gear clatter. As I said before, most good mechanics can hear and distinguish a piston slap from other engine noise. There is no piston slap that I have heard in relation to this noise situation.

However, an ignition knock is entirely plausible. Also known as pinging or detonation, spark knock is Harley-Davidson's old and ongoing nemesis. Detonation is an unplanned, spontaneous, explosive igniting of the fuel/air mixture in the combustion chamber due to excessive heat and pressure. Mild ignition knock may not leave telltale evidence. In severe cases, there will be damage to the top of the piston, and sometimes to the cylinder walls and the combustion chamber.



I feel that the sprocket (left) shaft bearing, which now uses the same roller bearing as the pinion (right) side, also has a part in transmitting power pulses along the drivetrain.

Compensators & Bearings

Many people blame a weak compensator assembly for this noise. Proponents of this theory have spent much time on replacements and adjusting torque values of the compensator nut ever since the Motor Company replaced the reliable, tapered Timken bearing kits with a big roller bearing on the rubber-mount models in 2003 and the Softails in 2000. I dismissed these concerns after a check of the new compensator design, and feel this issue is a red herring. After all, the compensator sprocket dampening assemblies have been used on all Big Twins from 1965 on, having first been used with great success at absorbing harmful engine pulses in 1955, thus protecting the powertrain for over five decades. On the surface, how could this be the cause?

Many mechanics, including those in the high-performance crowd, blame the oversized sprocket shaft roller bearing introduced in 2003. The sprocket shaft bearing supports the left side of the flywheel assembly and the sprocket (power output) shaft, which are located in the left engine case. I am no fan of using this bearing for this purpose. This is the same bearing successfully used on the pinion (right) side of the motor to support the right side of the flywheel assembly and the pinion shaft in the right engine case. There is a big difference in the stresses imposed at these two locations. The pinion shaft and its bearing primarily absorb up and down forces and the bearing's roller bearing design easily accommodates this. The sprocket side has this same supportive up-down force role, which, again, is not a problem. However, there are two types of pulses moving along the sprocket shaft. The first is the transfer of torque — generated on the downward thrust of a piston on its power stroke — through the sprocket shaft and into the compensator sprocket. This is the power that is transferred to the rear wheel via the primary chain, clutch basket, and transmission.

The second stress is more difficult for the system to handle. The 45-degree, uneven, awkward firing order of the H-D V-twin delivers unwanted harmonics through the powertrain. These throbbing forces cause discomfort to the rider and mechanical parts alike. Thus the uneven engine firing sequence is the main motivation for rubber-mounting or counterbalancing, depending on model, to combat the negative effects of the engine's power pulses. Hence the V-Rod, imported V-twins, and the new breed of aftermarket power plants (like the S&S X-Wedge) increase the firing sequence to more

comfortable, vibration-lessening, cylinder angles: 56 or 60 degrees.

A roller bearing design, no matter how big and strong, is unable to withstand these side forces for a long time. I don't like this roller bearing, plain and simple. It replaced the very able, opposed, tapered Timken bearings and mating races, which were used with great and enduring success from 1956 to 2002. As much as I dislike the use of this roller bearing for this particular purpose, I cannot single it out and blame it for the fifth-gear clatter. This bearing began use in 2003 in all rubber-mount Twin Cams and in 2000 in all Softail models, but the gear clatter did not occur until 2007. To further complicate the issue, the 2006 Dyna is outfitted with the six-speed Cruise Drive and the sprocket shaft roller bearing, but there are not any complaints that I am aware of regarding clatter. The noise begins in the engine, possibly as a spark knock and travels through the powertrain back to the rear pulley.

Band-Aid For A Symptom?

I believe kinetic energy pulses, or refraction, roll backward from the rear wheel pulley and through the powertrain. They reenter the transmission from the back, causing the backlash clatter in fifth gear. The mainshaft and countershaft fifth gears absorb the power pulses creating the noise via backlash clatter. Backlash occurs within the mating spur or straight-cut gears because the gear teeth are not in constant contact. There are spaces between the gear teeth. Sixth, fourth, third, and second gears are helical-cut, so the gear teeth are in constant contact with each other. Thus, backlash is not an issue in helical-cut gears. If there were no spur-cut gears in the Cruise Drive, this fifth-gear clatter would not exist. Of course, the refracted energy pulses might manifest themselves in other ways. Or they might not manifest at all, just roll back and forth like exhaust pulses. The spur-cut, first-gear set does not make any discernible refractive backlash noise because the fifth gears have already absorbed the returning pulses.

The Echo Chamber

The offending noise emanates evenly in all directions from the transmission, but the primary covers act as an echo chamber, resulting in the belief by some that the noises originate there. Switching from SYN3 fluid to thick transmission hypoid gear oil will lessen, but not eliminate, the clatter. Why is this not a burning issue with the 2006 Dyna, where the six-speed Cruise Drive was first used? I think a number of factors easily explain this.

I think the real culprit is the compensating gear in the primary. It's not strong enough to do the job in fifth, so it's unloading.

The Dyna is lighter, its riders more prone to higher rpm riding. We already know that riding at higher rpm in fifth gear will lessen and/or cause this gear clatter to cease. Dyna riders do not smell the roses as much as the touring bike owners do. Furthermore, the Dyna rear pulley is two nubs bigger (68) than the 2007 Twin Cam (66), resulting in a higher secondary ratio of 2.13:1 for the 2006 Dyna versus 2.06:1 for the 2007 Twin Cams. The Dyna has a final drive gear ratio of 2.88:1 versus 2.79:1, and an overall gear ratio of 2.96 versus 2.70 for the Touring models. Therefore, the refraction whip is pulsing with a different wave configuration. Also, the Dyna and Softail primary system is a different shape and length from that on the Touring models. The internal webbed support structure and dampening system is also of a dissimilar style. Result: the echo chamber effect is muted.

I think the final answer of why the problem occurs in only 2007 models is actually a combination of factors, with each one alone incapable of causing the power pulse refraction noise. First, the secondary, final, and overall gear ratios are unique to 2007 and 2008 Twin Cams. However, the 2008 Touring models have the IDS system installed right from the factory while the 2007 models have the traditional rigid-mounted rear pulley sprocket. The sprocket shaft roller bearing has a part in transmitting power pulses, too. Ordinarily, the engine's compensating sprocket can cope with these power pulses in combination with the sprocket shaft roller bearing, especially after realizing and checking the crucial torque specification procedures of the compensator nut. In contrast, the tapered Timken sprocket shaft bearings allowed up to and beyond 400 ft-lbs. torque, or however much the backyard mechanic could muster with no ill consequences.

An Aggravating Culprit?

However, the kicker that brings this noise problem all together is the super-sized primary gear ratios compared to the conservative ratios in predecessor Twin Cams. We move from a compensator engine sprocket of the antecedent 25 tooth up to a radical 34 tooth. This overwhelms the compensating sprocket's capacity to absorb power pulses as effectively as before. Higher gearing always encourages the possibility of spark knock, especially when overcoming the effects of the massive sprocket going up the rpm range. The pulses roll down the powertrain only to return back via the rigid-mounted, energy-transferring, rear pulley sprocket, particularly at lower rpm levels. The returning harmonic pulses find the absorption point of least resist-

ance, which, in this case, is the spur-cut fifth gears.

The IDS cure is to rubber-mount the rear pulley sprocket to absorb traveling pulses and prevent their transference back, or at least disrupt the wave pattern of the pulses. Harley-Davidson, in order to preserve traditional design, goes to inordinate lengths to mask symptoms as opposed to curing some problems. We now have compensator sprockets at the front and rear of the powertrain to curb the fifth-gear clatter. Therefore, the spur-cut gears are not the origin of fifth-gear clatter, but the end result of harmonic pulses traveling unhindered back and forth along the powertrain, much like exhaust pulses do in the exhaust system. Time will tell how reliable the rear rubber-mounted pulley is.

V-Rods spearheaded the IDS system. However, the high-rpm V-Rod's torque curve is different from the Twin Cam curve. The last time H-D attempted a rubber-mounted compensator was long ago, with the disastrous Shovelhead FXS Sturgis. Rubber technology has improved drastically since then, plus the IDS rubbers are larger and doubled in number. So, if you're experiencing the clatter on your 2007 FLHT series Twin Cam, I feel confident this may be your fix ("enhancement?") for dampening the mechanical noise! An all-helical-gear transmission, like that provided by S&S Cycle, would eliminate a noise problem without requiring a dampening solution. Ditto with the BAKER Drivetrain F6F helical-gear fix for the Cruise Drive.

IDS Installation

Whenever installing any kit, always use the Harley-Davidson workshop manual in conjunction with the instructions sheet supplied with the parts. In this case, use the 2007 Touring manual (#99483-07), along with "Instructions: Isolated Drive System — J04467, Rev. 2007-06-28." We can see that the release date for the IDS is June 28, 2007. As with any mechanical work where injury may occur with accidental start-ups or battery-powered rotation of parts, it is crucial to disconnect the battery ground and the maxi-fuse before doing any work. Also, remove any rings and hanging jewelry, such as necklaces and wrist chains. Loose metal objects can short out powered electrical parts. Rings can leave perfect scars around fingers if they cause an electrical short.

The IDS installation is straightforward. Just follow the removal and installation of the rear wheel instructions in the manual. The instruction sheet that comes with the kit is informative and clear.

The 2007 H-D six-speed tranny uses both spur-(straight-cut) and helical-cut gears, as you can see on these tranny components at a H-D manufacturing facility.

There are two instructions of note. The first is the bearing (#40670-06) installation into the new final drive sprocket pulley (#40265-08). Use H-D's rear-wheel compensator sprocket bearing remover/installer (#H-D-48921). Also, use this tool for the removal of worn bearings when servicing and replacing with a new bearing. The second instruction of note ensures the new pulley sprocket threaded holes are deep enough for the new 7/16"-14 hex screw bolts and captive washers (#3814) that hold the compensator bowl (#40560-05) to the rear wheel. A 7/16"-14 x 1-1/2" go/no-go gauge (also called a gauge screw) is supplied with the complete kit (#40287-07). The 7/16"-14 x 1-1/2" designator means the hole is 7/16" in diameter with 14 threads per inch, which is a standard-sized national coarse (NC) thread. The bolthole threads to a depth of 1-1/2" deep. The stock wheel bolthole threading may not be as deep as indicated by the go/no-go gauge screw. If not, thread them to 1-1/2" with a 7/16"-14 tap.

Use hot, soapy water and a nylon brush to wash away any old threadlock material from the sprocket pulley wheel mounting holes. Do not use a wire brush of any type. After lubricating them with a half-and-half mix of water and isopropyl alcohol, install the six rubber isolators into the compensator bowl (#40278-08) according to the instruction sheet. Do not use oil or any other petroleum-based product for this purpose, as it may cause the rubbers to deteriorate. Align the compensator bowl mounting holes with those in the rear wheel. The bowl obviously must face out for the pulley sprocket lugs to interact with the installed rubbers. Now install the bolts and captive locking washers in the standard criss-cross pattern. Tighten them in an alternating pattern (back and forth) until you attain a torque of 65 ft-lbs. (88Nm).

Next, install the inner thick spacer (#11846) against the inner compensator bowl bore. Relubricate the rubbers with a 50/50 mix of water and isopropyl alcohol where they will contact the sprocket pulley lugs. Install the sprocket pulley, ensuring the lugs seat fully. When installing the wheel, use the outer thinner spacer (#11844) provided in the kit. Tighten the axle nut to the manual-specified torque to seat the parts. Loosen and retighten, ensuring the compensator bowl lip does not contact the inner sprocket face at any point in its circumference. You can then reconnect the negative ground cable and the maxi-fuse. Go for a test ride with the hope that the previously noisy gear clatter will be dampened/eliminated as a result of the IDS absorbing the engine-generated power pulses.

Conclusion

The IDS currently retails for around $375. This Harley-Davidson riding pleasure enhancement should offer a successful Band-Aid for the annoying fifth-gear noise, to both the rider and the EPA.

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